MECHANICAL SPECIFICATIONS - COMMERCIAL

MECHANICAL GENERAL PROVISIONS

PART 1: GENERAL

1.01 NOTE:

All work under this section shall be subject to the General Conditions hereinbefore written for the entire work, noting especially the reference to interlocking divisions for the Contractors responsibility under each division. All requirements under this section shall apply to work under Division 15.

1.02 SCOPE:

A. The Contractor shall provide and install all labor, equipment and materials shown on the Mechanical Drawings and specified under the Division 15, or as required for complete and successfully operating mechanical and plumbing systems.

1.03 EXAMINATION OF PREMISES:

A. The Contractor shall examine the premises and fully acquaint himself with all existing conditions so that all problems pertaining to work under this division are fully understood. No subsequent allowance will be made in this connection for any error of judgment or negligence on the Contractor's part.

1.04 CODES:

A. All heating and air conditioning shall be done in strict accordance with all requirements of International Mechanical Code, publications of the American Society of Heating, Refrigerating and Air Conditioning Engineer, the National Electrical Code of the National Fire Prevention Association and other NFPA requirements, specifically NFPA pamphlets 90A and 96, the ASME Boiler Code including C.S.D.–1–1998.

B. In addition, all work shall be installed in accordance with requirements of any other applicable building, plumbing, mechanical, fire and safety codes. Requirements set forth in the Occupational Safety and Health Act will be strictly adhered to.

C. Work shall conform to the requirements of the latest editions of the following codes, regulations, specifications and standards:

* American Society for Testing and Materials (ASTM)
* Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
* Air Conditioning and Refrigeration Institute (ARI)
* American Society of Mechanical Engineers (ASME)
* Council of American Building Officials (CABO)
* National Electrical Code (NEC)
* National Board of Fire Underwriters
* National Electrical Manufacturers Association (NEMA)
* Underwriters Laboratories, Inc. (UL)
* United States of America Standard Institute
* National Institute of Standards & Technology (NIST)
* Occupational Safety and Health Act (OSHA)
* American National Standards Institute (ANSI)
* National Fire Protection Association (NFPA)
* American with Disabilities Act (ADA)

1.05 LAWS, ORDINANCES, PERMITS AND FEES:

A. The Contractor shall give necessary notices, obtain and pay for permits, prepare all documents and obtain all necessary approvals of all Regulating Authorities having jurisdiction; obtain all required Certificates of Inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

B. The Contractor shall include in the work, without extra cost to the Owner, all labor, materials, services, apparatus, drawings (in addition to Contract Drawings and Documents) required to comply with all applicable laws, ordinances, rules and regulations.

1.06 GENERAL REQUIREMENTS:

A. Everything necessary for the completion of the work and successful operation thereof, whether they may be definitely specified or indicated or not, shall be furnished and completed in a manner corresponding with the rest of the work as though they were herein distinctly described and specifically provided for.

B. The Contractor shall have competent foremen on the premises at all times to check layout and superintend the installation of all work included in this division of the specifications and to provide information regarding locations and sizes of chases, openings, etc., and be responsible for the accuracy of such information. The foremen shall layout and superintend the installation of all hangers, inserts, sleeves and other work in masonry and concrete in advance of the work during construction of building, giving consideration to the work of other trades to prevent interference in the location of pipes, conduits, ducts and other equipment.

C. The Contractor shall provide complete connections for equipment furnished under sections of this division, or under other divisions, or by the Owner, which requires connection under this Division.

D. All individual pieces of equipment shall be separately valved and fitted with unions so that the individual piece of equipment may be removed for servicing without disturbing other portions of the system.

E. No beams, columns, structural members, etc., shall be sleeved for the passage of piping or ducts, except where noted on the drawings and approved by the Architect.

F. The general arrangements and details of the equipment, piping, ducts, etc., are shown on the drawings. Dimension or scales shown are approximate and must be checked at the building by the Contractor prior to the installation of any equipment or the fabrication of any equipment. Dimensions for the fabrication of piping, equipment, etc., shall not be scaled from the drawings, but shall be acquired by accurate measurements at the building. Any equipment or materials fabricated off the site, or any work which is installed on the job, which blocks the work of other trades, and is caused by the Contractor's neglect to coordinate his work with the work of other trades, shall be modified or reinstalled without change in the contract price.

G. All systems and equipment shall be arranged to operate without objectionable noise or vibration. Where objectionable noise or vibration occurs, modifications or changes shall be made until satisfactory results are obtained, at no additional cost to the Owner.

H. Unless otherwise indicated or required all piping shall be installed parallel to the lines of the building. Piping shall be installed straight and free of traps, sags. and bends. Pipe shall be free of kinks, wrinkles and flattened sections. Piping shall properly fit into place and not be forced or stretched.

1.07 SCHEDULE:

A. Within 30 days of contract date, the Contractor shall submit to the Architect for approval, a schedule showing make, type, manufacture's specifications for each article of equipment or specialty and shall give dimensions, rated capacity, kind of material, finish, guarantee, etc., and such other detailed information as may be required. When approved, such schedule shall be an addition to the specifications here in with, and shall be of equal force, in that no variation will be permitted except with the approval of the Architect.

