Part II
Division 23
HVAC

SECTION 23 00 00

HVAC

1 PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the printed form of Contract and General Conditions, Supplementary Conditions, and Division 1 which are hereby made a part of this Section of the Specifications will be negotiated with G.C.

B. Examine all drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 DESCRIPTION OF WORK

A. This is a design build project. The contractor shall hire Registered Professional engineer (Maine State registration required) to prepare drawings and calculations for the owner's approval. Engineer will provide $1,000,000.00 liability insurance. The engineer shall provide during the construction two site visits and submit report. The engineer will also provide a final punch list and report. The engineer shall also provide all the site visits required by the inspection agencies and the building department. The work covered in this section of the specifications consists of furnishing all labor, equipment, appliances and material and in performing all operations in connection with this HVAC System, complete, in strict accordance with this Section of the specifications and without limiting the generality thereof includes:

1. General Requirements:

a) The intention is to provide complete installed HVAC systems as required by Maine State Mechanical Code, Maine State Building Code, ASHRAE standards and these specifications including drawings and calculations prepared by a Registered Professional Engineer (Maine State registration required).

b) If any contradiction, ambiguity, error, inconsistency, omission or incomplete system appears in or between any contract documents, the contractor shall before submitting the final bid and signing the contract for construction, notify the general contractor and request a written resolution as to which methods or materials will be required. If the contractor fails to make a request for interpretation or resolution, no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the architect. This generally means the use of the highest quality material, most expensive way of performing the work and providing complete functioning system for proper operation.

c) Each and every trade or subcontractor will be deemed to have familiarized themselves with all the contract documents of this projects,

including architectural, structural, mechanical, electrical, and site work, and to have visited the site, so as to avoid error, omissions and misinterpretations. Related information may be provided on contract documents other that those associated with the subcontractor's trade. The contractor is responsible for coordinating related work of all the contract documents. No additional compensation will be authorized for alleged errors, omissions or misinterpretations whether they are a result of failure to observe this requirement or not.

d) All penetrations of assemblies exposed to the exterior environment shall be sealed with foam sealant or equivalent sealer to provide zero air infiltration. Coordinate with fire stopping requirements.

e) No component of any system shall run through the stair enclosure that does not relate to or serve the stair enclosure.

f) Refer to architectural drawings for type and location of all fire rated walls. Any penetration through wall bottom or top plates shall be Fire Stopped. Any penetration the fire rated wall shall be Fire Caulked. Refer to section 7250 for procedure.

g) Refer to architectural drawings for type and location of all fire rated walls. Any penetration through wall bottom or top plates shall be Fire Stopped. Any penetration the fire rated wall shall be Fire Caulked. Refer to section 7250 for procedure. Provide submittals of UL designs selected and the product information for approval.
Without limitation pay attention to the following items:

a. Chases behind bathroom (wall between corridor and bathroom) and walls between units are fire rated. Fire Caulk all penetration.

b. Top and bottom wall plates at ceiling and at floor are part of fire separation. Fire Stop all penetrations through plates.

h) Any wall location changes shall be coordinated through the G.C for review with the architect.

i) All roof penetrations shall be on the back slope of the rood minimum 10 ft. away from ridge.

j) Immediately following installation cover all duct openings with plastic cover to protect it from building dust and debris. Cover ends if duct until connected to grills. Upon connection to grills provide dust cover over grills. The plastic cover shall remain in place until building is pressure tested. If this is not provided contractor will be required to clean the inside of the ductworks.

2. Remove existing boilers and pumps and piping serving the retail area. Provide modular high efficiency boilers (minimum 90% efficiency) to serve the retail areas and residential areas. The capacities shall be as listed below:

   a) The systems shall be designed to maintain 75 degree winter inside temperature with –20 outside temperature. Submit heat loss calculations.

   b) The system for the residential areas shall be two pipe change over type vertical fan coil units with fan cycle controls (Whalen or equal). System shall be designed for future chiller installation on roof. All piping shall be sized for chilled water and insulated vapor tight for chilled water. We estimate 400 CFM unit for each apartment. Submit proposed fan coil unit for each typical unit. Submit calculations. Run condensate drain to storm system in basement. Provide electric baseboard for all exterior unit toilets and also toilets with roof. Interior toilets do not require heat.

   c) Provide toilet exhaust shaft and toilet exhaust fan with radiation damper.

   d) Provide corridor ventilation system.

   e) Ceiling registers shall be Metal Aire Model V4004D or equal Hart and Cooley with radiation dampers.

   f) Return grille shall be Metal Aire Model RH or equal Hart and Cooley.

   g) Diffusers shall be Model Metal Aire 5500-15 or equal Hart and Cooley with radiation dampers.

   h) Fire dampers shall be provided at the fire rated ceilings and fire rated shafts.

   i) Ductwork shall be A combination of galvanized metal and insulated flexible per SMACNA

   j) Flexible ducts shall be insulated Buck duct or equal.

   k) 90 Degree sharp elbows will be avoided for flexible ducts. If it cannot be avoided, hard metal elbows shall be provided.

   l) Supply ductwork in the ceiling space will be insulated.

   m) Provide cabinet heaters with remote wall mounted thermostats for stairs, entries.

   n) Dryer exhaust system and dryer box shall be provided.

   o) Toilet exhaust fan shall be Model Panasonic FV-08VF2 with radiation

damper single speed or equal 1.0 sones or less.

p) Dwelling unit Kitchen exhaust shall be recirculating type by G.C

q) All equipment shall be installed per manufacturers recommendations. Contractor will provide vibration isolation system as required for quiet operation.

r) Provide toilet exhaust for all public toilets and janitors closet.

s) Provide exhaust for laundry room.

t) Provide combustion air for gas fired dryers.

u) Provide exhaust and make up (via heat recovery unit for the storage rooms)

v) Provide hot water unit heaters for the storage rooms.

w) Provide heat for common toilets.

x) Provide make up air and exhaust provision for future restaurant.

3. Corridor ventilation system shall be provided with roof top gas fired units. Provide minimum (2) units. Each unit will have 4 ton capacity. In general the ducts shall run in ceiling space, if ductwork has to run on roof due to ceiling space restrictions it shall be protected by the HVAC contractor EPDM roofing or another acceptable means.

4. Elevator lobbies and vestibules will be heated. Heater shall be electric by HVAC contractor. Wiring by Electrical contractor.

