DIVISION 10 000 SPECIALTIES

PART 1: GENERAL

1.01 Division 01 applies to this Division.

1.02 Storage

a. Store materials to avoid hindering work of other Sections and to avoid damage or soiling of materials.

1.03 Shop Drawings

a. Submit three copies for items included in this Division in accrodance with Division 01. In lieu of shop drawings on small items, a sample may be furnished which, when approved, may also be used in the Project.

1.04 Install in accordance with manufacturer's instructions.

1.05 General Clarifications

a. Check construction progress to make sure that necessary slight adjustments in basic construction shall be made to fit specialties ordered. It shall be the responsibility of suppliers to advise the Contractor of changes in size to make required adjustments without additional cost to the Owner. If suppliers fail to do so, they shall be responsible for having adjustments made at their expense when specialties are installed.

b. Furnish anchors and fastenings as required.

1.06 Guarantees and Warrantees

a. Deliver to Owner through Contractor in proper form, guarantee and warranties on specialty items, none of which shall be less than one year.

b. Materials, equipment, or installation found to be defective or non-conforming to specification standards shall be replaced or repaired at Supplier's expense or his installers.

1.07 Installation:

a. Installation shall be complete and under direction of a competent supervisor who, before final acceptance, shall run operation tests with movable parts to the satisfaction of the Architect.

SECTION 10 400: IDENTIFYING DEVICES

PART 1: GENERAL

1.01 SCOPE

a. Furnish materials and perform labor required to complete directories, letters, and insignia.

1.02 SAMPLE AND SHOP DRAWINGS

a. Submit samples of letters and shop drawings of directories and insignia for approval by the Architect as per Article 10 and Article 5 of the UAP General Conditions.

1.03 QUALIFICATIONS OF MANUFACTURER

a. Manufacturer of all works under this section of the specifications shall be approved by the Architect as per Article 10.02 of the UAP General Conditions.

PART 2: PRODUCT

2.01 Materials

a. Brass and/or plastic and/or stainless steel as shown on drawings.

b. Wood for mounting base.

PART 3: EXECUTION

3.01 Workmanship

a. Execute in high quality workmanship comparable with artworks.

SECTION 10 415 BULLETIN BOARDS

PART 1: GENERAL

1.01 Scope

a. Furnish materials and equipment and perform labor required to complete all bulletin boards.

b. Refer to drawings.

PART 2: PRODUCTS

2.01 MATERIALS

a. 12.5 millimeters (1/2") thick plywood backing.

b. 12.5 millimeters (1/2") thick neltex board tacking.

c. Black felt facing.

d. Aluminum or wood frame as shown on drawing.

e. 6 millimeters (1/4") plate clear sliding glass on standard rollers, tracks and guides.

PART 3: EXECUTION

3.01 Workmanship

a. All bulletin boards shown on the drawings shall be furnished and installed true to line, plane and levels.

SECTION 10 520 FIRE EXTINGUISHERS AND CABINETS

PART 1: GENERAL

1.01 Scope

a. Includes:

1. Furnish and install wall-mounted fire extinguishers.
2. Furnish and install fire extinguishers and cabinets.

1.02 Correlate work with other trades.

PART 2: PRODUCTS

2.01 Fire Extinguishers

a. Units shall be of 15 lb. (6.8 kg) dry power ABC stored pressurized type equipped with a pressure gauge. Unit shall not require recharging except after use.

b. Instructions for repairs, maintenance, and recharging, shall be attached to and a part of fire extinguisher units.

c. Units shall be tested and approved by Underwriters Laboratory. UL rating shall appear on extinguisher label.

2.02 Fire Extinguisher Cabinets shall be two-piece, semi-recessed type, with shop primed steel tubs, return trim and doors. Doors shall have roller catches with a minimum glass area in upper section.

PART 3: EXECUTION

3.01 Installations shall be neat and secure without visual flaws.

SECTION 10 800 TOILET AND BATH ACCESSORIES

PART 1: GENERAL

1.01 Scope

a. Furnish materials and perform labor required to complete installation of Toilet and Bath Accessories.

b. Refer to Drawings for location, sizes, details and extent of work involved.

1.02 Samples

a. Submit samples of all toilet and bath accessories to be installed for approval by the Architect as per Article 10.02 of the UAP General Conditions.

PART 2: PRODUCTS

2.01 Accessories

a. Toilet Paper Holder - Porcelain sunk-type similar color as wall tiles. Provide one for each water closet stall.

b. Sanitary Napkin Receptacle - Stainless steel as per Architect's design. Provide one for every women's toilet room.

c. Waste Receptacle - Stainless steel as per Architect's design. Provide one for every toilet room.

PART 3: EXECUTION

3.01 Installation of Accessories

a. Locate accessories as indicated on the drawings.

b. Where accessories are required to be set in cement grout they shall be thoroughly bedded and allowed to set firmly.

c. Where accessories are set with screws, provide the necessary grounds, inserts, screws and bolts as required to provide suitable anchorage.

d. Use brass screws or bolts for securing concealed members and use oval head chromium plated screws and bolts where exposed.

e. Unless otherwise indicated on the drawings, the approximate height from floor to center of accessories shall be as follows:

Toilet Paper Holder - 710 millimeters to 760 millimeters (28 to 30 inches)

Sanitary Napkin Receptacle - 760 millimeters to 910 millimeters (30 to 36 inches).

DIVISION 11 000 EQUIPMENT

PART 1: GENERAL

1.01 Division 01 applies to this Division.

1.02 Storage

a. Store materials to avoid hindering work of other Sections and to avoid damage or soiling of materials.

1.03 Shop Drawings

a. Submit three copies for items included in this Division in accordance with Division 01. In lieu of shop drawings on small items, a sample may be furnished which, when approved, may also be used in the Project.

1.04 Install in accordance with manufacturer's instructions.

1.05 General Clarifications

a. Check construction progress to make sure that necessary slight adjustments in basic construction shall be made to fit specialties ordered. It shall be the responsibility of suppliers to advise the Contractor of changes in time to make required adjustments without additional cost to the Owner. If suppliers fail to do so, they shall be responsible for having adjustments made at their expense when specialties are installed.

b. Furnish anchors and fastenings as required.

1.06 Guarantees and Warrantees

a. Deliver to Owner through Contractor in proper form, guarantee and warranties on specialty items, none of which shall be less than one year.

b. Materials, equipment, or installation found to be defective or non-conforming to the specification standards shall be replaced or repaired at Supplier's expense or his installers.

1.07 Installation:

a. Installation shall be complete and under direction of a competent supervisor who, before final acceptance, shall run operation tests with movable parts to the satisfaction of the Architect.

DIVISION 12 000 FURNISHINGS

PART 1: GENRAL

1.01 Division 01 applies to this Division.

SECTION 12 100 ARTWORK

PART 1: GENERAL

1.01 Scope

a. Furnish all Artwork required.

1.02 Qualification of Artwork Supplier

a. Supplier or artist of all Artwork pieces shall be subject to the Architect's approval.

PART 2: PRODUCTS

2.01 Required Art Pieces

a. Oil painting on canvas with 12.5 millimeters (1/2 inch) plywood backing.

b. Brass metal sculpture.

PART 3: EXECUTION

SECTION 12 600 FURNITURE

PART 1: GENERAL

1.01 Scope

a. Furnish materials and equipment and perform labor required to complete all free standing movable furnishings such as chairs, sofas, desks, cabinets, and others.

b. Refer to Drawings

1.02 Samples

a. Submit samples of typical joints, sections, hardware finish and color of furniture for approval by the Architect as per Article 10.02 of the UAP General Conditions

PART 2: PRODUCTS

Acceptable materials are:

a. Wood - kiln dried Narra or Tanguile

b. Plywood - Narra: 6 millimeters (1/4 inch), 12.5 millimeters (1/2 inch) or 19 millimeters (3/4 inch) thick.

c. Upholstery - non-sag - #9 for seat
- #11 for backrest
Coil spring; Marcelo Foam Rubber; Urethane; Abaca Waste; Cotton batting; Cotton twine; U-nail; cuttacks; shoe tacks; Piping Cord; Alexander thread; wax; twine; Rugby; Parket rubber cement and Hand Cardboard

d. Upholstery cover - Naughyde or Fabric as per schedule

e. Miscellaneous - U.S. made metal sliders, rubber casters, chrome or brass ball casters

PART 3: EXECUTION

3.01 Workmanship

a. Framing - cut square on bearings, closely fitted, accurately set to require lines and levels and rigidly secured in place.

b. Millwork and Trim - conform to design and details and finished smooth and free from machine or tool marks that will show through finish.

c. Joints - shall be tight and formed so as to conceal shrinkage. Shop liters 10 centimeters (4 inches) or more from heel to point and shall be glued and locked.

d. Varnishing - done in accordance with the best workmanship of the trade.

