

SECTION 230000-MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.02 ALTERNATES

There are alternates that apply to this section

1.03 DEFINITIONS

ATC Automatic Temperature Control
EC Electrical Contractor (Division 16)
GC General Contractor
HC Heating (mechanical) Contractor
PC Plumbing Contractor

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation and perform all operations required to install a complete heating, ventilating and air conditioning system in the building, in accordance with these specifications and applicable drawings.
2. All temperatures are expressed in degrees Fahrenheit.
3. Perform demolition and removal as required.
4. Work to be performed shall include, but is not limited to, the following:
 - a. Remove ductwork that is not being reused.
 - b. Remove furnace and cooling unit that are not being reused.
 - c. Kitchen exhaust hoods, ductwork and fire suppression
 - d. Insulation
 - e. Bathroom fans and ductwork
 - f. Dryer exhaust vents
 - g. Sheetmetal
 - h. Automatic Temperature Control (ATC)
 - i. Tests and balance
5. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, ductwork and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.

6. Before submitting proposal, Mechanical Contractor shall be familiar with all conditions. Failure to do so does not relieve Mechanical Contractor of responsibility regarding satisfactory installation of the system.
7. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors') materials and equipment into place.
8. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under this section.

B. Related Work Described Elsewhere

1. Excavation and backfill
2. Cutting and patching
3. Firestopping between building construction and pipe sleeves and between building construction and ductwork, Section 07900.
4. Electrical conduit and wiring, except as noted below
5. Roofing, and framing of openings.

1.05 PERMITS

- A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.
- B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.06 CODES, ORDINANCES AND PERMITS

- A. All work performed under this Section of the Specifications shall be done in accordance with applicable National, State and local Codes, Laws and Ordinances. The following abbreviations are used for reference to standards which are to be followed:

| | |
|--------|---|
| AABC | Associated Air Balance Council |
| ADA | Americans With Disabilities Act |
| AMCA | Air Movement & Control Association |
| ANSI | American National Standards Institute |
| ARI | Air Conditioning and Refrigeration Institute |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| BOCA | Building Officials and Code Administrators |
| NEC | National Electrical Code |
| NFPA | National Fire Protection Association |
| NEMA | National Electrical Manufacturer's Association |

| | |
|--------|---|
| OSHA | Occupational Safety and Health Act |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association |
| UL | Underwriter's Laboratories |

- B. The latest issue of each Code in effect at the time of bidding shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

- A. Qualification of Workpersons

Use sufficient qualified workpersons and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of system throughout.

- B. Work performed shall conform with all Local and State Rules and Regulations, as well as those of the National Fire Protection Association (N.F.P.A.).

- C. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.

1.08 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. **All materials and equipment of the same classification shall be the product of the same manufacturer**, unless specified otherwise.

- A. The phrase "or approved equal" shall be defined to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.
- B. Approval by Architect for such substitution shall not relieve Mechanical Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work
- C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.
- D. Materials and equipment determined as an "approved equal" and/or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. Manufacturer, model, etc.) specified.

- E. Any additional cost resulting from the substitution of equipment, regardless of acceptance by the Architect or Engineer, shall be paid by this Contractor.
- F. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the State of Maine) when available. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

1.09 PLANS AND SPECIFICATIONS

Mechanical Contractor shall provide his sub-contractors with a copy of the ENTIRE portion of Part 1 of this specification, portions of this specification and copies of drawings which pertain to the equipment to be supplied at no cost to the sub-contractor. Provide ATC Contractor with entire set of Electrical plans and specifications. Provide Testing and Balancing sub-contractor with copies of shop drawings indicating coil gpm's, air handling unit air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor's expense.

1.10 SHOP DRAWINGS & SUBMITTALS

- A. Refer to Division 1 for information regarding requirements for shop drawing submittals. Shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data clearly indicated, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.
- B. It is desirable for shop drawings to be submitted electronically, including all documentation outlined in paragraph "A" above. Hard copies of shop drawings must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.
- C. Mechanical shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data clearly indicated, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused. Review must be obtained on the following items:
 - 1. Ductwork and Accessories
 - a. Registers, diffusers, and grilles
 - d. Duct sealant
 - e. Turning vanes
 - f. Side takeoff fittings
 - g. Flexible duct
 - h. Kitchen hood exhaust duct
 - 2. Mechanical Equipment (sound data must be provided with all interior motorized equipment).
 - a. Full warrantee information must be included with all submittals..
 - b. Fans and accessories - provide full fan curves and computer selection printouts.