1.08 QUALITY STANDARDS:

A. Manufacturers specified herein, under Division 15, represent products that meet the project's standards.

B. Where three or more manufacturers of one product are listed, the Contractor shall bid the job using one of these manufacturers. Should the Contractor desire to substitute another material or product for the material or product specified (if specifically permitted elsewhere within these contract documents), he shall apply in writing for such permission. Requests for substitutions must be submitted within fourteen (14) days after award of contract or notice to proceed, whichever shall occur first; shall state the credit (or extra cost) involved by the use of such substitution, the advantage to the Owner in accepting such substitution, and acknowledgement that ramifications or impact on other trades and the construction schedule has been considered and costs associated with the substitution are reflected in the request. The Contractor shall pay all costs to determine acceptability of the proposed substitution including, but not necessarily limited to, the following:

1. For tests required by the Engineer for evaluation of both the specified product and the proposed substitution.
2. For additional evaluation time of the Engineer.
3. For shipping costs to and from the Engineer, to the Owner, etc. as may be required for evaluation.
4. For any mockup, installation, or other demonstration required by the Engineer for evaluation of the product(s).

B. In the event that a substituted item is submitted twice and approval is not obtained by the second submission, the Contractor shall furnish the specified item of material or equipment at no additional cost to the Owner.

C. The Contractor is responsible for assuring products supplied by listed or alternate manufacturers are of equivalent or better quality as the primary specified manufacturer. This quality standard will apply to all components of the product.

1.09 SUBMITTALS:

A. Submittals shall consist of manufacturer's certified scale drawings, cuts, catalogs or descriptive literature with complete certified characteristics of equipment, dimensions, capacity, code requirements, motor drive and testing. In addition, Contractor shall provide working shop drawings of ductwork, piping, sprinklers, tank vault and any other details which may be required to clarify installation of piping or equipment.

B. Certified performance curves for all fans and pumps shall be submitted for approval.

C. Prior to submittal, the Contractor shall check the submittals thoroughly to ascertain that they comply in detail with the Plans and Specifications, the electrical characteristics are correct for the available service, and that dimensions are shown and checked to fit available space with recommended access. Any deviations from Plans and Specifications shall be clearly noted on the certified submittals. Submittals shall include a reference to the appropriate section, page, paragraph number of the specification. The installer shall stamp the submittal with his firm's name, date, and approval noted, indicating that the above has been complied with. Submittals received without his stamp will be returned disapproved without further explanation.

D. Submittals shall be tendered for items of equipment specified under each section of the specifications or specified on the drawing.

E. Any changes in any trade brought about by substitutions of specified equipment shall be done at no change in the contract price.

F. Failure to submit Shop Drawings or Material Lists in ample time for proper checking and necessary re–submission, shall not be allowed as reason for any claim for extension of time or delay.

G. The review of a Shop Drawing or Material List shall not be considered as a guarantee of the measurements of the building conditions, or that the Shop Drawings or Material Lists has been checked to see that the item submitted properly fits the building conditions. Review shall not in any way relieve the Contractor of his responsibility or necessity for furnishing material or performing work as required by the specifications and contract drawings, or relieve the Contractor of his responsibilities for correctness of dimensions and quantities, or for proper coordination of details and interface with other trades.

1.10 RECORDED CHANGES INFORMATION:

A. As the work progresses, the Contractor shall record on a set of white prints, the installed locations, sizes and depths of all piping, services, trenches, etc. in the project wherever they differ from those indicated on the Contract Drawings. All dimensions shall be established from the datum points approved by the Architect. Upon completion of work, the Contractor shall turn over to the Architect one (1) neat copy of white prints showing required Recorded Changes Information.

1.11 TEMPORARY SERVICE:

A. The permanent building facilities, transformers, etc. may be used for temporary power. Written approval must be obtained from the Owner before facilities may be used.

B. When the permanent heating equipment is installed, it may be used for temporary heating; this time cannot be deducted from the guarantee period. All equipment shall be kept lubricated and in first class operating condition. Filters shall be in place at all times when the air handling system is operating. If the air handling equipment is operated, filters shall be replaced at the conclusion of the work. The equipment and related ductwork shall be thoroughly cleaned at the conclusion of work before final filters are installed. If permanent heating equipment is used, it must be kept in continuous operation.

1.12 ELECTRICAL REQUIREMENTS:

A. Items of electrical work including power wiring, disconnects and motor starters will generally be provided under the Electrical Division of the specifications, unless otherwise noted. Where electrical work is required for equipment furnished and installed under sections of this division including control wiring, interlocking, starters, disconnects, power wiring, heat tracing of mechanical or plumbing piping, etc. and is not included under the Electrical Division, it shall be furnished and installed under this Division, in conformance with the requirements of the "Electrical Work" Division.

1.13 COORDINATION OF TRADES:

A. The Subcontractor shall give full cooperation to other trades and shall furnish in writing, with copies to Architect, and information necessary to permit the work of all trades to be installed in proper sequence and with the least possible interference of delay.

B. If the Subcontractor installs his work without coordinating with other trades, and the installation interferes with their installation, he shall make any changes necessary in this work to correct the condition, without extra charge to the Owner.