5. Retail areas will be provided with hot water unit heaters for temporary heat. HVAC work by future tenant.

6. Stairs and storage rooms and all non-air-conditioned areas will be heated with electric fan type heaters with remote wall mounted thermostats.

7. Air to air heat pump for the elevator machine rooms will be provided.

8. Elevator shaft will be ventilated per Code. Provide fail safe motorized damper interlocked with fire alarm system, coordinate with electrical contractor.

9. Trash room shall be exhausted to roof.

10. Ductwork, grilles and registers, fire and smoke dampers.

~~11.~~ Temperature controls and control wiring shall be provided. Thermostat shall be Honeywell non-programmable digital heating cooling thermostat.

12. Testing adjusting and balancing shall be done by the HVAC contractor. Independent balancing contractor shall not be used.

B. Related Work: The following work is not included in this Section and is to be performed under the designated Sections:

1.	SECTION		FLASHING FOR ROOF CURBS
2.	SECTION		ELECTRICAL WIRING AND STARTERS
3.	SECTION	03300	CONCRETE PADS
4.	SECTION		LOUVERS
5.	SECTION	02200	EXCAVATION AND BACKFILL
6.	SECTION	08305	INSTALLATION OF ACCESS DOORS
7.	SECTION	02200	ROUGH GRADING AND PATCHING

1.3 DEFINITIONS

A. "The Contractor" or "this Contractor" means specifically the Subcontractor working under his respective Section of the Specifications.

B. "Furnish" or "provide" means to supply, erect, install and connect up complete in readiness for regular operation of the particular work referred to, unless otherwise specified.

1.4 INTENT

A. It is the intention of these Specifications to provide the equipment to be furnished complete in every respect, and this Contractor shall furnish all equipment needed and usually furnished in connection with such systems. Equipment, materials and articles incorporated in the work shall be new and of the best grade of their respective kinds for the type of work involved.

1.5 CODES, ORDINANCES AND PERMITS

A. All work shall be installed in accordance with the laws, ordinances, rules and regulations of all local and State Authorities, having jurisdiction and the rules and regulations of the National Board of Fire Underwriters.

B. All motors and motor control equipment shall meet the requirements of the National Electrical Code, and comply with the requirements of the NEMA and the local public utility furnishing current to the building.

C. This Contractor shall apply and pay for inspection, permits, certificates of inspection, and license fees in connection with his work, and shall deliver same to the Architect at the completion of the work.

D. All diagrams required by local or State Authorities shall be supplied by this Contractor.

1.6 INSTRUCTIONS TO THE OWNER

A. All mechanical equipment installed in connection with this Section shall be put in operation in the presence of duly authorized representatives of the Owner with 24-hour notice given the Owner's representative for each appointment. Instructions shall be given to the Owner's employee appointed to familiarize himself with the systems and equipment. Three copies of the operating manual, parts list, and bulletin, shall be delivered to the Architect for approval.

B. The Manual shall include the following:

1. Summary description of the systems' operation.

2. Manufactures' literature, illustrations and technical data.

3. Guarantee and warranty data.

4. Parts list and parts numbers.

5. (3) Three copies of Maintenance, lubrication and replacement charts.

6. Trouble-shooting charts.

7. Fire stopping methods.

1.7 BASES AND SUPPORTS

A. Furnish and install all supplementary steel required for setting and/or hanging all piping and equipment.

B. Wherever necessary, this Contractor shall provide all bases and supports not part of the building structure, or required size, type, and strength, as approved by the Architect, for all equipment and materials furnished by him.

C. All equipment, bases and supports shall be adequately anchored to the building structure to prevent shifting of position under operating conditions.

D. Concrete piers and bases will be furnished by the General Contractor, except where otherwise noted.

1.8 EXAMINATION OF SITE

A. Before submitting his proposal, this Contractor shall visit the site, examine the condition, and thoroughly acquaint himself with the obstacles and advantages for performing the work. He shall also study the drawings and specifications explanatory of the work to be performed and compare them with the information gathered by the examination of the site.

B. This Contractor shall not be allowed to charge for extra work caused by his unfamiliarity with the site, drawings, specifications or rules of the various governing authorities.

1.9 SHOP DRAWINGS

A. Submit for approval copies of descriptive literature giving performance data, physical size, wiring diagrams, capacity, materials, etc., for all items listed below:

1. All equipment.

2. Refrigerant and Water Piping and ductwork.

3. Duct and pipe Insulation.

4. Temperature control equipment and diagrams.

5. Submit all fire stopping methods for approval

1.10 SUBSTITUTIONS

A. Substitutions of equipment or materials other than those shown on the drawings or named in the specifications may be made only with the written approval of the Architects, who reserve the right to require adequate proof of the quality of the substitute before permitting its use. Prior signing contract, contractor shall provide list of all major items to be or may be substituted for review.

B. Where a Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring, or of any other part of the mechanical, electrical or architectural layout, all such redesign, and all new drawings and detailing required therefore shall with the approval of the Architect be prepared by this Contractor at his own expense.

1.11 APPROVALS

A. Engineers approval of the system, equipment, and shop drawings shall not relieve this Contractor from the responsibility for deviations from contract documents, unless he has in writing called attention to such deviations, at the

time of submission and secured written approval, not shall it relieve him from responsibility for errors in submittal.

1.12 PERMITS, FEES, AND TAXES

A. This Contractor shall apply, pay all Plumbing and HVAC fees and taxes and prepare all required documents necessary to obtain required permits and certificates.

1.13 COORDINATION OF TRADES

A. Where the work of this Contractor will be installed in close proximity to work of other trades, or where there is evidence that the work of this Contractor will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Architect, this Contractor shall prepare composite working drawings and sections at a suitable scale designated by the Architect clearly showing how his work is to be installed in relation to the work of other trades.

B. If this Contractor installs his work before coordinating with other trades or so to cause interferences with work of other trades, he shall make necessary changes in his work to correct the condition without extra charge.

1.14 TEMPORARY OPENINGS

A. This Contractor shall ascertain, from his examination of the architectural drawings, whether any special temporary openings in the building will be required for the admission of apparatus furnished under his contract, and he shall notify the Architect accordingly. In the event of failure of this Contractor to give sufficient notice to the Architect in time to arrange for these openings during construction, this Contractor shall assume all costs of providing such openings thereafter.