DIVISION 13 000

PART 1: GENERAL

1.01 Special construction, as its name indicates, is unique - and required inspection commensurate with the level of uniqueness and the special demands and characteristics of the materials utilized. In many cases, inspection of special construction is a composite of the components making up the special construction. In other cases, manufacturer's or designer's direction must be carefully followed. Wherever possible, those parties involved in the specification and production of the special construction components should be made a party to their inspection. Often, the contractor or vendor provides a special field erection representative for direction and quality control.

DIVISION 14 000 CONVEYING SYSTEMS

PART 1: GENERAL

1.01 Division 01 applies to this Division.

SECTION 14 200 ELEVATOR

PART 1: GENERAL

1.01 Scope

a. Furnish materials and equipment and perform labor required to complete all labor work.

b. See drawings for sizes, details, location and extent of work required.

1.02 Description of Conveyer System

a. Control - Multi-Voltage Control Equipment. This system is arranged to provide smooth and practically constant acceleration and retardation under all operating conditions. During the acceleration and retardation periods, the voltage applied to the elevator motor is gradually changed by varying the field strength of the generator without interruption of power to the motor.

b. Motor Generator Set - two-bearing, self-ventilated type. Rotating element will have a single continuous steel shaft. Motor shall operate at moderate speed with high efficiency and low power consumption and shall have sufficient capacity to handle without overheating the peak currents typical of elevator service.

c. Automatic Starting and Stopping of Motor: Generator Set - started automatically by the registration of a car or landing call and shall continue to run for approximately 12 seconds after the car has answered the last registered call.

d. Protective Devices - overload relays shall be supplied to protect the driving motor of the motor generator set against overload or phase failure and the generator armature against over-load.

e. Starter - furnish suitable magnet switches for starting the motor generator set.

f. Operating Devices:

1. In the car: Flush type finished metal panel containing a series of push buttons number to correspond to the landings services, as emergency-stop switch, light switch and an emergency call button connected to a bell which serves as an emergency signal.
2. At the hoistway landing: Provide "UP" or "DOWN" push button at each intermediate landing and a single button at each terminal landing.

g. Operation: Car shall not be started unless the car door is in the closed position and all hoistway doors are locked in the closed position.

1.03 Permits and Fees

a. Obtain and pay for all necessary government inspection permit.

1.04 Guarantee

a. The elevator contractor shall guarantee that the materials and workmanship of the apparatus installed by him under these specifications are new and first class in every respect and that he will

make good any defects, not due to ordinary wear and tear or improper use of cars which may develop within one year from date of completion.

1.05 Submittals

a. Furnish five sets of drawings free of charge showing the general arrangement of the elevator equipment for approval before work is begun.

PART 2: PRODUCTS

2.01 Car Platform - constructed of structural steel frames covered with 2 layers of wood flooring shall be T & G Pinewood underside of car platform shall be covered with gauge 16 sheet metal.

2.02 Other Accessories provided:

a. Hoistway entrances (refer to drawing)
b. Door operator
c. Geared traction machine
d. Steel tees guide rails
e. Slide guides for car and counter weight
f. Spring buffers for car and counter weight
g. Rubber sound reducing pads
h. Rail brackets and fastenings, machine beams, wiring material, counterweight, screen, hoist and governor ropes.
i. Vinyl tiles and lighting fixtures
j. Car position indicator
k. Combination hall position indicator and button
l. Brake, motor micro self-leveling sheaves and beams
m. Erection wiring materials
n. Other necessary accessories and item to complete

PART 3: EXECUTION

3.01 Installation

a. Install in a first-class workmanship manner in accordance with applicable codes governing the requirements of all installation.

b. Paint all exposed elevator work after installation.

3.02 Maintenance

a. Furnish maintenance free of charge on the entire elevator work for a period of 3 months after completion of the work.

SECTION 15 011 MECHANICAL GENERAL REQUIREMENTS

PART 1: GENERAL

1.01 Application: All sections of Division 15, "Mechanical" of this project except as specified otherwise in each individual section.

1.02 Work Included

a. Supply and Installation of Air-Conditioning Equipment (Regular and Precision units) including piping, fittings, supports, accessories, insulation, controls and other accessories.

b. Mechanical air ventilation and exhaust system including ductwork, registers, grilles support and all required accessories.

c. Supply and Insallation of starters, relays and other controls components necessary for equipment operations.

d. Relocation of existing air conditioning equipment and controls including dampers, pipes, ducts, wires, conduits and all required accessories.

e. Testing, Adjusting and Balancing of air and water systems including insturments, labor and all necessary equipment.

f. Grouting of openings in floors and walls after all pipes, or ducts are in place and sealing of all openings if not used.

g. Anything that has been ommitted in any item of work or materials usually furnished, which are necessary for the completion of the Mechanical Work as outlined herein before. Such items must be and are hereby included in this Division of Work.

1.03 Submittals:

Submit shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable industry, and technical society publication reference, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

a. Shop Drawings: Drawings shall be a minimum of 215 mm by 280 mm in size, with a minimum scale of 1:100 m., except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installations details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipement. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If

equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

b. Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

c. Codes, Permits and Fees:

1. The work under this contract is to be installed according to the latest requirements of the following: *Mechanical - Philippine National Building Code Regulations of Muntinlupa.* Nothing contained in these specifications or shown on the drawings shall be construed as to conflict with National and Local Ordinances or Laws governing the installation of the Mechanical Work, and all such laws and ordinances are hereby made part of these specifications. The Contractor is required to meet the requirements thereof.
2. Codes and standards of the following organizations other than mentioned above are referenced in this Division:
   - American Society for Testing Materials (ASTM)
   - American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
   - Air Moving and Conditioning Association, Inc. (AMCA)
   - American Refrigeration Institute (ARI)
   - Sheets Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
   - National Fire Protection Association (NFPA).
   - American National Standard Institute (ANSI)
   - National Electrical Manufacturer's Association (NEMA)
   - Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Publications
3. All construction permits and fees required for this work shall be obtained by the Contractor. The Contractor shall furnish the Architect, the Engineers and the Owner final certificated of inspections and approval from the proper government authorities after the completion of the work. The Contractor shall prepare all as-built plans and all other paperwork required by the approving authorities.
4. Approval from authorities of all plans for construction shall be secured by the Contractor.

d. Standards Complance: When materials or equipment must conform to the standards such as the American national Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA). American Refrigeration Institute (ARI), and Underwriters Laboratories (UL), proof of such conformance shall be submitted to the Owners for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing and is approved by the Engineers. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. the certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

1.04 Operation and Maintenance Manual: Furnish an operation and maintenance manual for each item of equipment. Furnish copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that equipment tests are performed, and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words *OPERATION AND MAINTENANCE MANUAL,* the name and location of the equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and telephone numbers of each subcontractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown; description of the function of each pricipal item of equipment; the procedure for starting; the procedure for operating; shutdown instruction; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts list for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonable convenient to the project site. The manual shall be complete in all respects for equipment, controls, accessories, and associated appurtenances provided.

1.05 Posted Operating Instruction: Furnish approved operating instructions for each system and principal item of equipment for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved, and shall be framed under glass or in approved laminated plastic and posted where directed. Operating instructions

MECHANICAL Technical Specification

SANDIGANBAYAN BUILDING

SECTION 15011

MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 APPLICATION: All sections of Division 15, "Mechanical" of this project except as specified otherwise in each individual section.

1.2 WORK INCLUDED:

1.2.1 Supply and installation of air handling units, fan coil units and Air cooled Condensing Unit including foundations, supports, refrigerant piping, valves, fittings and all required accessories.

1.2.2 Supply and installation of air distribution system including ducts, dampers, sound attenuators, diffusers, grilles, plenums, insulation, supports and all required accessories.

1.2.3 Supply and installation of exhaust system including, fans, filters, ducts, supports and all required accessories.

1.2.4 Supply and installation of Control System including controllers, sensors, actuators, starter relay, wires, conduits and components necessary for equipment operations.

1.2.5 Testing, Adjusting and Balancing of the mechanical system including instruments, labor and all necessary equipment.

1.2.6 Grouting of openings in floors and walls after all pipes, or ducts are in place and sealing of all such openings if not used.

1.2.7 Anything that has been ommitted in any item of work or materials usually furnished, which are necessary for the completion of the Mechanical Work as outlined herein before. Such items must be and are hereby included in this Division of Work.

1.3 SUBMITTALS: Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable industry, and technical society publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and

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data submitted in lieu of catalog data are not acceptable and will be returned without approval.