C. The Contractor shall provide dimensioned fabrication drawings of critical areas as described hereinbefore.

1.14 SCAFFOLDING, RIGGING, HOISTING:

A. The Contractor shall shall provide all scaffolding and rigging services necessary for the erection and delivery into the premises of all equipment and materials provided under this section, and shall remove same from premises when no longer required.

1.15 DRAWINGS:

A. The drawings are generally diagrammatic and are intended to convey the scope of work and indicate the general arrangement of equipment, ducts, conduits, piping and fixtures. The location of all items not definitely fixed by dimensions are approximate only. The exact locations necessary to secure the best conditions and results must be determined at the project by the Contractor and shall have the approval of the Architect before being installed. Do not scale drawings.

PART 2: PRODUCTS

2.01 ACCESS DOORS:

A. All concealed valves, dampers, controls, fire dampers and other devices requiring manual operation or maintenance, shall be provided with metal access doors and frames. Doors shall be Zurn, Inland Steel Project Company "Milcor", quality standard of the following Milcor style:

* Style AT in acoustic tile surfaces
* Style K in plastered surfaces
* Style M in masonry or ceramic tile surfaces
* Style DW in dry wall walls and ceilings

B. Access panels and doors shall meet the fire protection rated walls and floor/ceiling assemblies in which they are installed.

C. Access doors shall be properly sized for the particular application and shall be furnished under the sections requiring same, unless a means of access is otherwise afforded. Access doors in rated surfaces shall carry UL rating equal to the surface in which it is installed.

D. Access doors shall be installed as required by Local Codes.

2.02 EQUIPMENT FOUNDATIONS AND SUPPORTS:

A. All Contractors responsible for work under the Mechanical and Electrical Divisions are to provide concrete housekeeping pads under their respective equipment mounted on the floor or on the ground. Pads shall be 4" thick and shall extend 1" beyond each edge of the equipment supported and all edges shall be beveled.

B. Equipment suspended or supported from above shall be secured by means of approved hanger rods and other supports properly attached to the structural system. Sub–framing of structural steel beams, angles, or channels shall be provided for all items of mechanical equipment, where said framing is required, but not furnished under another section.

C. For pipe hangers and supports and spacing of each, see Pipe Hangers and Support section.

D. In no case shall runs of piping be supported from other pipes. Trapeze hangers may be used for parallel runs of pipe with the same pitch or grade. It will be permissible by proper arrangement between the plumbing and heating trades to use common trapeze hangers for such pipes.

E. Vibration isolators shall be provided for all items of equipment producing vibration likely to be transmitted to the structure, or portions of building which will disturb occupants.

F. All pipes shall be braced to prevent shock and swaying.

2.03 CONCRETE WORK:

A. All concrete work required under any section shall be provided and installed under that section, and shall be performed in accordance with the requirements of the general specifications for concrete work as hereinbefore written, except where included under another section. Coordinate to avoid omission or duplication.

2.04 SLEEVES AND ESCUTCHEONS:

A. Provide standard iron pipe size steel sleeves for all lines passing through concrete slabs and masonry walls. All sleeves shall be set before concrete is poured. Holes required in masonry shall be made with core drills in a manner approved by the Engineer.

B. Sleeves for pipes through walls and floors shall be of sufficient size to permit the insulation, where specified, to continue through the sleeves. Sleeves through floors shall be flush with the underside of the slab and extend ¾" above finish floor in wet areas only. Projecting sleeves shall be provided with anchors to prevent them from being loosened and knocked down in the floor construction. The annular space between pipe and all sleeves shall be caulked with polysulfide caulking compound. The annular space shall not be larger than ½"for all pipes.

C. Escutcheon plates shall be used to conceal sleeve openings and openings in masonry walls. Ceiling and wall plates shall be chrome plated, properly secured in place. Floor plates shall be cup type, similar to Grinnell No. 400. At the Contractor's option, split type escutcheons equal in quality to one–piece type may be used.

2.05 FLASHING:

A. All roof drains and all floor drains, pipes and pipe sleeves which are installed in floors or walls with have membrane waterproofing, shall have flashing clamp devices.

B. All roof mounted equipment shall have roof curbs or use utility equipment rails and shall be flashed water tight. Coordinate flashing details with Architectural drawings. All ductwork through roof shall pass through roof curbs which extend a minimum of 12" above the roof.

C. Piping passing through the roof shall be waterproofed and flashed in an approved manner. Coordinate with Architectural drawings.

PART 3: EXECUTION:

3.01 IDENTIFICATION OF PIPING AND EQUIPMENT:

A. All items of mechanical equipment such as HVAC units, fans, pumps, unit heaters, etc. shall be identified by approved nameplates. Nameplates shall be securely affixed, in a manner approved by the Engineer, to each individual piece of equipment and also to include, but not be limited to, each starter, switch, relay and transformer, which controls the equipment. Nameplates shall bear notations corresponding to the same notations on the framed wiring diagrams and operating instructions. Nameplates shall be equal to Seton Nameplate Co. aluminum with a black enamel background and with etched or engraved natural aluminum lettering or laminated phenolic with white letters on black background.

