

Annex B

Technical Specifications

Table of Contents

Section 1 - QUALITY REQUIREMENTS.....	1
Section 2 - EXECUTION REQUIREMENTS	8
Section 3 - WATER STORAGE TANK.....	13
Section 4 - SHEET WATERPROOFING	15
Section 5 - STEEL DOORS AND FRAMES.....	22
Section 6 - INTERIOR PAINTING	29
Section 7 - PAINTS AND COATINGS	43
Section 8 - MECHANICAL GENERAL PROVISIONS	52
Section 9 - PLUMBING FIXTURES.....	56
Section 10 - ELECTRIC WATER HEATERS	63
Section 11 - SPLIT-SYSTEM AIR-CONDITIONING UNITS	64
Section 12 - LIGHTING INSTALLATIONS	70
Environmental Practice for Disposed Liquid Waste	76

SECTION 1 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. The Contractor shall submit Quality Assurance Program consisting of the Quality Assurance Manual, Project Quality Assurance Plan. Such program shall be subject to the Engineer's approval.
- B. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- C. Comply with manufacturers' instructions, including each step in sequence. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; locate before securing products in place.

1.4 REFERENCES

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

1.5 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals and finishes.
- C. Accepted mock-ups shall be comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Engineer.
- E. Submit drawings showing location and details of Mockup plus a description report of Mockup.
- F. Submit test certificates for tests to be undertaken.
- G. Testing operations may include, but not limited to, weather tests, seismic, water, air, wind resistance, permeability and load safety.
- H. Submit test reports for Visual and Tests of Mockups: Indicate substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria and other supportive data.

1.6 TESTING AND INSPECTION SERVICES

A. Scope:

1. This section covers testing services including selection and payment, contractor submittals, agency responsibilities, agency reports, limits on testing authority, Contractor responsibilities and schedule of tests.
2. Employment and payment for services of an independent testing agency or laboratory to perform specified testing shall be borne by the Contractor.
3. Employment of testing agency or laboratory in no way relieves Contractor's obligation to perform Work in accordance with the requirements of the Contract Documents.

B. Performance and Standards:

1. ASTM C802: Practice for Conducting an Inter-laboratory Test Program to Determine the Precision of Test Methods for Construction.
2. ASTM C1021: Practice for Laboratories Engaged in the Testing of Building Sealants.
3. ASTM C1077: Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
4. ASTM C1093: Practice for Accreditation of Testing Agencies for Unit Masonry.
5. ASTM E329: Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.
6. ASTM E543: Practice for Determining the Qualification of Nondestructive Testing Agencies.
7. ASTM E548: Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.
8. ASTM E699: Practice for Criteria for Evaluation of Agencies Involved in Testing, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.
9. ASTM E779: Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

C. Submittals:

1. Prior to start of Work, submit testing laboratory name, address, and telephone number and names of full time specialist and responsible officer to the Engineer for approval.
2. Submit copy of report of laboratory facilities inspection made, with memorandum of remedies of any deficiencies reported by the inspection.

- D. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by the Engineer.
1. Laboratory: Authorized to operate at Project location.
 2. Laboratory Staff: Maintain full time registered Engineer or specialist on staff to review services.
 3. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- E. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by the Engineer or Employer.
- F. Reports will be submitted by independent firm to the Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- G. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
1. Notify the Engineer and the independent firm 24 hours prior to expected time for operations requiring services.
 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
- H. Testing and employment of testing agency or laboratory shall not relieve the Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- I. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by the Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
- J. Agency Responsibilities:
1. Test samples of mixes submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
 3. Perform specified sampling and testing of Products in accordance with specified standards.

4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or Products.
6. Perform additional tests required by Engineer.
7. Attend preconstruction meetings and progress meetings.

K. Agency Reports:

1. After each test, promptly submit four copies of report to Engineer and to Contractor.
2. Include the following:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in Project.
 - g. Type of inspection or test.
 - h. Date of test.
 - i. Results of tests.
 - j. Conformance with Contract Documents.
3. When requested by Engineer, provide interpretation of test results.

L. Limits on Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

M. Contractor's Responsibilities:

1. Deliver to agency or laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.
3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested.

- b. To obtain and handle samples at the site or at source of Products to be tested.
 - c. To facilitate tests.
 - d. To provide storage and curing of test samples.
4. Notify Engineer and laboratory 36 hours prior to expected time for operations requiring testing services.

N. Schedule of Tests:

- 1. Individual Specification Section: Tests required and standards for testing.

1.7 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test and adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications with CV of observer to the Engineer, thirty (30) days in advance of required observations. The Observer shall be subject to the approval of the Engineer.

Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning any new Work, means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify that utility services are available, of correct characteristics and in the correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 2 - EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cleaning.
- B. Protecting installed construction.
- C. Manual for materials and finishes.
- D. Manual for equipment and systems.
- E. Product warranties and product bonds.
- F. Protection and making good.

1.2 CLEANING

- A. General:
 - 1. Execute cleaning during progress of the work and at completion of the work.
 - 2. If the Contractor fails to clean up during or at completion of work, the Employer may do so, and the cost thereof shall be charged to the Contractor.
 - 3. Conduct cleaning and disposal operations to comply with codes, ordinances, and anti-pollution laws.
 - 4. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
 - 5. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- B. Cleaning during Construction:
 - 1. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulations of waste material, rubbish and windblown debris, resulting from construction operations.
 - 2. Provide on-site containers for the collection of waste materials, debris, etc.
 - 3. Remove waste materials, debris and rubbish from the site periodically and dispose off at legal disposal areas away from the site.
- C. Dust Control:

1. Clean interior spaces to the start of finish painting and continue cleaning on and as-needed basis until painting is finished.
 2. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.
- D. Final Cleaning:
1. Employ skilled workmen or specialized firm for final cleaning.
 2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials from sight-exposed interior and exterior surfaces.
 3. Clean interior and exterior glass, and surfaces exposed to view; remove temporary labels, stains and foreign substances, wash and shine glazing, and polish transparent and glossy surfaces.
 4. Wax and polish finish floors.
 5. Clean all hardware with cleaning materials appropriate to surface and material being cleaned.
 6. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
 7. Ventilating System: Replace filters of operating equipment; clean ducts, blowers and coils if units were operated without filters during construction.
 8. Clean debris from roofs, gutters, downspouts, and drainage systems.
 9. Clean site; sweep paved areas, rake clean landscaped surfaces.
 10. Comply with all special cleaning instructions contained in the specifications.
 11. Remove temporary services, construction equipment, tools and construction facilities, mock-ups, temporary structures, surplus materials, debris, waste, and rubbish from site.
 12. Put site in neat, orderly condition, ready for use. Leave all spaces clean and free from debris.
 13. Prior to final completion, conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

1.3 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

- C. Provide protective coverings at walls, projections, jambs, sills and soffit of openings.
- D. Protect floors, stairs and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.4 MANUAL FOR MATERIALS AND FINISHES

- A. Submit four copies of preliminary draft or proposed formats and outlines of contents before start of Work. The Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Employer, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 14 days prior to final inspection. Draft copy will be reviewed and returned after final inspection, with the Engineer's comments. Revise content of document sets as required prior to final submission.
- D. Submit four sets of revised final volumes in final form within 10 days after final inspection.
- E. Products, Applied Materials and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.
- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition and details of installation. Include recommendations for inspections, maintenance and repair.
- H. Additional Requirements: As specified in individual product specification sections.

- I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.5 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers and manufacturers, within ten days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information and are notarized.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in binder with durable plastic cover.
- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Employer's permission, submit documents within ten days after acceptance.
 - 2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.6 PROTECTION AND MAKING GOOD

- A. The Contractor shall protect all completed Works from damage until the completion and handing over of the Works to the approval of the Engineer.

Should any Works be damaged before handing over of the Works, the Contractor shall at his expense make good or replace as required, to the satisfaction of the Engineer.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 3 - WATER STORAGE TANK

A. General

Provide and install a rotationally molded polyethylene water storage tank suitable for the storage of potable water, complete with all required accessories, fittings, and connections, in accordance with the manufacturer's recommendations and the Engineer's approval.