1.3.1 Shop Drawings: Drawings shall be a minimum of 215 mm by 280 mm in size, with a minimum scale of 1:100 m, except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

1.3.2 Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

1.3.3 Codes, Permits and Fees:

1.3.3.1 The work under this contract is to be installed according to the latest requirements of the following:

Mechanical – Philippine National Building Code
Regulations of the Quezon City

Nothing contained in these specifications or shown on the drawings shall be construed as to conflict with National and Local Ordinances or Laws governing the installation of the Mechanical Work, and all such laws and ordinances are hereby made part of these specifications. The Contractor is required to meet the requirements thereof.

1.3.3.2 Codes and standards of the following organizations other than mentioned above are referenced in this Division:

1.3.3.2.1 American Society for Testing Materials (ASTM)

1.3.3.2.2 American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).

1.3.3.2.3 Air Moving and Conditioning Association, Inc. (AMCA).

1.3.3.2.4 American Refrigeration Institute (ARI).

1.3.3.2.5 Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.3.3.2.6 National Fire Protection Association (NFPA).

1.3.3.2.7 American National Standard Institute (ANSI)

1.3.3.2.8 National Electrical Manufacturer's Association (NEMA)

1.3.3.2.9 Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Publications

1.3.3.3 All construction permits and fees required for this work shall be obtained by the Contractor. The Contractor shall furnish the Architect, the Engineers and the Owner final certificates of inspection and approval from the proper government authorities after the completion of the work. The Contractor shall prepare all as-built plans and all other paperwork required by the approving authorities.

1.3.3.4 Approval from authorities of all plans for construction shall be secured by the Contractor.

1.3.4 Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Owners for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing and is approved by the Engineers. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

1.4 OPERATION AND MAINTENANCE MANUAL: Furnish an operation and maintenance manual for each item of equipment. Furnish copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that equipment tests are performed, and furnish the remaining manuals before the contract is completed. Inscribe the following

identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of the equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and telephone numbers of each subcontractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts lists for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonably convenient to the project site. The manual shall be complete in all respects for equipment, controls, accessories, and associated appurtenances provided.

1.5 POSTED OPERATING INSTRUCTIONS: Furnish approved operating instructions for each system and principal item of equipment for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved, and shall be framed under glass or in approved laminated plastic and posted where directed. Operating instructions shall be attached to or posted adjacent to each principal item of equipment and include directions for start up, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other areas as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weatherproof materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.6 INSTRUCTION TO OPERATING PERSONNEL: When specified in other sections, the Contractor shall furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours) of instruction furnished shall be as

specified in other sections. When more than 4 man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

1.7 DELIVERY AND STORAGE: Equipment and materials shall be handled, stored, and protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved. Damaged or defective items shall be replaced.

1.8 STANDARD PRODUCTS/SERVICE AVAILABILITY:

1.8.1 Materials and Equipment: Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size.

1.8.2 Experience Required: The two years' experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures.

1.8.3 Alternative Service Record: Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.8.4 Service Support: The equipment items shall be supported by service organizations. The Contractor shall submit a list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8.5 Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.9 SAFETY REQUIREMENTS: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto

shall be fully enclosed or properly guarded. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.10 MANUFACTURER'S RECOMMENDATIONS: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.11 ELECTRICAL REQUIREMENTS: Electrical components of mechanical equipment and systems such as motors, starters, and Start/Stop button controls and pilot shall be provided under this Division and shall be as specified herein and as necessary for complete and operable systems. Extended voltage range motors will not be permitted. Interconnecting wiring for components of packaged equipment shall be provided as an integral part of the equipment. All interconnecting power wiring and conduit for field erected equipment and all control wiring rated at 100 volts or higher and conduit shall be as specified in Division 16. Control wiring rated under 100 volts and conduit shall be as specified in Division 15. Motor control equipment forming part of motor control centers or switchgear assemblies and all necessary conduit and wiring connecting such assemblies, centers, or other power sources to mechanical equipment shall conform to Division 16.

*** END OF SECTION ***

SECTION 15840

DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Air-Conditioning and Refrigeration Institute (ARI) Publications:

410-81	Forced-Circulation Air-Cooling and Air-Heating Coils
610-74	Standard for Central System Humidifiers

1.1.2 Air Diffusion Council (ADC) Publications:

1062 R4	Equipment Test Code
AD-63	Measurement of Room-to-Room Sound Transmission Through Plenum Air Systems

1.1.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Publications:

52-76	Methods of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

1.1.4 American Society for Testing and Materials (ASTM) Publications:

A 123-78	Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A 167-81	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A 386-78	Zinc-Coating (Hot-Dip) on Assembled Steel Products
A 527-80	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
B 117-73 (R 1979)	Method of Salt Spray (Fog) Testing

C 553-70 (R 1977)	Mineral Fiber Blanket and Felt Insulation (Industrial Type)
D 1654-79a	Standard Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
#96-80	Water Vapor Transmission of Materials

1.1.5 National Fire Protection Association (NFPA) Publication:

90A-78	Installation of Air Conditioning and Ventilating Systems

1.1.6 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA) Publications:

(1975)	High Pressure Duct Construction Standards (HPDCS)
(1976)	Low Pressure Duct Construction Standards (LPDCS)
(1967)	Manual for the Balancing and Adjustment of Air Distribution Systems

1.1.7 Underwriters' Laboratories, Inc. (UL) Publications:

181-81	Factory-Made Air Duct Materials and Duct Connectors
555-79	Fire Dampers and Ceiling Dampers
586-77	Test Performance of High Efficiency, Particulate, Air-Filter Units
900-77	Test Performance of Air Filter Units
1096-81	Electric Central Air-Heating Equipment

1.2 GENERAL REQUIREMENTS: Section 15011, "General Requirements, Mechanical," with the additions and modifications specified herein, applies.

1.2.1 SUBMITTALS

1.2.1.1 Manufacturer's Data:

a. Dampers
b. Insulation and Vapor Barrier
c. Louvers
d. Diffuser, Registers and Grilles

1.2.2 SMACNA Duct Construction Manuals: The SMACNA

recommendations shall be considered as mandatory requirements. Substitute the word "shall" for the word "should" in these manuals.

1.2.3 Pressure-Velocity Classification: Production areas shall be classified as low pressure duct class.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS:

2.1.1 Galvanized Steel Sheets: ASTM A 527; weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq. ft. of a sheet.

2.1.2 Galvanized Steel Hot Dipped After Fabrication: ASTM A 123.

2.2. LOW PRESSURE DUCT CONSTRUCTION: Duct construction, and reinforcements shall conform with the SMACNA LPDCS and NFPA 90A. Air Ducts shall not pulsate or vibrate when in operation. Air leakage shall be less than one percent of the system capacity. Limits where pressure classification for rectangular ducts sytems change shall be as indicated. Curved elbows shall have a centerline radius not less than 1-1/2 times the width of ducts. Sheet metal gages shall be as follows:

Thickness (mm)	Longest side dimension (mm.)
0.6	Less than 750
0.8	775 to 1200
1.0	1225 to 1800
1.2	Greater than 1800

2.2.1 Joints: Construct joints to meet the requirements of the leakage test herein specified.

2.2.2 Fittings: Square elbows, round elbows, fittings, branch take-offs, transitions, splitters, duct volume dampers, fire dampers, flexible connections, and access doors shall conform with the SMACNA LPDCS. Test holes shall be factory fabricated, airtight, and noncorrosive with screw cap and gasket.

2.2.3 Rectangular Ducts: Joints between sections of duct and between ducts and fittings shall be as required by SMACNA LPDCS.

2.3 CASINGS AND PLENUMS:

2.3.1 Field-Fabricated Components: Unless otherwise indicated, metal thickness, reinforcements, joint sealing, and fabrication and erection of equipment casings and plenums shall conform with SMACNA HPDCS and LPDCS.

2.3.2 Factory-Fabricated Components: Factory-fabricated and insulated sheet metal may be used if conforming to paragraph

"Field-Fabricated Components." The panels shall be of modular design pretested for structural strength, thermal control, condensation control, and acoustical control. The panel joints shall be sealed and access doors shall be gasketed to prevent air leakage. Insulate access doors. Fasteners shall be corrosion resistant.

2.4 DIFFUSERS, REGISTERS, AND GRILLES:

2.4.1 Material and Finishes: Construct diffusers, registers, and grilles of steel or aluminum. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc-phosphate treated prior to priming and painting and or have a baked-on enamel finish. Colors shall be selected or approved by the Architect and Engineers.