1.15 OPENINGS IN EXTERIOR WALLS

A. Openings in exterior walls and roofs shall be kept properly plugged and caulked at all times, except when being worked on, to preclude the possibility of flooding due to storms or other causes. After completion of the work, openings for which this Contractor is responsible shall be permanently sealed and caulked in a manner approved by the Architect.

1.16 ACCESSIBILITY

A. All work shall be installed so that all parts required are readily accessible for inspection, operating, maintenance, and repair. Minor deviations from the drawings may be made to accomplish this, but changes to magnitude shall not be made without prior written approval from the Architect.

1.17 CUTTING AND PATCHING

A. The Heating and Ventilating Contractor shall be responsible for all required cutting and drilling associated with his work, but in no case shall cut into any structural elements without the written approval of the Architect.

B. All rough patching and finish patching shall be provided by the General Contractor.

1.18 GUARANTEE

A. Guarantee in accordance with requirements of contract form. Partial approval of a portion of work does not affect the validity of the guarantee.

B. This Contractor shall guarantee that all work installed will be free from any and all defects in workmanship and/or materials that all apparatus will develop capacities and characteristics specified.

C. If, during a period of one year from the date of completion and acceptance of the work, any such defects in workmanship, materials or performance or unauthorized deviation from contract documents appear, he will, without cost to the Owner, remedy such defects within a reasonable time to be specified in notice from the Architect.

D. He shall correct all damage to insulation, paint, woodwork, or building caused by defects in his work, equipment, and its operation. Guarantee shall include startup, shutdown, maintenance, and 24-hour service during the guarantee period.

E. Any apparatus that required excessive service during the first year of operation will be considered defective and shall be replaced.

1.19 RECORD DRAWINGS

A. Record drawings shall be kept on the job site and updated continuously by the Contractor as the work progresses.

B. Record drawings shall show exact locations and sizes of all the work to be concealed. Especially note the location of the valves, volume dampers, fire dampers, etc.

C. Non-availability of the updated record drawings or inaccuracies therein shall be grounds for cancellation and/or postponement of any final inspection by the Engineer.

C. The record drawings required to be furnished under this Section are of drawings numbered H-#

1.20 ELECTRIC WORK

A. Power wiring will be furnished and installed by the Electrical Contractor.

B. HVAC contractor shall coordinate with electrical contractor and provide requirements for line voltage wiring requirements. Lack of coordination will not be an extra to owner

C. All wiring furnished under this Section shall be in accordance with the Electrical Work Section of these Specifications, the National Electric Code, and applicable local codes.

1.21 TESTING AND ADJUSTMENTS

A. After the installation is completed and ready for operation, this Contractor shall test the system under normal operating conditions. Whenever the equipment or system under test is interrelated with and depends upon the operation of other equipment, systems and controls for proper operation, functioning and performance, the latter shall be operated simultaneously with the equipment or system being tested.

B. All defective work shall be promptly repaired or replaced and the tests shall be repeated until the system or components parts thereof receive the approval of the Architect. Any damage resulting from tests shall be repaired and damaged materials replaced, all to the satisfaction of the Engineer.

C. Tests shall be performed in the presence of and to the satisfaction of the Engineer and such other parties as may have legal jurisdiction.

D. Labor, materials, instruments and power required for testing shall be furnished by this Contractor unless otherwise indicated under another Section of the Specifications.

E. After completion of the installation work called for in this Specification, this Contractor shall furnish necessary mechanics or engineers for the adjustment and operation of the system to the end that the system may be adjusted and turned over to the Owner in perfect working order.

F. All piping and connected equipment shall be tested to 100 pounds hydrostatic pressure and proven tight before installation of equipment.

G. Test and balance the entire system. Submit written report to the Engineer for approval.

1.22 TEMPORARY HEATING

A. Special reference is made to "Heating During Construction", Section 1 of the SUPPLEMENTARY CONDITIONS.

B. The Heating and Ventilating Contractor shall coordinate his work with the

progress of construction so that the permanent heating system will be ready to provide Temporary Heating as soon as possible.

D. The General Contractor shall pay the cost of temporary heating. The HVAC contractor shall to thoroughly clean and put in first-class condition any portion of the permanent heating system used for Temporary Heating.

1.23 ACCESS PANELS

A. The Heating and Ventilating Contractor shall provide all necessary access panels and be responsible for providing locations and quantities of the access panels to the G.C. to install all access panels. The spin collars will not have dampers and will not require access doors.

1.24 DRAWINGS

A. This is a design build project. The contractor shall hire Registered Professional engineer (Maine State registration required) to prepare drawings and calculations in compliance with Maine State Mechanical Code, Maine State Building Code, ASHRAE standards and these. Specifications.

B. Drawings shall be coordinated through the General Contractor with all other trades including structure prior to completion.

C. The design should incorporate freezing prevention for all piping and systems. Coordinate with other trades through G.C.. Heat trace and insulation alone will not be accepted.

D. All ductwork penetrating a fire rated wall shall have a fire damper. These shall be reviewed and coordinated through G.C. with the Architect.

E. All ceiling registers and grilles penetrating a dwelling unit drywall ceiling shall have ceiling radiation dampers.

F. Should any contradiction, ambiguity, error, inconsistency, omission or incomplete system appear in or between any of the Contract Documents, the Contractor shall, before submitting the final bid and signing the contract for construction, notify the General contractor and request a written resolution as to which methods or materials will be required. In the event of conflicting requirements of standards, drawings or specifications, the Contractor shall comply with the more stringent requirements. Before submitting the final bid and signing the contract for construction the Contractor shall obtain a written interpretation from the Architect. In no case shall the Contractor proceed with the affected work until advised by the Architect.
If the Contractor fails to make a request for interpretation or resolution no excuse will be accepted for failure to carry out the work in a satisfactory manner, as interpreted by the Architect. This generally means the use of the highest quality material, most expensive way of performing work and providing complete functioning systems for proper operation,

Each and every trade or Subcontractor will be deemed to have familiarized themselves with all Contract Documents of this project, including Architectural, Structural, Mechanical, Electrical and Site Work, and to have visited the site, so as to avoid errors, omissions and misinterpretations. Related information may be provided on Contract Documents other than those associated with the Subcontractor's trade. The Contractor is responsible for coordinating related work of all the Contract Documents. No additional compensation will be authorized for alleged errors, omissions and misinterpretations, whether they are a result of failure to observe this requirement or not.