B. Tank Construction

Tank shall be manufactured from high-quality, food-grade polyethylene materials approved for potable water storage.

Tank shall be of three-layer construction, consisting of:

Outer UV-resistant protective layer.

Intermediate insulating layer to reduce heat transfer and algae formation.

Inner food-grade layer suitable for drinking water contact.

Tank shall be seamless, corrosion-resistant, non-toxic, and resistant to chemical attack, rust, and environmental degradation.

Tank shall be suitable for outdoor installation and designed to withstand local climatic conditions.

C. Performance Requirements

Suitable for storage of potable (drinking) water.

UV stabilized and resistant to prolonged exposure to sunlight.

Opaque construction to minimize light penetration and inhibit algae growth.

Resistant to cracking, deformation, and discoloration under normal operating conditions.

Designed to maintain water quality without affecting taste, odor, or color.

D. Accessories

Lockable inspection manhole cover.

Inlet, outlet, overflow, and drain connections as indicated on the drawings.

Ventilation arrangement with insect screen.

Level indicator, where specified.

All fittings and accessories shall be suitable for potable water applications.

E. Quality Assurance

Manufacturer shall have a minimum of ten years documented experience in the production of polyethylene water storage tanks.

Tank shall comply with applicable international standards for potable water storage and food-contact

materials.

F. Warranty

Provide a manufacturer's warranty of not less than five (5) years against defects in materials and workmanship.

END OF SECTION

SECTION 4 - SHEET WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes waterproofing membrane, drainage panels and protective cover.
- B. Related Sections:
 - 1. Section 02320 - Backfill.
 - 2. Section 07212 - Board Insulation.
 - 3. Section 07620 - Sheet Metal Flashing and Trim.
 - 4. Section 07900 - Joint Sealers.
 - 5. Division 15 - Mechanical: Plumbing fixtures and plumbing specialties.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 - 2. ASTM D449 - Standard Specification for Asphalt Used in Dampproofing and Waterproofing.
 - 3. ASTM D450 - Standard Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing.
 - 4. ASTM D471 - Standard Test Method for Rubber Property-Effect of Liquids.
 - 5. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 6. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 7. ASTM D822 - Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
 - 8. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 9. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.
 - 10. ASTM D2581 - Standard Specification for Polybutylene (PB) Plastics Molding and Extrusion Materials.
 - 11. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane.
 - 12. ASTM D4551 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane.
 - 13. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
 - 14. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Roofing Contractors Association:

1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

1.3 SYSTEM DESCRIPTION

- A. Waterproofing System: Capable of resisting existing water head with the required factor of safety and preventing moisture migration to interior.

1.4 SUBMITTALS

- A. General Requirements: Requirements for submittal procedures.
- B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- C. Product Data: Submit data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.
- D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.
- B. Test material samples in accordance with ASTM D449 and ASTM D450. C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Membrane Manufacturer: Company specializing in waterproofing sheet membranes with minimum fifteen years documented experience.
- B. Applicator: Company specializing in performing work of this section with minimum ten years documented experience.

1.7 MOCKUP

- A. General Requirements: Quality requirements for mockup.
- B. Construct Mockup, 10 m² of horizontal and vertical panels; to represent finished work with internal and external corners, seam jointing, attachment method, counterflashing cover, drainage panel, base flashings, control/expansion joints, and protective cover.
- C. Locate where directed by the Engineer.
- D. Remove mockup when directed by the Engineer

1.8 PRE-INSTALLATION MEETINGS

- A. General Requirements: Administrative requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

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

1.10 WARRANTY

- A. General Requirements: Execution requirements for product warranties and bonds.
- B. Provide twenty-year warranty for each waterproofing system including coverage of materials and installation, and all resulting damage resulting from failure to resist penetration of moisture.
- C. For warranty repair work, remove and replace materials concealing waterproofing.

PART 2 PRODUCTS

2.1 SHEET MEMBRANE WATERPROOFING

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

2.2 COMPONENTS

- A. Modified Bituminous Membrane: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS), and/or atactic polypropylene (APP) type, reinforced with non-woven polyester, fiber glass, polyethylene and/or polypropylene; smooth surfaced; thickness and roll width as per manufacturer's recommendations; with compatible seam tape and termination bar; conforming to following below criteria.

- B. Criteria:

1.	<u>Properties</u>	<u>Test</u>
a.	Tensile Strength	ASTM D412
b.	Elongation	ASTM D412
c.	Hardness - Shore A	ASTM D2240
d.	Tear Strength	ASTM D624 and/or D1004
e.	Water Absorption	ASTM D471
f.	Moisture Vapor (perms)	ASTM E96
g.	Exposure at Low Temperature	ASTM D822
h.	Brittleness	ASTM D746

- C. Seaming Materials: As recommended by membrane manufacturer.

- D. Flexible Flashings: As recommended by membrane manufacturer.

2.3 ACCESSORIES

- A. Surface Conditioner: type compatible with membrane, as recommended by membrane manufacturer.

- B. Adhesives: As recommended by membrane manufacturer.

- C. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

- D. Battens: As recommended by membrane manufacturer.

- E. Disc Washers and Screws: As recommended by membrane manufacturer.

- F. Circular Membrane Discs: As recommended by membrane manufacturer.

- G. Reglet Strip Devices: As recommended by membrane manufacturer.

- H. Sealant: As stated in Section 07900 and as recommended by membrane manufacturer.
- I. Mortar Beveled Corners (Fillet) at Intersections:
 - 1. Portland Cement: ASTM C150, Type I, gray color.
 - 2. Fine Aggregate: ASTM C144 and/or C404.
 - 3. Water: Clean and potable.
 - 4. Calcium chloride is not permitted.
 - 5. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
 - 6. Achieve uniformly damp sand immediately before mixing process.
 - 7. Add admixtures in accordance with manufacturer's instructions to achieve uniformity of mix and coloration.
 - 8. Re-temper only within two hours of mixing.
- J. Protective Covers:
 - 1. For Horizontal Surfaces: Unless otherwise stated or shown on the drawings, heavy duty rigid polypropylene protection boards specified in Section 07212, or cement sand screed, mix (1:3).
 - 2. For Vertical Surfaces: Unless otherwise stated or shown on the drawings, heavy duty rigid polypropylene protection boards specified in Section 07212.
- K. Can't Strips: Remolded composition material and/or Bitumen impregnated fiberboard.
- L. Flexible Flashings: As recommended by membrane manufacturer.
- M. Counterflashing: as specified in Section 07620.

PART 3 EXECUTION

3.1 EXAMINATION

- A. General Requirements: Administrative requirements for coordination and project conditions.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- B. Verify items penetrating surfaces to receive waterproofing are securely installed.
- D. Verify substrate surface slopes to drain for horizontal waterproofing applications.

A.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing.

- C. Execute cement sand mortar at all intersections to make beveled corners (fillet) of size 50 x 50 mm.
- D. Do not apply waterproofing to surfaces unacceptable to manufacturer or applicator.
- E. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer and in accordance with Section 07900.
- F. Apply surface conditioner at rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

3.3 INSTALLATION - GENERAL

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

3.4 INSTALLATION - ADHESIVE BONDED, SELF ADHERED AND TORCH APPLIED MEMBRANE WATERPROOFING

- A. Roll out membrane. Minimize wrinkles and bubbles.
- B. Remove release paper layer. Roll out on substrate with mechanical roller to encourage full contact bond.
- C. Apply adhesive at rate recommended by manufacturer, Bond sheet to substrate except those areas directly over or within 75 mm of control or expansion joint.
- D. Apply membrane by torch application, coated side down.
- E. Lap sides and ends.
- F. Overlap edges and ends and seal with contact adhesive, or by heat sealing, minimum 75 mm. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- G. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- H. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams. Coordinate with drain installation, Division 15 - Mechanical.
- I. Install flexible flashings. Seal watertight to membrane.
- J. Seal membrane and flashings to adjoining surface

K. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 150 mm above horizontal surface for first ply and as recommended by the manufacturer at subsequent plies laid in shingle fashion.