2.4.2 Sound Pressure Level: The inlets and outlets shall be sound rated and certified in accordance with ADC 1062 R4, in dB of noise criterion (NC) based on sound power level minus 10 dB (10 Exp. minus 12 watts ref.) in each octave band. Conform with the following permissible room sound pressure levels:

NC Range, dB	Typical Application
25-30	Conference Rooms
30-35	All other areas

2.4.3 Throw: Defined as distance from the diffuser, register, or grille to the point which the air velocity falls below 100 feet per minute. Throw shall not exceed 1.5 times the outlet mounting height.

2.4.4 Drop: Maximum drop of air stream shall not be so great that it is within 6 feet of the floor at the end of the throw.

2.4.5 Ceiling Diffusers: Equip with baffles or other devices required to provide proper air distribution pattern as indicated. Provide factory-fabricated, single key, volume dampers. Except Linear air diffusers internal parts shall be removable through the diffuser-neck for access to the duct and without the use of special tools.

2.4.5.1 Circular, Square, and Rectangular Diffusers: Each ceiling diffuser shall consist of four or more concentric circular elements designed to deliver air radially in a generally horizontal direction without excess smudging of the ceiling. The interior elements of square and rectangular ceiling diffusers may be circular, square, or rectangular as manufacturer's standard.

2.4.6 Registers: Supply registers shall be double-deflection type. Provide volume dampers furnished by the manufacturer. Volume dampers shall be of the group-operated, opposed-blade type and key adjustable by inserting key through face of register. Operating mechanism shall not project through any part of the

register face. Provide exhaust and return registers as specified for supply registers, except that they shall have a single set of nondirectional face bars or vanes having the same appearance as the supply registers.

2.4.7 Grilles: Construct and finish as specified above for registers, except that volume dampers shall be omitted.

2.5 DUCT SLEEVES AND PREPARED OPENINGS:

2.5.1 Duct Sleeves and Closure Collars: Fabricate from 20 gage galvanized steel. Where sleeves are installed in bearing walls or partitions, use black steel pipe, standard weight, instead.

2.5.2 Prepared Openings: Provide one-inch clearance between the duct and the sleeve.

2.6 DEFLECTORS: Factory-fabricated and factory-or-field-assembled units consisting of curved turning vanes for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved vanes for square elbows.

2.7 ACCESS DOORS: Door frame shall be welded in place. Door shall be rigid and airtight with neoprene gaskets and two or more galvanized steel hinges and tension fasteners. Provide doors as large as practical. Mount doors, if possible, so that air pressure holds them closed.

2.8 DAMPERS AND LOUVERS: Shall be 2-gage heavier than ducts in which installed. Dampers shall be opposed-blade type. The construction shall be of aluminum or galvanized steel with interlocking edges and maximum 10-inch blade width. Conform with SMACNA HPDCS.

2.9.1 Splitter Manual Volume Dampers: Balancing, factory-fabricated type. Equip dampers with accessible mechanism such as quadrant operators or 3/16-inch rods brought through the side of ducts with locking setscrew and bushing. Where operators occur in finished portions of the building, operators shall be chrome-plated with all exposed edges rounded.

2.9.2 Fire Dampers: Provide on all penetrations of machine room walls and floors.

2.9.3 Louvers: Fixed type. Fold or bead the edges of louver blades to exclude driving rain. Louver frames shall be made of 16] aluminum. Provide bird (insect) screen constructed of the same type metal as the louvers.

2.9.4 Bird Screens: 1/2-inch by 1/2-inch mesh, 0.063-inch diameter aluminum wire or 0.013-inch diameter stainless steel wire. Insect screen frames shall be grooved type with vinyl or neoprene spline insert for securing screen cloth.

2.10 DUCT INSULATION: Fiberglass, ASTM C 553, Type I (flexible resilient), Class B-5 (up to 204 degrees C), 48 kg. cu. m. nominal, with double reinforced aluminum foil vapor barrier, to be used on concealed ducts.

2.10.1 Rigid Fiberglass: ASTM C 612; block and board type; Class 2 (up to 204 degrees C), 80 kcm cu. m. with aluminum foil vapor barrier for exposed ducts.

2.10.2 Fire Resistance: Insulation, adhesives, vapor-barrier materials, and other accessories, except as specified herein, shall be noncombustible. The materials shall not have a flame-spread rating more than 25 and a smoke-developed rating not more than 50 in accordance with NFPA 255, ASTM E 84, or UL 723.

2.10.3 Insulation Thickness: Use 50 mm thick for production area and dry storage. For other areas, use 25 mm thick rigid or flexible blanket insulation on ducts, plenums, and casings with operating temperatures 90 degrees C or less.

2.10.4 CANVAS INSULATION JACKETS: Provide Canvass Jackets on exposed insulated ducts and paint with the same color as the ceiling.

2.10.5 ADHESIVES, SEALANTS, AND COMPOUNDS: Shall be compatible with materials to which applied and suitable for the service. They shall comply with requirements for fire resistance.

2.10.6 ACCESSORIES:

2.10.6.1 Insulation Bands: 20 mm wide plastic straps.

2.10.6.2 Anchor Pins: Provide anchor pins and speed washers recommended by the insulation manufacturer.

2.10.6.3 Aluminum-Foil-Backed Pressure-Sensitive Adhesive Tape: 75 mm minimum width and limited to use on insulation with with aluminum foil facing.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 General: Installation shall conform with NFPA 90A and SMACNA LPDCS. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, and dampers. Use electrical isolation between dissimilar metals. Install ductwork accessories as indicated in accordance with the manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and service.

3.1.2 Ductwork: Install airtight. When air distribution systems are operated, there shall be no chatter, vibration, or dust marks.

3.1.2.1 Field Changes to Ductwork: Those required to suit the sizes of factory-fabricated equipment actually furnished, shall be designed to minimize expansion and contraction. Use gradual transitions in field changes as well as modifications to connecting ducts.

3.1.2.2 Dampers: When installed on ducts to be thermally insulated, equip each damper-operator with stand-off mounting brackets, bases, or adapters to provide clearance between the duct and operator not less than the thickness of insulation. Stand-off mounting items shall be integral with the operator or standard accessory of damper manufacturer.

3.1.2.3 Deflectors: Provide in square elbows, duct-mounted supply outlets, take-off or extension collars to supply outlets, and tap-in branch-off connections. Adjust supply outlets to provide air volume and distribution as indicated or specified.

3.1.2.4 Fire Dampers: Install for ducts penetrating machine room walls, walls and where ducts systems serve two or more floors in accordance with UL 555.

3.1.2.5 Access Doors: Provide for automatic dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, and other concealed apparatus requiring service and inspection in the duct systems.

3.1.2.6 Duct Sleeves and Prepared Openings: Install for duct mains, duct branches, and ducts passing through roofs and ceilings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings.

3.1.2.6.1 Duct Sleeves: Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.

3.1.2.6.2 Prepared Openings: Allow one-inch clearance between duct and opening or one-inch clearance between insulation and opening for insulated ducts, except at grilles, registers, and diffusers.

3.1.2.6.3 Closure Collars: Provide of not less than 4 inches wide on each side of walls or floors where sleeves or prepared openings are installed. Fit collars snugly around ducts and insulation. Ground smooth edges of collar to preclude tearing or puncturing insulation covering or vapor barrier. Use nails with maximum 6-inch centers on collars.

3.1.2.6.4 Packing: Pack with Fed. Spec. HH-I-1030 mineral fiber in spaces between sleeve or opening and duct or duct insulation.

3.1.3 Duct Supports: Unless otherwise indicated, provide not less than two one-inch by 1/16-inch galvanized strap-iron hangers

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spaced one on each side of duct. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing.

3.1.3.1 Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals, as indicated or required. For round ducts, securely fasten flexible connections by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connections to metal collars.

3.1.4 Inspection Plates and Test Holes: Provide where required in ductwork or casings for all balance measurements. Test holes shall be factory fabricated, airtight, and noncorrosive with screw cap and gasket. Extend cap through insulation.

3.1.5 Acoustical Duct Lining: Apply the lining in cut-to-size pieces attached to interior of ducts with fire-resistant adhesive. Top and bottom pieces shall lap the side pieces. Secure pieces together with welded pins or clips. Do not distort the ducts or burn through or mar the finish surface of ducts. Pins and washers shall be flush with the surface of duct liners. Seal breaks and punctures of duct liner coating with fire-resistant adhesive. Exposed edges of the liner at duct-ends and other joints where lining will be subject to erosion shall be coated with a heavy brush coat of fire-resistant adhesive. To prevent delamination of glass fibers. Duct liners may also be applied to flat-sheet-metal with fire-resistant adhesive. At top and bottom surface of ducts; duct liners shall be then secured by welded pins or adhered clips.

3.1.6 Flashings: Provide waterproof flashings where ducts pass through exterior walls and roofs.

3.1.7 Cleaning of Ducts: Remove all debris and dirt from ducts and wipe clean. Before installing air outlets, use air handler to blow dry air through entire system at maximum attainable velocity. Provide temporary air filters for this operation.

