LEBANESE REPUBLIC
GENERAL DIRECTORATE OF THE PRESIDENCY
PRESIDENTIAL PALACE COMPOUND- BAABDA

Provision of services related to the Design and Preparation of Complete Tender Documents for Solar P.V System for the Presidential Palace Compound

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TENDER DOCUMENTS

VOLUME 2

TECHNICAL SPECIFICATIONS

MECHANICAL ENGINEERING SERVICES

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Provision of services related to the Design and Preparation of Complete Tender Documents for Solar P.V System for the Presidential Palace Compound

VOLUME 2 : TECHNICAL SPECIFICATION

TABLE OF CONTENTS

SECTION 2 – MECHANICAL ENGINEERING SERVICES

Division 21 – Fire Suppression

Division 23 - Heating and Ventilation

Division 21 - Fire Suppression

SECTION 211317
CLEAN AGENT FIRE EXTINGUISHERS SYSTEM

Part 1 - GENERAL

1.01 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.03 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA- 2001.

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.04 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 2001.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

Part 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: To establish a standard of quality, design and function desired, drawings and specifications are based on products by the approved manufacturer.

B. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following manufacturers:
   1. Naffco
   2. Kidde Fire Systems
   Or approved equal

2.02 EXTINGUISHING-AGENT CONTAINERS

A. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.

1. Finish: Manufacturer's standard color, enamel or epoxy paint.
2. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
3. Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
4. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.
5. Clean Agent: FM-200; HFC 227ea, heptafluoropropane
6. Discharges Nozzles:
   Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application

Part 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.02 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

Division 23 – Heating and Ventilation

SECTION 233300
MOTORIZED DAMPNERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Smoke dampers.
   2. Combination fire and smoke dampers.

1.3 SUBMITTALS

A. Product Data For each type of product.

   1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

   1. Special fittings and manual- and automatic-volume-damper installations.
   2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
   3. Duct security bars.
   4. Wiring Diagrams: For power, signal, and control wiring.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "Ventilation Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with AMCA 500-D "Laboratory Methods of Testing Dampers for Rating" for dampers rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, Z275 (G90) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 1008/A 1008M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Aluminum Sheets: ASTM B 209M (ASTM B 209), Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.

D. Extruded Aluminum: ASTM B 221M (ASTM B 221), Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 6-mm minimum diameter for 900-mm length or less; 10-mm minimum diameter for lengths longer than 900 mm.

2.2 SMOKE DAMPERS

A. General: Labeled to UL 555S. Smoke dampers shall be labeled for one-and-one-half-hour or three hours rating to UL 555 as per design requirements.

B. Smoke Detector: Integral, factory wired for single-point connection.

C. Frame and Blades: 1.6-mm thick, galvanized, sheet steel.

D. Mounting Sleeve: Factory-installed, 1.3-mm thick, galvanized, sheet steel; length to suit wall or floor application.

E. Rated pressure and velocity to exceed design airflow conditions.

F. Damper Motors: Provide for modulating or two-position action.

1. Motor Sizes: large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated.
   Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 17 N x m and breakaway torque rating of 17 N x m.
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof.
5. Nonspring-Return Motors: For dampers larger than 2.3 sq. m, size motor for running torque rating of 17 N x m and breakaway torque rating of 34 N x m.
6. Two-Position Motor: 230 V, single phase, **50 Hz**.
7. Modulating, Spring-Return Motor: 230 V, single phase, **50 Hz**.

G. Accessories:

1. Auxiliary switches for signaling or position indication.
2. Test and reset switches, damper or remote mounted as practical.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Type: Dynamic; rated and labeled according to UL 555 and UL 555S.

B. Fire Rating: **1-1/2 and 3** hours.

C. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.

D. Heat-Responsive Device: Replaceable, **165 ° F (74 ° C)** rated, fusible links.

E. Smoke Detector: Integral, factory wired for single-point connection.

F. Blades: Roll-formed, horizontal, interlocking 1.6-mm-thick, galvanized sheet steel.

G. Leakage: Class I.

H. Rated pressure and velocity to exceed design airflow conditions.

I. Mounting Sleeve: Factory-installed, 1.3-mm- thick, galvanized sheet steel; length to suit wall or floor application.

J. Master control panel for use in dynamic smoke-management systems.

K. Damper Motors: Modulating or two-position action.

L. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for heating Equipment."

1. Motor Sizes: large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated.
   Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof.
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
6. Electrical Connection: **230 V**, single phase, **50 Hz**.

M. Accessories:

1. Auxiliary switches for signaling or position indication.
2. Test and reset switches, damper or remote mounted as practicle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "Ventilation Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

E. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

F. Provide test holes at fan inlet and outlet and elsewhere as indicated.

G. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

1. Install fusible links in fire dampers.

H. Install duct silencers **rigidly to ducts**.

I. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.
3. Install access panels adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

L. Install flexible connectors to connect ducts to equipment.

M. Connect diffusers or light troffer boots to low pressure ducts with maximum 1500-mm (60-inch) lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with **adhesive plus sheet metal screws**.