- c.. Kitchen hood
- d. Zone damper systems
- 3. Insulation
 - a. Duct
- 6. Automatic Temperature Control (ATC) System

1.11 PRODUCT HANDLING

A. Protection

Use all means necessary to protect heating, ventilating and air conditioning materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.12 AS-BUILT DRAWINGS

See section 01720, "Project Record Documents".

1.13 MAINTENANCE MANUAL

A. On completion of this portion of the work, and as a condition of its acceptance, submit for approval two copies of a manual describing the system. Mechanical equipment manuals shall be separate from plumbing manuals. All manuals shall be original copies, not photocopies or they will be refused for re-submittal. Prepare manuals in durable 3-ring binders approximately 8½ inches by 11 inches in size with at least the following:

- 1. Identification on the front cover and spine stating general nature of the manual.
- 2. Neatly typewritten index.
- 3. Complete instructions regarding operation and maintenance of all equipment involved.
- 4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name, address and telephone number of nearest vendor of parts.
- 5. Copy of all guarantees and warranties issued.
- 6. Where contents of manuals including manufacturer's catalog pages, clearly indicate the precise item included in this installation and delete, or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.

B. In addition to above, provide two (2) separate offset style binders properly identified, each containing a copy of all reviewed shop drawings and catalog cuts. (NOTE: May be incorporated in Maintenance Manuals, if binders are of adequate size.)

1.14 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Mechanical Contractor at no extra cost to the Owner.

1.15 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.16 MINOR DEVIATIONS AND DISCREPANCIES

- A. The drawings are intended to indicate only diagrammatically the extent, general character and approximate locations of mechanical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, plumbing and electrical drawings so that work under this section is properly installed and coordinated with other Sections.
- B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the mechanical drawings, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.
- C. Questions to the Architect or Engineers are encouraged, but any answers or advice is non-binding. Therefore, inquires about such items should be made at least 4 days prior to when bids are due to allow time for a clarifying addendum to be issued.
- D. Any conflicts arising from duplication of equipment specified in different portions of the specifications shall be brought to the attention of the Architect prior to submitting bids. Failure to do so does not relieve the Contractor from responsibility of providing said materials and equipment and a credit will be taken for the duplicated item(s).

1.17 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.18 COORDINATION

- A. Contractor shall be responsible to coordinate his work with that of other trades to adjust to field conditions prior to commencing work. If a reasonable solution cannot be achieved without compromising the integrity of the intended design or would result in additional cost

the Architect must be notified immediately prior to commencement of work. Failure to do so does not relieve the Contractor from providing and installing the systems to the satisfaction of the Architect at no additional cost.

- B. Contractor shall be responsible to review job conditions and identify conflicts and/or obstructions to ductwork and piping prior to fabrication. If conflicts and/or obstructions are noted the Architect must be notified immediately prior to commencement of work. The cost of any fabrication work performed without confirmation and notification of conflicts and/or obstructions shall be the responsibility of the contractor.

1.19 WORKPLACE SAFETY

Mechanical contractor shall be responsible for the safety of his workpeople.

PART 2 - PRODUCTS

2.01 BATH FANS

A. General

1. Fans with capacity and types shown on the drawings shall be provided and installed. All roof curbs, unless otherwise noted, shall be provided by the fan manufacturer and installed by the General Contractor. This Contractor shall furnish the General Contractor with the correct sizes of roof curbs bases for units supplied. In order to establish a standard, fan model numbers indicated below are based on Cook (unless noted otherwise) Equivalent units by Acme, Greenheck and Ilg ONLY will be considered.
2. Fan selection shall be based on sloping portion of curve with spare capacity of 20% of total CFM and static pressure without increasing motor size. **Provide full fan curves with submittals that shown the entire operating range of the fan - not just the operating point. Fans that are submitted without this data will not be accepted.**
3. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be listed by the Canadian Standards Association Testing Laboratory (CSA). Sones indicated on drawings are maximum allowable.