B. All service piping which is accessible for maintenance operations (except piping in finished spaces) will be identified with pressure–sensitive vinyl identification markers. Direction of flow arrows are to be included on each end of the marker.

C. Where required by local codes, all piping shall be appropriately marked with color–coded bands at the locations and spacing required by the code.

3.02 VALVE CHARTS AND TAGS:

A. All valves shall be provided with tags as specified in this section. Tags shall be secured to valve wheels with metal chain. Stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent, need not be so equipped. Care shall be exercised in selecting valve numbers to prevent conflict between various trades. The Contractor shall furnish schematic drawings prepared on tracing mylar showing locations, details of arrangement, etc., of all manual and automatic control valves indicating identity and function. A print of this drawing shall be framed and mounted where directly by the Architect.

3.03 CLEANING:

A. At the conclusion of the work, the premises shall be left broom clean. All factory–applied enamel paint shall be cleaned and waxed with industrial quality wax.

3.04 LUBRICATION:

A. All bearings in equipment shall be provided with adequate facilities for lubrication. All oiling devices, fittings, etc., shall be accessible. Lubricate all bearings upon completion of work. Lubricants shall be as specified by equipment manufacturers.

3.05 PROTECTION:

A. All materials and equipment shall be properly and effectively covered and protected by the Contractor during the execution of the work.

B. During the execution of the work, the open ends of all piping, ducts and conduits and all openings in equipment shall be closed so as to prevent the entrance of all foreign matter. Plumbing fixtures shall be boarded over.

C. Any damaged equipment, piping, etc., shall be replaced by the Contractor at his expense.

3.06 WATERPROOFING:

A. All waterproofing and damp–proofing of the building shall be cleaned and left unharmed by the installation of the work under this division. Wherever any of the work or piping under this division has to pierce waterproofing or damp–proofing, including outside walls, they shall be caulked to wall in a manner satisfactory to the Architect and made watertight. Any waterproofing damaged or destroyed shall be re–water–proofed and made tight by the Contractor. Insulation shall also be waterproofed as required.

3.07 START–UP AND INSTRUCTIONS:

A. Upon the completion of the installation of all major pieces of equipment, a factory–authorized representative shall fully inspect the installation and confirm it complies with the manufacturer's instructions and is free of any damage and faulty components. The equipment shall be started by the representative and run at peak performance to ensure the equipment operates as intended. The representative shall check operating parameters including but not limited to voltage, running amps, supply and return temperatures, motor speed, vibration and excessive noise. All test data shall be recorded on a factory start–up data sheet and submitted to the engineer for review.

B. Upon the completion of all work the Contractor shall thoroughly instruct the Owner in the operation and maintenance of all the various apparatus and equipment. This shall be done after the complete system has been put in operational condition and tested as hereinbefore specified.

C. Furnish to the Owner, three copies of complete operation and maintenance data covering all equipment installed under this division. This shall include all submittals, factory start–up test sheets, all certifications, as–built drawings and replacement parts literature and a brief description of the operating feature of the equipment. This manual shall be submitted to the Architect for approval prior to presentation. Manuals shall be compiled into three ring binders and arranged in a neat organized manner. The binder shall be tabulated and include a table of contents and labeled tabs for quick reference. Each type of equipment shall be placed under a separate tab.

D. Manufacturers' suggested maintenance schedules shall be provided for all equipment. This shall include periods for greasing, filter changes, oil changes, etc. Maintenance schedules shall be listed as separate section of the operation and maintenance manual.

3.08 GUARANTEE:

A. In addition to the guarantee obligations contained in the GENERAL CONDITIONS, the Contractor shall guarantee the complete mechanical systems installation, as embraced by this specification, free from all mechanical and electrical defects for the period of one (1) year–beginning from the day of final acceptance of the work by the Architect.

EXISTING CONDITIONS

PART: 1 GENERAL

1.01 SCOPE:

A. The Contractor shall make all necessary changes to the existing mechanical systems to accommodate the new work.

B. Material and equipment made superfluous by reason of the new work shall become the property of the Contractor and shall be removed from the site unless the equipment is specifically indicated to be retained by the Owner, in which case the Contractor will disconnect and remove the equipment and deliver it to a location selected by the Owner.

1.02 SITE VISIT:

A. Prior to preparing the bid, the Mechanical contractors shall visit the site and familiarize themselves with all existing conditions and make all necessary investigations as to locations of utilities and all other matters which can affect the work. No additional compensation will be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

PART: 2 PRODUCTS

2.01 GENERAL:

A. The Contractor shall furnish all labor, material and equipment necessary to complete the demolition work and maintain existing/systems required to remain in service during the construction phase and/or after the completion of the work.

B. Where new work causes interference with existing work, the new work or the existing work shall be altered or modified as required. No alteration or modification shall be performed without written approval by the Architect.

PART: 3 EXECUTION

3.01 UTILITY COORDINATION:

A. The Contractor shall coordinate the removal or relocation of existing utility systems with the utility companies prior to commencement of the work.

B. No work shall be performed on or near existing service entrance and distribution equipment without the approval of the authorized utility representatives.