1.25 DEMOLITION

A. Disconnect and remove all piping, ductwork, equipment shown on Drawings. Cap-off all ducts and pipe ends. All equipment and material remains Owner's property. Any equipments and materials not wanted by the Owner shall be removed from the site and be disposed of per State, Local and E.P.A regulations at this Contractors expense.

2 PART 2 PRODUCTS

2.1 PIPE CLASSES

A. Class I piping shall be Schedule 40 seamless black steel, ASTM A53, Grade A pipe and fittings.

B. Class II piping shall be Type L copper pipe per ASTM B88.

C. Class III piping shall be Schedule 40 PVC with solvent joints.

D. Class IV grooved piping system in mechanical rooms and unfinished basements, for piping system in sized 2-«" and above, the Victaulic grooved piping may be used in lieu of welding/flanging. The temperature range of the system is between -30oF to +230oF, couplings, fittings, valves, strainers suction diffusers shall be used in mechanical rooms and other exposed areas. Refer to manufacturers latest instructions for hanging and supporting.

2.2 PIPE JOINTS

A. Solder joints shall be made with (95-5) tin-antimony solder with non-corrosive flux.

B. Threaded joints shall conform to ANSI Standard B2 and shall be made with permacel tape or approved joint compound applied to male thread only.

C. Welded joints shall be made by qualified welders meeting the requirements of the Section IX of the ASME Boiler and Pressure Vessel Code. Welding shall be done by metal-arc welding process.

D. Flanged joints shall be made with carbon steel bolts per ASTM A-307, Grade B gaskets.

E. Piping joints for dissimilar materials shall be made with dielectric unions.

2.3 VALVES

A. Furnish valves as manufactured by Milwaukee (numbers listed) Lunkenheimer, Crane, Nibco.

B. Application of the valves shall be as follows. Milwaukee Numbers given to establish quality.

PIPING CLASS VALVE TYPE	SIZE	CLASS I	CLASS II
Gate	2" and smaller	1151 1169	
	2-1/2" and above	F-2885-M	1149
Globe	2" and under	590-T	1589-T
	2-1/2" and above	F-2981-M	F-2981-M
Check Valve	2" and under	509T	1590T
	2-1/2" and above	F-2974-M	F-2974-M
Non-Slam Check Valve	2" and under	548A	1400
Ball Valves	2" and under	BA-100	BA-150

C. Miscellaneous valves:

VALVE TYPE	SIZE	MODEL
Strainer	2" and under	Spence Type V or V2
	2-1/2" and above	Spence Type V2
Combination Balancing and Shut-off	2" and under	Illinois Series 4000
	2-1/2" and above	Illinois Series 5000
Plug Valve	2" and under	Rockwell Figure 114
	2-1/2" and above	Rockwell Figure 115
Butterfly Valve	All sizes	Rockwell LFW 2.04

2.4 HANGERS AND SUPPORTS

A. Provide all hangers and supports in conformance with ANSI B31-1 for the various parts of the mechanical work. For insulated pipes, hangers shall be of size and shape so that insulation be continuous through hangers.

B. Pipe hangers, supports, hanger rods, protection saddles and inserts shall be as manufactured by Carpenter and Patterson, Inc. (Figure numbers given) or Grinnell, Fee and Mason. Concrete inserts- Figures 20, 300, 500, 650, 510 and 108 Clamps Figures 14, 15, 45, 47, with 22 Spring hangers-Figures 445, 450, 468, 482, and 498 Pipe guides- Figures 1001 Clevis pipe hangers-Figures 100, 265, 286 Swivel pipe hangers-Figures 16
Pipe roll hangers-Figures 17, 53, 63, 142, or 183

C. Pipe Support Spacing:

PIPE SIZE	STEEL PIPE MAXIMUM SPAN	COPPER PIPE MAXIMUM SPAN	ROD DIAMETER (INCHES)
1/2" to 1"	7 ft.	6 ft	3/8"
1-1/4" to 2"	10 ft.	6 ft.	3/8"
2-1/2" to 4"	12 ft.	10 ft	1/2"
5" to 6	14 ft	10 ft	3/4"
8" to 12"	20 ft	10 ft.	7/8"

Plaster Pipe shall be supported as recommended by the manufacturer.

2.5 APPLICATION OF PIPING CLASSES

A. The applications for the piping classes shall be as follows:

SYSTEM	PIPING CLASS
Hot/Chilled Water	I or II
Condensate Drain	PVC

2.6 SLEEVES

A. Approved sleeves for the passage of all piping through foundation walls, floors and partition walls shall be furnished by the HVAC Contractor and set into the construction by the trade involved.

B. Sleeves for passage of pipes through waterproofed walls or floors and through foundation walls below outside grade shall be approved castings with collar or fin for embedding in the construction, or wrought iron pipe sleeve with welded fin (assembly galvanized), or cast iron with brazed fin. Pipes shall be lead caulked in sleeves and the whole installation made watertight.

C. Sleeves through masonry walls shall be Schedule 40 steel pipe. Sleeves through

non-bearing walls shall be galvanized metal 24 gauge.

D. Sleeves through concrete floors shall have anchoring rings or lugs to hold sleeve in floor construction.

E. Sleeves shall be at least two sizes larger than the pipe accommodated, and sized to permit continuous insulation on pipes with at least 1/4" clearance around covering.

F. Sleeves shall have spaces between pipe and sleeve scaled with a ploysulfide sealant.

G. Escutcheons shall be installed around all exposed pipe passing through finished floor, wall or ceiling. Escutcheons shall be chrome plated, secured in place by set screw or clips.

2.7 WATER SPECIALTIES

A. Automatic air vents shall be Sarco 13W or Armstrong 21-AR with 3/4" pipe connections.

B. Pressure gauges shall be 4-1/2" diameter, east aluminum case, phosphor, bronze tube, H.O. Trerice Co., Model 500X, Crosby-Ashton, Moeller.

C. Thermometers shall be 9" cast aluminum case, separable socket, H.O. Trerice Co., Model BX, Crosby-Ashton, Moeller.

D. Flexible connectors shall be neoprene spool type expansion joints with one corrugation, metal retaining rings control unit and constructed in accordance with pipe class specification designed for continuous temperatures up to 250oF.

E. Expansion joints shall be Belmont No. 3190 reinforced TFE expansion joint constructed in accordance with the pipe class specifications with white virgin TFE fluorocarbon resin bellows.