B. Types

- A. Ceiling-Mounted humidity sensing exhaust fans shall be Nutone QTXEN110S Fans or approved equal by Broan, Panasonic or Greenheck.
 1. Maximum 2.0 sones.
 2. Energy Star Qualified
 3. Internal humidity control to automatically turn fan on in either or these conditions.
 - a. A rapid to moderate (owner adjustable) increase of humidity.
 - b. Humidity above a user-adjustable set-point (50%-100% RH).
 4. Fan is also to be energized any time the light switch is on.

2.02 KITCHEN HOOD AND KITCHEN HOOD EXHAUST SYSTEM

- A. Provide and install a NFPA96 kitchen hood exhaust systems.

Commercial Range Hood s

1. Hood: Provide and install a single wall canopy type kitchen hood and exhaust system as shown on drawings. Construction shall be not less than 18 gauge type 304 polished stainless steel. Hoods shall carry seal of U.L., N.S.F. and N.F.P.A. 96.
2. Duct: Exhaust duct shall be Metal-Fab, Inc. Model IPIC Series 4G Grease Duct or approved equal. Provide all cleanouts and offsets as required. Including fan adaptor plate and plate supports.
3. Grease Extractors: Grease extractors shall be 2 inch thick baffle type, listed for use

with cooking equipment, tight fitting and firmly held in place, easily accessible and removable for cleaning; installed at an angle not less than 45 degrees and equipped with pitched drip trap beneath lower edge. Units shall be adjustable to facilitate air balancing across hood opening. Provide removal tool. Kleen-Gard or approved equal.

4. Kitchen Exhaust Fans shall be Greenheck CUBE141 or approved equal.
 1. Upblast fan UL762 listed Grease fan
 2. Aluminum housing with backward inclined aluminum wheel
 3. Curb cap with prepunched mounting holes
 4. Drain trough
 5. Nema-1 Disconnect
 6. Provide with insulated vented curb for pitched roof by fan manufacturer.
5. Lights: Furnish a single UL listed vapor proof light at center of hood suitable for use with 100 watt incandescent bulbs (by Div. 16), all factory pre-wired to an 8 inch x 8 inch x 4 inch junction box on top of hood. Division 16 to provide wall switches for light and fan controls.
6. Kees model KA or approved equal by Aerolator, Duo-Aire, Econovent, Greasemaster, Greenheck or LDI. No other hood acceptable unless reviewed by Engineer prior to bid and accepted by addendum.

Kitchen Hood Fire Extinguishing System

1. Furnish and install fire extinguishing system, complete, in kitchen hood and duct systems to meet BOCA Code and requirements of latest edition of NFPA 96. Systems to be "Range Guard" wet chemical type, equal to KARBALLOY II by Automatic Sprinkler Corp., and protect kitchen hood, plenum, grease filters, exhaust duct, cooking appliance, and supplied with adequate size bottles as required. All devices furnished shall be constructed and installed in accordance with manufacturer's instructions and shall be in accordance with UL-300 requirements.
2. System to be provided with:
 - a. Controls including remote manual pull station and provision for automatic appliance power shut-off.
 - b. Pressure switch with two (2) dry contacts and interposing relay for connection to fire alarm system.
 - c. Complete piping system of Schedule 40 steel pipe with malleable iron fittings. Exposed piping under hood shall have stainless steel or chrome plated elbows, fittings and chrome plated tubing sleeves.
 - d. Semi-annual factory authorized inspection of system during 12 month warranty period.
3. In lieu of above, extinguishing system may be provided with kitchen exhaust hood. System to be wet chemical type with complete pre-piping of hood with nozzles installed and tanks mounted in a 12 inch deep utility cabinet at end of hood. Field hook-up to be provided by qualified factory

2.03 SHEETMETAL

A. General

The work under this section includes all the required sheetmetal and duct work, extensions for grilles, manual dampers, automatic counterbalanced (backdraft) dampers, deflectors, setting of control dampers, grilles, registers, diffusers, flexible connections and roof hoods as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