3.02 OUTAGES:

A. All mechanical outages which will interfere with the normal use of the building in any manner, shall be done at such times as shall be mutually agreed upon by the Owner.

B. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area, shall be scheduled at least ten (10) days in advance with the Owner. All such outages shall be performed on other than normal duty hours.

C. The Contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and at the convenience of the Owner.

3.03 CONNECTIONS AND ALTERATION TO EXISTING WORK:

A. When existing work is removed, all piping, ductwork, etc. shall be removed back to the point of tie–in or below/behind finished areas and capped.

B. Removal and/or relocation of existing services shall be closely coordinated with the Owner as they impact adjacent areas which shall remain operational.

C. While performing connections and alterations to existing mechanical work, the contractor shall take extreme care to protect all existing materials, equipment, casework, etc. from dirt, debris, and damage. All damage to existing material, equipment, casework, etc. shall be repaired at the Contractor's expense.

3.04 CUTTING AND PATCHING:

A. Cutting and patching associated with the work in the existing structure shall be performed in a neat and workmanlike manner. Existing surfaces which are damaged by the Contractor, shall be repaired or patched with new materials.

B. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by recirculating or rotary, non–percussive methods.

C. Patching of areas disturbed by installation of new work and/or required demolition, shall match existing adjacent surfaces as to material texture and color.

BALANCING AND CHECKING OF SYSTEMS:

PART 1: GENERAL

1.01 SCOPE:

A. Total System Balanced shall be performed by an agency certified by the Associated Air Balance Council (AABC) and approved by the Owner's Representative. All work done by this agency shall be by qualified Technicians under the direct supervision of an AABC Certified Test and Balance Engineer.

B. Total System Balance shall be performed in accordance with the latest edition of the AABC National Standards, Total system Balance, and in accordance with the scope of work specified in the contract documents.

C. Specify systems shall be balanced in accordance with all the procedures listed in the AABC National Standards. These systems include, but are not necessarily limited to:

* Supply, Return, and Exhaust Systems
* Hydronic Systems including but not limited to:
* Chilled water
* Heating Water
* Dual Temperature Water
* Cooling Tower Water
* Water Source heat pump
* Domestic Hot Water Recirculating System
* Make–up air Systems
* Outside air Systems
* Over–pressure Relief Systems
* Life Safety Air Systems

D. Total System Balance shall not begin until systems are complete and operational

E. Upon the completion of the work, the Test and Balance Agency shall submit 4 copies of the complete Test and Balance Report to the Engineer for review.

F. One agency shall be responsible for all phases of Total System Balance.

G. The responsibility for performing Total System Balance, as defined by ASHRAE, is "The overall concept requires one source be responsible for the complete testing, adjusting, and balancing of all systems.

H. Projects constructed in phases shall be balanced at the completion of each phase. At the completion of the entire project all systems shall be checked and adjusted as a complete and fully integrated facility.

I. The Test and Balance Agency shall permanently mark the settings of all valves, dampers, and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked.

PART: 2 PRODUCTS

2.01 SUBMITTALS

A. The name of the Test and Balance Agency, plus the name and registration number of the Certified Test and Balance Engineer, shall be submitted to the Owner's Representative for approval within 30 days after the award of the project contract.

B. The selected Test and Balance Agency shall submit to the Owner's Representative.

1. Detailed Procedures
2. Agenda
3. Report Forms
4. AABC National Project Performance Guarantee

C. An approved copy of each of the above must be returned to the Test and Balance Agency before Total System Balance is begun.

D. If a complete submittal in accordance with Paragraph B is not received within the specified time, the Owner's Representative reserves the right to select the Test and Balance Agency.

2.02 ADDITIONAL WORK

A. The contractor shall provide the Test and Balance Agency with one set of the following documents:

1. Within 30 days after approved selection of the Test and Balance Agency
   a. Contract drawings
   b. Applicable Specifications
   c. Addenda
2. As issued
   a. Change orders
3. Report Forms
   a. Approved shop drawings
   b. Approved equipment manufacturer's submittal data.
   c. Approved temperature control drawings

B. The contractor shall provide the Test and Balance Agency with:

1. Reasonable time, as determined by the Test and Balance Agency, to complete Test and Balance prior to the specified completion date.
2. Completely operable systems
3. The right to adjust the systems
4. Access to system components
5. Master keys, if the building is occupied
6. Secure storage space for tools and instruments

C. The contractor shall be responsible for start–up and operation of systems during Total System Balance. Start–up shall include the following:

1. All equipment operable in safe and normal condition
2. Temperature control systems installed complete and operable.
3. Proper thermal overload protection in place for electrical equipment
4. Air systems:
   A. Final filters clean and in place. If conditions warrant, the Contractor shall install temporary media in addition to the final filters.
   b. Duct clean of debris
   c. Correct fan rotation
   d. Fire and Volume dampers in place and open
   e. Coil fins cleaned and combed
   f. Access doors closed and duct end caps in place
   g. All outlets installed and connected
   h. Duct system leakage shall not exceed the rate specified
5. Construction strainers removed from base mounted pumps
6. All coil strainers cleaned

D. If it is determined by the Test and Balance Agency that drive changes are required, the Mechanical Contractor must obtain and install all necessary new drive components needed to properly balance air moving equipment and systems to with–in design tolerances.

