SCOPE OF WORK

1. Drawings and general provisions of Contract, including General and Special Conditions, apply to all Sections of this Scope of Work.

2. PROJECT DESCRIPTION

The project consists of the construction, delivery, and setup of modular dental unit in city, state. The modular dental unit is to be built to meet all local and state codes for _____. (Special conditions such as: **This modular dental unit will be in a coastal rainforest climate. High winds and rain in excess of 150 inches per year are typical. Design and construction shall take these conditions into consideration.)** The modular dental unit is to meet all National Fire Protection Association (NFPA), Uniform Building Code (UBC), Americans with Disabilities Act (ADA), and the American Institute of Architects (AIA) Guidelines for Design and Construction of Hospital and Health Care Facilities. The concrete pad and utility service lines for the modular dental unit have been provided under a separate contract. All utility service lines terminate in an underground vault, set in the concrete pad. It is the contractors responsibility to connect all utility lines from the utility vault to the modular dental unit.

*3. The Contractor shall submit three sets of construction plans to the (Organization) for review and approval prior to commencing any construction including: *

A. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements. Equipment locations (exposed and concealed), dimensioned from prominent building lines. This Scope of Work includes drawings to assist the Contractor in equipment locations, room sizes, furnishing and other requirements. A copy of these AutoCAD lite drawings are available from the Division of Health Facilities Engineering.

B. **NO CONSTRUCTION SHALL BEGIN UNTIL THE (Organization) APPROVES THE PLANS SUBMITTED BY THE CONTRACTOR. THE CONTRACTOR IS ENCOURAGED TO WORK WITH THE GOVERNMENT THROUGHOUT THE PLAN DEVELOPMENT TO AVOID POSSIBLE DELAYS CAUSED BY REJECTION AND RESUBMITTAL OF CONSTRUCTION PLANS.**

* C. Construction Plans shall be submitted to:

Name
Street Address,
City, State, ZIP **

4. The Modular Dental Unit shall be complete and operable building ready for installation of government furnished and installed dental equipment. All electrical, telephone, computer, domestic water, sewer, air, and vacuum lines shall be stubbed out to locations shown in the drawings. All necessary utilities shall be provided to and capped at locations where the X-ray units (3 ea), Dental Chairs (4 ea), casework (4 assist, 1 center console), dental air compressor, dental vacuum pump, film processor, ultra sonic cleaner, and Panoral will be installed.

5. All Design and construction shall be in accordance with the following minimum design standards:

A. Uniform Building Code (UBC) most recent approved edition.
B. Uniform Plumbing Code (UPC) most recent approved edition.
C. Uniform Mechanical Code (UMC) most recent approved edition.
D. Comply with Mandatory Requirements (See following list of Standards, Laws, Presidential Executive Orders, Departmental Policies).

Life Safety - The Life Safety Code, National Fire Protection Association (NFPA) Publication No. 101, most recent edition, is the minimum life safety standard for all federally-assisted construction programs. The Life Safety Code supplements shall be applied as they are applicable to the particular classification of

facility occupancy. The Life Safety Code, NFPA 101, where state and local codes exceed the requirements of the Life Safety Code, NFPA 101, the more stringent may be followed.

Dental Air/Vacuum System - Dental air and vacuum system shall comply with Standards for Health Care Facilities, NFPA 99, Chapter 4.

Accessibility of Buildings to the Disabled - There is increased public awareness of barriers that make reasonable use of facilities difficult or impossible for the disabled. This has resulted in some national and local requirements for accessibility intended to help insure the rights of all individuals to be self-sufficient. The best known and often used requirements are those based upon American National Standards Institute (ANSI) A117.1, "American National Standard for Accessible and Usable Buildings and Facilities."

State, local, and other standards for accessibility and usability may be more stringent than UFAS. Under Titles II and III of the Americans with Disabilities Act (ADA) public, private, and public service facilities will need to comply with "Accessibility Guidelines for Buildings and Facilities" (ADAAG).

Earthquake Provisions - Occupational Safety and Health Act and Public Law 95-124 - Various legislation concerned with safety implicitly or explicitly, requires consideration of earthquake resistance of structures. Public Law 95-124, "Earthquake Hazards Reduction Act of 1977," requires Federal agencies to use land use planning and construction practices to achieve appropriate earthquake resistance for new and existing structures.

Minimum Guidelines for Health Facilities - Most Recent Edition. The requirements stated in the "Guidelines for Design and Construction of Hospitals and Health Care Facilities" (Published by the AIA Press 1996/1997) are minimum guidelines for constructing and equipping projects for which Federal assistance is requested. These guidelines are necessary to insure properly planned and well constructed health care facilities that can be efficiently maintained and operated to furnish adequate services.

For Federal Programs

Metric System - Metric Conversion Act of 1975 - The Metric Conversion Act of 1975, as amended by the Omnibus Trade and Competitiveness Act of 1988, established the modern metric system (System International or SI) as the preferred system of measurement in the United States. These Acts require that the metric system be used in all Federal procurement, grants, and business-related activities.

* As of January 1, 1994, all construction documents are completely metric in accordance to General Services Administration guidelines. As established in General Services Administration Order ADM 8000.1B, “When metric is not the accepted industry system, soft metric, hybrid, or dual systems will be used during the transistion.”

*

Access to Construction Site - Departmental Policy - The contractor shall allow access to (Organization) officials at all times.

Final Inspection and Closeout - Departmental Policy - Contracting Officer shall conduct a final inspection of the construction to closeout the project.

Energy Conservation - Departmental Policy - This policy has been developed to insure that reasonable energy conservation features are incorporated into facilities receiving Federal financial assistance. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) Standard 90-75 "Energy Conservation in New Building Design" will be used as a minimum standard in performing energy conservation analyses for all federally-assisted construction projects.

Protection of Building Materials - Protect all building materials from physical damage and from

deterioration by moisture, soiling, and other sources. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

6. WORK SEQUENCE

The Contractor shall prepare and coordinate with the (Organization) a Construction Schedule for all work scheduled.

The Contractor shall submit for government approval three sets of construction plans. Construction plans must be approved by the (Organization) prior to commencing construction of the Modular Dental Unit. Approval of plans by the government does not relieve the Contractor of the responsibility for providing a complete and functional Modular Dental Unit in accordance with these specifications.

The contractor shall notify the Contracting Officer fifteen days before construction of the modular unit to allow the government time to arrange for an on-site inspector during the construction. The contractor shall give the (Organization) inspector access throughout construction of the modular dental unit.

The presence of the (Organization) inspector is to record information and possible deficiencies. The (Organization) inspector does not have the authority to approve changes or accept work and the inspector's presence does not relieve the (Organization) responsible for quality control or conformance with the contract.

Prior to transporting the Modular Dental Unit, the contractor shall make arrangement for an inspection by the Contracting Officer. The Contractor must receive written authorization from the Contracting Officer prior to transportation of the Modular Unit.

7. CONTRACTOR USE OF PREMISES

Full (Organization) Occupancy: The (Organization) will occupy the site and existing building during the entire construction period. Cooperate with the (Organization) during construction operations to minimize conflicts and facilitate (Organization) usage. Perform the Work so as not to interfere with the (Organization) operations.

Confine operations to areas within contract limits indicated on drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

Keep driveways and entrances serving the premises clear and available to the (Organization) and the government's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

8. APPROVAL TO TRANSPORT MODULAR BUILDING

A. Provide a minimum of fourteen days advanced notice to the Contracting Officer before date of requested inspection for approval to transport modular building.

B. Inspection Procedures: On receipt of a request for inspection, the Contracting Officer will either proceed with inspection at the factory or advise the Contractor of unfilled requirements. The Contracting Officer will prepare a letter approving the transportation following inspection, or advise the Contractor of construction that must be completed or corrected before the letter will be issued.

1. The Contracting Officer will repeat inspection at the factory when requested and assured that the Work has been substantially completed.

9. FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Contracting Officer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Contracting Officer.
4. Submit consent of surety to final payment.
5. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
6. Obtain and submit releases enabling the unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
7. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, and similar final record information.
8. Deliver tools, spare parts, extra stock, and similar items.
9. Make final change-over of permanent locks and transmit keys to the Government. Advise the (Organization) personnel of change-over in security provisions.
10. Complete start-up testing of systems, and instruction of the (Organization) operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
11. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Reinspection Procedure: The Contracting Officer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Contracting Officer.

1. Upon completion of reinspection, the Contracting Officer will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

10. RECORD DOCUMENT SUBMITTALS

A. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that is important to the Government but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
5. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

B. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Contracting Officer and the Government's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the (Organization) for record purposes. Comply with delivery to the (Organization) Sample storage area.

C. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

11. CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange to meet with the (Organization) personnel to provide instruction in proper operation and maintenance of equipment and building systems. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.

5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

C. Provide Contract Officer with a Certificate of Manufacturer or “Vehicle” Title.

12. FINAL CLEANING

A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

B. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

C. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Government's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

13. MODULAR DENTAL UNITS

A. The project consists of general, mechanical, and electrical work for providing a "Gold Label" modular building, complete with connection of electrical, sewer and domestic water lines. Provide interior improvements, complete with cabinets, appliances, fixtures, electric heat pumps and electric water heaters as shown on the drawings and/or specified.

Exterior stairs and ramp will be provided by others.

1. Manufacturer's standard components may be used, providing components, accessories, and complete structure conform to architectural design appearance shown and to specified requirements.

B. Shop Drawings: Submit complete erection drawings showing anchor bolts settings, sidewall, end wall, and roof framing, transverse cross sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

C. Certification: Submit written Certification prepared and signed by a Professional Engineer verifying that building design meets indicated loading requirements and codes of authorities having jurisdiction.

D. The building shall be constructed at the factory to comply with the "Gold Label" standards as issued by Industries Factory Built Structural Section and in conformance with the following codes and regulations (latest edition):

1. Americans with Disabilities Act (ADA)
2. State and National Electrical Code
3. Uniform Mechanical Code
4. Uniform Building Code
5. Uniform Plumbing Code
6. Uniform Federal Accessibility Standards 41 CFR, 101-19.6

E. Structural Framing: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Building Manufacturers Association's "Design Practices Manual".

F. Structural Steel: For design of structural steel members, comply with requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
1. Welded connections: Comply with requirements of the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

G. Design Loads: Basic design loads over and above dead and collateral loads are to meet all local requirements for wind, snow, and seismic loads for Neah Bay, Washington.

1. Collateral loads include additional dead loads over and above the weight of the building system such as mechanical systems.