B. Ducts

1. The size of ducts marked on the drawings will be adhered to as closely as possible. The right is reserved to vary duct sizes to accommodate structural conditions during the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. All ducts shall be arranged to adjust to "field conditions". The Sheet Metal Contractor shall coordinate his work with Division 16 and other trades.
2. Ducts shall be constructed of galvanized steel in accordance with the following table of duct sizes OR the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct unless otherwise shown on drawings.

| <u>Dimensions of Longest Side</u> (inches) | <u>Minimum Sheet</u> <u>Metal Gauge</u> |
|---|--|
| Up thru 12 | 26 |
| 13 --> 30 | 24 |

3. Methods of fabrication and installation shall be in strict accordance with guidelines set forth in the latest SMACNA Guide and Data Book for Low and Medium Pressure Duct Construction unless otherwise shown on drawings. Cross break all ducts with largest dimension being 18 inches and larger. Beaded ducts are not acceptable except for ductwork less than 18 inches in either direction.
4. All dampers and deflectors shall be a minimum of #22 gauge and stiffened as required. Splitter dampers shall not be acceptable.
5. All joints in ducts shall be made air tight, and all branches and turns shall be made with long radius elbows and fittings. Long radius elbows are defined as having a centerline radius of 12 times the width of the duct. If long radius elbows are not used, elbows 18 inches wide and larger shall be provided with fixed double wall airfoil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width. Square elbows less than 18 inches wide shall be provided with single wall turning vanes. Square elbows with outside corners cut at 45° or rounded are not acceptable.
6. All ducts shall be installed with necessary offsets, changes in cross sections, risers, and drops which may be required. They shall be constructed with approved joints and be supported in an approved manner.

7. Round ductwork shall be constructed in accordance with the latest SMACNA HVAC Duct Construction Standards for round and oval duct construction. Ductwork larger than 8 inches in diameter shall employ spiral seams. All turns shall be made with smooth (not segmented), long radius elbows and fittings. All seams shall be type RL-5, grooved seam pipe lock or better. *Lap seams are not permissible.* Gauge thicknesses shall be as outlined in SMACNA for galvanized steel round duct gauge selections for maximum 2 inches w.g. static pressure. Ductwork shall be supported with full wrap-around band and single hanger strap as indicated in Figure 4-4 of the 1985 edition of the SMACNA HVAC Duct Construction Standards handbook.
 8. Furnish and install flexible connections on all air handling units and cabinet unit heater. Connections shall be made from Ventglas neoprene coated glass fabric as furnished by Ventfabrics, Inc., or approved equal.
 9. Every precaution shall be taken to keep interior of duct system free from dirt and rubbish and to protect all ducts and equipment during construction. At completion, this Mechanical Contractor shall thoroughly clean all equipment to the satisfaction of the Architect.
 10. Spaces between ducts and wall or floor construction shall be caulked to make smoke and water tight with 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant or approved equal.
 11. Testing, Balancing and Leak Testing... See Part 3, EXECUTION
 12. Requirements set forth in applicable codes (see part one) shall supercede SMACNA standards.
- C. Diffusers, Registers and Grilles
1. Grilles and/or registers shall be installed at all air supply and return openings as shown. All units to be aluminum, except as noted, and provided with baked enamel finish to match color of grille or register and countersunk screw holes. Mounting screws shall be oval head type with head painted to match finish. Unless stated otherwise, the following list is based on model numbers of Anemostat to establish a standard of quality (if substituting, certified sound criteria shall be included with submittals indicating CFM and NC levels of each register and grille) [or approved equal units by Krueger, Price and Titus only]

Anemostat model X3HD with $\frac{3}{4}$ inch, 45° front blade spacing, front blades set horizontal. Equal units by Krueger, Price and Titus only will also be considered for review.
 2. Diffusers shall be installed at all air supply openings as shown. All units to be steel with white baked enamel finish.

Anemostat model EPL. Equal units by Krueger, Price and Titus only will also be considered for review.

