SECTION 15011

MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Under this Section, the Mechanical Contractor shall furnish all labor, materials and equipment for Mechanical General Requirements, as shown on the Plans, as specified and/or directed.

1.2 REFERENCES

A. The publications listed below and their latest revisions form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. Code of Federal Regulations (CFR) Publications:

29-1910-SUBPART O Machinery and Machine Guarding

29-1910.219 Mechanical Power-Transmission Apparatus

1.3 RELATED REQUIREMENTS

A. Division 1 – Special Conditions

B. Division 15 - Mechanical

1.4 SUBMITTALS

A. Submit shop drawings, manufacturer's data, publication compliance, certified test reports, and manufacturer's certificates of compliance for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication, or delivery of the items to the job site. Shop drawings shall be accompanied by a letter of transmittal, and all shop drawings shall be suitably identified with the name of the project, contract number, Contractor's name, date

and initials indicating approval of such submittal by the Contractor under the applicable specification. Partial submittals will not be 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 the specific technical paragraph reference which specifies each item, applicable industry and technical society publication references, and other information necessary to establish contract compliance of each item to be furnished.

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

2. Shop Drawings: 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 ensure 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 of plans, sections, and elevations shall be to a standard scale utilizing standard paper dimensions, with scale noted, and indicate adequate clearance for the operation, maintenance, and replacement of operating equipment devices.

3. Manufacturer's Certificates of Compliance: Submit certification from manufacturer attesting that materials and equipment to be furnished for this project comply with the requirements of this specification and of the reference publications. Pre-printed certifications will not be acceptable; certifications shall be the manufacturer's original; certifications shall be not more than one year old. The certification shall not contain statements that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as"; "achieve the same

end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material". The certification shall simply state that the product conforms to the requirements specified. Certificates shall be signed by the manufacturer's official authorized to sign certificates of compliance.

1.5 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)

C. National Electrical Manufacturers Association (NEMA)

D. American Society of Mechanical Engineers (ASME)

E. American Gas Association (AGA)

F. American Refrigeration Institute (ARI), and

G. Underwriters' Laboratories (UL),

1. Independent Testing Organization Certificate: In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.6 OPERATION AND MAINTENANCE MANUAL

A. Furnish an operation and maintenance manual for each item of equipment. Furnish three copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual to the Owner's Representative for review and approval not more than 90 calendar days after an item is approved, but at least 60 calendar days prior to field acceptance testing of the item. Furnish the remaining manuals at least 60 days prior to contract completion. 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 shut-down; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shut-down 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.

1.7 CATALOGED PRODUCTS

A. Materials and equipment shall be cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be manufacturer's latest design that complies with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the items need not be the products of the same manufacturer. Each item of equipment shall have the manufacturer's name, address, model number and serial number on the nameplate securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.8 LAYOUT OF THE WORK

A. Coordinate the proper relation of the work to the building structure, existing utilities and to the work of all trades. Visit the premises and become familiar with the dimensions in the field, and advise the Director's Representative of any discrepancy before performing any work.

1. Contract Drawings: The Contract Drawings represent the general intent as to piping and equipment arrangements. All locations and dimensions shown shall be field verified and minor alterations made if so required. Where dimensions are not given for the location and arrangement of mechanical systems, locations may be assumed to be approximate, and may be altered if required. Major modifications to the indicated arrangements shall be approved by the Owner's Representative prior to the installation of mechanical systems. Schematic diagrams represent the overall system requirements and do not necessarily indicate the physical orientation, location or dimensions of that system.

2. Record Drawings: The Contractor shall maintain a record of the progress of the work and shall submit three (3) sets of As-Built Drawings upon completion of the project.

1.9 MANUFACTURER'S RECOMMENDATIONS

A. Unless otherwise stated in the Contract Specifications, all new equipment items, and specialties shall be installed in strict accordance with the recommendations of the manufacturer of the items being installed. Prior to the installation of new items, the Contractor shall submit to the Owner's representative printed copies of the manufacturer's installation recommendations. 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. Failure to install items in accordance with manufacturer's recommendations can be cause for rejection of the work items installed.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Properly store, adequately protect, and carefully handle equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Engineer. Replace damaged or defective items.

1.11 SAFETY REQUIREMENTS

A. Equipment Safety: Fully enclose or properly guard in accordance with 29 CFR 1910.219 belts, pulleys, chains, gears, couplings, projecting setscrews, keys, rotating parts, and other power transmission apparatus, located where persons can come in close proximity thereto. Points of operation, ingoing nip points, and machinery producing flying chips and sparks shall be guarded in accordance with the applicable portions of 29 CFR 1910-SUBPART O. Provide positive means of locking out equipment so that equipment cannot be accidentally started during maintenance procedures. 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 the type specified.

B. Access: Provide catwalks, maintenance platforms, and guardrails where required for safe operation and maintenance of equipment. Provide ladders or stairways to reach catwalks and maintenance platforms. Ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

C. Warning Sign: Provide a permanent placard or sign at the entrance to confined spaces contained in the equipment. The sign shall warn personnel not to enter the space until the atmosphere inside has been tested and systems have been de-energized.