H. Manufacturer's Qualifications: Provide portable wood buildings as produced by a manufacturer with not less than 5 years successful experience in the fabrication of pre-engineered wood buildings of the type and quality required.

I. Skirting: To match modular unit siding in color.

* J. Deleted. See Sections 25 and 26.
*

K. Windows: Windows shall be double insulated glazed thermopane glass, tubular sections of extruded polyvinyl chloride frames, fixed windows. Head height shall be 2,032 mm. Location and size shall be per plan and elevation with variances allowed as required by design or code.

L. Water Heater: 190 L high efficiency electric water heater.

M. Painting:

1. All colors to be approved by the Contracting Officer.
2. All exposed exterior woodwork: Heavy bodied stain, two coats.
3. All exterior metal: Factory finished or two coats of paint.
4. Metal exterior doors: Prefinished.
5. Interior GWB: Primer and two coats alkyd enamel, semi-gloss.
6. All exterior siding: Two coats of paint as recommended by siding manufacturer.

N. DENTAL EQUIPMENT

1. Dental equipment will be supplied by the (Organization) and installed by the (Organization). **Delete this sentence if the contractor will furnish and install the dental equipment.**
2. Contractor shall install all necessary electrical connections, and all water, waste, vacuum, and air lines required for the dental equipment and building systems.

14. METAL FABRICATIONS

A. Structural Performance of Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.

B. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

1. Black finish, unless otherwise indicated.
2. Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another grade or weight or both required by structural loads.

C. Fasteners: Select fasteners for the type, grade, and class required.

D. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

E. Fabricate handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.

F. Close exposed ends of pipe by welding 21mm thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 6mm or less.

G. Secure handrails with wall brackets and end fittings. Provide bracket with not less than 38mm clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or at spacing required to support structural loads.

15. ROUGH CARPENTRY

A. For light framing provide "Stud" or "Standard" grade lumber for stud framing of Hem Fir.

B. Framing Standard: Comply with N.F.P.A. "Manual for Wood Frame Construction," unless otherwise indicated.

C. For structural framing, provide the following grade and species: No. 2 grade, Hem Fir.

D. For exposed framing lumber, trim and deck material, provide material complying with the following requirements: Redwood, No. 1 Grade per WWPA rules.

E. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

F. Plywood Backing Panels: For mounting electrical or telephone equipment, provide plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 12mm.

G. Plywood Underlayment for Resilient Flooring (13mm): For underlayment under 15 mm in indicated thickness, provide plywood construction panels with fully sanded face complying with the following requirements: Grade designation: APA UNDERLAYMENT INT with exterior glue.

H. Plywood Underlayment for Carpet (13mm): Provide plywood construction panels in thickness indicated and complying with the following requirements: Grade Designation: APA UNDERLAYMENT INT with exterior glue.

16. SHEATHING

A. Subfloor: APA RATED SUBSHEATHING (16mm, T&G): Exposure Durability Classification: EXPOSURE 1.

B. Wall Sheathing: APA RATED SHEATHING (13mm): Exposure Durability Classification: EXPOSURE 1.

C. Roof Sheathing: APA RATED SHEATHING (13mm): Exposure Durability Classification: EXPOSURE 1.

17. AIR INFILTRATION BARRIER

A. Polyethylene sheet, 0.155mm thick with a moisture vapor transmission rate of 400 grams/sq. meter/24 hrs. per ASTM E 96, procedure B; flame spread and smoke developed ratings of 5 and 10 per ASTM E 84.

18. FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 38mm of bearing on wood or metal.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 1219mm.

C. Cover sheathing with air infiltration barrier as follows:

1. Apply asphalt-saturated organic felt horizontally with 51mm overlap and 152mm endlap; fasten to sheathing with corrosion-resistant staples.

D. Floor Construction:

1. Under Sheathing: Vapor Retarder as specified
2. Floor Joists: As required by design with a minimum of 38 mm x 235 mm at 406 o.c. kiln dried.
3. Subfloor: 16 mm ply sheathing.
4. Underlayment: 13 mm ply underlayment.
5. Vinyl Flooring: Per section 31.F of these Specifications
6. Insulation: R-19 with vapor barrier.

E. Exterior Walls:

1. Exterior Subsheating: 13 mm ply sheathing with vapor barrier.
2. Exterior Siding: Fiber reinforced cement siding.
3. Finish: Prefinished.
4. Wall Framing: 50 mm x 150 mm.
5. Insulation: R-19 with vapor barrier.

F. Interior Wall:

1. Wall Framing: 50 mm x 100 mm.
2. Finish: 16 mm G.W.B., painted.
3. Insulation: R-11, for sound, as indicated on construction documents.

G. Roof Construction:

1. Provide for a pre-engineered roof truss system with 3/12 pitch in accordance with the Contractor's design through Labor & Industries review. The roofing material shall be a metal of a color selected by the Government.
2. Insulation: R-30 with vapor barrier..
3. Ceiling: 610 mm x 1219 mm acoustical panels in T-bar grid..
4. Subsheathing 13 mm Plywood or equal.
5. Gutters and down spouts to be 127 mm continuous. Color to match roof.
6. Roof vents - 356 mm dia.
7. Ceiling - Suspended T-Grid.

19. EXTERIOR STANDING AND RUNNING TRIM AND RAILS

A. Trim and Rails: For trim and rails in form of boards and worked products, provide lumber complying with the following requirements including those of the grading agency listed with species.

1. Species: Western red cedar; WWPA, Grade 1.
2. Texture: Surfaced (smooth).

B. Felt Underlayment: Asphalt-saturated organic felts, unperforated, conforming to requirements of ASTM D 26, Type 1, No. 15.

20. BUILDING INSULATION

A. Provide insulating materials that comply with requirements and with referenced standards. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Unfaced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing); and as follows:

1. Mineral Fiber Type: Fibers manufactured from glass.
2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

21. VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6.0 mils thick, with a maximum permeance rating of 0.2 perms.

B. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 406mm o.c.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an airtight seal between penetrating objects and vapor retarder.

22. MANUFACTURED ROOF PANELS

A. Water Penetration: Provide panel systems with no water penetration as defined in the test method when tested in accordance with ASTM E 331 at an inward static air pressure differential of not less than 6.24 psf and not more than 12.0 psf.

B. Fire Resistance Rating: Provide panel systems that have been tested and listed by design no. in UL "Fire Resistance Directory" for 2-hr. assembly rating.

C. Wind Uplift: Provide roof panel system including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance. To meet local requirements per site location.

D. Finish Warranty: Furnish panel manufacturer's written warranty covering failure of the factory-applied exterior finish on metal wall and roof panels within a twenty year warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

E. Structural Quality Galvanized Steel Sheet: Hot-dip zinc-coated steel sheet complying with ASTM A 446 with G90 coating complying with ASTM A 525, Grade C or to suit manufacturer's standards.

F. Color: As selected by the Contracting Officer from the manufacturer's standard colors.

G. Concealed Clip Roof Systems: Manufacturer's standard factory-formed concealed clip roof system designed for mechanical attachment of panels to roof. Form panels of 24-gage zinc-coated or aluminum-zinc-coated steel sheets. Roof panels shall be standing seams with concealed fasteners and designed for the weather condition previously set out in this scope of work.

H. General: Comply with manufacturers' instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.

1. Apply ice and water dam up minimum 1219 mm from outside face of building wall.

I. Roof Panels shall have a twenty year warranty against defects.

23. SIDING

A. This Section includes the following: Fiber reinforced cement siding.

B. Special Project Warranty: Submit a written warranty, executed by manufacturer, agreeing to repair or replace siding that fails in materials or workmanship within the specified warranty period. Failures include, but are not limited to, deformation or deterioration of siding beyond normal weathering. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

C. Fiber Reinforced Cement Siding: Solid fiber reinforced cement siding:

1. Texture: Woodgrain.

D. Comply with siding manufacturer's installation instructions and recommendations.

24. FLASHING AND SHEET METAL

A. Gutters and downspouts (rain drainage).

B. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 20 gage except as otherwise indicated.

C. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

D. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

E. Gutters and downspouts to be factory finished with color to match metal roof.

25. STANDARD STEEL DOORS AND FRAMES

A. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

B. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.

C. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152 and which are labeled and listed by UL, Factory Mutual, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.

D. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

E. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.

G. Provide metal doors of SDI grades and models specified below or as indicated on drawings or schedules:

1. Exterior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 16-gage galvanized steel faces.

H. Provide metal frames for doors of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 18-gage cold-rolled steel.

I. 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 in accordance with ASTM C 236 or ASTM C 976 on fully operable door assemblies.

26. FLUSH WOOD DOORS

A. Types of doors required include the following:

1. Solid core flush wood doors with wood veneer faces.

B. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction.

C. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall be in effect during following period of time after date of Substantial Completion.
   a. Solid Core Interior Doors: Life of installation.

D. Solid Core Doors for Factory Finish: Comply with the following requirements:

1. Faces: Natural birch, plain sliced.
2. Construction: PC-5 (Particleboard core, 5-ply).

E. Fire-Rated Solid Core Doors: Comply with the following requirements.

1. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
2. Edge Construction: Provide manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.

27. WINDOWS

A. Windows: Extruded tubular plastic sections, factory fabricated, vision glass, related flashings, anchorage and attachment devices.

B. Configuration: Fixed, non-operable

C. Air Infiltration: Limit air infiltration through assembly to 0.03 L/s/sq m of wall area, measured at a reference differential pressure across assembly of 75 Pa as measured in accordance with ASTM E283.

D. Provide five year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Warranty shall also include coverage for degradation of color finish.

E. Plastic: ASTM D4099, **Grade 30**; hollow tubular sections of extruded polyvinyl chloride (PVC), with ultra-violet resistant color coating.

F. Exterior and Interior Surface Color: White

G. See drawings for window schedule

H. Lead Lined Glazing Standard: Where lead glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with local and state codes of each project location. Extent of lead glass is shown on Construction Documents.

1. Warranty Period: Manufacturer's standard but not less than 10 years after date of substantial completion.

28. DOOR HARDWARE

A. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

B. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door

hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

C. Number of Hinges: Provide 3 hinges per door.

D. Standard System: Except as otherwise indicated, provide new masterkey system for Project.

E. Equip locks with manufacturer's standard 6-pin tumbler cylinders.

F. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

G. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system.

H. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated. Provide standard (open) strike plates for interior doors where wood door frames are used.