PART: 3 EXECUTION

3.01 PRE–CONSTRUCTION PROCEDURES

A. Pre–construction plan checks and mechanical construction reviews shall be provided by the Test and Balance Agency. The Test and Balance Agency shall fully review all contract documents and shall submit a full report of any areas that may not be possible to balance or other circumstances that may affect the successful balancing of any system. This report shall be submitted within 30 days after approval of the Test and Balance agency.

3.02 GENERAL BALANCING PROCEDURES

A. The Test and Balance Agency shall cooperate with the Owners Representative and all Contractors to perform the work in such a manner as to meet the job schedule.

B. The Test and Balance agency shall leave all system components in proper working order, such as:

1. Replace belt guards
2. Close access doors
3. Close doors to electrical switch boxes
4. Restore thermostats to specified settings

C. All recorded data shall represent a true, actually measured, or observed condition.

D. Any abnormal conditions in the mechanical systems or conditions which prevent Total System Balance, as observed by the Test and Balance Agency, shall be reported as quickly as possible to the Architect/Engineer.

E. The Contractor shall provide any required additional balancing devices, including but not limited to additional volume dampers and balancing valves, as determined by the Test and Balance Agency.

F. The various systems shall be balancing to within the following tolerances unless otherwise directed:

Supply Air	−5% to +5% of design CFM
Return Air	−5% to +5% of design CFM
Outside Air	−5% to +5% of design CFM

G. Duct leakage shall be determined by comparing transverse measurements to the sum of all outlet flows. Duct leakage shall not be more than +/− 5% of the design air flow rate.

3.03 TEMPERATURE RECORDINGS

A. The Test and Balance Agency shall record temperature performance readings of all coils, listing, entering and leaving dry bulb and wet bulb temperatures when outside temperature is 80° F or above and entering and leaving dry bulb temperatures when outside temperature is 45° F or below.

PART: 4 FINAL ACCEPTANCE INSPECTION / COMMISSIONING

4.01 Testing and Balancing Final Acceptance/Commissioning

A. At the time of Testing and Balancing final acceptance / Commissioning, the TAB Agency shall recheck, in the presence of the Owner's Representative / Commissioning Agent, specific and random selections of data recorded in the certified TAB Report.

B. Points and areas for recheck shall be selected by the Owner's Representative / Commissioning Agent.

C. Measurements and test procedures shall be the same as the submitted and accepted test and balance agenda.

D. Selections for verification, specific plus random, shall be a minimum of 10%, and shall not exceed 50% of the total number tabulated in the TAB Report, except where special air systems require a complete recheck for safety reasons.

E. If 10% of the random verification tests demostrate a measured flow deviation of 10% or more from that recorded in the certified TAB Report, the report shall be automatically rejected. In the event that the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified TAB Report submitted, and a new inspection test / commissioning performed by the TAB Agency, all at no additional cost to the owner.

F. Final Acceptance of the Testing and Balancing will occur after the successful completion of the TAB verification / commissioning process.

SHEET METAL DUCTWORK

PART: 1 GENERAL

1.01 SCOPE:

A. Furnish and install all sheet metal work necessary for complete heating, ventilation and air conditioning systems. Construction shall be in accordance with SMACNA recommendations, or UL 181.

B. All work shall conform with NFPA No. 90A. and the International Mechanical Code.

C. All duct systems, unless otherwise noted, shall be built to medium pressure (6" WG static pressure) and low–pressure (2" WG static pressure) construction standards.

PART: 2 PRODUCTS

2.01 SHEETMETAL WORK:

A. All medium pressure supply ductwork and fittings shall be galvanized steel in accordance with SMACNA standards for a static duct pressure of 6" WG. with a seal class "A" rating.

B. All low pressure rectangular ductwork shall be galvanized steel and shall be constructed to 2"WG minimum in accordance with SMACNA standards and have a class "B" seal rating. Where indicated on the plans or described herein furnish duct with 1.5" thick internal lining.

C. All low pressure round duct and fittings shall be galvanized steel duct or approved equal and constructed to 2"WG minimum.

D. All metal ductwork shall be constructed and installed in accordance with the Sheet Metal and Air Conditioning Contractor's National Association – Third Edition 2005 and shall be air–tight and neat in appearance. Low pressure duct systems shall be constructed using a seal class "B" rating. Medium pressure duct systems shall be constructed using a seal class "A" rating. Cross joints in all low–pressure and medium pressure ducts, supply, return and exhaust, shall be sealed with fire retardant sealer or duct tapes securely glued in place. Interior surfaces shall be smooth and free of obstructions.

E. All duct lines shall be true and smooth. Where exposed ducts pass through openings in partitions and ceilings, they shall be fitted with trim angles to close joint between duct and construction.

F. Ductwork exposed to damp or wet conditions shall be constructed of aluminum with the same duct construction standards as indicated above.

G. Duct dimensions shown on the plans are the interior "free" opening dimensions. Ducts required to have an internal lining shall be constructed in a manner to maintain the interior dimensions indicated.