1.12 ELECTRICAL REQUIREMENTS

A. Motors, controllers, contactors, and disconnects shall conform to and shall have electrical connections provided under Division 16 - Electrical. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Power wiring and

conduit for field installed equipment shall be provided under and conform to the requirements under

1.13 SPECIAL CONDITIONS

A. The Contractor must be aware that work may be performed within or around occupied and/or operating facilities and shall be responsible to coordinate with the Owner regarding planned interruptions to mechanical and electrical services, and the contractor's bid shall include considerations for scheduling such interruptions.

1. Protection of Existing Work: The Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, or to be reused. The Contractor shall insure that structural elements are not overloaded and additional structural supports required as a result of any cutting, removal or demolition work performed under any part of this Contract are added. The Contractor shall minimize disruption of existing non-contract work areas as much as possible.

2. Upon damage to existing equipment, buildings and/or structures, the Contractor shall immediately notify the Owner. All damages shall be repaired by the Contractor, or shall be replaced if beyond repair to match the existing to the Owner's satisfaction.

3. Protection of Buildings from the Weather: The interior of the buildings and all materials and equipment shall be protected from the weather at all times.

4. Protection of Personnel: Where the safety of non-contractor personnel is endangered in the area of the work, barricades shall be used. Additional protection shall be provided, if required, to preserve the safety of non-contractor personnel in the immediate area of the work.

5. Protection of existing systems: The Contractor shall take all needed precautions to prevent the ingress of dust, dirt, debris, and other contaminants resulting from his work, from entering

existing ventilation, plumbing supply or drainage systems. Systems being modified shall be plugged, capped, dammed, or otherwise isolated from new work in progress until work is complete and final connections are to be made. The Contractor shall be responsible for the cleaning of existing systems should they become contaminated as a result of his work, including but not limited to purging or vacuuming of system components and replacement or washing of filters and strainers. Repair or replacement of equipment or devices, damaged as a result of debris or contamination, shall be at the Contractor's expense.

1.14 INSTRUCTION TO OWNER'S PERSONNEL

A. When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Owner's personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors 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 Owner for regular operation. The number of days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 days of instruction are specified, use approximately half of the time for classroom instruction. Use other time 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, provide additional instruction to acquaint the operating personnel with the changes or modifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SCOPE OF WORK

A. The Mechanical Contractor shall provide all required labor, materials, equipment, and associated services as

described below and as detailed elsewhere in the contract documents. Work performed shall be complete in every detail, based on standard workmanlike practices, code compliance requirements, and manufacturer's instructions, as to satisfy the function and intent of the design. Refer to section 3.2 herein.

B. The responsibility of the Mechanical Contractor shall include, but not strictly be limited to, the following:

1. Provide and install new supply fan, including required mounting/support hardware.

2. Provide and install new exterior louver. Coordinate with General Contractor for location and size of openings. General Contractor shall create and prepare openings for louver installation.

3. Provide motorized damper with actuator for louver scheduled to have same.

4. Provide electric duct heater as scheduled.

5. Provide and locate thermostat for duct heater and fan control.

6. Provide galvanized sheet metal ductwork, including required mounting/support hardware, trim and accessories.

3.2 ITEMS NOT SPECIFIED

A. Standards for Materials and Products: Where no kind of quality of material is directly specified, a first-class standard article as approved by the Engineer shall be furnished. All materials and equipment to be furnished and installed shall be new and free from all defects.

B. Common typical items not shown or specified but necessary for its proper installation and finishing, and not otherwise supplied with specified equipment, shall be included in the Contractor's estimate, the same as if hereby specified or shown. Such items shall include, but not be limited to, standard fasteners, adhesives, shims, cover plates and bungs, brackets, and clips.

3.3 INTERPRETATION OF CONTRACT DOCUMENTS

A. Should any ambiguities or discrepancies be found in the project documents to which the Contractor has failed to call attention to before submission of his bid, then the Engineer shall interpret the intent of the contract documents, and the Contractor hereby agrees to abide by the Engineer's interpretation and agrees to carry out the work in accordance with the decision of the Engineer. It is expressly stipulated that neither the instructions nor the specifications shall take precedence, one over the other, and it is further stipulated that the Engineer may interpret or construe the specifications of the work, and of that question the Engineer shall be the sole judge.

3.4 SITE LOGISTICS

A. Storage of Materials and Equipment: The Contractor shall place and store their materials as directed. Each Contractor shall be responsible for providing secure temporary storage for their materials and equipment, including such items as storage containers, temporary sheds, lockers, fencing and tool boxes. Temporary storage shall be removed from the site upon completion of work. The Owner shall not be responsible for securing the Contractor's materials or property, and shall not be held liable for damage or theft of inadequately stored materials or equipment.

B. Waste Management: The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his machines, materials, employees, or work and shall locate waste in designated areas as directed. All waste materials and demolished equipment shall be disposed of in an approved, legal manner. The Owner reserves the right to claim materials and equipment removed as part of this contract, and upon request the Contractor shall turn over such items to the Owner.