I. Closers and Door Control Devices:

1. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
2. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
3. Provide parallel arms for all overhead closers, except as otherwise indicated.
4. Access-Free Manual Closers: Where manual closers are indicated for doors provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.

J. WEATHERSTRIPPING AND SEALS

1. Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
2. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified Do not install surface-mounted items until finishes have been completed on the substrates involved.

29. GYPSUM BOARD ASSEMBLIES

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

B. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

C. STEEL FRAMING COMPONENTS FOR SUSPENDED CEILINGS

1. General: Provide components complying with ASTM C 754 for materials and sizes unless otherwise indicated.
2. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
3. Hanger Rods and Flat Hangers: Mild steel and zinc-coated or protected with rust-inhibitive paint.
4. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

D. Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in either 13mm or 16mm thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

1. Gypsum Wallboard: ASTM C 36 and as follows:
   a. Type: Regular for vertical surfaces, unless otherwise indicated.
   b. Type: Type X where required for fire-resistive-rated assemblies.
   c. Thickness: 13mm, unless otherwise indicated.

E. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and following requirements: 1. Sheet steel zinc-coated by hot-dip process; and 2. Cornerbead on outside corners by reference to Fig. 1 designations in ASTM C 1047:

F. JOINT TREATMENT MATERIALS

1. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

G. INSTALLING STEEL FRAMING FOR SUSPENDED CEILINGS

1. Suspend ceiling hangers from building structural members and as follows:
   a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   c. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

d. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

e. Do not connect or suspend steel framing from ducts, pipes or conduit.

2. Sway-brace suspended steel framing with hangers used for support.

3. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.
   a. Wire Hangers: 4mm (8-gage) diameter, 1219mm o.c.
   b. Carrying Channels (Main Runners)): 38mm, 1219mm o.c.
   c. Rigid Furring Channels (Furring Members): 406mm o.c.

4. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

H. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

1. On wood truss system, apply base layers and face layers horizontally (parallel to truss) with joints of base layers located over truss chord and face layer joints offset at least one truss chord member with base layer joints.

2. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows: Fasten with screws.

I. Install corner beads at external corners.

J. Install edge trim where edge of gypsum panels would otherwise be exposed or semiexposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

K. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214. Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and flat paints over light textures.

30. ACOUSTICAL PANEL CEILINGS

A. Fire-Performance Characteristics: Provide acoustical ceilings that are identical to those tested for the following fire-performance characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

2. Fire-Resistance Ratings: As indicated by reference to design designations in UL "Fire Resistance Directory," for types of assemblies in which acoustical ceilings function as a fire- protective membrane and tested per ASTM E 119. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

B. Standard for Acoustical Ceiling Units: Provide manufacturers' standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types,

patterns, acoustical ratings, and light reflectances, unless otherwise indicated. Mounting Method for Measuring NRC: Type E-400 (plenum mounting in which face of test specimen is 400 mm away from the test surface) per ASTM E 795.

C. Fissured Pattern: Units matching pattern indicated by reference to manufacturers' standard pattern designations, with other characteristics as follows: 1) Color/Light Reflectance Coefficient: White/LR 0.80; 2) Edge Detail: Square; and 3) Size: 610mm by 1219mm by 16mm.

D. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

E. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

F. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 12 gage.

G. Hanger Rods: Mild steel, zinc coated, or protected with rust- inhibitive paint.

H. Flat Hangers: Mild steel, zinc coated, or protected with rust inhibitive paint.

I. Angle Hangers: Angles with legs not less than 22mm wide, formed with 0.927mm-thick galvanized steel sheet complying with ASTM A 446, Coating Designation G90, with bolted connections and 24mm-diameter bolts.

J. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow faced suspension systems, provide suspension system manufacturer's standard edge moldings that match width and configuration of exposed runners.

K. Wide-Face Capped Double-Web Steel Suspension System: Main and cross-runners roll-formed from prepainted or electrolytic zinc-coated cold-rolled steel sheet, with prefinished 24mm-wide metal caps on flanges; other characteristics as follows:

1. Structural Classification: Heavy-Duty System.
2. Cap Material and Finish: Steel sheet painted in color as selected by Contracting Officer's Representative from manufacturer's standard colors.

L. Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook." Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C 636.

31. SHEET VINYL FLOOR COVERINGS

A. Commercial Grade sheet vinyl floor coverings with integral coved base, without backing.

B. Type I sheet vinyl floor coverings are those having wear layers with a minimum binder content of 90 percent.

C. Samples for verification purposes in form of 152mm by 229mm sections of each different color and pattern of sheet vinyl floor covering product specified, showing full range of variations expected in these characteristics.

D. Fire Performance Characteristics: Provide sheet vinyl floor coverings with the following fire performance characteristics as determined by testing products per ASTM test method by Underwriters Laboratories, Inc. (UL) or another testing and inspecting agency acceptable to authorities having jurisdiction.

E. Install sheet vinyl floor coverings and accessories after other finishing operations, including painting, have been completed. **Sheet vinyl flooring shall be installed on site after the modular unit has been setup. Exceptions: Install vinyl flooring in bathrooms and mechanical room prior to installation of fixtures and equipment in these rooms.**

F. Filled Vinyl Sheet: Provide vinyl sheet with FS L-F-475, Type II, Grade A requirements, with manufacturers recommended static load limit of 100 psi and 1829 mm minimum sheet width.

1. Static Load Limit: 100 psi minimum as recommended.
2. Thickness: 2.2 mm nominal.
3. Sheet Width: 1829 min.

G. RESILIENT WALL BASE

1. Rubber Wall Base: Products complying with FS SS-W-40, Type I.

32. CARPET

A. Carpet Surface Burning Characteristics: Provide carpet identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting organization.

1. Test Method: DOC FF 1-70.
2. Rating: Pass.

B. Cushion Surface Burning Characteristics: Provide carpet cushion identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet cushion with appropriate markings of applicable testing and inspecting organization.

1. Test Method: DOC FF 1-70.
2. Rating: Pass.
3. Test Method: ASTM E 84.
4. Flame Spread: 25 or less.
5. Smoke Developed: 450 or less.

C. Carpet Cushion Type A-1: Natural fiber; sterilized, mildew resistant, and permanently mothproofed.

1. Weight: 906 g.
2. Thickness: 6mm plus 5 percent maximum.

D. Carpet shall be installed on site after the modular unit has been setup.

E. Comply with manufacturer's recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position; do not place seams perpendicular to door frame, in direction of traffic through doorway. Do not bridge building expansion joints with continuous carpet.

F. Extend carpet under removable flanges and furnishings and into alcoves and closets of each space.

G. Provide cutouts where required, and bind cut edges where not concealed by protective edge guards or overlapping flanges.

H. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.

I. Carpet Designation: Type C.

1. Surface Texture: Level Textured Loop
2. Gauge: 3.2 mm
3. Pile Height: 6.35
4. Face Yarn: 80% Camalon SD nylon, 20% Dupont Antron nylon.
5. Stitches: 11 per 25.4 mm.
6. Dye System: Solution Dyed.
7. Face Yarn Weight: 849 g per square yard.
8. Backing Materials:
   a. Primary: Woven Polypropylene
   b. Secondary: Action Bac
9. Total Weight: 1882 g per square meters
10. Width: 3658 mm
11. Warranty: 10 year limited wear.
12. Colors: As selected from mfr.'s standard colors by Contracting Officer
13. Texture & Pattern: Colonial #50522
14. Manufacturer: Shaw or equal.

33. PAINTING

A. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Contracting Officer's Representative will select from standard colors or finishes available.

B. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application.

C. Colors: Provide color selections made by the Contracting from the manufacturer's full range of standard colors.

D. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

1. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
2. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
4. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

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

F. PAINT SCHEDULE

1. Gypsum Drywall Systems: Lusterless (Flat) Emulsion Finish: Two coats.
   a. Primer: White, interior, latex-based primer.
   b. Finish Coat: Interior, flat, latex-based paint.

2. Cedar Trim and Plywood Soffits:
   a. First Coat: Heavy Bodied Stain (FS TT-P-52).
   b. Second Coat: Heavy Bodied Stain (FS TT-P-52).

3. Exterior Siding
   a. Semi-gloss Finish: 2 finish coats per siding manufacturers recommendations.

4. Ferrous Metal: Primer is not required on shop-primed items: Full-Gloss Alkyd Enamel: 2 finish coats over primer.

34. WALL SURFACE PROTECTION SYSTEMS

A. This Section includes the following types of wall surface protection systems:

1. Wall protection systems, including:
   a. Wall guards.
   b. Corner guards.
   c. Rigid sheet wall covering panels.
2. Door protection systems, including: Kick/armor plates.

B. Samples for Initial Selection: For initial selection of color, pattern and surface texture, provide the manufacturer's standard color chips consisting of actual sections of each vinyl plastic material required showing the full range of materials, colors, and textures available.

C. Fire Performance Characteristics: Provide wall surface protection system components that are identical to those tested in accordance with ASTM E 84 for the fire performance characteristics

indicated below. Identify wall surface protection system components with appropriate markings from the testing and inspection organization.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

D. Impact Strength: Provide wall surface protection system components with a minimum impact resistance of 25.4 ft. lbs per sq. ft. when tested in accordance with ASTM D 256 (Izod impact, ft. lbs per inch notch).

E. Rigid Plastic Material: Extruded, textured, chemical- and stain-resistant, high-impact, polyvinyl chloride (PVC) or acrylic modified vinyl plastic, thickness as indicated. Comply with specified requirements of ASTM D 256 for impact resistance and ASTM E 84 for flame spread and smoke developed characteristics.

F. Plastic Sheet Wall Covering Material: Textured, chemical- and stain-resistant, high-impact, polyvinyl chloride (PVC) or acrylic modified vinyl plastic sheets, thickness as indicated. Comply with specified requirements of ASTM D 256 for impact resistance and ASTM E 84 for flame spread and smoke developed characteristics.

G. Surface-Mounted, Resilient Plastic Corner Guards: Provide surface-mounted, resilient plastic corner guard assembly consisting of a snap-on-type plastic cover installed over a continuous aluminum retainer, height as indicated.

1. Cover shall be rigid, impact-resistant plastic, minimum 2mm thick, in dimensions and profiles indicated: Corner Radius: 6mm
2. Retainer: Manufacturer's standard continuous, one-piece, extruded aluminum retainer, minimum 1.5mm thick.
3. Accessories: Provide prefabricated, injection-molded top cap and aluminum base with concealed splices, cushions, mounting hardware, and other accessories as required: Top caps shall match color of plastic covers and shall be field adjustable for close alignment with snap-on plastic covers.
4. Mounting Method: Countersunk screws with mounting holes 203mm on center.