H. Furnish and install volume control dampers, splitters, and other devices, with locking handles and memory stops, at all locations indicated on drawings and where required to properly balance the systems and to deliver the air quantities specified. All branch ducts serving a single air device shall be equipped with a volume control damper.

I. Furnish and install in each duct connection to motor driven equipment, a flexible joint to prevent vibration being transmitted from equipment to ductwork.

J. Turning vanes shall be provided for all square elbows and shall be the acoustical type.

K. Flexible duct shall be Hart & Cooley F116 or F118 or approved equal. The duct shall have two plies of polyethylene encapsulating a wire helix and insulation with a "R" value of 6.0 or 8.0; R–6.0 shall be used when within the building enevelope and R–8.0 shall be used outside the building envelope. The duct shall have a vapor barrier and comply with the requirements of UL–181, NFPA 90A and ASTM C–518. The duct shall have a flame spread rating less than 25 and a smoke development rating of less than 50. The duct shall be rated for a maximum continuous working temperature of 140 degrees.

2.02 FIRE DAMPERS:

A. Furnish and install approved fusible link fire dampers where indicated on the drawings and where required by local codes and the standard of the National Fire Protection Association and by the latest directions of the inspection Authorities.

B. Fire dampers construction shall be in accordance with the requirements set forth in NFPA Pamphlet No. 90A including latest revisions. Fire dampers shall be so designed so as to close against the flow of air. Fire dampers shall be tight closing and shall be set in frames which shall be securely fastened to ductwork at fire partitions.

C. Fire dampers in floor and masonry openings shall be of the multi–leaf accordion type, as manufactured by Air Balance, Inc., or approved equal, and shall be held in the normally open position by means of adequately spaced heavy gauge wires with fusible links. Vertical dampers shall rely on gravity for closing. Horizontal dampers shall be provided with adequate strength springs for forced closing when links melt. Damper frames shall in all cases, be of the type which shall be installed with a ducted pocket to contain the damper leaves in the normal position and which will provide a maximum free area of the full indicated opening size for passage of air.

D. Number and locations of fire dampers and fusible link registers, etc., described and shown, are the minimum number and designation required. It shall be the Contractor's responsibility to satisfy that his bid includes all dampers and devices required at the date of submitting his bid.

E. Any changes in requirements by the governing authorities which are made effective prior to bid date, shall be provided and installed at no charge in contract price.

F. Adequately sized removable and replaceable airtight panels shall be provided in the ductwork for access to all damper links. Access panels in building construction shall be provided to service dampers.

G. Combination Fire & Smoke Dampers shall be factory furnished single dampers that meet the performance and quality criteria of both fire dampers and smoke dampers indicated in this section. Coordinate the interface of the dampers with other trades.

2.03 SMOKE DAMPERS:

A. Smoke dampers shall have a UL classification of UL 555S or UL 555 as applicable and shall be low leak type.

B. Dampers shall be capable of operating at 350°F and shall close completely in less than 20 seconds.

C. Dampers shall operate with fire alarm system or with local indications as shown or as directed.

D. Dampers shall have electric actuation with factory mounted and wired integral duct smoke detector. Transmit alarm to the fire alarm system upon activation. Damper shall operate on a corresponding signal from the fire alarm system.

E. Dampers shall have optional automatic reset.

F. Combination Fire & Smoke Dampers shall be factory furnished single dampers that meet the performance and quality criteria of both fire dampers and smoke dampers indicated in this section. Coordinate the interface of the dampers with other trades. Combination dampers shall be "Greenheck" model FSD quality standard.

2.04 REGISTERS, GRILLES, & DIFFUSERS

A. Registers, grilles, and diffusers shall be as specified on the drawings. Acceptable manufacturers are Titus, Tuttle and Bailey, Metal Aire, and Price. Submitted air devices shall meet or exceed the quality standards of the specified air device and shall be equal in terms of type, appearance, and performance.

B. Where volume dampers cannot be installed in the branch duct and where otherwise indicated, the air device shall be equipped with an opposed blade damper. The damper shall be constructed out of the same material as the air device.

C. Air devices shall be furnished with the proper border and frame to interface with the type of surface it is being mounted to.

PART: 3 EXECUTION

3.01 INSTALLATION:

A. Provide all necessary devices to balance the airflow to produce air quantities at outlets as marked on the drawings.

B. Make provisions for, and install in ductwork, all automatic control systems, dampers, smoke dampers, smoke sensors, thermometers and similar equipment furnished under this or other sections of the specifications. Provide angle iron or channel frames and sheet metal duct collars as required for mounting ATC dampers and manual dampers over weatherproof louvers for air intake and exhaust, as indicated on drawings.

C. Duct connections to flanged coils, etc., shall be made with soft neoprene gaskets with adhesive between coil and duct flange.

D. Provide access panels in the duct for access to fire dampers. Provide access panels in all ceilings and walls to allow access to concealed dampers and accessories that require manual operation or visual inspection. Where possible, dampers, valves and accessories shall be installed in a common location to minimize the number of access panels.