C. Coordination with Other Trades: The Contractor shall be proactive in coordinating their work with that of other trades, including but not limited to temporary extension, removal or relocation of services or equipment under the responsibility of other trades. The Contractor shall coordinate for temporary openings in

existing structures to permit the removal or installation of materials and equipment where necessary, and unless otherwise specified the cost of providing these temporary openings shall be borne by the Contractor as included in the contract.

+ + END OF SECTION + +

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SECTION 15140

SUPPORT AND ANCHORS

PART 1 – GENERAL

1.1 GENERAL

A. The General Provisions of the Contract, including General and Supplementary General Conditions and Division 1 General Requirements, apply to the work specified in this Section.

1.2 WORK INCLUDED

A. Pipe, duct, and equipment hangers, supports, and associated anchors.

B. Sleeves and seals.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 15011.

B. Indicate hanger and support framing and attachment methods.

PART 2 – PRODUCTS

2.1 MANUFACTURERS PIPE HANGERS & SUPPORTS

A. B-line

B. Miro Industries

C. Approved equal

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 inch to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 inch and Cold Pipe Sizes 6 inch and over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inch and over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inch and over.

F. Vertical Support: Steel riser clamp.

G. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

H. Shield for Insulated Piping 2 inch and smaller: 18 gage galvanized steel shield over insulation in 180 degree segments, minimum 12 inch long at pipe support.

I. Shield for Insulated Piping 2-1/2 inch and larger (Except Cold Water Piping): Pipe covering protective saddles.

J. Shields for Cold Water Piping 2-1/2 inch and larger: Hard block non-conducting saddles in 90 degree segments, 12 inch minimum length, block thickness same as insulation thickness.

K. Cast Iron pipe shall be supported at every joint and at a maximum of 5 feet between supports.

2.3 HANGER RODS

A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded (minimum size 3/8 inch diameter, see paragraph 3.01 herein), as required.

2.4 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gauge galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe or 18 gauge galvanized steel. All pipe sleeves shall be 2 standard sizes larger than the pipe being used.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Sleeves for Ductwork: Form with galvanized steel.

E. Stuffing or Fire Stopping Insulation: Glass fiber type, non-combustible, cover with fire barrier caulk.

F. Caulking and Sealants

1. All penetrations thru non-fire and fire rated walls and assemblies shall be sealed with 3M-Fire Barrier Caulk # CP25WB and/or 3M-Fire Barrier # FS-195 plus wrap/strip or, an approved equal, meeting the requirements of ASTM-E-814 and ANSI/UL1479, as shown on the drawings.

2.7 FLASHING

A. Metal Flashing: 26 gauge galvanized steel.

B. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

C. Caps; Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.8 FABRICATION

A. Size sleeves large enough to allow from movement due to expansion and contraction, two standard sizes larger than the pipe passing through. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Provide copper plated hangers and supports for copper piping.

2.9 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 – EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

A. All piping shall be supported from the building structure by means of approved hangers and supports similar to B-line, Miro Industries Inc, or equivalent. Piping shall be supported to maintain required grading pitching of lines, to prevent vibration and to secure piping in place, and shall be so arranged as to provide for expansion and contraction. Chain, perforated strap, bar, or wire hangers are not permitted.

1. Work shall not be supported by or from other trades such as Electrical, HVAC, and any work done under this division. Work, however, may be supported by or from a trapeze or similar type support that may be common for all trades.

2. There shall be no direct contact between dissimilar metals. Coordinate with hanger manufacturer.

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inch of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support vertical piping at every deck penetration. Support vertical cast iron pipe at each floor at hub.

F. Where several pipes can be installed in parallel and at same elevation, provide multiple supports or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Piping shall not be hung from other piping, ducts, conduits, equipment or items installed by other trades. Hanger rods shall not pierce ductwork.

I. Provide protection shields and saddles at supports with insulated or covered piping.

J. At no time will piggy backing of supports be permitted.

K. Where codes having jurisdiction requiring closer spacing, the hanger spacing shall be as required by code in lieu of the distances required herein.

3.2 PENETRATIONS

A. Set sleeves in position in formwork. Provide reinforcing around sleeves. Core drill as required when slabs are in place.

B. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth with fire resistant caulk and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between sleeve and pipe or duct and adjacent work with fire stopping insulation and fire stopping caulk seal. See paragraph 2.07 herein. Provide close fitting metal collar or escutcheons covers at both sides of penetration.

D. Install chrome plate steel or stainless steel escutcheons with set screws at finished surfaces. Where piping is insulated the escutcheons shall be outside the insulation.

E. Joints, seams or penetrations in the building envelope, that are sources of air leakage, shall be sealed with durable caulking materials, closed with gasketing systems, taped or covered with moisture vapor-permeable house-wrap. Sealing materials spanning joints between dissimilar construction materials shall allow for differential expansion and contraction of the construction materials. This includes sealing around tubs and showers, at the attic and crawl space panels, at recessed lights and around all plumbing and electrical penetrations. These are openings located in the building envelope between conditioned space and unconditioned space or between the conditioned space and the outside.