H. Semirigid Sheet Wall Covering: Provide manufacturer's standard semirigid, embossed, fiber-backed, impact-resistant plastic sheets. Sheets shall comply with fire performance characteristics specified and be chemical- and stain-resistant. Provide manufacturer's standard matching moldings and trim as required.

1. Sheet Size: 1219mm x 2438mm
2. Sheet Thickness: 10mm thick.

I. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

J. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

K. Aluminum Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

L. Install wall surface protection units plumb, level, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.

M. Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.

35. FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

A. This Section includes the following: Fire extinguishers, Fire extinguisher cabinets, and Fire extinguisher mounting brackets.

B. UL-Listed Products: Fire extinguishers shall be UL listed with UL Listing Mark for type, rating, and classification of extinguisher.

C. General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, that comply with authorities having jurisdiction.

D. Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled steel container.

E. Mounting Brackets: Designed to prevent accidentally dislodging extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish. Square edge trim.

F. Provide fire extinguisher cabinets of suitable size for housing fire extinguishers of types and capacities indicated.

1. Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
2. Fire-Rated Cabinets: UL-listed with UL Listing Mark with rating of wall where it is installed.

G. Cabinet Type: Suitable for mounting conditions indicated of the following types:

1. Surface-mounted: Cabinet box (tub) fully exposed and mounted directly on wall.
2. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   a. Rolled-edge trim with 32mm backbend depth.
   b. Trim Metal: Of same metal and finish as door.

H. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

36. TOILET AND BATH ACCESSORIES

A. This Section includes toilet and bath accessory items including the following:

a. Toilet Tissue Dispenser
b. Paper Towel Dispenser
c. Grab Bar
d. Soap Dispenser
e. Surgical Soap Dispenser
f. Mirror Unit

B. Roll-In-Reserve Toilet Tissue Dispenser: Fabricate of stainless steel for mounting indicated below, size to store and dispense either 114mm-diameter or 127mm-diameter core tissue rolls, with reserve roll placed in service by automatic release or by action of manual release bar.

Hinge front of unit with pivot hinge and secure with tumbler lockset. Mounting: Surface mounted, concealed anchorage. See Construction Documents for mounting height.

C. Surface mounted Paper Towel Dispenser: Stainless steel unit fabricated for surface-mounting. Dispenser 400 C-Fold of 525 Multi-Fold towels without adjustment on adapters. Door has tumbler lock and piano hinge. Cabinet slots indicate refill time.

D. Stainless Steel Type Grab Bars: Provide grab bars with wall thickness not less than 18 gage and as follows:

1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
2. Clearance: 38mm clearance between wall surface and inside face of bar.
3. Gripping Surfaces: Smooth, satin finish.
4. Heavy-Duty Size: Outside diameter of 38mm.

E. Liquid Soap Dispenser, Horizontal-Tank Type: Fabricate for surface mounting, sized for 40-fluid-ounce minimum capacity. Provide stainless steel piston, springs, and internal parts designed to dispense soap in measured quantity by pump action. Provide cover of type 304 stainless steel in No. 4 finish, with unbreakable window-type refill indicator.

1. Equip unit with push-type valve for dispensing soap in liquid form.

F. Standard Stainless Steel Framed Mirror Units: Fabricate frame with channel shapes not less than 20 gage, with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430 bright polished finish.

G. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible. Anchor per manufacturers recommendation.

H. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed. Anchor per manufacturers recommendation.

I. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamper proof glass installation and prevent moisture accumulation, as follows:

1. Provide galvanized-steel backing sheet, not less than 22 gage and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

J. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamper proof, and theft proof installation, as follows:

1. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

K. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Contracting Officer's representative.

L. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

M. Secure mirrors to walls in concealed, tamper proof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

N. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446. Provide anchoring blocking in substrates per manufacturers recommendation.

37. PLASTIC LAMINATE CASEWORK

A. Provide all plastic laminate Casework, counter tops, and accessory items necessary for complete installation. Refer to plans for specific details and requirements.

B. Provide Casework as manufactured by Crystal Cabinet Works, Inc., Princeton, MN (612-389-4187). Construction and design shall be Compro Architectural Casework, C-10 style, or equal.

C. High pressure plastic laminate shall be used on all doors and drawer faces and shall meet all NEMA standards.

D. Colors to be selected from full range of Wilsonart or Formica laminates by Contracting Officer.

E. Thermofused impregnated decorative overlay bonded to 20 kg density industrial grade particle board. Particle board shall have a moisture content not to exceed 8%.

F. White melamine laminate for cabinet interiors behind doors and drawers and interior of all open cabinets.

G. Front edges of cabinet boxes to match door/drawer face in a PVC or high pressure laminate edge banding.

H. Door and drawer front edges to be:

1. PVC or high pressure laminate edge banding to match face, or
2. PVC edge banding 3 mm thick, in choice of colors.

I. Hinges: One pair per door up to and including 1067 mm height. One and one-half pair over 1067 mm in height. Fully concealed, spring loaded, self closing hinge opens to 170^0 and fully adjustable in all dimensions

J. Pulls: Recessed plastic pulls

K. Drawer guides

1. Standard drawers, side mounted wrap around slides, cream colored epoxy coated steel, nylon roller, self closing, 100 lb. load rating. [or]
2. File drawers, side mounted, zinc plated, full extension guides, 100 lb. load capacity.

L. Catches: 12 lb. Magnetic door catches to be installed in base, wall and tall cabinets (Magnetic door catches are not required when using concealed self closing hinge).

M. Cabinet bases shall be: Integral to cabinet with rubber or vinyl base furnished and installed.

N. Wall & Tall Cabinets (and base cabinet bottoms) 19 mm thick melamine laminated particle board.

O. Base Cabinets to have two stretchers across top of cabinet, 19 mm thick x 88 mm deep melamine laminated particle board. Cabinets of 686 mm wide shall have a third stretcher between door and drawer.

P. Cabinet Ends: Exposed Ends 19 mm thick, high pressure laminated particle board.. Concealed Ends 19 mm thick, white melamine laminated particle board.

Q. All standard cabinets sides 533 mm or higher to have holes drilled for adjustable shelves 32 mm on center.

R. Fixed and Adjustable Shelves: 19 mm white melamine laminated particle board two sides. Front edge of shelves to be edge banded in white PVC. Adjustable shelf supports to be heavy duty steel pin surrounded by clear molded nylon.

S. Cabinet Backs: Concealed cabinet backs to be 13 mm particle board with white melamine laminate on inside surface and tan color melamine laminate on outside surface. All edges rabbeted to fit into sides, tops and bottoms. Exposed exterior backs to be high pressure laminate.

T. Doors and Drawer Fronts: All doors and drawer fronts to be 17 mm thick, 45 lb. density, particle board with high pressure plastic laminate, .762 mm thickness on faces and white high pressure cabinet liner on inside faces. Door and drawer front edges shall be edged to match face in high pressure laminate or PVC edge banding.

U. Drawers: Drawer fronts shall be applied to drawer sub-front. Drawer sides, back and sub-front to be 13 mm white melamine laminated particle board. All exposed edges are white PVC edge banded. Drawer bottom to be 6 mm white melamine laminated particle board and is dadoed and glued into drawer sides, back and sub-front.

V. Counter Tops: Horizontal grade high pressure plastic laminate, 1.3 mm thickness, bonded to 19 mm thick particle board. Back to have melamine plastic laminate as balancing sheet. Exposed edges shall match horizontal surface and shall be built up to a 38 mm thickness. Counter tops shall be square nosed with square edged back splash, butt joints.

W. Cabinet parts shall be accurately machined and constructed with glue and dowel method.

X. Cabinet ends shall be dadoed and rabbeted to receive bottoms, tops and backs. Backs shall be securely glued into sides, tops and bottoms.

Y. Drawer bottom shall be fully housed into drawer sides, back and sub-front using rabbeted construction. Drawer sides, backs and sub-front shall be glue and dowel construction for a secure fit.

Z. Erect Casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, etc.

AA. All materials to be guaranteed for a period of one year from manufacturing and workmanship defects.

38. HORIZONTAL LOUVER BLINDS

A. Samples for initial selection purposes in manufacturer's standard sizes showing full range of colors available for each type of blind indicated.

B. Surface Burning Characteristics: Provide blinds identical to those tested for the following fire performance characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Lifting and Tilting Mechanisms: Noncorrosive, self-lubricating materials.

D. Blind Units Installed Between (Inside) Jambs: Width and length equal to 13mm less than opening dimensions formed by jamb, head, and sill members of opening in which each blind is installed.

E. Install blinds level, plumb, and located so exterior slat edges in any position are not closer than 25mm to interior face of glass lites, gaps between slat ends and jambs do not exceed 6mm plus or minus 3mm, and bottom rail in fully lowered position is within 13mm of bottom of window or other opening.

39. BASIC MECHANICAL MATERIALS AND METHODS

A. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.

C. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

D. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet-Metal: 0.701 mm or heavier, galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron or Thermoplastic: Cast-iron or fabricated thermoplastic "wall pipe", having plain ends and integral water stop, except where other features are specified.
4. Cast-Iron Sleeve Fittings: Commercially-made, sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
   a. Underdeck Clamp: Clamping ring with set-screws.

E. Mechanical Contractor shall furnish and install access doors and panels for mechanical items requiring access which are concealed behind finished surfaces. All access panels must have key locks to prevent unauthorized access.

F. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Install dental equipment piping as indicated, except where deviations to layout are approved.

G. Install piping in concealed interior and exterior locations, except in equipment room.

H. Install piping free of sags and bends.

I. Install piping tight to allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw, and polished chrome-plated finish. Use split-casting escutcheons where required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.
3. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.
4. Piping in Utility Areas: Stamped-steel, concealed hinge, spring clips.

L. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material.

M. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

N. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

O. Install equipment giving right-of-way to piping systems installed at a required slope.

P. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

Q. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

R. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

S. Install access panels and doors when mechanical equipment requiring observation or maintenance are concealed behind finished surfaces including but not limited, to the following:

1. Fire dampers.
2. Smoke dampers (fire and smoke dampers).
3. Temperature control dampers.
4. Duct coils.
5. Items of mechanical equipment, fans, etc.
6. Valves, air vents, drains.
7. Shock absorbers that require access.