D. Sealing of Ducts

1. All interior ductwork (except prefabricated grease ducts and welded duct) shall be sealed with low VOC water based duct mastic, either "MP" (Multi-Purpose), Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or United Duct Seal (United McGill Corp.) water base, latex or acrylic type sealant. All transverse joints to be continuously sealed. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. Duct tape, in any form or material, is also prohibited.
2. For exterior applications, "Uni-Weather" (United McGill Corp.) neoprene based sealant shall be used. No other sealants may be used.
3. All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3" wide open weave fiberglass tape. Sufficient additional sealant shall then be applied to completely imbed the cloth. All sealants shall be UL rated at no more than flame spread of 5 and smoke developed of 0. At contractor's option Hardcast 1602 sealant tape may be used in lap joints and flat seams.

F. Manual Dampers

1. See Part 3, EXECUTION for installation notes.
2. Manual dampers with smallest dimension 5 inches or less shall be shop fabricated, single 22 gauge blade, 3/8 inch rod, provided with position indicator and locking quadrant.
3. Manual dampers with smallest dimension larger than 5 inches but smaller than 11 inches shall be single blade steel, 16 gauge construction, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
4. Manual dampers with smallest dimension larger than 11 inches shall be opposed blade steel, 16 gauge construction, linkage concealed in frame, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
5. Dampers to be installed in aluminum ductwork shall be fabricated of aluminum or isolated from ductwork with rubber grommets between the damper and the duct to prevent oxidation between dissimilar metals.
6. Provide hand quadrants for all manual dampers, Ventline Model 560 or approved equal.

G. Flexible Duct

Provide and install insulated flexible duct where shown on drawings. Ducts 20 inches in diameter and smaller shall be a double lamination of polyester encapsulating a steel wire helix forming an air-tight inner core. The core shall be wrapped in a blanket of fiberglass insulation (R 4.2) and sheathed in a rugged and durable reinforced metallized polyester jacket. Duct shall be class 1, U.L. 181 compliant and rated for not less than 2 inches w.g. positive working pressure. Duct internal diameter shall be same size as diffuser served. Atco UPC 030 or approved equal.

H. Side Takeoff Fittings (for flexible duct)

Provide and install, at all flexible duct branches to diffusers, a bellmouth side takeoff fitting similar to detail on drawing M2, "*Flexible Duct and Diffuser Connection Detail*"; with manual damper. Fittings shall be pre-manufactured with bell end shall have a 1½ inch radius and employ a self-adhesive gasket seal and be pre-drilled for attachment screws. Units with manual dampers shall be heavy duty with bearings and hand quadrants. Fittings shall be anchored to ductwork with *not less than* three (3) screws. Final diameter shall be same size as diffuser served. Units shall be no thinner than 22 gauge, G-90 galvanized steel. Buckley Bellmouth HD-BM, HD-BMD or approved equal by Flexmaster or United Enertech.

I. Turning Vanes

1. Provide and install at all square duct elbows 18 inches and larger, and where shown on drawings, fixed double wall airfoil type turning vanes. Turning vanes shall be constructed as outlined in the latest SMACNA HVAC Duct Construction Standards guidebook, Figure 2-3.
2. Provide and install at all square duct elbows less than 18 inches in width, and where shown on drawings, fixed single wall turning vanes. Turning vanes shall be constructed as outlined in the latest SMACNA HVAC Duct Construction Standards guidebook, Figure 2-3.

J. Louvers

1. All exterior louvers shall be extruded aluminum construction with interior bird screens and anodized in color to be selected by Architect. Provide not less than 2 color chip cards with submittals for review (photocopies not acceptable). Frames and blades shall a free area of not less than 47% (combination type) and 55% (stationary type) and no less than 0.081 inches thick. The following list is based on model numbers of Ruskin to establish a standard of quality; approved equal units by American Air Warming and Arrow are acceptable.
2. Louvers shall be stationary blade type. Units to be 6 inches deep with certified rating of zero water penetration at free area velocity of 900 FPM based on tests in accordance with AMCA Standard 500. Units 48 inches and less in width shall be Model ELF6375X.