3.3 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

C. Provide manufacturers curbs for mechanical roof installations 12 inch minimum high above roofing surface unless otherwise noted. See paragraph 2.06 A herein. Flexible sheet flash and counter flash with sheet metal; seal watertight.

++ END OF SECTION ++

SECTION 15290

DUCTWORK INSULATION

PART 1 – GENERAL

1.1 GENERAL

A. The General Provisions of the Contract, including General and Supplementary General Conditions and Division 1 General Requirements, apply to the work specified in this Section.

1.2 WORK INCLUDED

A. Furnish all labor, equipment, materials and accessories, and perform all operations required, for the correct fabrication and installation of thermal insulation applied in accordance with applicable project specifications and drawings, subject to the terms and conditions of the contract.

B. Ductwork insulation.

C. Insulation jackets.

1.3 REFERENCES

A. ANSI/ASTM C553 – Mineral Fiber Blanket and Felt Insulation.

B. ANSI/ASTM C612 – Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E84 – Surface Burning Characteristics of Building Materials.

D. NFPA 255 – Surface Burning Characteristics of Building Materials.

E. UL 723 – Surface Burning Characteristics of Building Materials.

F. UL 181-Pressure Sensitive Tape

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in ductwork insulation application with three years minimum experience. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

B. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturer's current submittal or data sheets showing compliance with applicable specifications.

C. Materials: UL listed; flame spread/fuel contributed/smoke developed rating of 25/-/50 in accordance with NFPA 255, UL 723.

1.5 SUBMITTALS

A. Submit product data in accordance with Section 15011.

B. Include product description, list of materials and thickness for each service, and locations.

C. Submit manufacturer's installation instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.

1.7 DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The contractor shall use whatever accepted means to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use accepted means necessary to protect the work and materials of other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out before installation will provide installed performance that is equivalent in all respects to new, completely dry insulation.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Johns Manville.

B. Knauf.

C. Owens Corning.

2.2 MATERIALS

A. Type A: Flexible glass fiber; ANSI/ASTM C612; commercial grade; 'k' value of 0.29 maximum at 75 degrees F; foil scrim facing for air conditioning ducts. Vapor barrier shall be legibly printed by the manufacturer to show nominal thickness, R-valve and type of insulation. Knauf Duct Wrap with Commercial Foil Skrim (FCK) .75PCF.

B. Type B: Rigid glass fiber; ANSI/ASTM C612, Class 1; "k" value of 0.24 maximum at 75 degrees F; 0.002 inch foil scrim facing for air conditioning ducts. Knauf Air Duct.

C. Interior duct insulation is not acceptable.

D. R-Value identification marks are to be in maximum intervals of 10 feet.

2.3 ACCESSORIES

A. Adhesives: UL approved waterproof fire-retardant type.

B. Indoor Jacket: 6 oz./sq. yd. canvas. Pre-sized glass cloth, minimum 7.8 oz./sq. yd.

C. Outdoor Jacket: Coated glass fiber sheet, 30 lb./sq. yd.

D. Lagging Adhesive: Fire resistive to NFPA 255, UL 723.

E. Impale Anchors: Galvanized steel, 12 gage, self-adhesive pad.

F. Joint Tape: Glass fiber cloth, open mesh, UL 181A or UL181B.

G. Tie Wire: Corrosion resistant, Annealed steel, 16 gauge.

PART 3 – EXECUTION

3.1 SITE INSPECTION

A. Before starting the work under this section, carefully inspect the site and installed work of the other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with the project drawings and specifications and material manufacturer's recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with the applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

A. Install materials after ductwork has been tested and approved.

B. Ensure that all surfaces over which insulation is to be installed are clean and dry.

C. Ensure that insulation is clean, dry, and in good mechanical condition with all factory applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

3.3 INSTALLATION

A. General:

1. Ductwork dimensions indicated are net inside dimensions required for air flow.

2. Before installing insulation, ensure that all seams and joints in the ductwork have been sealed.

3. Install materials in accordance with manufacturer's instructions, recommendations and all governing codes and regulations.

4. Install insulation materials with smooth and even surfaces. Butt joints firmly together to ensure complete and tight fit over surfaces to be covered.

5. Maintain the integrity of factory applied vapor barrier jacketing on all insulation, protecting it against puncture, tears, or other damage. All staples used on cooling or dual temperature ductwork insulation shall be coated with suitable sealant to maintain vapor barrier integrity.

6. All insulation exposed to the weather shall contain a protective finish or jacketing as recommended by the insulation manufacturer.

7. All supply and return ductwork conveying interior air that passes through unconditioned spaces within the building envelope shall be insulated to a minimum of R-6 and be sealed by exterior vapor barrier with a continuous sealed seam.

8. All supply and return ductwork conveying interior air that passes through conditioned spaces shall be insulated to a minimum of R-3.5 and be sealed by exterior vapor barrier with a continuous sealed seam.