O. Label access doors according to Section "Identification for Heating Piping and Equipment."

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

SECTION 233416
FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes centrifugal fans for indoor installations.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.

B. Operating Limits: Classify according to AMCA 99.

C. Performance Criteria:

1. The fan schedule shows liter per second (l/s) or cubic feet per minute (CFM) and design static pressure.
2. Provide fans and motors capable of stable operation at design conditions and at ll0 percent pressure but not to exceed 185 Pa (3/4-inch) additional pressure.
3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation a smaller motor may be approved in the interest of energy conservation.
4. Select fan operating point as follows:

    a. Forward curved and axial fans: Right hand side of peak pressure point.
    b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.

D. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.

E. Noise level shall not exceed level allowed for place of installation. Noise level for all ceiling mounted equipment shall not exceed NC35.

F. Overall efficiency shall be minimum 60 percent.

G. All fan bearings, where applicable, shall be of heavy duty type suitable for continuous operation.

1.4 SUBMITTALS

A. Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

C. Coordination Drawings, including floor plans and sections drawn accurately to scale. Submit with Shop Drawings. Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

D. Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

E. Field Test and Commissioning Reports: As specified in "Field Quality Control" and "Commissioning" Articles in Part 3 of this Section. Indicate and interpret test results for compliance with performance requirements.

F. Maintenance data for fans to include in the operation and maintenance manual specified in Division 1.

1. Include: Lists of parts and troubleshooting maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

C. AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Local Certification: Fans should be certified by local authorities as applicable.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units as required for movement to the final location following manufacturer's written instructions.

C. Lift and support units with the manufacturer's designated lifting or supporting points.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify clearances.

B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

1.8 COORDINATION AND SCHEDULING

A. Coordinate the size and location of concrete housekeeping pads. Cast anchor-bolt inserts into pad.
Concrete reinforcement and formwork requirements are specified in "Cast-in-Place Concrete" Section.

1.9 EXTRA MATERIALS

A. Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Acme Engineering & Mfg. Corp.
2. Aerovent, Inc.
3. Carnes Co.
4. Loren Cook Co.
5. Greenheck Fan Corp.
6. ILG Industries, Inc.
7. PennBarry Co..
8. Trane Co. (The).
9. Twin City Fan Companies.

2.2 GENERAL FAN REQUIREMENTS

A. General

1. Performance data for all fans and spare parts shall be determined in accordance with the provisions of ASHRAE 51.
2. Sound pressure level ratings of ducted fans shall comply with AMCA 301 and shall be the result of tests made in accordance with AMCA 300.
3. Sound pressure level ratings of non-ducted fans shall comply with AMCA 301 and shall be the result of tests made in accordance with AMCA 300. Application of sound pressure level ratings shall conform to AMCA 302. Unit construction shall conform to applicable
standards contained in AMCA 99 and to requirements specified.
4. Safety provisions for power transmission equipment and non-ducted inlets and outlets shall include guards and screens, unless other provisions are required, and shall be constructed in accordance with applicable provisions of ANSI B11.19. Installation shall be such that fan vibration-isolation provisions are not negated.
5. Fan wheels shall be statically and dynamically balanced at the factory.

B. Corrosion Protection: All steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D 1735 water fog; ASTM B 117 salt spray; ASTM D 3359 adhesion; and ASTM G 152 / ASTM G 153 weather meter.

C. Air-Handling System Balancing Provisions: All necessary facilities shall be provided for the adjustment of fan speed for each air-handling system during air-quantity balancing operations. Facilities provided shall be one of the following:

1. A variable-pitch drive with variable range to produce the fan speed necessary for proper air balance.
2. A continuously variable drive or power unit to produce the fan speed necessary for proper air balance.
3. A series of fixed-pitch pulleys that can be interchanged until the proper fan speed has been determined.

2.3 SMOKE EXHAUST FAN

A. General Description: Belt-driven mixed flow, dual speed, fully weatherproofed and constructed of corrosion resistant materials. Structural steel support components to be zinc plated and suitable for smoke exhaust. Fans to be UL listed for smoke removal with operation temperature of 260°C for a minimum of four hours continuous operation, or shall be classified F400 (400°C for 2 hours) as per EN 12101-3.

B. Fan Housing: Heavy gauge steel hot dip galvanized after fabrication, designed to provide easy access from roof level to all moving parts including motor, without dismantling unit.

C. Fan wheels: Heavy gauge steel, multi-blade, mixed flow, non-overloading, non-stall type, fully balanced at factory.

D. Motor: Explosion proof, type Class H insulation, continuously rated, provided with permanently lubricated sealed ball bearings not requiring lubrication for 25000 hours of operation and in-built thermal overload protection.

E. Sound Pressure Level: Select to give sound levels less than 50 db measured on the A-scale of a standard sound level meter at 3 m from the open fan inlet.

F. Accessories: Fan to be complete with the following: fusible link damper lifter to provide heat and smoke relief in the event of an electrical power fail are factory wired safety disconnect switch mounted inside housing, flexible conduit to receive field wiring, all around expanded aluminum bird and protection screen, neoprene foam sealing strip for air seal between base and curb and fixings to roof curb.