2.04 INSULATION AND CONDENSATE PROTECTION

A. General

1. Insulation shall be provided for all new hot water supply and return piping, refrigerant piping, outside air intakes, supply ducts, exhaust ducts and other insulation where shown on drawings.
2. Insulation systems shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

D. Duct and Equipment Insulation

1. Insulate the following ducts with 1-/2"" inches thick fiberglass duct wrap with factory applied vapor barrier facing:
 - a. All rigid supply and outdoor air intake ductwork in the ceiling space..
3. Material to carry U. L. label. All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24 inches or wider, mechanical fasteners shall be provided approximately 12 inches O.C.

E. Condensate Protection

Solder or weld bottom and sides of ducts connected to outdoors to prevent water leaks from rain and snow. Seal duct wrap and liner to minimize condensation.

F. Installation

All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

2.05 AUTOMATIC TEMPERATURE CONTROL (ATC)

A. General

1. Furnish and install a complete system of electronic temperature controls.
2. ATC Contractor must be capable of providing, installing and servicing the control system in its entirety. Sub contracting of ATC wiring is permissible but the ATC contractor shall be ultimately responsible and liable for proper installation as outlined in Divisions 15 and 16 of this specification.
3. The control systems shall be provided and installed by trained control mechanics regularly employed in installation and calibration of ATC equipment.
4. Shop drawings of entire control system shall be submitted for approval before work is started.

5. Provide Temperature Control technician to test the complete ATC systems sequences for specified cycles of operation with the Testing and Balancing Contractor.
6. ATC Contractor must, at the end of the warranty period, furnish the Owner with all access codes and passwords assigned to the ATC control systems. ATC Contractor shall also instruct the Owner in the use of all digital control software and provide a backup copy of the final software package to the Owner on CD.

B. Scope

Control shall be provided for, but not limited to the following: System to be a Honeywell 3-zone networked damper system or approved equal.

1. 3-zone damper systems for each of two air handling systems.
2. Heat/cool master thermostat for each of two air handling systems.

C. Incidental Work by Others

b. Sheet Metal Contractor shall:

- (1) Install all automatic dampers.
- (2) Provide necessary blank-off plates required to install dampers that are smaller than duct size.
- (3) Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
- (4) Provide access doors or other approved means of access through ducts for service to control equipment.

c. The General Contractor shall:

- (1) Provide all necessary cutting, patching and painting.
- (2) Provide access doors or other approved means of access through ceilings and walls for service to control equipment.

D. Electric Wiring

1. All low voltage and data wiring for installation of temperature controls shall be by ATC Contractor, except as noted. Power wiring for equipment shall be by Division 16, "ELECTRICAL". See Part 1, Paragraph 1.03, sub-paragraph C, "MECHANICAL ELECTRICAL WORK" for specific requirements. Exception: Power wiring from circuit breaker to temperature control panel(s) will be provided and installed by the ATC Contractor.
2. Temperature Control Contractor shall be responsible for coordinating installation of his wiring conduits with Division 16, "ELECTRICAL".

E. Submittal Brochure

1. The following shall be submitted for approval:
 - a. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
 - b. Panel layouts and name plate lists for all local and central panels.
 - c. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
 - d. Product data for all control system components.

F. Instruction and Adjustment

Upon completion of the project, the ATC Contractor shall:

1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and relays provided under this section.
2. Furnish two (2) instruction manuals covering function and operation of control systems for use of the Owner's operating personnel. A competent technician shall be provided for instruction purposes. Allow for an instruction period of not less than 2 hours.

G. Guarantee

Control system shall be guaranteed to be free from original defects in both material and workmanship for a period of not less than one (1) year of normal use and service. This guarantee shall become effective starting the date Architect agrees Owner has begun to receive beneficial use of the system.

H. Hazardous Materials

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the ATC system.

I. Thermostats

1. Provide clear locking covers for units all zone thermostats.
2. All zone thermostats shall be electronic..
3. All thermostats shall be mounted according to ADA requirements (<http://www.access-board.gov/adaag/html/adaag.htm#4.27>). Maximum 48" to top of thermostat.