L. Seal items protruding to or penetrating through membrane and install Counterflashing membrane material.

3.5 FIELD QUALITY CONTROL

A. General Requirements: Quality requirements for testing and inspection services, and execution requirements for testing, adjusting and balancing.

B. On completion of horizontal membrane installation, dam installation area in preparation for flood testing.

C. Flood to minimum depth of 25 mm with clean water. After 48 hours, inspect for leaks.

D. When leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by the Engineer; repeat flood test. Repair damage to building.

E. When area is proven watertight, drain water and remove dam.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. General Requirements: Execution requirements for protecting installed construction.

B. Do not permit traffic over unprotected or uncovered membrane.

C. Protect membrane from damage by adhering protection board over membrane surface. Scribe and cut boards around projections and interruptions.

3.7 SCHEDULES

A. As indicated on drawings and were directed by the Engineer.

END OF SECTION

SECTION 5 - STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel doors.
 - 2. Steel door frames.
 - 3. Fire-rated door and frame assemblies.
 - 4. Louvers in doors.

1.2 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.3 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Details of doors including vertical and horizontal edge details.
 - 3. Frame details for each frame type including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for factory-finished doors and frames.
- D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.
- E. Oversize Construction Certificates: For door assemblies required to be fire-protection rated and exceeding size limitations of labeled assemblies.

1.4 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: Test at atmospheric pressure.
 - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 3. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.
- C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Doors and Frames:
 - a. Approved companies accepted by the Engineer.

2.2 MATERIALS

- A. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), consisting of two 0.053 inch (1.3 mm) thick face.
- C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless), consisting of 0.067 inch (1.7 mm) thick face.
- D. Door Louvers: Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - 1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - 2. Lightproof Louvers: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
 - 3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible links and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by the same testing and inspecting agency that established fire-resistance rating of door assembly.

- E. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.067-inch- (1.7-mm-) thick steel sheet for:
 - 1. Level 3 steel doors.
 - 2. Wood doors.
- C. Frames of 0.093-inch- (2.3-mm-) thick steel sheet for:
 - 1. Level 4 steel doors.
- D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- E. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- F. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
- G. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
- C. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
 - 1. Metallic-coated steel sheet where indicated.
- D. Core Construction: One of the following manufacturer's standard core materials that produce a door complying with SDI standards:
 - 1. Vertical steel stiffeners with rock wool.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Single-Acting, Door-Edge Profile: Beveled edge.
- H. Double-Acting, Door-Edge Profile: Round vertical edges with 2-1/8-inch (54-mm) radius.
- I. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- J. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- K. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- L. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.
- M. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified according to ASTM E 413.
 - 1. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or better.

- N. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.
- O. Frame Construction: Fabricate frames to shape shown.
1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 2. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 3. Provide terminated stops, unless otherwise indicated.
- P. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- Q. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- R. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.
- S. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.6 FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
1. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- B. Doors and frames and all exposed steel members are to be of powder coated finish. Items indicated for powder coating, thickness of coating shall be minimum 60 microns (to be measured according to QUALICOAT regulation).

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
 2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 3. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
 4. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 5. For in-place gypsum board partitions, install knock-down, drywall slip-on frames.
 6. Install fire-rated frames according to NFPA 80.
 7. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
 1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
 2. Smoke-Control Doors: Install to comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

- A. Prime -Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 6 - INTERIOR PAINTING

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Particular Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of exposed interior items and surfaces.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, the Engineer will select from standard colors and finishes available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - a. Toilet enclosures.
 - b. Finished mechanical and electrical equipment.
 - c. Light fixtures.
 - d. Elevator entrance doors and frames.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Utility tunnels.
 - d. Pipe spaces.
 - e. Duct shafts.
 - 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
 - 4. Operating parts include moving parts of operating equipment and the following:

- a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections include the following: Division 9 Section "Portland Cement Plaster". Division 9 Section "Gypsum Board".
Division 9 Section "Architectural wood works" Division 8 Section "Wood doors"
Division 9 Section "High-Performance Coatings".

Refer to the finishing schedule for locations of application.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
- 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
- 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Submit a complete method statement and materials submittal with detailed specification compliance sheet, for Engineer's approval.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product to be replaced. Include a detailed comparison of physical properties, qualities and performance characteristics between specified and proposed comparable paint product, including as a minimum:
- 1. Chemical composition and properties.
 - 2. Opacity.

3. Cleanability.
 4. Scrub resistance, wet and dry
 5. Adhesion.
 6. Exposure resistance.
- D. Samples for Initial Selection: For each type of finish-coat material indicated.
1. After color selection, Contractor shall furnish color chips for surfaces to be coated.
 - a. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 2. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 3. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
 4. Submit 3 Samples on the following substrates for Engineer's review of color and texture only:
 - a. Concrete / Masonry: 100-by-150-mm Samples for each color and finish.
 - b. Painted Wood: 200-mm- square Samples for each color and material on hardboard.
 - c. Stained or Natural Wood: 100-by-200-mm Samples of natural- or stained-wood finish on representative surfaces.
- E. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Performance Of Paints: Paints shall be fit for purpose and manufactured specifically for the applications indicated and uses intended, taking into account the type, nature, location, and aesthetic and utility requirements of the project
 - a. Opacity: paint shall cover or hide the substrate to the Engineer's satisfaction.
 - b. Cleanability: paint shall not absorb dirt and shall be capable of being washed or scrubbed periodically, to the Engineer's satisfaction, without adverse effect on its attributes or appearance.
 - c. Scrub resistance wet and dry: paint shall resist abrasion caused by scrubbing in accordance with ASTM D 2486.
 - d. Adhesion: paint shall adhere firmly to the substrate without peeling.

- D. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required.
- 2. Engineer will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least 9 sq. m.
 - b. Small Areas and Items: Engineer will designate items or areas required.
- 3. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, Engineer will use the room or surface to evaluate coating systems of a similar nature.
- 4. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 7 deg C. Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 10 and 32 deg C.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 7 and 35 deg C.
- C. Do not apply paint in rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 3 deg C above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 WARRANTY

- A. Special Warranty for Painting works: The Contractor shall provide a guarantee of material and workmanship for all painting works provided under this Contract.

PART 2- PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Manufacturers' Names:
 - 1. Jotun
 - 2. Sipes
 - 3. Tinol
 - 4. DULUX
 - 5. Or approved equal

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- A. Colors: As selected by the Engineer from manufacturer's full range.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Engineer about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Concrete, External Portland Cement Plaster and Concrete Masonry. Prepare concrete and concrete masonry blocks, surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 - c. For concrete surfaces and external plaster apply a priming coat and fill

- blow holes, minor cracks and other surface defects with compatible stucco and rub down flush with surface.
 - d. For concrete masonry surfaces, fill holes, cracks and other surfaces defects with block filler flush with surface and apply one coat of the filler to fully cover paint area.
- 3. Internal Portland Cement Plaster:
 - a. Clean the surface and remove efflorescence, chalk, dust, dirt, grease or oils. Smooth the surface with sand papers or abrasive papers and remove trowel marks if any. Clean the surface and apply a priming coat. Apply two coats of compatible stucco in both directions, vertical and horizontal and sand as required to obtain perfect smooth uniform surfaces. Use putty/block filler where required or directed by the Engineer.
- 4. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges and corners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- a. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - b. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - c. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total

dry film thickness of the entire system as recommended by manufacturer.

- E. Block Fillers: Apply block fillers to concrete and concrete masonry block at a rate to ensure complete coverage with pores filled.
- F. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been primecoated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- G. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
- I. Provide satin finish for final coats.
- J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

- A. Engineer reserves the right to invoke the following test procedure at any time and as often as Employer deems necessary during the period when paint is being applied:
 - a. Engineer will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 - b. Testing agency will perform appropriate tests for the compliance with product requirements.
 - c. Engineer may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 - a. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Engineer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - a- After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

3.7 PARTICULAR SPECIFICATIONS

A. WALL PUTTY

- a- Surfaces where indicated shall receive one or more applications of putty filler until smooth surface is obtained to the Engineer's approval.