F. Cold water make-up pressure regulating valve shall be Watts.

2.8 AIR SEPARATORS

A. Air separators for piping system 2-1/2" and above shall have tangential inlet and outlet connections, constructed per ASME for 125 psig working pressure and ASME stamped. Provide with blowdown connection, less strainer.

Make: Bell and Gossett "Rolairtrol", Taco, or Armstrong.

B. Air separator for piping system 2" and smaller shall be equal to Taco air extractor with hi-vent or equal.

2.9 EXPANSION TANK

A. Expansion tank shall be constructed in accordance with ASME Code for 125 lbs.

working pressure. Tank shall be of the size indicated on the drawings and shall include sight glass, airtrol fitting and drain cock. Tank shall be supported from floor or ceiling structure. Tank shall be Bell and Gossett, or Taco.

2.10 BASE MOUNTED PUMPS

A. Base mounted pumps shall be single stage, vertical split case and suction type.

B. Pump casing shall be cast iron, bronze fitted construction, serviceable without disturbing piping connections or motor.

C. The impeller shall be bronze with double wear rings, hydraulically and dynamically balanced.

D. Make: Bell and Gossett Series 80, Taco, Aurora.

2.11 INLINE PUMPS

A. Inline pumps shall be single stage, vertical split case and suction type.

B. Pump casing shall be cast iron, bronze fitted construction, serviceable without disturbing piping connections or motor.

C. The impeller shall be bronze with double wear rings, hydraulically and dynamically balanced.

D. Make: Bell and Gossett , Taco, Aurora.

2.12 CONVECTORS

A. Elements shall be copper tubes, extended into cast iron headers, aluminum fins, ribbed steel side plates and fin tube supports.

B. Front and top panels shall be 14 gauge steel. End panels shall be 18 gauge reinforced steel. Cabinet shall be phosphatized, galvanized and painted with primer and finished with baked enamel
finish.

C. Recessed cabinet type units shall have fronts sealed with 3/8" sponge rubber. Provide carlock type access door.

2.13 WATER TREATMENT

A. This Contractor shall retain the services of a qualified water treatment subcontractor who will analyze the water and recommend a chemical treatment.

B. During the first year, after the initial treatment, the Water Treatment Subcontractor

shall visit the installation twice and submit report about the condition of the system.

C. Provide sufficient chemicals for one year's water treatment. For each water system, provide four (4) quart capacity chemical feeder and pipe to each water system.

D. Water treatment shall be provided for all water systems including make-up water to cooling tower. Water treatment Sub-contractor shall provide all necessary tests and equipment for a complete water treatment.

2.14 UNIT HEATERS

A. Factory assembled unit consists of heating element, fan, motor, adjustable louvers. Vertical or horizontal air flow type as scheduled.

B. Heavily braced cabinet, painted with primer and finished with baked enamel.

C. Coils shall be copper tube with aluminum fins tested at 300 psig.

D. Motors shall be shaded pole or permanent split capacitor type with sleeve bearings.

E. Make: Trane, Airtherm, McQuay.

2.15 CABINET HEATERS

A. Factory assembled unit consisting of chassis, heating coil, fan board and fan, motor and insulation, filter.

B. Cabinets shall have 16 gauge steel front panels and 18 gauge steel end and top panels. Front panel shall be insulated over
entire coil section. Access door for coil connection side. Cabinet shall be phosphatized and flow-coated with based on enamel. Submit color chart for selection.

C. Coils shall be 1-inch OD seamless copper tubes with aluminum fins. Maximum working pressure 75 psig. Leak tested under water with air at 250 psig.

D. Fans shall be centrifugal, forward curved, double width type.

E. Motors shall be permanent split capacitor type with integral thermal overload protection.

F. Filters shall be 1-inch throw away type.

G. Accessories: Motor starters, transformer, extended motor oilers.

H. Make: Trane, Airtherm, McQuay.

2.16 SHEET METAL WORK

A. Sheet metal work shall be fabricated and installed in accordance with the applicable

recommendations of the "Duct Manual and Sheet Metal Construction for Ventilation and Air Conditioning Systems" published by the National Association of Sheet Metal and Air Conditioning Contractors.

B. Sheet metal ductwork shall be fabricated from galvanized steel of lock forming quality or aluminum of the following gauges:

Up to 12"	26 USS Gauge
13" to 30"	24 USS Gauge
31" to 54"	22 USS Gauge
55" and up	20 USS Gauge
Round	22 USS Gauge

C. Kitchen exhaust duct shall be 16 gauge black iron with welded joints.

D. Clothes dryers vent duct shall be minimum 24 USS gauge or aluminum. Sheet metal screws or other fastening means which extend into the duct shall not be used.

E. Longitudinal duct seams shall be Pittsburgh lock type. Transverse joints shall be secured with sheet metal screws or bolts. No button punching will be allowed. All joints shall be taped in an approved manner to prevent leakage, or sealed with duct sealer.

F. Branches to and from the main trunk shall be made at an angle approved by the Architect but shall in no case exceed 45 degrees to the line of the main trunk. Changes in size shall be made with tapered connection approved by the Engineer but shall in on case exceed 30 degrees to the line of air flow. For all changes in direction where the center line radius is less than 1-1/2 times the width of the duct, turning vanes shall be provided. These shall be double vane type as manufactured by Barber-Colman Company, Aero- Dyne Company, Air Filter Corporation, or Harrington Bros.

G. Ductwork shall be rigidly supported and secured to a substantial portion of the building's construction, reinforced and braced as necessary to be free from vibration, rattle and noise. Hangers shall be galvanized and securely suspended from the building. Drilling of structural steel will not be permitted.

H. Splitter and volume dampers shall be two gauges heavier than the ducts in which they are installed. Damper blades shall be riveted to the supporting rod. Cast or malleable brackets riveted to the side of the ducts shall be used to support the damper rod. Splitter dampers shall be sufficiently long to extend the full width of the branch duct to which attached. Locking quadrants shall be as manufactured by the Mastro Machine Company or equal.

I. Fire dampers and smoke dampers shall be constructed and installed in accordance with the standards of the NBFU, shall be U.L.labeled, as manufactured by Ruskin, Phillips, Air Balance, Prefco Company.