E. Flexible duct shall be installed on supply air systems connecting the air device to the branch duct. Flexible ducts shall have the inner diameter specified on the plans. Flexible ducts shall not exceed 8 ft. in length and shall not turn more than a total of 180 degrees. Flexible ducts shall not be used on return, outside air, and negative pressure exhaust systems unless directed by the Engineer.

F. Ductwork which does not meet minimum leakage specified in "Balancing" section of specifications shall be reworked until the minimum requirement is reached.

INSULATION:

PART 1: GENERAL

1.01 SCOPE:

A. Provide and install insulation as hereinafter specified for all piping and duct systems where indicated.

1.02 FIRE SAFETY CONSIDERATIONS:

A. All insulating materials used shall have Flame Spread Rating not exceeding 25, and a Smoke Developed Rating not to exceed 50. These ratings shall be determined and verified by ASTM E–84, NFPA 255, or UL 723.

B. Insulation using "Salts" to impart fire safety will not be accepted.

1.03 MANUFACTURERS:

A. Insulation shall be by one manufacturer, either "Owens–Corning" or other manufacturers as specified hereinafter.

PART 2: PRODUCTS

2.01 PIPING INSULATION:

A. All piping shall be insulated with "Owens–Corning" SSL–11 preformed fiberglass pipe insulation with all service jacket and self–sealing lap. (Thickness as scheduled below).

B. All exposed piping shall be insulated same as above.

C. "Zeston" or approved equal jacket system shall be used for all valves, fittings, and joints in the piping system, with insulation.

2.02 DUCT INSULATION:

A. All heating and air conditioning supply and return ductwork and outside air ducts within the building envelope shall be wrapped with minimum 2" thick foil–faced fiberglass duct insulation with vapor barrier having a minimum R–5 value. Where ducts occur outside the building envelope 3" thick insulation with vapor barrier with a minimum R–8 value shall be used. Ducts in ceiling spaces used as a return air plenum shall be insulated as above. Ducts shall be internally lined in lieu of external insulation where indicated on drawings or described herein.

B. Exposed ductwork in finished conditioned spaces shall not be externally insulated but shall have internal insulation. See below for requirements.

C. The first twenty feet (20') of supply and return air ductwork unless noted on the drawings for each HVAC unit shall be lined on the inside with 1.5" thick insulation with a minmum R–5 value as described in the Sheet Metal Ductwork section. Where ductwork occurs outside the building envelope 2" thick insulation with a minimum R–8 value shall be used. The lining shall be fastened with approved adhesive and weld pins. Weld pins shall be approved type and fastened in accordance with SMACNA manual recommendations. Duct dimensions shown on drawings are internal dimensions and shall be adjusted accordingly to compensate for the duct liner.

2.03 MISCELLANEOUS ITEMS:

A. Items such as expansion tanks, converters, pumps, etc. subject to sweating or excessive heat loss shall be insulated the same as the system to which they attach.

B. Particular attention is called to chilled water or dual temperature pumps and devices such as valves, sensors or other devices which require occasional or frequent servicing or checking. These pumps and devices shall have rigid, minimum two–piece insulation shells which are capable of being removed for inspection and replaced without damage.

PART 3: EXECUTION

3.01 INSTALLATION:

A. All insulation shall be applied on clean, dry surfaces only.

B. All insulation shall be continuous thru wall and ceiling openings, and sleeves.

C. Insulation on all cold surfaces where vapor barrier jackets are used, will be applied with continuous, unbroken vapor seal. Hangers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapor–sealed to prevent condensation.

D. Inserts shall be installed at outside hangers. Inserts between the pipe and pipe hangers shall consist of rigid pipe insulation of equal thickness to the adjoining insulation, and shall be provided with vapor barrier where required. Insulation inserts shall be B–Line or equal and shall not be less than the following lengths:

½" to 2–1/2" pipe size: 6" long

E. Metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and length specified for the insulation hanger inserts. Metal shields shall be B–Line or equal.

F. Specified adhesives, mastics and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.

G. Exposed insulated vertical pipe shall be protected to eight feet (8') above floor with 22 gauge smooth paintable riveted steel jacket. Vertical piping in equipment rooms do not require metal jackets.

3.02 INSULATION EXPOSED TO WEATHER:

A. Duct Insulation:

1. All insulation exposed to weather shall be rigid type, 3" thickness with a minimum R–8 value.
2. Approved weatherproofing includes factory applied type II jacket or two coats of class I adhesive finish with a layer of glass cloth between the coats. The total, dry film thickness shall be approximately 1/16 inch.

B. Pipe Insulation:

1. All pipe specified to be insulated that is exposed to the weather, shall have rigid fiberglass insulation at least ½" thicker than specified.
2. The insulation shall be applied over heat tape which is wrapped around the pipe and thermostatically controlled.
3. All pipe insulation exposed to the weather shall be finished with a minimum 24–gauge aluminum jacket, which is completely weather sealed.

3.03 OTHER MANUFACTURERS:

A. Other acceptable manufacturers are Johns Mannville, Gustin Bacon, PPG and Knauf. These manufacturers are acceptable provided they meet the quality of the specified material. This includes the items which are standard for the specified material.

PROGRESS ISSUE 11-11-2014

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ISSUE DATE

MECHANICAL SPECIFICATIONS

M301

project no. : 14-080