B. ACRYLIC PAINT

- a- Provide, store and apply acrylic paint to substrates with the following requirements complementary to the general specifications including all needed materials, accessories, tools and scaffolding.
- b- Acrylic based semi-gloss finish to be used in water solvent paint systems applied on interior columns, walls and ceilings.

Color : To the selection of the Engineer

Finish : Flat, unless otherwise specified

Recommended thinner : Sweet water

Description : High quality acrylic latex paint, 100% acrylic latex resin, durable, mildew resistant, alkaline resistant. Semi-gloss water borne thixotropic paint based on pure acrylic emulsion.

Mass density	:	Approx. 1.36 g/cm ³
Solid contents colours	:	Approx. 40 % by volume depending on
Over coating intervals	:	min. 3 hours
Flash point	:	None
Shelf time	:	Over 1 year
Type of application	:	Synthetic brush or medium nap roller
Primer	:	As per Manufacturer recommendations
Number of coats and	:	As per Manufacturer's recommendations to the satisfaction of the Engineer
Plastered walls and ceilings	:	Cleaning - Primer Putty - Sanding - - Undercoat - Putty Sanding - Paint - - Checking - Paint.
Masonry Concrete	:	Cleaning - Masonry filler - Sanding - Undercoat - Putty - Sanding - Paint - Paint, unless otherwise recommended by the Manufacturer.

Note: Use putty wherever required by the Engineer.

1. Concrete: Provide the following paint systems over cementitious surfaces:

- a. Flat Acrylic Finish: primer + undercoat + 2 finish coats.
 - b. Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.025mm.
 - c. Undercoat: same material for finish coats specified hereafter diluted to the manufacturer's recommendations.
 - d. First and Second Coats: Flat, acrylic latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.060mm per coat.
6. Gypsum Board: Provide the following finish system over interior gypsum board surfaces:
- a. Flat Acrylic Finish: primer + undercoat + 2 finish coats.
 - b. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031mm.
 - c. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.060mm.
7. Plaster: Provide the following finish systems over new, interior Portland cement plaster surfaces:
- a. Flat Acrylic Finish: primer + undercoat + 2 finish coats.
8. Primer: Alkali-resistant, acrylic-latex, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.036mm.
9. Undercoat: same material for finish coats specified hereafter diluted to the manufacturer's recommendations.
10. First and Second Finish Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.064mm per coat.

C. EMULSION PAINT

- 1 Provide, store and apply emulsion paint to substrates with the following requirements complementary to the general specifications including all needed materials, accessories, tools and scaffolding.
2. Emulsion paint, to be used in water solvent paint systems applied. Colors and finishes : To the selection of the Engineer
Description : High quality acrylic copolymer based emulsion paint. Alkaline resistant and

washable.

Mass density	:	Approx. 1.3 g/cm ³ ,
Solid contents	:	39 % by weight , depending on colors
Over coating intervals	:	min. 2 hours
Clean-up solvent	:	Soap & water
Type of application	:	Spray, brush or roller
Number of coats	:	To the satisfaction of the Engineer and the following minimum application Primer + 2 coats putty + undercoat + 2 finishcoats

D. Woodwork and Hardboard: Provide the following paint finish system over new, interior woodsurfaces:

1. Semigloss Acrylic-Enamel Finish: 2 finish coats over a wood undercoat.

- a. Undercoat: Alkyd- or acrylic-latex-based, interior wood under coater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031mm.
- b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.066mm.

2. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a wood under coater.

- a. Undercoat: Alkyd, interior enamel under coater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.031mm.
- b. First and Second Coats: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 0.061mm.

E. Stained Woodwork: Provide the following stained finishes over new, interior woodwork:

1. Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood

filler before applying stain.

- a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
 - b. Stain Coat: Alkyd-based, interior wood stain applied at spreading rate recommended by the manufacturer.
 - c. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
 - d. First and Second Finish Coats: Alkyd-based or polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the manufacturer.
- F. Natural-Finish Woodwork: Provide the following natural finishes over new, interior woodwork:
- 1. Polyurethane, Satin-Varnish Finish: 2 finish coats of a polyurethane, clear-satin varnish over a sanding sealer. Provide wood filler on open-grain wood before applying first varnish coat.
 - a. Filler Coat: Paste-wood filler applied at spreading rate recommended by the manufacturer.
 - b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
 - c. First and Second Finish Coats: Polyurethane varnish, as recommended by the manufacturer, applied at spreading rate recommended by the
 - d. manufacturer.

END OF SECTION

SECTION 7 - PAINTS AND COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- B. Painting and Decorating Contractors of America:
 - 1. PDCA - Architectural Painting Specification Manual.
- C. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

- A. General Requirements: Requirements for submittal procedures.
- B. Product Data: Submit data on finishing products and special coating.
- C. Samples:
 - 1. Submit two paper chip samples each 300 x 300 mm, illustrating color range and textures available for each surface finishing product scheduled.
 - 2. Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded.
- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, and substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

- A. General Requirements: Execution requirements for closeout procedures.
- B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Applicator: Company specializing in performing work of this section with minimum five years documented experience.

1.7 MOCKUP

- A. General Requirements: Quality requirements for mock-up.
- B. Construct mockup panel, size as directed by the Engineer, illustrating special coating color, texture, and finish.
- C. Construct door and frame assembly illustrating painting, stain and varnish, coating color, texture, and finish.
- D. Locate where directed by the Engineer.
- E. Remove mockup when directed by the Engineer.

1.8 PRE-INSTALLATION MEETINGS

- A. General Requirements: Administrative requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

- A. General Requirements: Product requirements for product storage and handling.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Storage of Paint Materials: Store at minimum ambient temperature of 7°C and maximum ambient temperature of 32°C in ventilated area, and as required by manufacturer's instructions.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. General Requirements: Product requirements.
- B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- C. Do not apply exterior coatings during rain/snow, or when relative humidity or moisture content of surfaces exceed those required by paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 7°C for interiors; 10°C for exterior, unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 18°C for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 860 lx measured mid-height at substrate surface.

1.11 SEQUENCING

- A. General Requirements: Requirements for Work sequence.
- B. Sequence application to the following:
 - 1. Do not apply finish coats until paintable sealant is applied.
 - 2. Back prime wood trim before installation of trim.

1.12 WARRANTY

- A. General Requirements: Execution requirements for product warranties and bonds.
- B. Furnish five-year manufacturer warranty for paints and coatings.

1.13 EXTRA MATERIALS

- A. General Requirements: Execution requirements for spare parts and maintenance products.
- B. Supply 4 liters of each color, type and surface texture; store where directed.
- C. Label each container with color, type, texture and room locations in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Paint, Transparent Finishes, Stain, Primer Sealers, Block Filler, and Field Catalyzed Coatings Manufacturers: Any internationally recognized manufacturers having an official technical agreement to conformity with standards for the products.
- B. Furnish materials as specified, as shown on drawings and to Engineer's satisfaction.

2.2 COMPONENTS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; prepare coatings for good flow and brushing properties, capable of drying or curing, and free of streaks or sags.
- B. Use products of the same manufacturer for succeeding coats. Where primer is shop applied to steel, subsequent coats may be the product of another manufacturer provided the coatings are mutually compatible.
- C. Colors, textures and degree of luster shall be as selected by the Engineer. Tint prime and undercoats approximately to the shade of the final coat but with sufficient variation to distinguish them from the preceding coat. Proprietary names used to designate colors or materials, are not intended to imply that products named are required, or to exclude equal products of other manufacturers.
- D. Colors of finishes shall not necessarily be manufacturer's stock colors. All materials for finishing coats shall be factory mixed and shall be of a standard quality equal to that of the standard colors of the material specified.
- E. Specular Gloss Range:
1. Ranges determined in accordance with ASTM D523:

<u>Sheen</u>	<u>Geometry / Degree</u>	<u>Gloss / Range</u>
Flat	85	Below 15
Eggshell	60	5 to 20
Semi-Gloss	60	30 to 65
Gloss	60	Over 65
 2. In locations where ambient temperature and humidity conditions encourage the ready formation of mildew, use paints with additional mildew inhibitive agent incorporate during the manufacturing process, of type and in concentration recommended by the paint manufacturer to withstand such mildew formation.
- F. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified.
- G. Patching Materials: Latex filler.
- H. Fastener Head Cover Materials: Latex filler.