   Exception: Where the design temperature difference between the interior and exterior of the duct or plenum is not greater than 15°F

9. All supply and return ductwork from rooftop units are to be insulated.

10. Insulation shall be installed in a manner that permits inspection of the manufacturer's R-value identification mark.

11. Ducts outside of building envelope shall be insulated to a minimum of R-8 and wrapped in accordance with section C below.

B. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.

C. Exterior Insulation (Type A or Type B) Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive or pressure sensitive tape matching the facing. Tapes shall be listed and labeled in accordance with UL 181A or UL 181B. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

4. Where ducts are 24 inch in width or greater, mechanical fasteners spaced at 18 inch centers are required on the bottom of the duct to prevent the insulation from sagging.

5. Exterior ductwork shall be wrapped in EPDM membrane, metallic or UV-resistant plastic jacketing, or other approved weather and UV resistant protective method.

D. Plenum Application:

1. Secure insulation to exterior surface of plenum in accordance with paragraph C above.

2. R values of insulation shall be in accordance with paragraph 3.03 part A-6, A-7, and A-10. herein.

E. Continue insulation with vapor barrier through penetrations as shown on the drawings.

F. All insulation of access doors shall be set in sheet metal double pan construction.

3.4 FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with the requirements herein to cover and protect insulation materials during installation.

3.5 PROTECTION

A. Replace damaged insulation, which cannot be satisfactorily repaired, as determined by the Engineer, including insulation with vapor barrier damage and moisture saturated insulation.

++ END OF SECTION ++

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SECTION 15820

IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide identification labels for all HVAC equipment, devices, piping, and ductwork installed under this contract, as specified herein.

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.

2. Warning signs and labels.

3. Duct labels.

4. Piping labels.

5. Valve Tags.

6. Stencils.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.4 PIPING LABELS

A. All service piping which is accessible for maintenance operations shall be identified with snap-on or wrap-around semi-rigid plastic (not pressure-sensitive adhesive) identification markers. Direction of flow arrows are to be included on each marker, unless otherwise directed.

B. In conformance with "Scheme for the Identification of Piping Systems" (ANSI/ASME A13.1), each marker must show approved color-coded background, proper color of legend in relation to background color, approved legend letter size, and approved marker length.

C. Pipe marking methods shall be of the following:

1. SETMARK Snap-On or SETMARK Strap-on markers

2. W.H. Brady pipe markers

3. Engraved and enamel-filled brass tags attached with brass chain

4. Stencils as per section 2.6 herein.

5. Other methods approved by the Engineer

D. Locations for pipe markers and identification tags are as follows:

1. Adjacent to each valve and fitting.

2. At each branch and riser take off.

3. At each pipe passage through walls, floors, or ceilings, on both sides of the penetration.

4. On all straight pipe runs every 25 feet.

5. Apply markers on the two lower quarters of overhead pipe and where view is not obstructed.

2.5 VALVE TAGS

A. All valves shall be identified with the appropriate service designation and valve number designation on 2-inch wide, 19-gauge brass tags.

1. Water valves: Round tag with 1/4 inch black-filled letters over 1/2 inch black-filled numbers.

2. Gas valves: Octagonal tag with 1/4 inch black-filled letters over 1/2 inch black-filled numbers.

B. Tags shall be fastened to valves with meter seals, brass "S" hooks, or brass jack chain. Brass tags and fasteners shall be manufactured by Seton Identification Products or equal.

C. Charts of all valves, new and existing throughout the building, shall be furnished in duplicate by the Contractor, said charts to include the following items:

1. Valve Identification Number.

2. Location.

3. Purpose.

One chart to be mounted in a frame and secured on a wall in a location as directed by the client. A second chart to be prepared and provided in a plastic protective envelope. Valve charts, frames, and envelopes to be manufactured by Seton Identification Products or equal.

2.6 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.

2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including

dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

A. Install self adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Green: For exhaust ducts.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 15847

ELECTRIC DUCT HEATERS

PART 1 GENERAL

1.1 GENERAL

A. The General Provisions of the Contract apply to the work specified in this Section.

1.2 SCOPE OF WORK

A. The contactor shall furnish and install Unit Heaters as supplied by Indeeco or equal as shown and as scheduled on the drawings, with required mounting components and accessories.

PART 2 PRODUCTS

2.1 FRAME AND TERMINAL BOX

A. Heater frames and terminal boxes shall be corrosion resistant steel and shall be provided with a hinged, latching cover and multiple concentric knockouts for field wiring.

B. Unless otherwise indicated, the terminal box shall be NEMA 1 type construction.

2.2 SAFETY CUTOUTS

A. Heaters shall be furnished with a disc type, automatic reset thermal cutout for primary overtemperature protection.

B. Heaters shall be furnished with disc type, load-carrying manual reset thermal cutouts, factory wired in series with heater stages for secondary protection.

C. Heat limiters or other fusible overtemperature devices are not acceptable.

D. Duct heater shall have factory installed and wired air flow switch to prevent heating element operation without

sufficient air flow. Air flow switch shall be of differential pressure type.