J. Miscellaneous Devices

Provide all the necessary relays, positioners, solenoid valves, transformers, etc. to make a complete and operable system.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all work is complete to the point where this installation may properly commence.
2. Verify that Mechanical systems may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION OF DUCTWORK AND EQUIPMENT

A. General

1. Size and general arrangements as well as methods of connecting all diffusers, registers, grilles, duct coils and equipment shall be as indicated, or to meet requirements for complete installation.
2. Construction standards and sheet metal gauges shall be as outlined in the latest edition of the SMACNA HVAC Duct Construction Standards handbook for metal and flexible ducts unless specifically indicated otherwise.
3. Manual Dampers
 - a. Manual dampers may be shop-fabricated on units 5 inches in height and less. All dampers larger than 5 inches **MUST** be pre-fabricated as previously outlined in this specification.
 - b. All manual dampers located within 10 feet of a fan outlet shall have the blades oriented perpendicular to the fan shaft.
 - c. Provide duct access door as large as possible up to 12 inches x 12 inches at EACH manual damper larger than 5 inches.

B. Protection and Cleaning

1. All open ends of ductwork which is to be unattended for 4 hours or more shall be temporarily protected with plastic sheeting and duct tape (or similar method) to reduce the collection of construction dust and debris.
2. Prior to testing and balancing and at the end of the construction, clean the interiors of all supply and return air ductwork before changing filters in air handling equipment. Careful coordination must be maintained between the time of testing

and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Testing

1. All ductwork shall be tested for leakage prior to installation of insulation and concealment.
2. Leakage test procedures shall follow the outlines and classifications in the latest edition of the SMACNA HVAC Duct Leakage Test manual. See Section 4 of the SMACNA leakage test manual for normal duct classifications.
3. Leakage amount shall not exceed the allotted amount for the pressure class or the allotted amount for that portion of the system, whichever is applicable.
4. Any ductwork which fails to meet the allotted leakage level shall be modified to bring it into compliance and shall retest it until acceptable leakage is demonstrated.
5. At completion of construction, Contractor shall provide written certification, on his company letterhead, indicating that all ductwork has been tested according to specified requirements. Document shall include date of test, test pressures used, leakage class and construction class of each section of ductwork tested.

3.03 TESTING, ADJUSTING AND BALANCING (TAB)

A. General

1. TAB contractor shall be a subcontractor to the Mechanical Contractor.
2. TAB contractor shall perform functional performance test of all Division 15 equipment and entire ATC system for specified operation and control sequences.
3. The mechanical contractor shall startup all Division 15 equipment as required by the equipment specifications. Mechanical contractor shall verify that systems are complete and operable before TAB commencing work. Ensure the following conditions:

3.04 CLOSING IN UNINSPECTED WORK

A. General

Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance

Should any work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been inspected completely and approved, make all

repairs and replacements with materials necessary for approval by the Architect and at no additional cost to the Owner.

3.05 TEMPORARY HEATING

- A. Mechanical Contractor shall install the new heating system and related equipment as soon as those portions of the building are ready and the work can be performed.
- B. Mechanical Contractor will be required to permanently connect as many units as possible for temporary heat.
- C. At the conclusion of the temporary heating period, the complete system shall be thoroughly cleaned.
- D. General Contractor will be required to assume full responsibility for the care and operation of the new equipment during its temporary use and to return the equipment to the Mechanical Contractor in perfect order, normal wear and tear excepted.
- E. Water, fuel and electric power required to operate the heating system for temporary heat shall be provided by the Owner..

3.06 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the Heating, Ventilating and Air Conditioning installation, including the removal all labels and all traces of foreign substance. Prior to testing and balancing vacuum and clean inside of all convectors, finned radiators (spackle droppings), unit ventilators, air handling units, VAV units, fans and cabinet unit heaters. Clean the interiors of ductwork as outlined in 3.04, "INSTALLATION OF DUCTWORK AND EQUIPMENT"; paragraph "B", "Protection and Cleaning".

307 INSTRUCTIONS

On completion of the job, the Mechanical Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The total period of instruction shall not exceed twenty-four (24) hours. ATC system instruction shall be in addition to this instruction period. The time of instruction shall be arranged with the Owner.

3.08 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (ductwork, piping, etc.), paper salvage (cardboard shipping containers, etc.), wood & plastic products, etc. The Mechanical Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, refrigerants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.09 HAZARDOUS MATERIALS

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the mechanical systems.

END OF SECTION 230000