8. Pipe cleanouts.

T. All mechanical equipment shall be retrained to meet seismic requirements of the applicable building code.

40. VALVES

A. This Section includes general duty valves common to most mechanical piping systems.

B. Valve Design: Rising stem or rising outside screw and yoke stems.

1. Nonrising stem valves may be used where headroom prevents full extension of rising stems.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Provide the following special operator features:

1. Handwheels, fastened to valve stem, for valves other than quarter turn.
2. Lever handles, on quarter-turn valves 150 mm and smaller.

E. Gate Valves, 50 mm and Smaller: MSS SP-80; Class 900, body and bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 1000 valves meeting the above where system pressure requires.

F. Ball Valves, 25 mm and Smaller: Rated for 1000 kPa saturated steam pressure, 2700 kPa WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide threaded ends for all applications.

G. Ball Valves, 32 mm to 50 mm: Rated for 1000 kPa saturated steam pressure, 2700 kPa WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide threaded ends for all applications.

H. Swing Check Valves, 50 mm and Smaller: MSS SP-80; Class 900, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 1000 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 900 valves are not available.

I. Locate valves for easy access and provide separate support where necessary.

J. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

41. MECHANICAL INSULATION

A. Hot Surfaces: Normal operating temperatures of 40 deg C or higher.

B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 4 deg C.

D. Thermal Resistivity: "r-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 25 mm thick. Thermal resistivities are expressed by the temperature difference in degrees C between two exposed faces required to cause one Btu to flow through one square meter of material, in one hour, at a given mean temperature.

E. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

F. Glass Fiber: Inorganic glass fibers, bonded with a thermosetting resin.

G. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

H. Board: ASTM C 612, Class 2, semi-rigid jacketed board.

1. Thermal Conductivity: 1.25 average maximum, at 24 deg C mean temperature.
2. Density: 96 kg/m^3 average maximum.

I. Blanket: ASTM C 553, Type I, Class B-2, jacketed flexible blankets.

1. Thermal Conductivity: 1.53 at compressed thickness, at 24 deg C mean temperature.
2. Density: 12 kg/m^3.

J. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed with self seal jacket.

1. Thermal Conductivity: 1.48 average maximum at 24 deg C mean temperature.
2. Density: 80 kg/M^3 average maximum.

K. Adhesive: Produced under the UL Classification and Follow-up service.

1. Type: Non-flammable, solvent-based.
2. Service Temperature Range: Minus 30 to 80 deg C.

L. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

M. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 16 deg C.

N. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:

1. Metal ducts with duct liner.
2. Flexible connectors for ducts and pipes.

3. Testing laboratory labels and stamps.
4. Nameplates and data plates.
5. Access panels and doors in air distribution systems.
6. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
7. Piping specialties including air chambers, check valves, plug valves, and flow regulators.

O. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer.

P. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.

Q. Pipe Insulation

APPLICATION	PIPE SIZE	MATERIAL	THICKNESS (mm)	VAPOR BARRIER NOTE 1	FIELD-APPLIED JACKET
DOM CW	ALL	GF	12.7	YES	NONE
DOM HW AND HW RECIRC	12.7 TO 100	GF	25	NO	NONE
SANITARY DRAINS AND TRAPS EXPOSED AT FIXTURES FOR DISABLED	ALL	FE	12.7	NO	NONE

R. Duct Systems

APPLICATION	FORM	MATERIAL	THICKNESS (mm)	VAPOR BARRIER	FIELD-APPLIED JACKET
MEDIUM VELOCITY SUPPLY DUCTS - FAN DISCHARGE TO VAV TERMINAL INLET	BLANKET	GF	38	YES	NONE

NOTES: 1. Field-Applied Jackets Canvas - Canvas.
2. Pipe Sizes: NPS - Nominal Pipe Size.
3. Materials: GF - Glass Fiber, FE - Flexible Elastomeric, CG - Cellular Glass, FPS-Fire Protection System.

42. WATER DISTRIBUTION PIPING

A. Connect building water line to existing service line in the utility vault.

B. Copper Tube: ASTM B 88, Type L Water Tube, drawn temper.

C. Copper Tube: ASTM B 88, Type K Water Tube, annealed temper.

D. Copper Tube: Chrome plated, equal to tubing to which it is connected.

E. Fittings

1. Wrought Copper Solder-Joint Fittings: ANSI B16.22, streamlined pattern.
2. Bronze Flanges: ANSI B16.24, Class 150, raised ground face, bolt holes spot faced.

F. Dielectric Unions: Threaded, solder, or grooved-end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.

G. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze wire reinforced protective jacket; minimum 1034 kPa working pressure, maximum 121 deg. C operating temperature. Connectors shall have sweat, flanged, or threaded-end connections to match equipment connected and shall be capable of 20 mm misalignment.

H. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.

I. Relief Valves: Sizes for relief valves shall be in accordance with ASME Boiler and Pressure Vessel Codes for indicated capacity of the appliance for which installed.

1. Pressure Relief Valves: Bronze body, test lever, and pressure relief at 1034 kPa.

J. Drain Valves: 15 mm wheel handle hose bibb with non-removable vacuum breaker and 20 mm male hose threads.

K. Install polished chrome plated tubing wherever such piping is exposed to view above the floor and below the ceiling. The crawlspace is excepted from this requirement.

L. Install Type K, annealed temper copper tube for pipe sizes 50 mm and smaller, with minimum number of joints, below ground.

M. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Dental supply lines are set by configuration of dental equipment. Therefore, written approval is required before any changes in piping locations.

N. Use fittings for all changes in direction and branch connections, except trap primer lines which may be bent to 115 mm radius minimum.

O. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated.

P. Install piping level with no pitch, free of sags or bends and with ample space between piping to permit proper insulation applications.

Q. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

R. Provide space to permit insulation applications, with 25 mm clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

S. Fire Barrier Penetrations: Where pipes pass though fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity.

T. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

Nom. Pipe Size - mm	Copper Tube Max. Span - mm	Min. Rod Dia. - mm
Up to 20	1500	10
25	1830	10
32	2130	10
40	2440	10
50	2440	10
65	2740	15
80	3050	15

U. Soldered Joints: For above ground applications. Comply with the procedures contained in the AWS "Soldering Manual."

V. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

W. Install backflow preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Install air gap fitting and pipe relief outlet drain without valves to nearest floor drain or as indicated on plans.

X. During the progress of the installation, notify the Contracting Officer at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the Contracting Officer.

1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed in after system is roughed in and prior to setting fixtures.
2. Final Inspection: Arrange for a final inspection by the Contracting Officer to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
3. Reinspections: Whenever the Contracting Officer finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the Contracting Officer.
4. Reports: Prepare inspection reports signed by the Contracting Officer.

Y. Test water distribution piping as follows:

1. Test for leaks and defects all new water distribution piping systems and parts of existing systems that have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
3. Cap and subject the piping system to a static water pressure of 690 kPa. Isolate the test source and allow to stand for 24 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair all leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for all tests and required corrective action.

Z. DISINFECTION OF WATER SYSTEMS

1. Before being placed in service all potable water piping shall be chlorinated in accordance with AWWA Standard C601-54 and as required by the Government Codes.

43. DRAINAGE AND VENT SYSTEMS

A. This Section includes building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

B. Cleanout Plugs: Match pipe material, threads complying with ANSI B2.1, countersunk head.

C. Use fittings for all changes in direction and all branch connections.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 150 mm shall be steel; pipe sleeves 150 mm and larger shall be sheet metal.

G. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

H. Install building drain pitched down at minimum slope of .0208 for piping 100 mm.

I. Extend building drain to connect to sewer stub-up out in utility vault.

J. Install hangers at the following intervals:

PIPE MATERIAL	MAX HORIZ SPACING (mm)	MAX VERT SPACING (mm)
Copper Tubing - 32 mm and smaller	1830	3050
Copper Tubing - 40 mm and larger	3050	3050
PVC Pipe	1220	1220

K. Install expansion joints on vertical risers as required by the plumbing code.

L. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:

1. as required by plumbing code;
2. at each change in direction of piping greater than 45 degrees;

M. Cleanouts Covers: Install wall cleanout covers for concealed piping, types as indicated.

N. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

O. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

P. Frost-Proof Vent Caps: Install frost-proof vent caps on each vent pipe passing through roof. Maintain 50 mm clearance between vent pipe and roof substrate.

Q. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

R. Trap all drains connected to the sanitary sewer.

S. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

T. Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:

1. Test for leaks and defects all new drainage and vent piping systems. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Rough Plumbing Test Procedure: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 3.05 meters head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
3. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 25 mm water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
4. Repair all leaks and defects and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for all tests and required corrective action.

U. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of a water based latex paint.

44. PLUMBING FIXTURES

A. Regulatory Requirements: Comply with requirements of ATBCB (Architectural and Transportation Barriers Compliance Board) "Uniform Federal Accessibility Standards (UFAS) - 1985-494-187" with respect to plumbing fixtures for the physically handicapped.

B. Listing and Labeling: Provide electrically operated fixtures that are listed and labeled.

1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Provide plumbing fixtures and trim, fittings, other components, and supports as specified in "Plumbing Fixture Schedule" on the plans.

D. Faucets General: Unless otherwise specified, provide faucets that are solid brass with polished chrome-plated finish.

E. General: Provide toilet seats compatible with water closets, and of type, color, and features indicated.

F. Plumbing Fixture Supports: ASME A112.6.1M, categories and types as required for wall-hanging fixtures specified, and wall reinforcement. Support categories are:

1. Carriers: Supports for wall-hanging water closets and fixtures supported from wall construction. Water closet carriers shall have an additional faceplate and coupling when used for wide pipe spaces. Provide tiling frame or setting gage with carriers for wall-hanging water closets.
2. Chair Carriers: Supports with steel pipe uprights for wall-hanging fixtures. Urinal chair carriers shall have bearing plates.
3. Chair Carriers, Heavy Duty: Supports with rectangular steel uprights for wall-hanging fixtures.
4. Reinforcement: 50 mm by 100 mm wood blocking between studs or 6 mm by 150 mm steel plates attached to studs, in wall construction, as required to prevent fixtures from flexing the wall finish to the point of damage.

G. Install supports for plumbing fixtures in accordance with categories indicated, and of type required:

1. Carriers for following fixtures:
   a. Wall-hanging fixtures supported from wall construction.

2. Chair carriers for the following fixtures:
   a. Wall-hanging lavatories and sinks.

3. Heavy-duty chair carriers for the following fixtures:
   a. Accessible lavatories.
   b. Fixtures where specified.

4. Reinforcement for the following fixtures:
   a. Wall-hanging lavatories in public rest rooms.
   b. Floor-mounted sinks required to be secured to wall.
   c. Electric water coolers.
   d. Clinic sinks.

H. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers' written installation instructions, roughing-in drawings, and referenced standards.

I. Install stop valve in an accessible location with room for hand to operate wheel or key in each water supply to each fixture.

J. Install trap on fixture outlet except for fixtures having integral trap or for fixtures which discharge through indirect waste piping to floor sink or floor drain.

K. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.

L. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

M. Plumbing fixtures specified by this section are described in the "Plumbing Fixture Schedule".

45. WATER HEATERS

A. Codes and Standards:

1. UL Compliances: Construct water heaters in accordance with the following UL standards:
   a. "Electric Water Heaters".

2. Provide water heater components which are UL-listed and labeled.
3. NEC Compliance: Install electric water heaters in accordance with requirements of NFPA 70, "National Electrical Code".
4. ASME Code Symbol Stamps: Provide water heaters and safety relief valves which comply with ASME Boiler and Pressure Vessel Code, and are stamped with appropriate code symbols.
5. ASHRAE Compliance: Provide water heaters with Performance Efficiencies not less than prescribed in ASHRAE 90A, "Energy Conservation in New Building Design".

B. Warranty on Heating Elements: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, heating elements with inadequate or defective materials and workmanship, including breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

1. Warranty Period: 3 years from Date of Substantial Completion.

C. Heater: Construct for working pressure of 1.04 MPa; magnesium anode rod; glass lining on internal surfaces exposed to water.

D. Accessories: Provide brass drain valve; 20 mm ASME temperature and pressure relief safety valve, with relieving capacity to exceed the BTUH of the water heater element; and cold water dip tube.

E. Controls: Provide thermostat for each element, factory wired.

F. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

G. Support: Place units on pads, orient so controls and devices needing service and maintenance have adequate access. Provide seismic bracing and protection as required.

H. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closest floor drain, or as indicated.

I. Gages: Provide thermometer on outlet piping of electric water heater.

46. DENTAL GAS PIPING SYSTEMS

A. This Section includes tubing, piping, and related accessories for the following dental gas systems.

1. Dental vacuum systems, designated "dental vac" and "V".
2. Dental compressed air systems, designated "dental air" and "A".

B. Installer Qualifications: Engage an experienced installer of dental air and vacuum systems.

C. **Provide dental air and vacuum piping systems complying with requirements of NFPA 99 "Standard for Health Care Facilities."**

D. Provide compatible accessories, tube, fittings, and valves for each system.

E. Provide product data submittals for the following:

1. Special purpose valves.
2. Dental air and vacuum outlets.
3. Dental air and vacuum accessories.

F. Construct and Inspect dental air and vacuum systems as required by NFPA 99 "Standard for Health Care Facilities".

G. Store precleaned and sealed dental air tube, fittings, valves, and accessories with sealing plugs and sealing packaging intact.

H. Label dental gas tube, fittings, valves, and accessories that have not been precleaned, and that have been precleaned but have seal or packaging that is not intact, with temporary labels indicating that cleaning is required before installation.

I. Clean and store dental vacuum piping and accessories as required by NFPA 99.

J. Copper Tube, Fittings, Valves, and Piping Components: Factory-cleaned, -purged, and -sealed, and marked or labeled "oxy" or “oxygen”.

1. Components required, but not available cleaned for oxygen service, may be provided, but must be cleaned before use as specified below under "PREPARATION."

K. Precleaned and Sealed Copper Tube: ASTM B 88, Type K or Type L, water tube, seamless, drawn temper, cleaned for oxygen service, purged, and with ends sealed.

L. Wrought-Copper Fittings: ASME B16.22, solder-joint, pressure type.

M. Flexible Connectors: Bronze or stainless-steel flexible pipe connectors.

N. Brazing Filler Metals: AWS A5.8, BCuP (copper-phosphorus) Series alloys. Flux is prohibited, except when used with bronze fittings.

O. Threaded-Joint Tape: Polytetrafluoroethylene (PTFE) plastic.

P. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos-free, and suitable for oxygen use.

Q. General: Where factory-precleaned and capped tubing and piping are not available, or when precleaned tubing and piping must be recleaned because of exposure, perform the following procedures:

1. Clean all dental gas pipe and pipe fittings, tube and tube fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service, in accordance with CGA G-4.1-85 "Cleaning Equipment for Oxygen Service."
2. Wash dental air piping, tubing, and components in a hot alkaline cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of one pound of chemical to three gallons of water.
   a. Scrub to ensure complete cleaning.
   b. Rinse with clean hot water after washing to remove cleaning solution.

R. Dental Air: Use "Precleaned and Sealed Copper Tube" with wrought copper fittings and brazed joints. Use soft copper tube with wrought copper fittings and brazed joints in sizes less than 15 mm.

47. DENTAL VACUUM PIPING AND FITTINGS

A. PVC, Type, DWV Pipe and Fittings: Schedule 40, ASTM D2665 pipe and fittings, with solvent cemented joints; DWV plastic fitting patterns shall conform to ASTM D3311.

B. Dental Vacuum: Use schedule 40 DWV PVC piping, with solvent cemented joints. Cleaned and prepared according to NFPA 99 requirements.

48. DENTAL AIR AND VACUUM REQUIREMENTS

A. Install zone valves in valve box anchored to structure. Install valves at angle that prevents closure of cover when valve is in closed position. A single box may be used for multiple valves when valves serve same area or same function.

B. Install accessories in accordance with NFPA 99 and manufacturer's printed installation instructions.

C. Cap dental air and vacuum tubing and piping to equipment and accessories.

1. Provide flexible pipe (tubing) connectors on air tubing connections to dental air compressors, vacuum tubing connections to dental vacuum pumps, and where indicated.

D. Electrical Connections: Install power wiring and disconnect switches adjacent equipment locations.

1. Grounding: Provide connection for grounding dental equipment in accordance with the National Electrical Code.

E. Install labeling on valves, valve box covers, and alarm panels in accordance with requirements of NFPA 99.

F. Captions and Color Coding: Use the following or similar dental gas captions and color coding for accessories, when specified and where required by NFPA 99.

1. Air: Black or white letters on yellow background.
2. Vacuum: Black letters on white background.

G. System Clearing: Purge dental air and vacuum system tubing and piping using nitrogen after installation of tubing but before installation of service outlet valves, alarms, and gages.

H. Schedule and conduct all NFPA 99 required tests of dental air and vacuum systems as required by NFPA 99.

I. Pressure Test: Subject each section of each system to test pressure of from 1034 kPa to 1379 kPa and nitrogen systems to test pressure of 1724 kPa with nitrogen before attachment of system components, after installation of station outlets with test caps (when supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water.

J. Standing-Pressure Test: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at 20 percent above normal line pressure but not less than 455 kPa. Subject vacuum and evacuation systems to 40 to 61 kPa minimum vacuum in lieu of pressure test.

K. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

49. DENTAL AIR AND VACUUM SYSTEMS EQUIPMENT

A. **Dental air and vacuum equipment will be purchased and installed by the** (Organization)**. The contractor is responsible for providing all piping and electrical connections necessary for the installation of the dental equipment including necessary control wiring conduit to the remote panel.**
(Omit if the contractor is to purchase and install the vaccum equipment.)

B. The following Reciprocating Dental Air Compressor will be provided and installed by the government. The contractor will provide all necessary piping and electrical connections.

1. Air Techniques Inc, model number L-60

C. The following Dental Vacuum Pump will be provided and installed by the government. The contractor shall provide all necessary piping and electrical connection.

1. VacStar 5, wired for 230 volt, 30 amp configuration.

D. DENTAL COMPRESSED AIR TURRET: Brass drop forging for dental compressed air at sink, 2-way 10 mm NPS female threaded inlet. Provide with brass shanks, and brass locknuts and washers.

E. Provide connections to piping and electrical systems for dental air compressors, dryers, vacuum pumps, and receiver tanks as recommended for the equipment specified above:

F. Provide support in floors to anchor, in locations indicated, and maintain manufacturers' recommended clearances. Orient so controls and devices needing servicing are accessible.

G. Provide connection to sewer for dental vacuum units.

H. Provide floor drain in mechanical room.

I. Electrical Connections: Provide electrical wiring and disconnect switches in the mechanical room for vacuum pump and dental compressor.

J. Provide dental compressor with outside air intake piping and outside discharge from vacuum pump in accordance with NFPA 99.

50. PACKAGED END WALL AIR TO AIR HEAT PUMPS

A. Codes and Standards:

1. ARI Compliance: Test and rate split system air to air heat pumps in accordance with ARI Standard for "Package End Wall Air to Air Heat Pumps". Provide ARI Certification.

2. ASHRAE Compliance: Design, construct, and assemble refrigerating system in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
3. ASHRAE 90A Compliance: Provide air to air heat pumps with not less than minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design".
4. UL Compliance: Design, construct, and assemble packaged end wall air to air heat pumps for use with duct systems so as to meet the safety requirements of UL Standard 559 "Heat Pumps".
5. UL Compliance: Design, construct, and assemble free-delivery packaged end wall air to air heat pumps so as to meet the safety requirements of UL Standard 484 "Room Air Conditioners".
6. UL Labels: Provide packaged end wall air to air heat pumps that are UL listed and labeled.

B. Product Data: Submit manufacturer's technical product data including rated capacities of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation, rigging, and start-up instructions.

C. Maintenance Data: Submit maintenance data and parts list for each packaged end wall air to air heat pump, control, and accessory; including "trouble shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual.

D. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

1. Warranty Period: 5 years from Date of Substantial Completion.

E. Provide factory-assembled and tested packaged end wall air to air heat pumps as indicated, consisting of cabinet; sealed refrigerant circuit, separately mounted condenser, including compressor and refrigerant to air heat exchanger; refrigerant to air heat exchanger (coil), and reversing valve (fail-safe in heating position), evaporator fans; refrigeration and temperature controls; filters; and outdoor supply damper. Provide capacities and electrical characteristics as scheduled.

F. Units shall have air cooled condenser. Sufficient refrigerant (CFC-Free) shall be contained in each system. Condenser shall have fan with totally enclosed fan motor, direct drive and permanently lubricated. Condenser shall have high efficiency hermetic compressor, high pressure controls, solid state demand defrost system, 1 year motor and controls warranty, 5 year compressor warranty and corrosion resistant, electrostically painted steel cabinet.