2.3 ELEMENT

A. Heating elements shall be open coil, 80% nickel, 20% chromium, Grade A resistance wire. Type C alloys containing iron or other alloys are not acceptable.

B. Coils shall be machine crimped into stainless steel terminals extending at least 1" into the airstream and all terminal hardware shall be stainless steel.

C. Coils shall be supported by ceramic bushings staked into supporting brackets.

2.4 ELECTRICAL

A. Heaters shall be rated for the voltage, phase, and number of heating stages indicated in the schedule. All three-phase heaters shall have equal, balanced, three-phase stages.

B. All internal wiring shall be stranded copper with 105°C insulation and shall be terminated in crimped connectors or box lugs.

C. Terminal blocks shall be provided for all field wiring and shall be sized for installation of 75°C copper wire, rated in accordance with NEC requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's instructions and the drawings.

3.2 SUBMITTALS

A. Submittals shall be in accordance with Section 15011.

3.3 OPERATION AND MAINTENANCE MANUAL

A. Operation and Maintenance Manual shall be in accordance with Section 15011 paragraph 1.4.

+ + END OF SECTION + +

SECTION 15855

VENTILATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: The Mechanical Contractor shall furnish all labor, tools, materials, and equipment necessary for providing ventilation fans and accessories as required for a complete installation, as shown and scheduled on drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Section 15860, Louvers.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following:

1. Underwriters Laboratory (UL705)

2. AMCA Standard 210

3. AMCA Standard 300

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval shop drawings showing the following:

1. Manufacturer's catalog data including materials, design, performance and dimensional information.

2. Manufacturer's published performance curve.

3. List of options and accessories with catalog data.

4. Manufacturer's installation instructions.

B. Test and Certifications:

1. Manufacturer's Certifications.

2. Manufacturer's 1-year warranty.

1.4 MANUFACTURER'S SERVICES

A. Certifications: The manufacturer shall provide the following certifications:

1. Certification that equipment meets the general intent of the specifications and list of all deviation from specifications.

2. Certification that equipment has been installed properly.

B. Manufacturer shall furnish all shop drawings and information as requested by the Engineer.

C. Manufacturer shall provide three copies of instructions for operating, maintaining and lubricating.

D. Manufacturer shall provide a 1-year supply of all necessary lubricants.

E. Manufacturer shall provide a 1-year warranty against defects in parts or workmanship.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: All materials shall be inspected for conformance with approved Shop Drawings.

B. Storage of Materials: All materials shall be stored in the original shipping cartons in a dry location until time of installation.

PART 2 - PRODUCTS

2.1 INLINE CENTRIFUGAL EXHAUSTER - DIRECT DRIVE

A. Direct-drive inline exhausters shall be centrifugal type as listed in the fan schedule.

B. Construction: Unit exterior shall be constructed of galvanized steel sheet over rigid frame. The fan housing shall be square in shape and readily attachable to

building ductwork. Unit side panels shall be removable for easy access for maintenance and service. Fan housings shall have universal mounting brackets to accommodate horizontal or vertical installations. Fans shall bear a permanent attached nameplate displaying model and serial number of the unit for future identification.

C. Wheel: Fan wheels shall be of the non-overloading centrifugal backward inclined type, constructed of aluminum and containing a matching, overlapping inlet venturi for optimum unit performance. Wheels shall be statically and dynamically balanced.

D. Drive: Direct drive coupling of motor shaft to fan wheel shall be made with a machined aluminum hub mounted onto the backplate of the fan wheel. Hub shall be line bored to eliminate the need for bushings.

E. Motor: Motors shall be of open construction, NEMA B, and closely matched to the fan load. A disconnect switch shall be factory installed and wired to the fan motor as standard. Motor shall be isolated from the airstream. All motors shall be UL recognized.

F. Manufacturer:

1. Inline Centrifugal Exhausters - Belt Drive.

a. Greenheck Fan Corp.

b. American Coolair Corp.

c. Or approved equal.

2.2 MANUAL SPEED CONTROLLER

A. Variable speed output.

B. Speed selector (minimum to maximum) with “Off” position.

C. Input: 115/230 volt.

D. Output: 10 amp inductive.

E. Fuse for overload protection.

F. PVC non-corrosive enclosure.

G. Product and manufacturer:

1. Vostermans Varifan MVS-1C.

2. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate wall openings with fan dimensions.

B. Install mounting hardware as recommended by manufacturer.

C. Expanded metal (galvanized) shall be used as additional reinforcement. Reinforcement shall be placed between the weather hood and fan on all fans, and on the interior of all louvers.

3.2 INSTALLATION

A. Install all fans and accessories according to manufacturer's recommendations and instructions.

B. Obtain manufacturer's written installation certification.

3.3 COORDINATION

A. The Contractor shall verify the dimensions and weights of the proposed ventilation equipment and accessories and provide appropriate support hardware.