G. Fusible Link Lifter: Fusible link damper lifter automatically opens the butterfly dampers when air temperature below the damper blades exceeds 74 deg. C to provide smoke and heat relief with no electrical power required.

H. Sheet Metal Parts: Enamel or prime coat before assembly. Do not prime coat aluminum parts.

I. Factory Finish for Fans Downstream from Humidifiers: Enamel or prime coat before assembly with 2 coats of paint. Prime coating on aluminum parts is not required.

J. Testing Requirements: The following factory tests are required as indicated:

1. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating ."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the fans. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fans according to manufacturer's written instructions.

B. Support units using the vibration-control devices indicated.

C. Install units with clearances for service and maintenance.

3.3 HOUSEKEEPING BASES

A. Construct concrete housekeeping pads as follows:

1. Coordinate size of housekeeping bases with actual unit sizes provided. Construct base 100 mm larger, in both directions, than the overall dimensions of the supported unit.
2. Form concrete pads with steel channels conforming to ASTM A 36/A 36M, size and location as indicated. Miter and weld corner and provide cross bracing. Anchor or key to floor slab.
3. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves to facilitate securing units.
4. Place concrete and allow to cure before installing units. Use portland cement conforming to ASTM C 150/C 150M, 27 MPa compressive strength, and normal-weight aggregate.
5. Clean exposed steel form according to SSPC Surface Preparation Specifications SP 2 or SP 3 and apply 2 coats of rust-preventive metal primer and paint.

3.4 CONNECTIONS

A. Duct installation and connection requirements are specified in other Sections. Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Electrical: Conform to applicable requirements in Division 26 Sections.

C. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A - 486B.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, alignment of fan shaft and motor shaft, alignment of pulleys, belt adjustments, and lubrication, and to report results in writing.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.7 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.8 COMMISSIONING

A. Final Checks before Startup: Perform the following operations and checks before startup, and report results in writing:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.

B. Starting procedures for fans are as follows:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor voltage and amperage.

C. Refer to "Testing, Adjusting, and Balancing for heating" Section for procedures for air-handling- system testing, adjusting, and balancing.

D. Replace or adjust fan and motor pulleys as required to achieve design conditions. Fix in final position after balancing is achieved.

SECTION 233713
LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceiling-, floor- and wall-mounted louvers as applicable to design requirements.

1.3 DEFINITIONS

A. Louvers: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall.

1.4 SUBMITTALS

A. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of louvers indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for louvers with factory-applied color finishes.

D. Samples for Verification: in manufacturer's standard sizes, showing the full range of colors. Prepare Samples from the same material to be used for the Work.

E. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate specific requirements of louvers, and are based on the specific requirements of the systems selected. Other manufacturers' products with equal performance characteristics may be considered.

B. NFPA Compliance: Install louvers according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following or approved equal:

1. Air Systems Components; Kreuger Div.
2. Anemostat Products; a Mestek Company.
3. Carnes Co. Inc.
4. Air Systems Components; Tuttle and Bailey Div.
5. Nailor Industries Inc.
6. Air Systems Components; Titus Div.

2.2 AIR-DIFFUSION DEVICE CONSTRUCTION

A. Air-diffusion device construction and mounting shall preclude flutter, rattle, or vibration. Devices shall have the modifications and accessories necessary for mounting in indicated surface construction.

B. Color selection shall be as directed by the Engineer.

C. Supply diffusers shall be provided with combination damper and equalizing grid. Dampers shall be extracting-splitter type, except as otherwise indicated.

D. Supply diffusers shall be selected to give required throw to nearest wall. Terminal velocity is not to exceed 0.5 m/s specified air quantity. Velometer velocities through diffuser are not to exceed 3.0 m/s. Supply diffusers are to be able to deliver air for cooling at 15 deg. C below room temperature without causing objectionable conditions.

E. Air-diffusion device volume and pattern adjustments shall be made from the face of the device.
Volume adjustments shall be made by **removable key**.

F. Gaskets shall be provided for supply-terminal air devices mounted in finished surfaces.

G. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded.

H. For ductwork of pressure classes 1000 to 2500 Pa (4 to 10 inch water gage), provide sponge- rubber gasket between flanges and wall or ceiling.

I. Size air outlets for minimum noise levels, not to exceed 30 db at specified air quantity, as measured on the A-scale of a standard noise level meter, unless specified otherwise.

2.3 MANUFACTURED UNITS

A. Louvers are scheduled at the end of this Section.

B. Louvers are scheduled on Drawings.

2.4 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing the Performance of Air Outlets and Air Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where louvers are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install louvers level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Install louvers with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust louvers to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of louvers, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace louvers that have damaged finishes.

3.5 LOUVERS SCHEDULE

A. Fixed Face Louvers :

1. Material: **Aluminum**.
2. Finish: **Baked enamel, color selected by Engineer**.
3. Mounting: **Countersunk screw**.
4. Damper Type: **Adjustable opposed blade**.
5. Accessories:

    a. **Front**-blade gang operator.
    b. Filter.