J. Access doors shall be pan type with a minimum of two window jamming locks each, and felted sealing strips at edges. Doors on insulated or lined ducts shall have

insulation within the panel. Doors shall be prefabricated type, Model FSA-100, as manufactured by Air Balance, Inc., Harrington Bros. or approved equal.

K. Flexible connections shall be Bent-Vinyl as manufactured by Vent Fabrics, Inc. or "Thermfab" as manufactured by Duro-Dyne Corp. tightly secured with metal bands. Flexible duct length shall not exceed 6 feet.

L. All ductwork dimensions shown on drawings are clear inside dimensions.

2.17 REGISTERS AND GRILLES

A. Registers and grilles shall be manufactured by Titus Manufacturing Company, Agitair. Each register and grille shall include sponge rubber gasket, opposed blade damper, and baked enamel, off-white finish.

B. Supply air registers shall have front blades parallel to the short dimension. Supply registers shall be four-way adjustable. Return registers shall have fixed, 30-degree fixed louvers.

C. The right is reserved to vary the dimensions and locations of grilles, registers, and diffusers to a reasonable extent as necessary as the work progresses.

2.17 FAN-COIL UNITS

A. Cabinet of 22 gauge galvanized steel, acoustically and thermally insulated with vapor-proof insulation.

B. Seamless copper tube-aluminum fin coil, centrifugal type fan, shaded pole motor, 1/2" thick throw-away filter, aluminum double deflection supply grilles, drain pan and condensate drain pipe.

C. Line voltage thermostat and integral fan speed switch. Thermostat shall be mounted at 60" above floor to centerline.

D. Unit shall be factory tested and wired. Power wiring shall be by Section 16. Unit shall include electric heating coil and face and bypass damper.

E. Make: Whalen Co., Airtherm, Trane, Carrier.

2.18 FANS

A. Centrifugal fans shall be of the type as scheduled on the drawings. All fans shall be statically and dynamically balanced. Fan housing shall be heavy gauge reinforced steel. Fan bearings shall be grease lubricated ball bearings selected for 200,000 hours average life. Provide extended grease line. Provide fan belt cover for belt drive fans.

Make: Carrier, Trane, York.

B. Propeller fans shall have high efficiency and low noise type air foil blades.

Wheels shall be statically and dynamically balanced. Fan panels shall be square die-formed steel with pre-punched holes for mounting. Motor shall be installed on a slotted base supported by a heavy gauge steel plate base securely attached to fan panel. Motor shall be open drip-proof. Provide galvanized black iron wire mesh fan and drive guard, electric or gravity shutter as scheduled on drawings. Make: Penn Ventilator Co., Loren Cook Company or Greenheck.

C. Roof Fans: Aluminum housing, direct or belt-drive non-overloading balanced aluminum fan, motor out of air stream, vibration isolators, disconnect switch, ball bearings, spring loaded automatic belt tightener, and aluminum bird screen. Provide and mount on prefabricated aluminum curb insulated with 2.0 pounds per cubic foot density sprayed urethane foam. Automatic operated damper, to open when fan starts, separateline.

D. Make: Jenn-Air, B.G. Industries, Coo, Exit-Aire, or approved equal.

E. Small package fans shall be centrifugal type ceiling mounted or in-line and shall include acoustical insulation, backdraft damper, UL labeled and permanently lubricated bearings.

F. Make: Nutone, Penn Ventilator Co., Loren Cook Co.

2.19 GAS FIRED ROOFTOP HVAC UNIT

A. Single-package heating and cooling unit, outdoor curb mounted, utilizing semihermetic reciprocating type compressor for cooling duty and gas combustion for heating duty.

B. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish. Unit shall consist of evaporator fan section, condenser section and fans, compressors, evaporator and condenser coils, economizer, with enthalpy controller, barometric damper, gas heating section, filters, roof curbs and heating/cooling thermostat.

C. Indoor evaporator fan shall be forward-curbed, centrifugal, belt driven type, statically and dynamically balanced. Fan bearings shall have 200,000 hours average life. Provide extended grease line.

D. Coils shall be constructed of aluminum fins mechanically bonded to seamless copper tubes and shall be leak-tested at 150 psig and pressure tested at 450 psig.

E. Make: Carrier, Trane or York.

2.20 ELECTRICAL WORK FOR TEMPERATURE CONTROLS

A. Electrical contractor shall only provide power wiring to motors. All other line voltage or low voltage wiring, interlock wiring, transformers, relays, time clocks and wiring, switches, and accessories shall be provided by the temperature control contractor.

2.21 MOTOR, DISCONNECTS, FUSES AND STARTERS

A. Furnish and install disconnects, fuses and magnetic starters required for the particular motor horsepower and voltage.

B. All fractional horsepower manual starters shall be double-pole type with thermal overload relay and indicating pilot light.

C. All manual motor starting switches shall be toggle operated two or three-pole switch mounted in NEMA 1 enclosure or for outdoor applications in NEMA 3R enclosure. All enclosed starters shall be furnished with a handle guard having locking provisions.

D. All magnetic motor starters except otherwise specified shall be across the line type rated with NEMA Standards, sizes and horsepower ratings. Starters shall be mounted in general purpose enclosures except otherwise noted on drawing. Provide H-O-A selector switch and auxiliary relays for all starters.

E. Coils shall be of molded construction. All coils shall be replaceable from the front without removing the starter from the panel. Overload relays shall be the melting alloy type. All starters shall be suitable for the addition of at least three external auxiliary contacts of any arrangement normally open or normally closed. Overload relays shall be adjustable and manually reset.

F. Motor starters shall be as manufactured by Square D, ITE and General Electric.

G. All starters in general shall be located in the vicinity of the panel feeding the starter.

H. Provide starters for all fans, pumps, HV units and automatic controlled equipment.

I. For small fans used exhausting storage rooms, conference rooms and alike provide wall switches.

2.22 BOILERS AND ACCESSORIES

A. High efficiency boilers with minimum 90% efficiency.

B. Furnish with water temperature sensor, control panel, and all required components.

C. Make Weil-McLain Ultra, Lochinvar Knight

2.23 BREECHING AND CHIMNEY

A. As recommended by the manufacturer. Run flues to side wall of boiler room.

2.24 ROTARY ROOF VENTILATORS (SPINNERS)

A. Spinners shall be galvanized steel construction, braced on the outside with aluminum bracing. Unit shall have ball bearings for silent operation.