B. It is the Contractor's responsibility to verify condition and location of structure the equipment is to be mounted to and notify the Architect of any adjustments or relocation that may be necessary prior to ordering materials or fabricating or installing components. Deviations from the contract documents made without written approval from the Architect and subsequently found to be unacceptable shall be corrected at the contractor's sole expense.

+ + END OF SECTION + +

SECTION 15860

LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: The Mechanical Contractor shall furnish all labor, tools, materials, and equipment necessary for providing louvers and accessories as required for a complete installation, as shown and scheduled on drawings and specified herein.

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

1.2 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Manufacturer's catalog data including materials, design, performance and dimensional data.

2. List of options and accessories furnished with louver along with respective catalog data.

3. Manufacturer's installation instructions.

B. Certifications:

1. Manufacturer's Certifications.

2. Manufacturer's 1-year warranty.

1.3 MANUFACTURER'S SERVICES

A. Certifications: The manufacturer shall provide the following certifications:

1. Certification that the equipment meets the general intent of the specifications and a list of all deviations from specifications.

2. Certification that equipment has been installed properly.

B. Manufacturer shall furnish all shop drawings and information as requested by the Engineer.

C. Manufacturer shall provide a 1-year warranty against defects in parts and workmanship.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: All materials shall be inspected for conformance with approved Shop Drawings.

B. Storage of Materials: All materials shall be stored in the original shipping cartons in a dry location until time of installation.

PART 2 - PRODUCTS

2.1 ADJUSTABLE LOUVERS

A. Adjustable louvers shall be designed to protect air intake in building exterior walls. All adjustable louvers shall be motorized.

B. The louver frames shall be the channel type fabricated from 6063-T5 aluminum. Frames shall be 4 inches deep.

C. The adjustable blades shall be of drainable design and fabricated from 6063-T5 aluminum.

D. The linkage shall be exposed on-blade linkage.

E. All louvers shall be furnished with a bird screen.

F. The motorized actuators shall be 120 Volts, internally mounted and shall fail in the closed position (power open, spring closed).

G. All louvers shall be sized as shown on the drawings and as specified in the louver schedule.

H. All louvers shall receive a 1.2-mil Kynar finish in a color as selected by the Owner from the manufacturer's color charts.

I. Louvers shall be designed to withstand wind loadings of 16 pounds per square foot or 80 mph.

J. Manufacturer:

1. Greenheck, Model ECD-401

2. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all louvers and accessories in accordance with the manufacturer's recommendations and published instructions.

B. Obtain manufacturer's written installation certification.

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 15890

DUCTWORK

PART 1 - GENERAL

1.1 GENERAL

A. Scope: Provide and install fabricated sheetmetal ductwork as shown and scheduled on drawings and specified herein.

B. The General Provisions of the Contract, including General and Supplementary General Conditions and Division 1 General Requirements, apply to the work specified in this Section.

1.2 SQUARE/RECTANGULAR DUCTWORK

A. Construct ductwork and casings in accordance with the mechanical code of N.Y.S. and with appropriate portions of the Low Velocity and Duct Construction standard of the Sheet Metal and Air Conditioning Contractor's National Association. Ducts shall be constructed of galvanized steel sheets in accordance with ASTM-A525. Zinc coating shall not be less than 1.25 ounces per square foot. Elbows shall be long radius or vaned. Seams and joints shall be tightly secured to stiffen the duct and to prevent air leakage. Leakage shall be less than five (5) percent of a fan scheduled capacity. Tape all transverse seams in supply ducts. Every effort shall be made by the Contractor to reduce leakage to the 5% maximum. Contractor shall submit detailed drawings showing the proposed construction, including joints, bracing, dimensions, and hanger types. Fabrication shall not start until the details are approved. All leaks shall be sealed to maintain the above minimum requirements.

B. Ducts shall be suspended by means of galvanized steel straps, minimum 1 inch x 16 gauge and be securely fastened to the structure and equipment. Ducts shall not be suspended from corrugated flooring or roofing.

C. Square 90° ductwork turns are to be avoided wherever possible but, if used, shall come equipped with 90°

turning vanes of galvanized steel with all mounting equipment, etc. for a proper installation.

D. Flexible aluminum ductwork is not acceptable.

E. All ductwork conveying interior air, that passes through an unheated space, or conveying unconditioned outside air within a conditioned space, shall be insulated to a MINIMUM of R6, and be sealed by exterior vapor barrier with a continuously sealed seam and shall include classroom and bathroom exhaust.

1.3 ROUND DUCTWORK

A. General

1. The contractor may, at his option, convert any or all rectangular ductwork to round, provided that the project space limitations are properly addressed, the overall system design static pressure is not exceeded, and the insulation requirements are met.

2. All round supply, return and exhaust ductwork shall be SPIROsafe® as manufactured by Lindab, Inc (800) 797-7476 or approved equal. The duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct which, when installed according to the manufacturer's instructions, will seal the duct joints without the use of duct sealer.

B. Materials

1. Unless otherwise noted, all duct and fittings shall be a minimum of G-90 galvanized steel in accordance with ASTM A-653 and A-924.