3.2 FIELD TESTS AND INSPECTIONS: The Contractor is responsible for the administration and direction of tests. Furnish instruments, equipment, connecting devices, and personnel for the tests. Notify Engineers days before inspection or testing is scheduled.

3.2.1 Low Pressure Ductwork Tests: Test ducts, plenums, and casings for air leakage. Prior to application of insulation, subject new ductwork to static pressure equivalent to that

indicated or implied in drawings. Before installing supply outlets, apply temporary caps where outlets will be connected. Connect a test blower temporarily to inlet end of duct and, by throttling its intake, adjust static pressure in duct to required value. Read voltage and current to blower motor and total static pressure across blower wheel. Apply these data to AMCA-certified performance table for the test blower to derive volumetric flow rate (CFM) of air injected into duct. This amount shall not exceed 5 percent of total air that duct is required to deliver. Remove temporary caps and test blower.

3.2.3 Performance Testing and Balancing:

3.2.3.1 Balancing and Testing of Air Systems: To achieve and confirm compliance with drawings and specifications. Prepare complete report of final test results and submit in quadruplicate. In all of the above, comply with SMACNA Manual for the "Balancing and Adjustment of Air Distribution Systems."

3.2.3.2 Sound Level Tests: Upon completion of testing and balancing of air systems, conduct sound level tests of conditioned spaces. Use approved calibrated sound level meter and record sound levels in dBA with air systems off, with heating system only operating, and with cooling system only operating. Record the following data for each room and system in quadruplicate:

a. Background sound level (systems off).
b. Total sound level with one system operating.
c. Total sound level corrected for background.
d. Sound power rating by manufacturer of the respective outlet.

3.2.3.2.1 Test Locations: Take sound level reading at location 6 feet from face of each outlet on a line at 45 degrees with face of outlet.

3.2.3.2.2 Remedial Action: If sound level at any observation point exceeds 50 dBA, the Contractor shall take remedial action as directed.

3.3 INSULATION

3.3.1 Preparation: Do not apply insulation until surfaces to be covered have been leak tested, have had rust and scale removed, and have been cleaned, dried, and inspected.

3.3.2 Application: Insulation shall be clean and dry when installed and kept dry during finish application. Wetted insulation will not be approved for installation. Install materials neatly with smooth and even surfaces with jackets drawn tight and smoothly cemented down on longitudinal and end laps. Scrap pieces shall not be used where a full-length section will fit. All surface finishes shall be extended to protect all surfaces, ends, and raw edges of insulation. Coatings and adhesives shall be applied at the manufacturer's recommended

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coverage per gallon.

3.3.2.1 Name Plates and Access Plates: Do not insulate name plates or ASME labels. Bevel insulation around name plates and ASME stamps.

3.3.2.2 Ducts, Plenums, and Casings: Insulate ventilating, and air conditioning, supply and return, from the outside air intake to the room outlets. Insulate flexible runouts, plenums, casings, and air handlers. Install rigid insulation on exposed ducts in inside and outside locations. Where indicated, provide rigid insulation lining inside ducts. Use flexible blanket insulation on concealed interior ducts and on exposed round or oval ducts. Insulation shall be continuous through walls and floors except at fire dampers.

3.3.2.3 Access Plates and Doors: On internally insulated ducts, plenums, and casings, continue insulation on access plates and doors. On externally insulated ducts, plenums, and casings, provide insulation-filled hollow steel panels and doors for access openings larger than 1 sm, where high operating temperatures present a hazard to personnel, or where moisture condensation on low temperature systems is a problem. Bevel insulation around access plates and doors.

3.3.2.4 Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 75 mm from edge of boards and spaced not more than 450 mm centers and secured with washers and clips. Spot-weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Where vapor barrier is specified, all joints, breaks, punctures, and voids shall be filled with vapor barrier coating compound and covered with vapor seal material identical to that surrounding. Neatly bevel insulation around name plates and access plates and doors. Each pin or anchor shall be capable of supporting a 10 kilogram force load. Protruding ends of clips shall be cut off flush after clips are secured and sealed with aluminum backed pressure sensitive tape and coated with silicone adhesive.

3.3.2.5 Flexible Blanket Insulation: Apply tightly and smoothly to duct. Seal joints of insulation with 100 mm wide waterproof bonding adhesive tape. In addition to adhesive tape, secure flexible insulation on the bottom of rectangular, horizontal, and sloping ducts with wire or outward clinch staples.

3.3.4.1 Equipment Insulation: Apply equipment insulation to fit as closely as possible to equipment. Insulation shall be grooved or scored where necessary to fit the contours of equipment. Stagger end joints where possible. Bevel the edges of the insulation for cylindrical surfaces to provide tight joints. Join sections of cellular glass insulation with bedding compound. After the insulation is in place on areas to be insulated, except where metal-encased, fill joints, seams,

chipped edges, or depressions with bedding compound to form a smooth surface. Bevel insulation around name plates, ASME Stamp, and access plates. Insulation on equipment that must be opened periodically for inspection, cleaning, and repair shall be constructed so insulation can be removed and replaced without damage.

3.3.4.2 Ducts, Plenums, Casings, and Equipment: Duct insulation and finishes shall be continuous through walls and floors except at fire dampers.

3.3.4.3 Exposed in Indoor Locations: Provide insulation with factory-applied jacket with integral vapor-barrier, as required by the service. Where use of factory-applied jacket would result in wrinkles or fishmouths, apply the following finishes. Where vapor barrier is required, apply two coats of Mil. Spec. MIL-C-19565, Type II, vapor-barrier coating with glass cloth or tape embedded between coats. Overlap glass cloth or tape 2 inches at joints. Where regular and irregular shapes occur, use factory-applied jackets and other finishes specified above in combinations.

*** END OF SECTION ***

SECTION 15653

UNITARY AIR CONDITIONING SYSTEMS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Air Conditioning and Refrigeration Institute (ARI) Publications:

210-81	Unitary Air Conditioning Equipment
260-75	Application, Installation and Servicing of Unitary Systems
310-82	Packaged Terminal Air Conditioners
360-81	Commercial and Industrial Unitary Air Conditioning Equipment

1.1.2 American National Standards Institute (ANSI) Publications:

B16.22-80	Wrought Copper and Bronze Solder-Joint Pressure Fittings
B31.5-83	Refrigerant Piping

1.1.3 American Society of Heating, Refrigerating, and Air Conditioning Engineers, (ASHRAE) Inc. Publications:

1980	Systems, Handbook and Product Directory
No. 15-78	Safety Code for Mechanical Refrigeration

1.1.4 American Society of Mechanical Engineers (ASME) Publication:

1983	Boiler and Pressure Vessels Code Section VIII-Vessels, Division 1 - 1983, with Addenda

1.1.5 American Society for Testing and Materials (ASTM) Publications:

B 88-83	Seamless Copper Water Tube
B 209-83	Aluminum and Aluminum-Alloy Sheet and Plate
B 280-83	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
C 534-82	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tabular Form
E 84-81a	Test for Surface Burning Characteristics of Building Materials

1.1.6 American Welding Society (AWS) Publication:

A5.8-81	Brazing Filler Material

1.1.7 Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry Publications:

SP-58-83	Pipe Hangers and Supports - Materials and Design
SP-69-83	Pipe Hangers and Supports - Selection and Application

1.1.8 National Electrical Manufacturers Association (NEMA) Publications:

MG-1-78 (R 82)	Motors and Generators
MG-1-78 (R 83)	Industrial Control and Systems
ICS 2-78 (R 83)	Industrial Controls Devices Controllers and Assemblies
ICS 6-78 (R 83)	Enclosures For Industrial Controls and Systems

1.1.9 Underwriters Laboratories (UL) Publications:

109-78	Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service and Marine Use
873-79	Temperature Indicating and Regulating Equipment

1.2. GENERAL REQUIREMENTS: Section 15011, "Mechanical General

Requirements," with the following additions and modifications, applies.

1.2.1 Submittals:

1.2.1.1 Manufacturer's Data:

a. Air Conditioners
b. Refrigerant Piping and Accessories

1.2.2 Piping Definition: Piping, as used in this specification, includes pipe, flexible unicellular insulation, tubes, flanges, bolting, gaskets, valves, and fittings; the pressure containing parts of other components such as strainers, sight gages, and dehydrators; and pipe supporting fixtures and structural attachments.

1.2.3 Safety Standard: Design, manufacture, and installation of mechanical refrigeration equipment shall conform to ASHRAE 15.