2.3 LIME PAINT

- A. Use only natural mineral or earth pigments. Avoid chrome, lead and cobalt pigments in order to avoid chemical reaction and change in color, fading or clump in solution.
- B. Primer: Dilute solution of un-pigmented potassium silicate.
1. 1-part of un-pigmented potassium silicate to 5-parts of water.
- C. Admixtures: Silica sand for best adhesion of silica paint.
- D. Protective Sealing Overcoat: Diluted solution of un-pigmented potassium silicate.

2.4 HIGH-PERFORMANCE COATINGS COMPONENTS

- A. Coatings - General: Furnish complete multi-coat systems formulated and recommended by manufacturer for applications indicated, in thicknesses indicated; number of coats specified does not include primer or filler coat.
 - 1. Lead content: None.
 - 2. Chromium content, as zinc chromate or strontium chromate: None.
 - 3. Maximum VOC content: As required by applicable regulations.
 - 4. Colors: As selected from manufacturer's standard colors or as per Drawings.
- B. Primers: As recommended by coating manufacturer for specific substrate with a minimum of 50 microns dry film thickness.
- C. Shellac: Pure, white type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. General Requirements: Administrative requirements for coordination and project conditions.
- B. Verify surfaces and substrate conditions are ready to receive Work as instructed by product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following values:
 - 1. Plaster and Gypsum Boards: 12 percent.
 - 2. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
 - 3. Wood: 15 percent, measured in accordance with ASTM D 4442.
 - 4. Concrete Floors: 8 percent.

3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.
- C. Marks: Seal with shellac those which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium or tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

-
- F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based, or compatible sealer or primer.
- G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- H. Concrete Floors: Remove contaminations, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Copper Surfaces Scheduled for Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
- J. Copper Surfaces Scheduled for Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Clean and immediately apply vinyl etch primer.
- K. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- L. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- M. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium meta-silicate after thoroughly wetting with water. Allow for drying.
- N. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- O. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- P. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.
- Q. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- R. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- S. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.

-
- T. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
 - U. Glue-Laminated Wood: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
 - V. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with clear sealer or tinted primer.
 - W. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.3 EXISTING WORK

- A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.4 APPLICATION

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- C. Sand wood and metal surfaces lightly between coats to achieve required finish.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- F. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- H. Finishing Mechanical and Electrical Equipment:
 - 1. Refer to Division 15 and Division 16 for schedule of color coding and identification banding of mechanical and electrical equipment, duct, piping, conduit, etc.
 - 2. Paint shop primed equipment.
 - 3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
 - 5. Paint interior surfaces of air ducts and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 - 6. Paint exposed conduit and electrical equipment occurring in finished areas.
 - 7. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

-
8. Color code equipment, piping, conduit and exposed duct work in accordance with requirements indicated or color schedule. Color band and identify with flow arrows, names and numbering.
 9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- I. Install Work as specified, as shown on drawings, in accordance with manufacturer's instructions, and to the satisfaction of the Engineer.

3.5 FIELD QUALITY CONTROL

- A. General Requirements: Quality requirements for testing and inspection services, and execution requirements for testing, adjusting and balancing.
- B. Inspect and test questionable coated areas in accordance with applicable code.

3.6 CLEANING

- A. General Requirements: Execution requirements for final cleaning.
- B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.7 SCHEDULES - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Shop primed items for site finishing are stated under Division 5 (i.e. Section 05500).

3.8 SCHEDULES - EXTERIOR SURFACES

- A. Wood - Painted (Opaque):
 1. One coat of latex or alkyd primer sealer.
 2. Two coats of alkyd or latex enamel, gloss or semi-gloss.
- B. Wood - Transparent:
 1. Two coats of stain.
- C. Wood - Shingles and Shakes:
 1. One coat of stain or clear sealer.
 2. Two coats of clear sealer.
- D. Glue-Laminated Wood and Wood Timber Members:
 1. One coat of stain or sealer.
 2. Two coats of varnish, gloss or semi-gloss.
- E. Pavement Markings:
 1. Two coats of thermoplastic reflectorized paint, yellow or white.
- F. Concrete, Concrete Block, Restored Masonry and Cement Plaster:
 1. One coat of primer sealer latex or alkyd.
 2. Two coats of latex or alkyd, flat.
- G. Gypsum Board and Cement Plaster Soffits:
 1. One coat of primer sealer latex or alkyd.
 2. Two coats of latex or alkyd, flat.

3.9 SCHEDULES - COLORS

- A. As indicated on drawings and/or as selected by the Engineer from manufacturer's range and samples.

END OF SECTION

SECTION 8 - MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Extent of Work: The extent of mechanical work includes but is not limited to the following:
1. Plumbing and fire protection systems.
 2. Air handling units with water heating coils or chilled water coils, air cooled chillers, fan coil units, humidifiers, exhaust fans, ductwork, grilles, diffusers, louvers, registers, filters, etc.
 3. HVAC control systems, including testing, adjusting and balancing.
 4. Water treatment.
- B. Related Work Specified Elsewhere:
1. General Requirements: Section 01010
 2. Joint Sealers: Section 07900
 3. Painting: Section 09900

1.02 COORDINATION OF MECHANICAL WORK

- A. General:
1. Arrange mechanical work in a neat, well-organized manner with piping and similar services running parallel with primary lines of the building construction and with a minimum of 2200 mm overhead clearance in exposed areas.
 2. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.

3. Give right-of-way to piping, which must slope for drainage. Advise other trades of openings required in their work for the subsequent move-in of large equipment of mechanical work.
- B. Coordination Drawings: For locations where several elements of mechanical (or combined mechanical and electrical) work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings (shop drawings) showing the actual physical dimensions (at accurate scale) required for the installation. Prepare and submit coordination drawings prior to purchase-fabrication-installation of any of the elements involved in the coordination.

1.03 QUALITY ASSURANCE

- A. Materials and workmanship shall comply with the applicable requirements of the following:
1. Specifications and drawings.
 2. Codes and standards listed in these specifications.
 3. Local regulations.
 4. Equipment manufacturers instructions.
- B. Welding: Qualify welding procedures, welders and operators in accordance with BS 2971 for shop and project site welding of piping work.
- C. Certification of Welders: No certifications shall be more than 18 months old. The Engineer may accept or reject any certification. Any certification tests required will be conducted at a place and time convenient to both the Contractor and the Engineer.
- D. Brazing: Certify brazing procedures and operators in accordance with BS 1723 for shop and job-site brazing of piping work.
- E. Testing and Coding of welders shall conform to BS 4871, Part 1:1982 and BS 4872, Part 1:1982.

1.04 SUBMITTALS

- A. General: For submittals refer to the requirements specified in related sections.
- B. The Contractor shall, four (4) weeks prior to the date of Substantial Completion, submit to the Engineer for his review two (2) complete sets of the following documents:
1. Prints of all As-built Drawings.
 2. Operation & Maintenance (O & M) Manuals in draft form.

- C. The Engineer shall review the submission and shall advise his comments or approval in writing within 30 days. The Contractor shall finalize the documents strictly on the basis of the Engineers' comments (if any) and shall submit the undernoted documents not later than 30 days from the date of Substantial Completion:

1. Two (2) complete sets of prints of As-Built Drawings in specified binders.
2. One (1) complete set of transparencies of As-Built Drawings.
3. All 'As-Built Drawings' shall be prepared on Autocad Version 15 or above. All the drawings shall also be submitted to the Engineer in electronic form (CD's) in addition to the 2 sets of prints.
4. One (1) complete set of original specimen of Operation & Maintenance Manuals as reproducibles.
5. Two (2) sets of copies of O & M Manuals.