B. Make: Empire or approved equal.

2.25 INSULATION

A. All insulation when installed shall have composite fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 255, and UL-723, not exceeding a flame spread of 25 and smoke developed or 50 when compared with red oak as 100, as approved under NFPA Pamphlet No. 90A and 90B.

B. Insulation shall not be applied to any system until the system has been tested and approved for release to be insulated. All insulation shall be kept dry and clean for application. All surfaces shall be clean and dry before application or insulation.

C. Piping shall be insulated with preformed, fiberglass pipe insulation with white, embossed, vinyl-coated self-sealing ASJ jacket. Fittings and valves shall be insulated with equal thickness of preformed or precut fiberglass sections and finished with PVC jackets as manufactured by Zeston, or approved equal. Exposed ends shall be similarly covered with PVC end closures.

D. Supply ductwork shall be insulated with 1" thick fiberglass duct wrap with vapor barrier. Supply and return ductwork shall be lined with 1" fiberglass liner 15 ft. distance from the rooftop unit.

E. Insulation materials shall be Owens-Corning, Johns Manville, Gustin-Bacon or approved equal.

F. The following systems shall be insulated.

1. Hot/Chille water mains: 1-1/2"
2. Hot/chilled water branches: 1-1/2"
3. Supply ductwork: 1"
4. Supply and return ductwork lining: 1"

G. Insulation shall be continuous through hangers and sleeves. Provide saddle between insulation and hangers.

2.26 AUTOMATIC TEMPERATURE CONTROL SYSTEM

A. Automatic temperature control system shall be electrical as manufactured by Honeywell, Barber-Coleman, Johnson Control Company or approved equal.

B. With the exception of valves and dampers, all control equipment and electric wiring in connection with the temperature control system shall be installed by the control equipment manufacturer. Automatic valves shall be furnished by the control

equipment manufacturer and installed by the Heating and Ventilating Contractor under his supervision. Automatic dampers shall be furnished by the control equipment manufacturer and installed by the Sheet Metal Subcontractor under his supervision. The temperature control system shall consist of all thermostats, valves, relays, control panels, dampers, damper motors, switches, piping, wiring and other accessories necessary to fulfill the intent of the Specifications.

C. Space thermostats shall be low voltage type adjustable throttling range, locking covers concealed adjustments, and include thermometers.

D. Insertion thermostats shall be remote bulb or rod-and-tube type, and shall include separable well when installed in water lines.

E Freeze protection thermostats shall be 20' capillary type secured to coil face with copper wire, manual reset type.

F. Damper and valve motors shall be capable of providing smooth proportional control under all operating conditions. All activators shall be provided with positive positioning, relays or sequencing relays. Control valves shall have self-djusting packing, equal percentage throttling plugs, stem travel indicators, removable discs, screwed body for 2" and smaller, flanged body for 2-1/2" and larger and shall be sized by the manufactured for the design conditions.

G. Automatically controlled dampers shall be louver type if two-position, opposed blade if modulating, 10" maximum width 16 gauge galvanized steel roll formed blade, 2" channel frame, 9brass or nylon bearings and hot dip galvanized outdoor air and exhaust relief damper. Blades shall have low leakage blow-up seals equal to Honeywell D642A.

H. Duct and immersion thermostats of the single input type shall have integral setpoint adjustments and throttling ranges adequate for the application. Duct thermostats shall have sensing elements of sufficient length and accuracy to measure average duct temperature in each location.

I. Aquastats - shall be line voltage type with single pole, single throw switching. Switches shall have an adequate rating for the applied load. j. Time clocks shall be electronic with battery back up, 7-Day programable type.

J. Sequence of operation:

1. Hot water boilers: Install factory provided controls. Install outdoor thermostat to modulate the main loop water temperature between 100 degrees F to 140 degrees F, when outside temperature 60 degrees F to 0 degrees F. All settings are adjustable.

2. One of the hot water circulating pump shall run when outside air temperature below 60 degrees F (adjustable). One pump shall be stand-by. Provide alternator and controls for the pumps.

3. Fan coil units in dwelling units will have unit-mounted thermostats. The system shall be fan cycling type with 3-speed switch.

4. Cabinet Heater and wall heater Control: Thermostat shall cycle the fan.

5. Rooftop HVAC Units: Install heating/cooling thermostat and wire to the unit. Economizer with enthalpy controller is provided with each unit. Economizer shall operate when outside temperature allows.

6. Exhaust Fans : HVAC contractor shall provide time clock to control their operations.

2.27 SMOKE AND FIRE STOPPING

A. Floor and corridor walls are fire rated. All pipes passing through these elements will be fire stopped per UL System #49 by filling the annular space with mineral wool and covering with 3M Fire Barrier CP25 S/L or N/S caulk. Comply with manufactures installations instructions.

2.28 PENETRATION AND FIRESTOPPING

A. All metal pipe penetrating through a fire-rated wall assembly shall have the space between the conduit and the fire rated membrane (drywall) filled with a UL approved fire caulk installation.

B. All metal pipe penetrating through fire-rated floor assembly shall have the space between the conduit and the fire rated membrane (drywall, concrete or plywood decking) filled with a UL approved fire caulk installation.

C. Install a UL approved fire caulk installation where any pipe penetrates a fire stop (top and bottom wall framing plates) inside the walls.

D. Large openings in slabs, which accommodate many pipes, shall be filled with concrete so that the rodent protection of the slab is maintained.

E. All penetrations of assemblies exposed to the exterior environment shall be sealed with foam sealant or equivalent sealer to provide zero air filtration through or around penetration. Coordinate with fire stopping requirements.

F. Large openings in slabs, which accommodate many pipes, shall be filled with concrete so that the rodent protection of the slab is maintained.

G. All penetrations of assemblies exposed to the exterior environment shall be sealed with foam sealant or equivalent sealer to provide zero air filtration through or around penetration. Coordinate with fire stopping requirements

3 PART 3 EXECUTION

3.1 PIPING (GENERAL)

A. Verify all existing conditions before proceeding with the work.

B. Install piping in a next manner with lines straight and parallel or at right angles to walls. Coordinate with other trades.

C. Use full length of pipe. Cut pipe square and clean before installing. Do not use bushings. Use reducers to facilitate air removal and water drainage from system.

D. Erect piping with proper provisions for expansion and contraction. Provide all required offsets, swing joints, expansion loops, anchors and guides. At expansion loops the elbow radius shall be equal to six times of the pipe diameter. Do not use miter elbows for expansion loops.