1.2.4 Motors: NEMA MG1. Motor starters shall conform to NEMA ICS 1 and ICS 2. Determine specific motor characteristics to insure provision of correctly sized starters and overload heaters. Motors shall be designed to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. Each motor shall be provided with short circuit and thermal overload protection as well as other safety devices as specified in the latest edition of the Philippine Electrical Code. When motor size provided differs from the size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate the equipment actually provided.

PART 2 - PRODUCTS

2.1 SPLIT-SYSTEM AIR CONDITIONERS: The separate assemblies shall be designed to be used together and ratings shall be based on the use of the matched assemblies. Provide performance diagrams for units with capacities not certified by ARI to demonstrate that the components of the air conditioning system furnished will satisfy the capacity requirement specified or indicated on the drawings. The system capacity, electrical characteristics and operating conditions shall be as indicated. Each motor shall be provided with short circuit and thermal overload protection as well as other safety devices as specified in the latest edition of the Philippine Electrical Code.

2.1.1 Single Zone Units: Units shall be single zone type arranged to draw through the coil sections.

2.1.2 Compressors: Hermetic or semihermetic type. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide compressors with crankcase heaters. Motors shall be constant. speed, squirrel-cage induction, low-starting current, high-torque type. Motor starter enclosure shall be general-purpose or weather-resistant type as needed in accordance with NEMA ICS 6.

2.1.3 Coils: Tubes shall be constructed of copper tubes mechanically expanded and bonded to aluminum fins of aluminum alloy 7072.

2.1.4 Condenser Controls: Provide high and low pressure switches and low oil pressure switch.

2.1.5 Fans, Condenser and Evaporator: Evaporator fan shall be manufacturer's standard. Select pulleys at approximately midpoint of the adjustable range. Motors shall be totally enclosed type. Starter enclosure shall be general-purpose or weather-resistant type as needed in accordance with NEMA ICS 6.

2.1.6 Temperature Control Systems: Thermostats shall be of the adjustable type and shall conform to applicable requirements of UL 873. Thermostats for air conditioners shall be provided with contacts hermetically sealed against moisture, corrosion, lint, dust, and foreign material. Thermostats shall be designed to operate on not more than 1.0 degrees Centigrade differential and of suitable range calibrated in degrees Fahrenheit or Centigrade. Thermostats shall have fixed cooling anticipation. Thermostat shall contain temperature sensing elements electrically connected to control the refrigeration compressor. The electrical characteristics shall be as indicated. The thermostat or subbase shall contain system selector switches to provide "FAN, COOL and OFF" and fan selector switches. All necessary relays, contactors, transformers, or motor starters shall be provided and located in a panel or panels for easy replacement and service.

2.1.6.1 Controls:

2.1.6.1.1 When fan selector switch is in "ON" position, the fan shall run continuously.

2.1.6.1.2 When thermostat is in "COOL" position with fan selector switch in "ON" position, the compressor and the condenser fan shall cycle together and the evaporator fan shall run continuously.

2.2 FILTERS: Provide filters to filter fresh air and return air and locate inside air conditioners Filters shall be cleanable (reusable) type. Filters shall conform to UL 900. Polyurethane filters shall not be used on units with multiframe filters.

2.3 REFRIGERANT PIPING AND ACCESSORIES: Provide accessories

as specified herein. A filter-drier shall be provided in the liquid line.

2.3.1 Field-Assembled Piping: Material and dimensional requirements for field-assembled refrigerant piping, valves, fittings, and accessories shall conform to ASHRAE 15 and ANSI B31.5, except as herein specified. Refrigerant piping shall be cleaned, dehydrated, and sealed when delivered. Refrigerant piping shall be seamless copper tubing, hard drawn, Type or L, conforming to ASTM B 88, except that tubing with outside diameters of 1/4-inch and 3/8-inch shall have nominal wall thickness of not less than 0.30-inches and 0.032-inches, respectively. Soft annealed copper tubing conforming to ASTM B 280 may be used where flare connections to equipment are required only in nominal sizes less than 1-inch.

2.3.2 Fittings: ANSI B16.22 for solder-joint fittings. UL 109 for flared.tube fittings.

2.3.3 Brazing Filler Material: AWS A5.8.

2.3.4 Pipe Hangers and Supports: As indicated in the drawings.

2.3.5 Pipe Sleeves: Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 8 mm space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and calk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

2.3.5.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A 53 or ASTM A 120, Schedule 40 or Standard Weight, zinc-coated steel pipe sleeves. -Extend sleeves in floor slabs 75 mm above the finished floor.

2.3.5.2 Sleeves in Partitions and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide zinc-coated steel sheet having a nominal thickness of not less than 0.6 mm.

2.3.6 Insulation: Flexible Unicellular comforming to ASTM C534; 1/2 in. thick for tube size 1/4 to 1-1/4 in. dia. and 3/4 in. thick for tube size 1-1/2 to 3 in. dia. Provide aluminum cladding on pipes exposed to the weather.

2.3.7 ELectrical Conduits: Conduits shall be electrical metallic tubing. Waterproof flexible connections shall be provided to motors exposed to outdoor conditions.

2.3.8 Electrical Wires: THW by phelps Dodge.

PART 3 - EXECUTION

3.1 INSTALLATION: ARI 260, and as specified herein.

3.1.1 General: Install equipment and components in a manner to insure proper and sequential operation of the equipment and equipment controls. Installation of equipment not covered herein or in manufacturers instructions shall be installed as recommended by manufacturers representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including; but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturers recommendation, unless otherwise indicated on drawings. Set anchor bolts and sleeves accurately using properly constructed templates. Anchor bolts shall be of adequate length and provided with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for all necessary servicing such as shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, valves, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.1.2 Unitary or Split Type Air Conditioning System: Install system as indicated, in accordance with the requirements of ASHRAE 15, and as recommended in the manufacturers installation and operational instructions.

3.1.3 Electrical Work: Electric motor-driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring from disconnect switches to equipment shall be provided. All electrical work shall be in accordance with the Philippine Electrical Code. Provide manual or automatic control and protective devices required for the operation herein specified and any control wiring required for controls and devices but not indicated.

3.1.4 Piping: Brazing, bending, forming and assembly of refrigerant piping shall conform to ANSI B31.5.

3.1.4.1 Pipe Hangers and Supports: Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58. Hanger types and supports for bare and covered pipes shall conform to MSS SP-69 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58.

3.1.4.2 Refrigerant Piping: Cut pipe accurately to measurements established at the site and work into place without

springing or forcing. Install piping with sufficient flexibility to adequately provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but located where they may be readily inspected. Run all pipe to be insulated as indicated and as required with sufficient clearance to permit application of insulation. Run all piping essentially as indicated and detailed on the plans; to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines shall not be permitted except where indicated. Provide sleeves of suitable size for all lines passing through building structure. Braze refrigerant piping with silver solder complying with AWS A5.8. The inside of tubing and fittings shall be free of flux. Clean the parts to be jointed with emery cloth and keep hot until the solder has penetrated the full depth of the fitting and the extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During the brazing operation, prevent an oxide film from forming on the inside of the tubing by slowly flowing dry nitrogen through the tubing to expel the air. Make provisions to automatically return oil on halocarbon systems. Installation of piping shall comply with ANSI B31.5.

3.1.4.3 Returning Oil From Refrigerant System: Install refrigerant lines so that the gas velocity in the evaporator suction line is sufficient to move the oil along with the gas to the compressor. Where equipment location requires vertical risers, the line shall be sized to maintain sufficient velocity to lift the oil at minimum system loading and corresponding reduction of gas volume. Install a double riser when excess velocity and pressure drop would result from full system loading. The larger riser shall have a trap, of minimum volume, obtained by use of 90 degree and 45 degree ells. Arrange the small riser with inlet close to bottom of horizontal line, and connect to top of upper horizontal line. Do not install valves in risers.

3.1.4.4 Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valved bypass line the same size as liquid line in which the drier is installed. Size of driers shall be determined by the piping and installation of the unit on location. Moisture indicators shall be installed in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed.

3.1.4.5 Locate strainers close to equipment they are to protect. Provide a strainer in the common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on strainer's body.

3.1.4.6 Flexible Unicellular Insulation: Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, and fittings in accordance with manufacturer's published instructions. Apply two coats of vinyl lacquer finish to flexible unicellular insulation in outside locations.

3.1.6 Access Panels: Provide access panels for all concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.1.7 Air Filters: Install air filters to allow access space for servicing the filters. Install filters with suitable sealing to prevent bypassing of air.

3.1.8 Flashing and Pitch Pockets: Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls.

3.2 FIELD TESTS:

3.2.1 Tests: All tests shall be performed by and everything required for test shall be furnished by the Contractor, including personnel. Equipment and materials certified as having been successfully tested by the manufacturer in accordance with referenced specifications and standards will not require retesting before installation. Equipment and materials not tested at the place of manufacture shall be tested before or after installation, as applicable, where necessary to determine compliance with referenced specifications and standards.