C. Construction

1. Unless otherwise noted, all duct and fittings shall be constructed per SMACNA's Duct Construction Standards (+10 in W.G.)

D. Fittings

1. All fitting ends shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket.

Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet all of the performance criteria set forth in the manufacturer's literature. Gasket shall be classified by Underwriter's Laboratories to conform to ASTM E-84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.

2. All fitting ends shall be calibrated to manufacturer's published dimensional tolerance standard and associated spiral duct.

3. All fitting ends from 3 inch to 24 inch diameter shall have rolled over edges for added strength and rigidity.

4. All elbows from 3 inch to 12 inch diameter shall be 2 piece die stamped and continuously stitch welded. All elbows 14 inch diameter and larger shall be standing seam gorelock construction and internally sealed.

5. The radius of all 90° and 45° elbows shall be 1.5 times the elbow diameter, unless otherwise noted on the drawings.

6. All fittings that are of either spot welded or button punched construction shall be internally sealed. When contract documents require divided flow fittings, only full body fittings will be accepted. The use of duct taps is unacceptable except for retrofit installations.

7. All volume dampers shall be SPIROsafe type DRU, DSU or DTU or approved equal. Damper shall be fitting sized to slip into spiral duct. Damper shall have the following features:

   a. Locking quadrant with blade position indicator.

   b. 2 inch sheet metal insulation stand-off

   c. Integral shaft/blade assembly

   d. Shaft mounted, load bearing sintered bronze bushings

e. Gasketed shaft penetrations to minimize leakage

E. Spiral Duct

1. Spiral duct shall be calibrated to manufacturer's published dimensional tolerance standard.

2. All spiral duct 14 inch diameter and larger shall be corrugated for added strength and rigidity.

3. Spiral seam slippage shall be prevented by means of a flat seam and a mechanically formed indentation evenly spaced along the spiral seam.

F. Performance

1. Duct system performance shall meet SMACNA's Leakage Class 3 requirements at the system design static pressure as indicated on the contract documents not to exceed -20 in W.G. or +12 in W.G.

G. Open Ended Ductwork

1. All open ended ductwork must be closed at all times after installation.

H. Submittals

1. Submittals are to be in accordance with Section 15011.

++ END OF SECTION ++

SECTION 15990

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: Provide labor and equipment to perform testing and balancing services, and provide certified balancing reports, as specified herein.

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

1.2 SUMMARY

A. Section Includes:

1. Procedures for Constant volume air systems

1.3 DEFINITIONS

A. TAB: Testing, adjusting, and balancing.

B. TABB: Testing, Adjusting, and Balancing Bureau.

C. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 10 business days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

C. Instrument calibration reports, to include the following:

1. Instrument type and make.

2. Serial number.

3. Application.

4. Dates of use.

5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by TABB.

2. TAB Technician: Employee of the TAB contractor and who is certified by TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide five business days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air exhaust systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following available TAB contractors that may be engaged include, but are not limited to, the following:

1. Precision Tab Services, Inc.

2. PC Testing and Balancing

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

D. Examine test reports specified in individual system and equipment Sections (where specified).

E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

F. Examine operating safety interlocks and controls on HVAC equipment.

G. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.

2. Automatic/programmable temperature-control systems are operational.

3. Equipment and duct access doors are securely closed.

4. Balance and volume dampers are open.

5. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance"

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation and ducts for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 15890 "Ductwork."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to material specifications.

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers/dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Verify that air duct system is sealed as specified in Section 15890 Ductwork.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to exhaust total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Engineer.

5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors.

B. Adjust volume dampers for main duct, and branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal inlets and calculate the total airflow for that branch.

2. Measure static pressure at a point downstream from damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each branch duct after all have been adjusted. Continue to adjust branch ducts to indicated airflows within specified tolerances.

C. Adjust air inlets for the room indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each intlet in the room to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

3.7 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Inlets: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems to allow access for performance measuring and balancing devices.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.

2. Manufacturers' test data.

3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB contractor.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

    a. Indicated versus final performance.

    b. Notable characteristics of systems.

    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Notes to explain why certain final data in the body of reports vary from indicated values.

14. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor dampers.

    b. Fan drive settings including settings and percentage of maximum pitch diameter.

D. Fan Test Reports: For exhaust fans, include the following:

1. Fan Data:

    a. System identification.

    b. Location.

    c. Make and type.

    d. Model number and size.

    e. Manufacturer's serial number.

    f. Arrangement and class.

2. Motor Data:

    a. Motor make, and frame type and size.

    b. Horsepower and rpm.

    c. Volts, phase, and hertz.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

E. Round Duct Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and fan number.

b. Location.

c. Duct static pressure in inches wg.

d. Duct size in inches.

e. Duct area in sq. ft..

f. Indicated air flow rate in cfm.

g. Indicated velocity in fpm.

h. Actual air flow rate in cfm.

i. Actual average velocity in fpm.

F. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.

b. Verify that balancing devices are marked with final balance position.

c. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner.

2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner and shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and

balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

+ + END OF SECTION + +