E. Where steel flanges are bolted to flat face cast-iron flanges the raised face shall be removed.

3.2 HANGERS

A. Do not use hangers, supports or equipment of the other trades to support piping systems.

B. All hanger rods shall be hung from inserts in concrete or from I-beam clamps on steel beams. Clamps shall have retaining clips and locknut. If inserts have not been provided, hangers shall be through bolted or inch or slug-in expansion bolts may be used with the permission of the Engineer. When pipe or equipment is hung or supported, no part of any equipment furnished by this Contractor or any part of the building shall be stressed beyond its normal allowable working strength. Drilling of building structural steel for attachment of hangers or supports is not permitted.

C. When two or more pipes run parallel, they may be supported with trapeze hangers with individual pipe supports.

D. Vertical piping passing through slabs shall be supported with riser clamps installed above slab and resting on floor sleeve.

E. All hangers and supports for copper tubing shall be heavily copper plated and sized for copper tubing.

F. Hangers for cold water piping or piping supported on roll hangers shall be sized for pipe insulation.

G. Insulation protection saddles shall be provided on all piping supported by all hangers.

H. Duct and immersion thermostats of the single input type shall have integral setpoint adjustments and throttling ranges adequate for the application. Duct thermostats shall have sensing elements of sufficient length and accuracy to measure average duct temperature in each location.

I. Aquastats shall be line voltage type with single pole, single throw switching. Switches shall have an adequate rating for the applied load.

3.3 VALVES

A. Locate all valves in accessible locations with stems up position.

B. Provide shut-off valves for all equipment and risers.

3.4 SLEEVES AND ESCUTCHEONS

A. Furnish and install sleeves on all pipes passing through walls, partitions, floors, foundations, etc. Sleeves for copper tubing shall be Type "L" hard tempered; for steel pipe, 26 gauge galvanized in frame partitions, Schedule 40 elsewhere. Caulk sleeves in fire walls with asbestos and cement.

B. Sleeves shall be sized to accommodate the covering and to provide 1/4" annular space.

C. Provide chrome-plated brass escutcheon plates over sleeve ends in finished areas.

D. The subcontractor is responsible for accurate location of setting of sleeves.

E. Steel sleeves will not be allowed in contact with copper pipe.

3.5 TAGS, CHARTS AND PIPE MARKING

A. Provide all valves in mechanical rooms laminated plastic taps with stamped numerals and name of service. Tags shall be attached to valve handles or stem necks with brass hooks or chains and properly secured.

B. Numbers shall correspond to the as-built drawings and a printed list. Printed list shall state numbers and location of each valve and control, equipment which the valve controls and other necessary information such as requiring opening or closing of another valve when one is to be opened or closed.

C. All piping in the mechanical rooms shall be marked with "Set-Mark" or approved equal pipe markers showing direction of flow and pipe service after pipe is insulated and/or painted.

3.6 UNIONS

A. Provide unions between the shut-off valve and equipment connection.

B. Provide dielectric unions when joining dissimilar materials.

3.7 WATER PIPING

A. Water piping shall have a uniform grade of 1 inch per 40 ft. in direction of flow.

B. Vent all high points with manual vents. Provide automatic vents at the top of risers.

C. Provide drain valves with hose ends at all low points and equipment.

3.8 TESTING, ADJUSTMENT AND BALANCING (WATER SYSTEMS)

A. Refer to Part I for additional requirements.

B. Provide services of independent and balancing agency to test and balance the water systems. Balancing work shall not begin until all HVAC systems have been completed, cleaned, tested and are in operating order.

C. Submit report for each system and equipment and element listing its name, function, size, model, electrical, and mechanical design conditions and actual design conditions.

D. All systems shall be balanced to +/-5% of its design requirements.

3.9 PUMPS

A. Base mounted pumps shall be leveled by means of properly spaced metal blocks or wedges located directly under the part of the baseplate carrying the greatest weight and spaced closely enough to give uniform support. Pumps shall be bolted down firmly and grouted in. Pump and motor alignment shall be made before and after the grout is poured, and again after the piping is connected.

B. Small in-line pumps shall be supported by the piping. Large in-line pumps shall be supported in such a way that pump shall not carry the weight of motor.

C. All pumps shall be provided with isolating gate valves, discharge throttling

valves, pressure gauges tapped onto inlet and outlet flanges, flexible connectors. Flexible connectors shall be pipe size.

3.10 DUCTWORK

A. Ductwork shall be installed per recommendations of SMACNA. Seal all duct seams with duct sealer to limit the system leakage to 5% of total capacity.

B. Provide splitter or balancing damper at every branch and as required to facilitate the systems balancing.

C. Provide fire damper with access door at all fire walls and floors.

D. Provide motor operated smoke and fire damper at all fire/smoke walls.

E. Provide access doors for servicing dampers, filters, coils controls, motors, etc. Minimum access door size shall be 14" x 14".

F. Provide flexible connectors at all fan, air handling and other equipment inlet and discharge connections.

G. Before the duct system is tested and balanced, the interior of all ducts shall be cleaned thoroughly by blowing through the system with the ventilating fan. Do not operate system without filters in air handling units. Provide clean set of filters prior to acceptance of the building by the owner.

3.11 EQUIPMENT INSTALLATION

A. Install all fans, air handling units on spring isolator or suspended from building structure with approved hangers, attachments, and vibration eliminators to minimize sound and vibration transmission to the building structure.

B. All suspension platforms shall be braced to prevent swaying.

C. Rooftop units shall be installed on roof curbs.

3.12 TESTING, ADJUSTING AND BALANCING

A. After the testing and adjusting work specified in Part I has been completed, provide services of an independent testing and balancing agency to test the operation of the entire system and balance the system.

B. Without limiting the testing and balancing, Contractor shall check operation of every fan, motor, drive, damper, damper operator. Make all required adjustments to bring the system to design conditions.

C. The testing and balancing Contractor then shall balance the entire system, including but not limited to fans main duct branches, supply/return/exhaust outlets, air handling units, etc., to +/- 5% of their design quantities.

D. The testing and balancing Contractor shall for each system prepare a balancing report listing for each equipment, air outlets, its name, service, mechanical and electrical specifications, design and actual measured quantities. Submit balancing report for approval.

...END OF THIS SECTION

Part II
Division 24-25

(Not Used)