Where it is not possible to finalize the As-Built Drawings until after the construction works are completed. These drawings shall be submitted not later than 30 days after the date of Substantial Completion.

The Contractor's submittals shall be subject to the Engineers final review and approval. In the event of protracted delays in the finalization of the O & M Manuals and As-Built Drawings and if these delays are attributable to the Contractor's lack of response, the Engineer shall make appropriate arrangement for other specialist to complete the documentation and the cost of such work shall be borne by the Contractor. Additionally, the Contractor at his own cost, shall provide the necessary mechanical and electrical plant attendance and maintenance until such time the complete set of O & M Manuals and As-Built Drawings are accepted by the Engineer.

- D. Operation and Maintenance Manuals: Submit operation and maintenance manuals, including flow diagrams, wiring diagrams, maintenance instructions, operating instructions, parts listings, and copies of other submittals indicated for inclusion. Organize each maintenance manual with index and thumb-tab marker for each section of information; bind in 50 mm, 4-ring, vinyl-covered binder with pockets to contain folded sheets, properly labelled on spine and face of binder.
- E. As-Built Drawings: The Contractor shall maintain at the job site one set of full size Contract Drawings, marked to show any deviations which have been made from the Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the Contract Drawings. These drawings shall be available for review by the Engineer at all times. As-built drawings shall comply with the requirements of Section 01010.

- F. Spare parts Lists: The Contractor shall provide recommended spare parts lists for two years, prepared by the manufacturers, for all the mechanical systems.

1.05 PAINTING

- A. General: Unless otherwise specified herein, carry out painting work in compliance with the specified requirements of Section 09900 "PAINTING".
- B. Coordination: Coordinate the painting with the painting of other work of a similar nature, and comply with indicated colour and colour matching requirements. Except as otherwise indicated, paint surfaces of mechanical work which would normally be painted with the application and exposure indicated.
- C. Painting Requirements: Paint the following categories of mechanical work which have not been fully factory-finished, except paint over factory finish which is not an acceptable color.
1. Accessible ferrous metal, regardless of whether exposed or concealed behind ceilings, shaft enclosures or similar finish construction; exclusive of cast iron which is to be either concealed or set flush with floors or decks.
 2. Zinc-coated (galvanized) metal surfaces; but excluding surfaces which are to be concealed.
 3. Aluminium surfaces which have not been specifically anodized as a final finish, but excluding surfaces which are to be concealed.
 4. Concrete, but only where adjacent non-mechanical-work concrete of a similar placement is required to be painted.
 5. Insulation on piping, ductwork, equipment and similar work; but excluding concealed surfaces and aluminium foil faced insulation.
 6. Paint inside of ductwork black, where it can be seen from occupied spaces through grilles or louvers (under any lighting condition).
 7. Do not paint over name plates on equipment, sliding/rotating shaft surfaces non-ferrous hardware/accessories/trim, and similar items where painting would normally be omitted.
 8. Paint piping (insulated and plain) in mechanical rooms and similar spaces the color required to comply with color-coding requirements of BS 1710.

END OF SECTION

SECTION 9 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

1.3 DEFINITIONS

- A. Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: For each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Wiring diagrams from manufacturer for electrically operated units.
- C. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.
 - 1. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.

- B. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.
- C. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- D. Coordinate with architectural drawings in color selection and installation of plumbing fixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.
- B. Store plumbing fixtures on elevated platforms in dry location.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURE STANDARDS

2.2 LAVATORY

Vitreous china, with Pedestal, with one hole for mixer as selected and supplied by interior decorator, complete with following trim and accessories:

- 1/2" single hole chrome plated monobloc mixer with fixed cast spout projection 132 mm with pull-knob 1 1/4" diameter pop-up waste.
- 1 1/4" chrome plated P-trap with wall tube and wall flange, adjustable type.
- Trap cover, white.
- Two 1/2" chrome plated angle valves with 300 mm long tubes and wall flanges, grohe or approved equal.
- Shelf.
- Mirrors, European make .
- Soap dish.

2.3 WATER CLOSET

A. Water closet shall be white vitreous china washdown siphonal action floor mounted vertical outlet with two (2) levels 6 lit flushing tank shall be complete with the following:

- Chrome plated water supply angle valve.
- Supports and all pipe works and accessories required for its installation, connection to water supply and drainage, supports, fixing its satisfactory operation.
- White solid plastic seat and cover complete with chrome plated hinge, rubber washers and plastic screws and nuts.
- 3/8" angle valve with 300 mm long tube.
- Toilet paper holder.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Include fitting insulation kits for accessible fixtures according to the following:
 - 1. Lavatories: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
 - 2. Lavatories: Cover hot-water supply, stop and handle, drain, trap, and waste to wall.
 - 3. Sinks: Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall.
 - 4. Sinks: Cover hot-water supply, stop and handle, drain, trap, and waste to wall.
 - 5. Fixtures with Offset Drain: Cover hot- and cold-water supplies, offset drain, trap, and waste to wall.

6. Fixtures with Offset Drain: Cover hot-water supply, offset drain, trap, and waste to wall.
7. Other Fixtures: Cover exposed fittings below fixture.

3.3 PLUMBING FIXTURE INSTALLATION

- A. Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.
- B. Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.
- C. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.
- D. Install floor-mounted, back-outlet water closets with fittings and gasket seals.
- E. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.
- F. Install toilet seats on water closets.
- G. Install wall-hanging, back-outlet urinals with gasket seals.
- H. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.
- I. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- J. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.
- K. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.
- L. Fasten recessed, wall-mounted fittings to reinforcement built into walls.
- M. Fasten wall-mounted fittings to reinforcement built into walls.
- N. Fasten counter-mounting plumbing fixtures to casework.
- O. Secure supplies to supports or substrate within pipe space behind fixture.
- P. Set shower receptors and mop basins in leveling bed of cement grout.
- Q. Install individual stop valve in each water supply to fixture. Use gate or globe valve where specific stop valve is not specified.

1. Exception: Omit stop valves on supplies to emergency equipment, except when permitted by authorities having jurisdiction. When permitted, install valve chained and locked in OPEN position.
- R. Install water-supply stop valves in accessible locations.
- S. Install faucet, laminar-flow fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.
- T. Install supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- U. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.
- V. Install shower, flow-control fittings with specified maximum flow rates in shower arms.
- W. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.
- X. Install disposers in sink outlets. Install switch where indicated, or in wall adjacent to sink if location is not indicated.
- Y. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- Z. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.
- AA. Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealants." Match sealant color to fixture color.
- BB. Comply with ADA requirements for installation of fixtures in areas accessible to the handicapped.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 15 Sections.

- B. Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.
- C. Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.
- D. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 16 Sections.

3.5 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.6 ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Clean fixtures, faucets, and other fittings, including flush tanks, with manufacturers' recommended cleaning methods and materials. Include the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from flush tanks and drains.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities, except when approved in writing by the Engineer.

END OF SECTION

SECTION 10 - ELECTRIC WATER HEATERS

1.01 WARRANTY

- A. Materials and Workmanship:
 - A. Commercial, Electric, Domestic-Water Heaters: Two years.
 - B. Residential, Electric, Domestic-Water Heaters: Two years.

1.02 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - A. Tank : Non ASME-code, steel.
 - B. Horizontal or Vertical arrangement.
 - C. Pressure Rating: 150 psig (**1035 kPa**).

1.03 RESIDENTIAL, ELECTRIC, domestic-WATER HEATERS

- A. Residential, Small-Capacity, Electric, Domestic-Water Heaters: Corrosion-resistant metal or steel with corrosion-resistant coating with 150-psig (1035-kPa) pressure rating.

1.04 DOMESTIC WATER HEATER ACCESSORIES

- A. Drain Pans: Corrosion-resistant metal with raised edge.
- B. Piping-type heat traps.
- C. Heat-trap fittings.
- D. Manifold kits.
- E. Combination temperature-and-pressure relief valves.
- F. Domestic-water heater mounting brackets.