3.2.1.1 Leak Testing: Upon completion of installation of the air conditioning equipment, test all factory- and field-installed refrigerant piping with Nitrogen to a test presure of 300 psig and maintain for 24 hours to acquire a leak-tight refrigerant system. If leaks are detected at time of installation or during the guarantee period, remove the entire refrigerant charge from the system, correct the leaks, and retest the system.

3.2.1.2 Evacuation, Dehydration, and Charging: After leak testing, evacuate the system using a reliable gage and a vacuum pump capable of pulling a vacuum of at least 1 mm Hg absolute. Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturers printed instructions. System leak testing, evacuation, dehydration, and charging with refrigerant shall comply with the requirements contained in ARI 260.

3.2.1.3 Startup and Operation Tests: Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to insure proper operation and sequence. The operational test shall be not less than 8 hours.

3.2.1.4 Performance Tests: Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, systems shall be performance tested to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, during which time hourly readings shall be recorded. At the end of the test period, the readings shall be averaged and the average shall be considered to be the system performance. SMACNA standard forms for Testing and Balancing complete with Engineer's or Manufacturer's data, and performance data shall be submitted.

*** END OF SECTION ***

SECTION 15011B

FIRE PROTEECTION GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 APPLICATION: All sections of Division 15, "Mechanical" of this project except as specified otherwise in each individual section.

1.2 WORK INCLUDED:

1.2.1 Supply and Installation fire protection water supply system including diesel engine driven fire pump, electric motor driven jockey pump, controllers, concrete base, engine exhaust system, insulation, day tank, fuel piping, fittings, supports, accessories, insulation, controls and other accesories.

1.2.2 Supply and installation of wet pipe automatic sprinkler system including sprinkler heads, pipes, valves, supports, and all required accessories,

1.2.3 Supply and installation of standpipe and hose system including hose stations, fire hose valves, cabinets, hangers, supports and all required accessories.

1.2.4 Suplly and installation of wet chemical type system for the kitchen hood including controls, tanks, agents, detection system, nozzles, pipes, valves supports and all required accessories.

1.2.5 Supply and installation of a fire alarm system for the supervision of the sprinkler system including supervisory switches, flow switches, fire alarm control panel, wires and conduits from circuit breakers provided by the electrical contractor to panel, interlocks with the kitchen hood fire protection system and the building fire alarm control panel.

1.2.6 Grouting of openings in floors and walls after all pipes, or ducts are in place and sealing of all such openings if not used.

1.2.7 Anything that has been ommitted in any item of work or materials usually furnished, which are necessary for the completion of the Fire Protection Work as outlined herein before. Such items must be and are hereby included in this Division of Work

1.3 SUBMITTALS: Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are

not acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable industry, and technical society publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

1.3.1 Shop Drawings: Drawings shall be a minimum of 215 mm by 280 mm in size, with a minimum scale of 1/8 inch per foot, except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

1.3.2 Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

1.3.3 Codes, Permits and Fees:

1.3.3.1 The work under this contract is to be installed according to the latest requirements of the following:

Mechanical - Philippine National Building Code
Regulations of Quezon City

Nothing contained in these specifications or shown on the drawings shall be construed as to conflict with National and Local Ordinances or Laws governing the installation of the Mechanical Work, and all such laws and ordinances are hereby made part of these specifications. The Contractor is required to meet the requirements thereof.

1.3.3.2 Codes and standards of the following organizations other than mentioned above are referenced in this Division:

1.3.3.2.1 American Society for Testing Materials (ASTM)

1.3.3.2.2 American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).

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1.3.3.2.3 Air Moving and Conditioning Association, Inc. (AMCA).

1.3.3.2.4 American Refrigeration Institute (ARI).

1.3.3.2.5 Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.3.3.2.6 National Fire Protection Association (NFPA).

1.3.3.2.7 American National Standard Institute (ANSI)

1.3.3.2.8 National Electrical Manufacturer's Association (NEMA)

1.3.3.2.10 Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Publications

1.3.3.3 All construction permits and fees required for this work shall be obtained by the Contractor. The Contractor shall furnish the Architect, the Engineers and the Owner final certificates of inspection and approval from the proper government authorities after the completion of the work. The Contractor shall prepare all as-built plans and all other paperwork required by the approving authorities.

1.3.3.4 Approval from authorities of all plans for construction shall be secured by the Contractor.

1.3.4 Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Owners for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable testing and is approved by the Engineers. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project

specification and of the referenced standards listed.

1.4 OPERATION AND MAINTENANCE MANUAL: Furnish an operation and maintenance manual for each item of equipment. Furnish copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that equipment tests are performed, and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of the equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and telephone numbers of each subcontractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts lists for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonably convenient to the project site. The manual shall be complete in all respects for equipment, controls, accessories, and associated appurtenances provided.

1.5 POSTED OPERATING INSTRUCTIONS: Furnish approved operating instructions for each system and principal item of equipment for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved, and shall be framed under glass or in approved laminated plastic and posted where directed. Operating instructions shall be attached to or posted adjacent to each principal item of equipment and include directions for start up, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other areas as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weatherproof materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.6 INSTRUCTION TO OPERATING PERSONNEL: When specified in other sections, the Contractor shall furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and

maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours) of instruction furnished shall be as specified in other sections. When more than 4 man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

1.7 DELIVERY AND STORAGE: Equipment and materials shall be handled, stored, and protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved. Damaged or defective items shall be replaced.

1.8 STANDARD PRODUCTS/SERVICE AVAILABILITY:

1.8.1 Materials and Equipment: Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size.

1.8.2 Experience Required: The two years' experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures.

1.8.3 Alternative Service Record: Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.8.4 Service Support: The equipment items shall be supported by service organizations. The Contractor shall submit a list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8.5 Manufacturer's Nameplate: Each item of equipment shall

have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.9 SAFETY REQUIREMENTS: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of equipment.

1.10 MANUFACTURER'S RECOMMENDATIONS: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.11 ELECTRICAL REQUIREMENTS: Electrical components of mechanical equipment and systems such as motors, starters, and Start/Stop button controls and pilot shall be provided under this Division and shall be as specified herein and as necessary for complete and operable systems. Extended voltage range motors will not be permitted. Interconnecting wiring for components of packaged equipment shall be provided as an integral part of the equipment. All interconnecting power wiring and conduit for field erected equipment and all control wiring rated at 100 volts or higher and conduit shall be as specified in Division 16. Control wiring rated under 100 volts and conduit shall be as specified in Division 15. Motor control equipment forming part of motor control centers or switchgear assemblies and all necessary conduit and wiring connecting such assemblies, centers, or other power sources to mechanical equipment shall conform to Division 16.

*** END OF SECTION ***

SECTION 15330

FIRE EXTINGUISHING SPRINKLER SYSTEMS
(WET PIPE)

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

A 53-83 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A 120-84 Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses

1.1.2 Factory Mutual System (FM) Publication:

Approval Guide (1985)

1.1.3 National Fire Protection Association (NFPA) Publications:

13 Sprinkler Systems

24 Private Fire Service Mains and Their Appurtenances

70 National Electrical Code

72A Installation, Maintenance and Use of Local Protective Signaling Systems for Guard's Tour, Fire Alarm and Supervisory Service

72B Installation, Maintenance and Use of Auxiliary Protective Signaling Systems

1.1.4 Underwriters Laboratories Inc. (UL) Publications:

262-80 Gate Valves for Fire-Protection Service & Am 83

Fire Protection Equipment Directory (1985)

1.2 QUALIFICATIONS OF INSTALLER: Prior to installation, submit data for approval showing that the Contractor has successfully installed automatic fire extinguishing sprinkler systems of the same type and design as specified herein, or that Contractor has a firm contractual agreement with a subcontractor having such required experience. The data shall include the names and locations of at least two installations where the

Contractor, or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

1.3 GENERAL REQUIREMENTS: Section 15011B, "Fire Protection General Requirements", applies to this section, with the additions and modifications specified herein.

1.4 DESCRIPTION OF WORK: The work includes providing new automatic wet pipe fire extinguishing sprinkler systems, Class II wet standpipe system, and Class I dry standpipe system. The equipment, materials, installation, workmanship, examination, inspection, and testing shall be in strict accordance with the required and advisory provisions of NFPA 13, except as modified herein. Each system shall include all materials, accessories, and equipment inside and outside the building to provide each system complete and ready for use. Install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and other construction and equipment in accordance with detailed drawings to be submitted for approval. Devices and equipment for fire protection service shall be UL listed or FM approved for use in wet pipe sprinkler systems. In the NFPA publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Fire Protection Consultant or as designated by the Owners.