G. Heat Exchangers: Provide refrigerant to air heat exchangers of coaxial type, with inner copper refrigerant tube and aluminum fin. Test and rate heat exchanger for 310 kPa refrigerant working pressure.

H. Controls: Provide necessary controls to include fan control, reversing valve control, compressor relays, random-start control relay, and 24-v control transformer. Provide the following control options:

1. Occupied/unoccupied and night set back.
2. Unit mounted thermostat with automatic changeover.
3. Programmable thermostat with night set back, heating, cooling, fan and auto settings. Provide locking cover.

I. Filters: Provide 30/30 disposable type filters in return air stream.

J. Install packaged end wall air to air heat pumps in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

K. Start-up packaged end wall air to air heat pumps, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

L. Furnish to (Organization), with receipt, the following spare parts for each split system air to air heat pump:

1. One set of matched fan belts for each belt driven fan.
2. One set filters for each unit.

51. DUCTWORK

A. Fibrous Glass Duct Construction Standards (FGDCS): Refers to the North American Insulation Manufacturers' Association's (NAIMA) Fibrous Glass Duct Construction Standards, 1st ed., 1989.

B. Comply with the latest edition of the SMACNA Fibrous Glass Duct Construction Standards.

C. NFPA Compliance: Comply with the following NFPA Standards:

1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

D. UL Compliance: UL listed and labeled as complying with UL Standard 181, Class 1.

E. Description: Rigid, rectangular fiber glass boards with edge treatment; factory molded and faced on 1 side with a vapor barrier.

F. Flexural Rigidity (EI): 475, standard duty.

G. Thickness: 25 mm.

H. Channel Reinforcement: Galvanized-steel channels fabricated from ASTM A 527 and having G 60 or G 90 zinc coating weight. Refer to FGDCS for channel sizes and spacing.

I. Tie Rods Reinforcement: 2.7 mm, galvanized-steel wire, length to suit termination method. Refer to FGDCS for rod sizes and spacing.

J. Reinforcing Rod Washers: 65 mm square by 0.71 mm thick minimum or 0.508 mm thick to suit termination method, galvanized-steel washer with turned edges.

K. Materials: Use the following closure materials as recommended by the fibrous glass duct manufacturer:

1. Heat-Activated Tape: A minimum of 65 mm wide, fiber glass-reinforced, foil/scrim tape complying with UL Standard 181A, Part H, and imprinted with the required information. Pressure sensitive tapes are not acceptable.

L. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated by the static pressure column of the equipment schedule.

M. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

N. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

O. Non-Fire-Rated Partition Penetrations: Seal space between construction opening and duct with metal flanges of same gage as reinforcing channels. Overlap opening on 4 sides by at least 40 mm.

P. Fire-Rated Partition Penetrations: Install fire dampers according to FGDCS, page 2-35. Seal space between construction opening and sleeve with fire-stopping materials.

52. FIRE BARRIER

A. The mechanical room (room 110) shall be separated from the remainder of the modular building by one-hour fire rated walls, floor, and ceiling.

B. Install Fire Damper in mechanical room (room 110) ductwork per Uniform Fire Code and the manufacturer's UL-approved printed instructions.

C. Fire Barrier Penetrations: Where pipes, duct work, etc. pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.

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53. FLEXIBLE DUCTS (Only allowed for connection between fibrous glass ductwork and diffusers and return air vents)

*

A. General: Comply with UL 181, Class 1, Air Duct.

B. Flexible Ducts - Uninsulated: Spiral-wound steel spring with flameproof vinyl sheathing.

C. Flexible Ducts - Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 40 mm-thick, glass fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in the inner liner.
2. Outer Jacket: Glass-reinforced, silver mylar with a continuous hanging tab, integral fiber glass tape, and nylon hanging cord.
3. Inner Liner: Polyethylene film.

54. AIR OUTLETS AND INLETS

A. Types of outlets and inlets required for project include the following:

1. Ceiling air diffusers.
2. Registers and grilles.

B. Codes and Standards:

1. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual". Provide air outlets and inlets bearing ADC Certified Rating Seal.
2. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

C. Provide manufacturer's standard ceiling air diffusers of size, shape, capacity and type as required.

D. Surface Compatibility: Provide registers and grilles with border styles that are compatible with adjacent surfaces. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

E. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:

1. Register and Grille Materials:
   a. Steel Construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.
   b. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.
2. Register and Grille Faces:
   a. Horizontal Straight Blades: Horizontal blades, individually adjustable, at manufacturer's standard spacing.
   b. Vertically Straight Blades: Vertical blades, individually adjustable, at manufacturer's standard spacing.

c. Horizontal 45 Degree Fixed Blades (H-45 Degrees): Horizontal blades, fixed at 45 degrees, at manufacturer's standard spacing.

3. Register and Grille Patterns:
   a. Single Deflection: 1-set of blades in face.
   b. Double Deflection: 2-sets of blades in face, rear set at 90 degrees to face set.

4. Register and Grille Dampers:
   a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register.
   b. Opposed Blade Fusible Link: Opposed blade damper with spring closing and UL-listed fusible link for 71 degrees C.

5. Register and Grille Finishes:
   a. Aluminum Enamel: Air-dried aluminum enamel prime finish.
   b. White Enamel: Semi-gloss white enamel prime finish.
   c. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.

F. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

G. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

H. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

55. ELECTRICAL REQUIREMENTS

A. Regulatory Requirements: Comply with provisions of the following codes.

1. NFPA 70 "National Electrical Code".
2. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

B. Prepare drawings to a scale of 1:50 or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
   a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
   b. Exterior wall and foundation penetrations.
   c. Fire-rated wall and floor penetrations.
   d. Equipment connections and support details.
   e. Sizes and location of required concrete pads and bases.
2. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
3. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, and other ceiling-mounted devices.

56. MAINTENANCE MANUAL AND SHOP DRAWINGS

A. Prepare maintenance manuals including the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

57. RACEWAYS, BOXES, AND CABINETS

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Comply with NECA "Standard of Installation."

D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

E. Outdoors: Use the following wiring methods (where approved for application):

1. Exposed: Rigid or intermediate metal conduit (including under chassis wiring).
2. Concealed: Rigid or intermediate metal conduit.
3. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid tight flexible metal conduit.
4. Boxes and Enclosures: NEMA Type 3R or Type 4.

F. Indoors: Use the following wiring methods (where approved for application):

1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquid tight flexible metal conduit.
2. Damp or Wet Locations: Rigid steel conduit.
3. Exposed: Electrical metallic tubing or rigid nonmetallic conduit.
4. Concealed: Electrical metallic tubing, electrical nonmetallic tubing, or rigid nonmetallic conduit.
5. Boxes and Enclosures: NEMA Type 1, except in damp or wet locations use NEMA Type 4, stainless steel.

G. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

H. Keep raceways at least 150 mm away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

I. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits enter or leave hazardous locations.
2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
3. Where otherwise required by the NEC.

J. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 150 mm above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.

K. Flexible Connections: Use maximum of 1830 mm of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

L. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

M. Raceway Supports: Comply with the NEC and the following requirements:

58. WIRES AND CABLES

A. This Section includes building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating.

D. Solid conductor for 10 AWG and smaller; stranded conductor for larger than 10 AWG.

E. UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with Project's installation requirements and as specified in Part 3 "Applications" Article.

F. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."

G. Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices and wall plates except as otherwise indicated. Verify color selections with Contracting Officer.

* H. Ground-Fault Interrupter (GFI) Receptacles: provide "feed-thru" type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 70 mm deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3.

*

I. Plugs: 20-amperes, 125-volts, 3-wire, grounding, armored cap plugs, parallel blades with cord clamp, and 10 mm cord hole; match NEMA configuration with power source's.

J. Plug Connectors: 15-amperes, 125-volts, bakelite-body armored connectors, 3-wire, grounding, parallel blades, double wipe contact, with cord clamp, and 10 mm cord hole, match NEMA configuration to mating plug's. Arrange as indicated.

K. Snap Switches: quiet type AC switches as indicated in Table 2. Comply with UL 20 and NEMA WD1.

L. Combination Switch and Receptacle: general-duty 3-way quiet switch, 20-amperes, 120-277 volts AC, with toggle switch handle, and 3-wire grounding receptacle, 20-amperes, 120-volts, equip with plaster ears, and with break-off tab feature which allows wiring with separate or common feed, with NEMA configuration 5-15R.

* Note: The government shall furnish to the contractor, 39 hospital grade receptacles. These receptacles shall be installed where plans call for **non-Ground-Fault Interrupter** duplex receptacles. The contractor shall furnish any additional receptacles beyond the 39 provided by the government as specified in paragraph L above.

*

M. Wall plates: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plate color to match wiring devices except as otherwise indicated. Provide plates possessing the following additional construction features:

1. Material and Finish: 1 mm thick, type 302 satin finished stainless steel.

N. Floor Service Outlets: modular, above-floor floor service outlets and fittings of types and ratings indicated. Construct of die cast aluminum, satin finish. Use design compatible with floor outlet wiring methods indicated. Provide 20-amperes, 125-volts, gray duplex receptacles. NEMA configuration 5-20R where indicated. Provide with 19 mm or 25 mm NPT, 25 mm long, locking nipple for installation where compatible with wiring method.

O. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

59. CIRCUIT AND MOTOR DISCONNECTS

A. Electrical Component Standards: Provide components complying with NFPA 70 "National Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

B. General: Provide circuit and motor disconnect switches in types, sizes, duties, features ratings, and enclosures as indicated. Provide NEMA 1 enclosure except for outdoor switches, and other indicated locations provide NEMA 3R enclosures with rain tight hubs. For motor and motor starter disconnects, provide units with horsepower ratings suitable to the loads.

C. Service Switches: General duty fusible switches. UL listed for use as service equipment under UL Standard 98 or 869.

60. ELECTRICAL IDENTIFICATION

A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:

1. Identification labeling for raceways, cables, and conductors.
2. Operational instruction signs.
3. Warning and caution signs.
4. Equipment labels and signs.

B. ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.

C. Adhesive Marking Labels for Raceway and Metal-clad Cable: Pre- printed, flexible, self-adhesive labels with legend indicating voltage and service (Emergency, Lighting, Power, Light, Power d.c., Air Conditioning, Communications, Control, Fire).