1.05 APPROVED MANUFACTURERS

- A. Hot Water Storage Tanks and Accessories: TCTI, Flammco or Equivalent

END OF SECTION

SECTION 11 - SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Conditions of Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 DEFINITIONS

- A. Evaporator-Fan Unit: The part of the split-system air-conditioning unit that contains a coil for cooling and a fan to circulate air to conditioned space.
- B. Compressor-Condenser Unit: The part of the split-system air-conditioning unit that contains a refrigerant compressor and a coil for condensing refrigerant.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
 - 1. Sample Warranty: Copy of manufacturer's proposed warranty, stating obligations, remedies, limitations, and exclusions.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units of sections of units showing the full range of colors available for units with factory-applied color finishes.

- D. Maintenance Data: For split-system air-conditioning units to include in maintenance manuals specified in Division 1.
- E. Warranties: Warranties specified in this Section.QUALITY ASSURANCE
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered.
- G. Paint finish shall be suitable for hot and humid climates. Unit shall be capable and suitable of working at outdoor ambient temperature of 37 deg. C.
- H. Sound-power-level, decibels reference, 10 to the minus 12 power watt, at the fan operating speed selected to meet the specified capacity. Sound level shall not exceed 40dBa at low speed and 48dBa at high speed.

1.5 WARRANTY

- A. Manufacturer's Warranty: Provide written warranty, signed by manufacturer agreeing to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

The manufacturer to be a reputable company with over 10 years of production history of the brand name . The manufacturers to be one of the below or an approved equivalent:

1. Carrier
2. Daikin
3. Fuji
4. Haier
5. Hisense

6. Trane

2.2 WALL- OR CEILING-MOUNTED, EVAPORATOR-FAN COMPONENTS

- A. Cabinet: Decorative standard manufacturer cover with removable panels on front and ends, and discharge drain pans with drain connection.
- B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240 or equivalent Eurovent codes, and with thermal-expansion valve.
- C. Fan and Motor: Centrifugal fan, directly driven by multispeed, electric motor with integral overload protection; resiliently mounted.
- D. Filters: manufacturer standard permanent, washable, cleanable type in aluminum frames.
- E. Remote control unit with wall mounting accessories

2.3 FLOOR STANDING, EVAPORATOR-FAN COMPONENTS

- A. Cabinet: Floor-mounted type with corrosion-resistant finish, suitable for exposed installation. Includes drain pan and front access panel.
- B. Refrigerant Coil: Copper tubes with hydrophilic aluminum fins, 3-row design with inner-grooved tubes.
- C. Fan and Motor: Direct-drive centrifugal fan with multi-speed motor.
- D. Filters: Manufacturer's standard washable type.
- E. Control: Supplied with remote control unit and wall mounting accessories.

2.4 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

- A. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: scroll rotary
 2. Inverter driven
 3. High efficiency type with COP above 3
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
- D. Fan: Aluminum-propeller type directly connected to motor.
- E. Motor: Permanently lubricated, with integral thermal-overload protection.
- F. Refrigerant: low GWP R32 or equivalent

2.5 ACCESSORIES

- A. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

EXECUTION

2.6 INSTALLATION

- A. Install the units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounted, compressor-condenser components on minimum 100 mm thick, reinforced concrete base; 100 mm larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3, "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- D. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 25 mm.
- E. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

2.7 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.
- D. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

2.8 FIELD QUALITY CONTROL

- A. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

2.9 COMMISSIONING

- A. Engage a factory-authorized service representative to perform startup service, and report results in writing.
- B. Verify that units are installed and connected according to the Contract Documents.
- C. Lubricate bearings, adjust belt tension, and change filters.

- D. Perform startup checks according to manufacturer's written instructions and do the following:
1. Fill out manufacturer's checklists.
 2. Check for unobstructed airflow over coils.
 3. Check operation of condenser capacity-control device.
 4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

2.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Employer's maintenance personnel to adjust, operate, and maintain split-system air-conditioning units. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

SECTION 12 - LIGHTING INSTALLATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract including "Conditions of Contract" and "General Requirements" specification sections, shall apply to this section.

1.2 SCOPE

- A. Work is deemed to include supply and installation of:
 - 1. Lighting fixtures.
 - 2. Wires/cables including protective earthing conductors, conduits, trunking and other raceways and fittings from outlet back to upstream outlet or to final branch circuit panelboard.
 - 3. Lamps.
 - 4. Fixing and supporting materials.
- B. All fixtures are to have two cable entry holes.
- C. Application: Lighting fixtures used in Chlorination room are to be rated for use in corrosive atmosphere
- D. Lighting Levels:
 - 1. The required lighting levels and color temperatures are the following:
 - ✓ Transformer room: 400 lux
 - ✓ Electrical room: 400 lux
 - ✓ Technical Room: 300 lux
 - 2. The uniformity ratio should be in accordance with CIE standards.

1.3 SUBMITTALS

The following data (but not limited to) shall be submitted for approval:

- 1. Details on each fixture, lamp and control gear including manufacturer's catalogue cuts, catalogue number, rating, material specification, overall dimensions, operating characteristics, photometric data, etc.
- 2. Installation details.

APPROVED MANUFACTURER

- ✓ PHILIPS (NETHERLANDS)

- ✓ MAZDA (FRANCE)
- Or other equal approved.

1.4 LIGHTING FIXTURES

- A. Unless otherwise specified, fixtures are to be manufacturer's standard series. Fixtures are to be fabricated, assembled and wired entirely at the factory. Site work is to be restricted to reassembling parts dismantled at the factory for packing and transportation.
- B. Housing is made of not less than 0.6 mm thick sheet steel. Sheet steel for reflectors should not be less than 0.8 mm thick. Aluminum sheet for reflectors should not be less than 1.0 mm thick.
- C. Light reflecting surfaces are to be finished with white baked enamel paint having a reflection factor not less than 80%. Finish is to withstand 72 hours exposure to an ultra-violet RS lamp placed 100 mm from surface.
- D. Wiring to be not less than 1mm², insulated for 220 V supply. Wiring is to be terminated on screw type insulated, terminal blocks.

1.5 LED LAMPS

- A. Within the Luminaires:
 - 1. The light source shall be high white Light Emitting Diodes (LEDs) with individual minimum efficacy of at least 100 lm/W arranged modularity to provide the required lighting output. All lumen figures shall be delivered {Hot} Lumens.
 - 2. The LEDs shall be from a reputed manufacturer of LEDs with proven past performance in accordance with ANSI/NEMA/ANSI C78.377-2008 – (American National Standard for Chromaticity of Solid-State Lighting Products) or similar approved International Standard.
 - 3. They shall only be from MacAdam Ellipse Step-3 or Step-4 Bins. Step-7 Binning is not acceptable.
 - 4. The CRI ≥ 70 .
 - 5. The LEDs shall be removable/replaceable on site by modular means without any possible risk to maintaining luminaire photometry and without the need to demount the fixtures for sake of future upgrading/maintenance requirements.
- B. Whole Luminaire Efficacy:
 - 1. The optimum efficiency of the luminaire shall be confirmed as follows:
 - 2. Minimum luminaire efficacy shall be $\geq 75 \text{ lm/cctW}$ (@ min 50°C, min 95%RH).
 - 3. Which is given as Total Luminaire Design (Deliver) Lumen Output (lm) over Total Luminaire Circuit Watts (cctW) at minimum 50°C Operating outside Ambient Temperature and minimum 95% Relative Humidity.

4. The efficacy being stated at minimum 50°C (Greater than or equal to 75 lm/cctW) should be supported by a thermal test report for the luminaire. This report should provide percentage depreciation of light output at 50°C from testing value of 25°C or 35°C. This can be compared with LM-79 efficacy at lab temperature from photometric report and derated. The effect on the driver case temperature at minimum 50°C should also be shown.

C. Optical Control:

1. Luminaire shall be fitted with optical refractors, diffusers and/or reflectors.
2. Different optics shall be proposed to exactly suit the specific applications.
3. Independent laboratory photometric test reports shall be submitted for the luminaire photometric files used in the lighting calculations. The testing should conform to IESNA LM-79-08 standards.