1.5 SUBMITTALS: Partial submittals will not be acceptable. Annotate descriptive data to show the specific model, type, and size of each item the Contractor proposes to provide.

1.5.1 Manufacturer's Data:

a. Alarm valves
b. Valves, including gate, check, and globe
c. Water motor alarms
d. Sprinkler heads
e. Pipe hangers and supports
f. Water flow switch
g. Fire department connection

1.5.2 Operation and Maintenance Manuals:

a. Alarm valves

1.6 AS-BUILT (RECORD) WORKING DRAWINGS: After completion, but before final acceptance of the work, furnish a complete set of drawings of each system for record purposes. Furnish upon acceptance the as-built drawings. Drawings shall be reproducible drawings similar to full size conQd

1.7 ELECTRICAL WORK: Provide electrical work associated with this section including power wiring from electrical disconnect switches to equipment. Provide control and sprinjlr system fire alarm wiring , including connections to fire alarm systems, under this section in accordance with NFPA 70. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

PART 2 - PRODUCTS

2.1 SPRINKLER HEADS: Heads shall have nominal 0.50-inch orifice. Release element of each head shall be of the ordinary temperature rating except fr the kitchen, and basement parking area which shall be of intermediate temperature rating or higher as suitable for the specific application. Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings. Finish nshall be subnnject to the Architect's approval.

2.1.1 Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed that permitted by NFPA 13. Uniformly space sprinklers on the branch piping.

2.2 CABINET: Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

2.3 ALARM VALVE: Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gauges, accessories, and appurtenances for the proper operation of the system.

2.4 WATER MOTOR ALARM: Provide alarm of the approved weatherproof and guarded type, to sound locally on the flow of water in each corresponding sprinkler system. Mount alarm on the outside of the outer walls of each building as shown on the plans.

2.5 WATER FLOW SWITCH: Provide switch with circuit opener or closer for the automatic transmittal of an to the sprinkler system fire alarm system and the building fire alarm system. Alarm actuating device shall have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and shall instantly recycle.

2.6 FIRE HOSE CABINETS : Provide as shown on the drawings. Cabinets at the basement parking area shall be surface mounted all other units shall be flushed on the wall. Firehose cabinet shall contain a 40 mm diameter angle type firehose valve, 30

meters of 25 mm diameter firehose, nozzle and a portable fire extinguisher. Trim shall be stainless steel.

2.7 ABOVEGROUND PIPING SYSTEMS: Inspect, test, and approve piping before covering or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through tapered reducing pipe fittings; bushings will not be permitted.

2.7.1 Sprinkler Pipe and Fittings: ASTM A53 Schedule 40 seamless. Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into the pipe when pressure is applied will not be permitted. Rubber gasketed grooved-end pipeand fittings with mechanical couplings shall be permitted in pipe sizes 1.5 inches and larger. Fittings shall be UL listed or FM approved for use in wet pipe sprinkler systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer.

2.7.2 Pipe Hangers and Supports: Provide in accordance with NFPA 13.

2.7.3 Valves: NFPA 13. Valves shall be UL listed or FM apprved for fire protection service.

2.7.3.1 Gate Valves: Shall be of the outside screw and yoke (OS & Y) type approved for fire service. Gate valves shall open by counterclockwise rotation. All gate valves shall be provided with supervisory switches to indiicate partially closed or fully position. Supervisory switch shall be part of this contract's sprinkler fire alarm control system.

2.7.3.2 Check Valves: Flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 100 mm diameter and larger.

2.7.3.3 Fire Hose Valve (Dry Standpipe): Gate Valve, 65 mm diameter, with National Standard male hose thread or a thread pattern compatible with that use by the local fire department. Valve shall be provided with cap and chain.

2.7.4 Identification Signs: NFPA 13. Attach properly lettered and approved metal signs to each valve and alarm device.

2.7.5 Inspector's Test Connection: Provide test connections where indicated on the plans and portion of each sprinkler system equipped with an alarm device. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without property damage.

2.7.6 Main Drains: Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13.

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2.8 PIPE SLEEVES: Provide where piping passes through walls, floors, roofs, and partitions. Grout sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. Firmly pack space with noncombustible insulation. Caulk both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

2.8.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A 53 or ASTM A 120, hot-dip galvanized steel pipe sleeves. Extend sleeves 75 mm above the finished floor.

2.8.2 Sleeves in Partitions and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide hot-dip galvanized steel sheet having a nominal weight of not less than 0.90 psf.

2.9 ESCUTCHEON PLATES: Provide one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on plates in unfinished spaces. Secure plates in proper position.

2.10 FIRE DEPARTMENT CONNECTIONS: Provide connections approximately 3 feet above finish grade, of the approved two-way type with 65 mm National Standard female hose threads with plug and chain.

2.11 DETECTION SYSTEMS: Provide sprinkler system supervision and detection. Connecting wiring shall be supervised. Provide wiring in protective metal conduit or tubing. Detectors located in areas subject to moisture or exterior atmospheric conditions shall be types approved for such locations. Furnish not less than two spare detectors of each type for each system.

2.11.1 Control Panel: Provide a control panel for the sprinklr system. Install in a surface-mounted steel cabinet with hinged doors and cylinder lock. Control panels shall be a neat, compact, factory-wired assembly containing components and equipment necessary to perform specified operating and supervisory functions of the system. House batteries in a lockable steel cabinet. Finish interior and exterior of cabinet with enamel paint; attach prominent rigid plastic or metal identification plates. Provide trouble lights on cabinet door, and provide trouble alarm above cabinet top. Provide 120 volts ac service, transformed through a two-winding isolation type transformer and rectified to low-voltage dc for operation of all system actuating, signal sounding, trouble signal, and fire alarm tripping circuits.

2.11.2 Secondary Power Supply: Provide nickel cadmium, lead calcium, or sealed lead acid rechargeable storage batteries and

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battery charger. Dry cell batteries will not be permitted.

2.11.3 Storage Batteries: Provide rechargeable lead calcium or sealed lead acid type with sufficient ampere-hour rating to operate the system under supervisory and trouble conditions for 60 hours and signal devices under alarm conditions for an additional 10 minutes. Separate cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts.

2.11.4 Battery Charger: Provide solid state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less. Locate charger within the control panel or within the battery cabinet.

2.11.5 Wiring: Provide in accordance with NFPA 70. Obtain ac primary power for control panel, battery charger as directed by the Electrical Engineers. Provide independent, properly fused safety switches, with provisions for locking the covers and operating handles in the POWER ON position for such connections. Paint the switch boxes red and identify by a permanent lettered designation. Wire for 120-volt circuits shall be No. 12 AWG minimum. Wire for low-voltage dc circuits shall be No. 14 AWG minimum. Provide wiring in rigid metal conduit, or intermediate metal conduit.

2.11.5.1 Conductor Identification: Identify circuit conductors within each enclosure where a tap, splice, or termination is made. Identify conductor by plastic coated, self-sticking printed markers or by heat-shrink type sleeves. Attach and secure markers to prevent accidental detachment. Properly identify control circuit terminations.

2.11.6 Fire Alarm: Provide equipment for the automatic transmittal of an alarm over the building fire alarm system and arrange to actuate by the flow of water.

2.11.7 Trouble Alarm: Provide local 4-inch electric alarm bell to indicate trouble or failure of the detection system or closure of a valve.

PART 3 - EXECUTION

3.1 INSTALLATION: Equipment, materials, installation, workmanship, examination, inspection, and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Keep the interior and ends of new piping and existing piping affected by Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position.

3.2 FIELD PAINTING: Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, and one coat of primer applied to a minimum dry film thickness of 1.0 mil. Provide primed surfaces with one coat of red enamel applied to a minimum dry film thickness of 1.0 mil. Shield sprinkler heads with protective covering while painting is in process. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

3.3 FIELD TESTING AND FLUSHING:

3.4.1 Preliminary Tests: Hydrostatically test each system at 200 psig for a 2-hour period with no leakage or reduction in gauge pressure. Flush piping with potable water in accordance with NFPA 13. Piping above suspended ceilings shall be inspected, tested, and approved before installation of ceilings. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. When tests are completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for formal inspection and tests.

3.5.2 Formal Inspection and Tests: FIre Protection Consultant and Owner's representative will witness formal tests and approve all systems before acceptance. Submit the request for formal inspection at least 8 days prior to inspection date. An experienced technician regularly employed by the system installer shall be present during the inspection. During the inspection, repeat any or all of the required tests as directed. Correct defects in work provided by the Contractor, and make additional tests until the systems comply with all contract requirements. Furnish appliances, flow meters, equipment, fuel, instruments, connecting devices, and personnel for the tests.

*** END OF SECTION ***

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