D. Identify Raceways of Certain Systems with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 50 mm wide,

completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 12.2 m maximum intervals in straight runs. Apply the following colors:

1. Fire Alarm System: Red
2. Security System: Blue and Yellow
3. Mechanical and Electrical Supervisory System: Green and Blue
4. Telephone System: Green and Yellow

E. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure- sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

F. Use conductors with color factory-applied the entire length of the conductors except as follows:

1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
   a. Apply colored, pressure-sensitive plastic tape in half- lapped turns for a distance of 25 mm from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 25 mm wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
   b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 13 mm from the terminal and spaced 13 mm apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

G. Power Circuit Identification: Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 6.4 mm steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 25 Kg test monofilament line or one-piece self-locking nylon cable ties.

H. Tag or label conductors as follows:

1. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
2. Multiple Circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

I. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic- laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

J. Install equipment/system circuit/device identification as follows:

1. Apply equipment identification labels of engraved plastic- laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 13 mm high lettering on 38 mm high label (50 mm high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.

    a. Panelboards, electrical cabinets, and enclosures.
    b. Access doors and panels for concealed electrical items.
    c. Motor starters.
    d. Contactors.
    e. Control devices.

K. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

61. SERVICE ENTRANCE

A. Electrical Service will be provided using the existing Health Clinic electrical service. Electrical Service will be provided up to the utility vault that is located in the existing Modular Dental Facility concrete pad. The modular building manufacturer shall provide the Contracting Officer with information on the size of electrical service and date that electrical service will be needed.

B. Single phase 230 volt power is available to the site.

C. The contractor shall make the connection from the utility vault to the Modular Dental Facility electrical panel.

62. GROUNDING

A. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).

B. UL Standard: Comply with UL 467, "Grounding and Bonding Equipment."

C. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

D. Conductor Materials: Copper only.

E. Equipment Grounding Conductor: Green insulated.

F. Grounding Electrode Conductor: Stranded cable.

G. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B-3.
2. Assembly of Stranded Conductors: ASTM B-8.
3. Tinned Conductors: ASTM B-33.

H. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.

I. Bonding Strap Conductor/Connectors: Soft copper, 1.27 mm thick and 51 mm wide, except as indicated.

J. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

1. Do not use raceway as the equipment ground conductor.

2. Install separate insulated equipment grounding conductors with circuit conductors for the following in addition to those locations where required by Code:
   a. Feeders and branch circuits.
   b. Lighting circuits.
   c. Receptacle Circuits.
   d. Single-phase motor or appliance circuits.
   e. **X-ray Equipment Circuits: Install separate insulated equipment ground conductor in circuits supplying X-ray equipment.**

3. Nonmetallic Raceways: Install an insulated equipment ground conductor in nonmetallic raceways unless they are designated for telephone or data cables.
4. Air Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120-V and above including air cleaners and heaters. Bond the conductor to each such unit and to the air duct.
5. Water Heater, Heat Tracing, and Anti-Frost Heater Circuits: Install separate insulated equipment ground conductor to each electric water heater, heat tracing, and surface anti-frost heating cable. Bond this conductor to heater units, piping, and connected equipment and components.

K. Signal and Communications: For telephone, alarm, and communication systems, provide a #4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.

L. Separately derived systems required by NEC to be grounded shall be grounded in accordance with NEC paragraph 250-26.

M. Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.

N. Electrical Room Ground Bus: Size, location, and arrangement as indicated. Space 25.4 mm from wall and support from wall 132 mm above finished floor, except as otherwise indicated.

O. Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

P. Braided-Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.

Q. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

R. Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.

S. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
2. Make connections with clean bare metal at points of contact.

3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

T. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

63. PANELBOARDS

A. Load Center: A panelboard with thermal magnetic circuit-breaker branches, primarily of the plug-in type, designed for residential and light commercial projects, operating at 240 V and below, in single versions, and equipped with combination flush/surface mounting trim.

B. Wiring diagrams detailing schematic diagram including control wiring, and differentiating between manufacturer-installed and field-installed wiring.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."

E. NEMA Standard: Comply with NEMA PB1, "Panelboards."

F. UL Standards: Comply with UL 61, "Panelboards," and UL 50, "Cabinets and Boxes."

G. Keys: Furnish six spares of each type for panelboard cabinet locks.

H. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.

I. Enclosures: Cabinets, flush or surface mounted as indicted. NEMA Type 1 enclosure.

J. Front: Secured to box with concealed trim clamps except as indicated. Front for surface-mounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.

K. Directory Frame: Metal, mounted inside each panel door.

L. Bus: Hard drawn copper of 98 percent conductivity.

M. Main and Neutral Lugs: Compression type.

N. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

O. Service Equipment Approval: Listed for use as service equipment for panelboards having main service disconnect.

P. Special Features: Provide the following features for panelboards as indicated.

1. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.

2. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.

Q. Surge Arresters: IEEE C62.11, "Standards for Metal-Oxide Surge Arresters for AC Power Circuits," or IEEE C62.1, "Surge Arresters for Alternating Current Power Circuits."

1. Description: Coordinate impulse sparkover voltage with system circuit voltage and provide factory mounting with UL-recognized mounting device.

R. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard mounted with epoxy or industrial cement or industrial adhesive.

S. Install panelboards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.

T. Mounting Heights: Top of trim 1321 mm above finished floor, except as indicated.

U. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.

V. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.

W. Provision for Future Circuits at Flush Panelboards: Stub four 25 mm empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future. Stub four 25 mm empty conduits into raised floor space or below slab other than slabs on grade.

X. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Y. Quality Control Program: Conform to the following:

1. Procedures: Make field tests and inspections and prepare panelboard for satisfactory operation in accordance with manufacturer's recommendations and these specifications.
2. Schedule tests with at least one week in advance notification.
3. Written reports of tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include records of repairs and adjustments made.
4. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating results of tests and inspections, responsible organization and person, and date.
5. Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system configuration and parameters. Where discrepancies are found, recommend final protective device ratings and settings. Use accepted ratings or settings to make the final system adjustments.
6. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
7. Exercise and perform of operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
8. Check panelboard mounting, area clearances, and alignment and fit of components.
9. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
10. Insulation resistance test of buses and portions of control wiring that disconnected from solid-state devices. Insulation resistance less than 100 megohms is not acceptable.
11. Ground resistance test on system and equipment ground connections.
12. Test main and subfeed overcurrent protective devices.

64. LIGHTING

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. Emergency Lighting Unit: A fixture with integral emergency battery power supply and the means for controlling and charging the battery. They are also known as an emergency light set. Emergency units are available with integral lamps only.

C. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply. Internal battery powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units are available with and without integral lamp heads and lamps.

D. Submittals: Product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:

1. Outline drawings of fixtures indicating dimensions and principal features.
2. Electrical ratings and photometric data with specified lamps and certified results of independent laboratory tests.
3. Data on batteries and chargers of emergency lighting units.

E. Comply with NFPA 70 "National Electrical Code" for components and installation.

F. Listing and Labeling: Provide fixtures and emergency lighting units that are listed and labeled for their indicated use on the Project.

1. The terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

G. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.

H. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.

1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
2. Lens Thickness: 3.2 mm, minimum.

J. Rod Hangers: 4.8 mm diameter cadmium plated, threaded steel rod.

K. Provide 120 volt, fluorescent two lamp fixtures with 32 watt T-8 type lamps, electronic ballast (THD less than 20%) suitable for operation at -20 °C, enclosed and gasketed, with acrylic plastic or glass lens, and interior reflective white surface. Conform to UL 1571, "Incandescent Lighting Fixtures."

L. Self-Powered Exit Signs (Battery Type): Integral automatic high/low trickle charger in a self-contained power pack. Battery: Sealed, maintenance-free, nickel cadmium type with special project warranty.

M. Conform to UL 924, "Emergency Lighting and Power Equipment" requirements for "Unit Equipment." Provide self-contained units with the following features and additional characteristics as indicated.

1. Battery: Sealed, maintenance-free, lead-acid type with 10 year nominal life minimum, and special project warranty.
2. Charger: Minimum two-rate, fully-automatic, solid-state type, with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80-percent of nominal or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery automatically recharges and floats on trickle charge when normal voltage is restored.
4. Wire Guard: Where indicated, provide heavy chrome plated wire guard arranged to protect lamp heads or fixtures.
5. Time-Delay Relay: Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit "on" for fixed interval after restoration of power from an outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

N. Support for Suspended Fixtures: Brace pendants and rods that are 1280 mm long or longer to limit swinging. Support stem mounted single-unit suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

O. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following in tests of emergency lighting equipment.

1. Duration of supply.
2. Low battery voltage shut-down.
3. Normal transfer to battery source and retransfer to normal.
4. Low supply voltage transfer.

P. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

* Q. Emergency Fluorescent Power Supply: Internal Type: Self-contained, modular, battery-inverter unit factory-mounted within the fixture body.

1. Test Switch and LED Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type, with a minimum nominal 10-year life.
3. Charger: Fully-automatic, solid-state, constant-current type.
4. Operation: Relay automatically turns 2 lamps on when supply circuit voltage drops to 80-percent of nominal or below. Relay disconnects lamp and battery automatically recharges when normal voltage is restored.

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R. TELEPHONE/COMPUTER NETWORK SYSTEMS

A. Extent of telephone/computer network systems work are indicated by drawings and schedules, and is hereby defined to include empty raceway from utility vault to locations shown on plans.

B. Requirements are indicated elsewhere in these specifications for work including, but not limited to raceways, and electrical boxes, required in connection with the installation of these systems.

C. Codes and Standards:

A. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC, including 800-Series articles as applicable to installation, and construction of telephone systems.

B. FCC Compliance: Comply with Part 68 and Subpart J of Part 15, Federal Communications Commission Rules, pertaining to telephone equipment and Class A computer registration by manufacturer.

C. Provide wiring with FCC labels indicating applicable FCC registration and numbering.

D. IEEE Compliance: Comply with Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to communication systems.

E. NEMA Compliance: Comply with NEMA's Pub No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

F. REA Compliance: Comply with Rural Electrification Administration specifications pertaining to construction and installation of telephone cabling.

G. EIA Compliance: Comply with EIA Standards RS-453, 455, and 464 pertaining to installation of telephone systems.

D. Install telephone/computer network systems as indicated, in accordance with recognized industry practices; ensure systems comply with installation and operational requirements of EIA, NEC and the Federal Communications Commission.

E. Provide equipment grounding connections for telephone systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

F. Telephone and Signal System Raceways install with a maximum of two 90-deg bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

SUGGESTED BIDDERS

A.
B.
C.