D. Thermal Management:

The LED modules shall be mounted on heavy duty heat sinks to ensure excellent heat dissipation. The design of the heat sinks shall be such that there is a direct thermal path from the LED junctions to the atmosphere, thus providing a thermal transfer effect throughout the life of the luminaire. The heat sinks shall be proprietary and designed by the lighting manufacturer to enable the luminaires to work efficiently in local climatic conditions. The luminaire shall be provided with a demonstrated ventilation arrangement allowing heat to be dissipated to the atmosphere. The luminaire shall be designed to prevent collection of debris on the heat sinks by proven and stated means.

- E. The Manufacturer shall provide test certification in accordance with "IEC 60068 – 2 68 Part 2 Test L: Dust and Sand" and should be submitted by the manufacturer from an independent / independently certified test laboratory. The test certificate should provide evidence that the heat increase inside the housing enclosure with dust and sand, should not be more than 10% of the heat inside without accumulation and with no adverse effect on the lifetime of the luminaire and components.

- F. The design shall be such that the luminaire shall be self-cleaning in normal operation. The luminaire shall be provided with heavy-duty rugged cast aluminum adjustable slip fitter mountable to suit the proposed pole. The Contractor shall coordinate with the LED fitting manufacturer and pole manufacturer to make sure complete compatibility of the products.

G. Ingress Protection:

1. The LED Fixture Driver and LED Engine/optical unit components shall be externally fully rated at a minimum of IP-65 (with the driver or driver housing to have a minimum rating of IP-66) and have proven means of negating internal condensation build-up.
2. They shall have a minimum mechanical strength rating of IK-07 (minimum IK-08 required for all glass components). All synthetic materials shall be 100% UV stable and scratch resistant.

H. Copper Content:

All Aluminum Die-cast components shall have a very low copper content of less than 0.1% for corrosion resistance or similar proven methodology of protection.

I. LED Sources Technical Requirements:

i. Within the fixture, the LED sources shall meet the following requirements:

1. Operating temperature rating shall be between $[-40^{\circ}\text{C}]$ and minimum $[+50^{\circ}\text{C}]$ at a minimum 95% Relative Humidity (RH).
2. Storage (i.e., non-operating/daytime) temperature: all LED components to be designed to tolerate between $[-40^{\circ}\text{C}]$ and minimum $[+80^{\circ}\text{C}]$ at a minimum 95% Relative Humidity (RH).
3. Correlated Color Temperature (CCT): 4000-6000K
4. Color Rendering Index (CRI): ≥ 70 .

ii. Luminaire manufacturer shall submit reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed Joint Electron Devices Engineering Council (JEDEC), or similar International approved equivalent; reliability tests on the LEDs as follows. Factory prerelease test reports shall be provided from the LED manufacturer duly complying with JEDEC JESD22-A108C, or equivalent, for operating life tests at 85°C ambient temperature and also for humidity and salt atmosphere corrosion tests. Standards and tests used must be stated.

J. LED Drivers Technical requirements:

1. Drivers shall be 1-10V dimmable and have a minimum efficiency of 85%.
2. Case (T_c $^{\circ}\text{C}$) Temperature rating $[-40^{\circ}\text{C}]$ to minimum $[+80^{\circ}\text{C}]$ and at a minimum 95% Relative Humidity (RH). Driver/Fixture to have some means of built-in overheat thermal protection in the form of automatic dimming or stepping/holding down of the driver where temperature exceeds operational limits. Thermal cut-out devices which turn the fixture LEDs completely off are not acceptable.
3. The driver and driver output current must be shown to be fully tested and compatible with the exact LED chips/engine of the luminaire. All information provided and the cost analysis/payback calculations should be calculated with the exact drive current including the calculation for the cycle, life and resultant increase or decrease of the energy consumption if applicable.
4. Input Voltage: Capable of 120-277 Volt, single phase, or as required by the site.
5. Power supplies can be UL Class 1 or II output, or similar European CE or International equivalent.
6. Surge Protection: Must be tested in accordance to the requirements of IEEE/ASNI C62.41.2-2002, Scenario I, Location Category C, or international equivalent.
7. Drivers shall have a Power Factor (PF) of $L: \geq 0.90$.

8. Drivers shall comply with non-consumer RFI.EMI standards or equivalent.
 9. Drivers shall be RoHS Compliant.
 10. Drivers shall have a total individual luminaire Harmonic Distortion (THD) of: $\leq 20\%$ in accordance with ANSI C82.77 (2002). However, the Contractor shall measure the harmonic at the supply point (LV side of the distribution substation) after the installation of all the LED street lights and adopt harmonic compensation methods to limit the total harmonics distortion in the supply voltage to maximum 5% as per IEEE 519 Regulations.
- K. Useful Life requirements: The useful life of the luminaire in terms of lumen output must be as specified by one of the following two methods.
1. As per LM-79-08 or approved international equivalent: Simplified B20-L70 threshold. A minimum of 50,000 operating hours before reaching the B20-L70 lumen output degradation point with no catastrophic failures. The B20-L70 lumen output must be capable of providing the luminance level and uniformity.
 2. Site Performance Method: A life time of number of hours specified by the site based on expected site lighting useful life must be capable of providing the luminance levels of uniformity.
- L. Useful Life Testing and Verification Procedure:
- Simplified B20-L70 Threshold: Perform LM-79-08 (or approved international equivalent) testing on the luminaire at both time intervals of 0 hours and 6,000 hours. The luminaire shall be operated continuously in the appropriate UL 1598/153 environment or equivalent except when it is removed to perform the LM-79 light output tests. If the light output determined at 6,000 hours is $\geq 96\%$ of the light output determined at 0 hours, the luminaire meets the simplified B20-L70 threshold for useful life.
- M. Site Performance Method:
- Perform lumen depreciation testing per LM-80-08 (or approved international equivalent) on the light sources (s) (module/array) for a minimum of 6,000 hours (longer testing period is encouraged). Identify the installed (in luminaire) operating temperature of the LED using the T_s point under operating ambient temperature of 50°C. From this interpolated curve, determine the lamp lumen depreciation (LLD) value and useful life that meets the needs of the site defined hours of operation to end of useful life as well as the luminance level and uniformity required.

PART 2 EXECUTION

2.1 INSTALLATION

- A. Install work in accordance with approved standards, as per manufacturer's recommendations, and to the satisfaction of the Engineer.
- B. Fixtures are to be installed aligned, leveled and at uniform heights within one room or area. Fixtures are to be supported with hangers to support weight of fixture.
- C. Exact position of fixtures must be coordinated with the reflected ceiling plan.
- D. Recessed fixtures in suspended ceilings are to be coordinated with exact dimensions of ceiling tiles.

END OF SECTION

The Best Environmental Practice for disposing the Liquid Waste from Kfarchima Laboratory

The current practice of discharging pesticide residues, analytical solutions, formulation samples, equipment washings and laboratory wastewater directly into the sink presents significant environmental, health, and operational risks. Such discharges may result in the contamination of wastewater networks, groundwater resources, and receiving water bodies, while also exposing maintenance personnel and the surrounding environment to potentially hazardous chemical substances. In addition, the accumulation of chemical residues within the drainage system may lead to long-term adverse environmental impacts and non-compliance with applicable environmental and hazardous waste management requirements.

To mitigate these risks, all liquid wastes generated from pesticide analysis, pesticide formulation testing, equipment washing, and laboratory operations should be collected through a dedicated drainage system that is completely segregated from the sanitary sewer network. The collected liquid waste should be conveyed through a dedicated pipeline to a sealed hazardous waste storage reservoir specifically designed for chemical waste containment. The storage reservoir should be routinely inspected, maintained, and emptied by licensed hazardous-waste contractors and the collected waste should be transported, treated, and disposed of at authorized facilities in accordance with applicable environmental regulations and hazardous waste management procedures. This approach will significantly reduce the risk of environmental contamination, improve laboratory safety, and ensure compliance with good laboratory practices and environmental protection requirements.