

**ADDENDUM NUMBER TWO
CLARIFICATIONS, CORRECTIONS, AND ADDITIONS TO:
THE CONSTRUCTION DRAWINGS AND/OR THE PROJECT MANUAL FOR CONSTRUCTION**

7 November 2013

**Sullivan County POB Dental Build-Out
Sullivan County Community Hospital**
2186 N. Hospital Blvd.
Sullivan, Indiana 47882

**The Estopinal Group LLC.
Project Number: SCCH.040.70**

TO ALL BIDDERS AND ALL REGULATORY AGENCIES:

This addendum forms part of the Contract Documents and modifies the project manual and/or construction drawings dated 10.30.2013. Acknowledge receipt of the addendum in the space provided on the bid form. Failure to do so may subject bidder to disqualification.

The following "items-by-number" refer to the project manual and/or construction drawings as indicated.

CLARIFICATIONS, CORRECTIONS & ADDITIONS:

Specifications:

- Item 1** Section 064023 Paragraph 2.2.E, Add Stevens Twin Pin 200# Shelf Support
- Item 2** Revise Section 200100, Copy Attached.
- Item 3** Revise Section 200300, Copy Attached.
- Item 4** Revise Section 201100, Copy Attached.
- Item 5** Revise Section 201300, Copy Attached.
- Item 6** Revise Section 202100, Copy Attached.
- Item 7** Revise Section 202200, Copy Attached.
- Item 8** Revise Section 202400, Copy Attached.
- Item 9** Revise Section 202500, Copy Attached.
- Item 10** Revise Section 203100, Copy Attached.
- Item 11** Revise Section 220100, Copy Attached.
- Item 12** Revise Section 220200, Copy Attached.
- Item 13** Revise Section 231200, Copy Attached.
- Item 14** Revise Section 250400, Copy Attached.
- Item 15** Revise Section 270710, Copy Attached.
- Item 16** Revise Section 231100, Add Acceptable Manufacturer: Price
- Item 17** Revise Section 230200, Add Acceptable Manufacturer: Lennox.
- Item 18** Section 081113 Add Acceptable Manufacturer: Metal Products Inc.

Drawings:

- Item 1 Sheet PR.1**
Add Automatic Door operators to One Leaf of Door 101 and One Leaf of the Exterior Door on Vestibule 100.
- Item 2 Sheet P2.0**
Provide and install a water softening system for the domestic water connected to the 1 ½" pipe located in Mechanical 128. The softening system should be located adjacent to the Future Data Room 126 and Staff Toilet 113 within Mechanical 128. The system shall be similar to Culligan Model HiFlo3-HC-90-1.5T capable of continuous flow rates of 29 GPM using a 14 x 65 resin tank and 24 x 40 brine tank. Pipe tank per manufacturer recommendations.
- Item 3 Sheet P2.0**
Underground piping starts inside the Foundation Wall at "CO" on Underslab Floor Plan.
- Item 4 Sheet P3.0**
Disregard all References to "Gases" and "Gas Outlets".

Item 5 Sheet E3.0

- A. Lighting fixture type "OLW" to have emergency inverter; fixture to be Cooper Catalog No. IST-B02-LED-E1-BLS-CWB-XXX or approved equivalent.
- B. Lighting fixture type "H" to be Cooper Catalog No. DCMF-SS-232-120-GL-ER81-AYC-CHAIN/SET-U or approved equivalent.

Item 6 Sheet E3.1

- A. Staff Break 111 – Revise fixture type "C3" nearest to door to fixture type "C3E".
- B. Vestibule 100 – Provide emergency inverter for both type "D" fixtures and make one type "D" a night lighting fixture.

Item 7 Sheet E4.1

- A. Provide Patch Panel in Data Room 125 as directed by the Electrical Engineer.
- B. Mechanical Rom 128 - Provide GFCI duplex receptacle for water softener, coordinate exact mounting location with water softener installer prior to rough-in. Route (2)#12 & #12 GND THHN/THWN in 3/4" conduit from GFCI receptacle to a spare 1P, 20A circuit breaker in panel "M1A".
- C. Mechanical Rom 128 - Provide 120V electrical connection to fire alarm panel. Route (2)#12 & #12 GND THHN/THWN in 3/4" conduit from fire alarm panel to a spare 1P, 20A circuit breaker in panel "M1A".
- D. Clarification: the single pole toggle switch located in the Business Office 122 is for connection to the two autodoor operators in Vestibule 100. Coordinate switch requirements with door access control contractor.
- E. Tagged Notes: Revise tag note No. 3 to read, "Proposed cabling path, provide cable management system and coordinate all paths with piping, duct work, etc. (note: stub-up conduits shall be routed to these cabling paths). provide two-4" conduit sleeves (or number as indicated) through walls crossed by cabling path. install sleeves above the suspended ceiling in-line with cabling path. Minimum clearance around J-Hooks to be 6" above ceiling, 6" above top J-Hook, and 18" in front. Refer to J-Hook Cabling Path Installation Detail on sheet E7.0.

Item 8 Sheet E5.1

- A. Clarification: Panel "P2A" is to be rated 240V, 3-phase, 3-wire.
- B. Reference panelboard schedule notes; delete item 'c.'

Item 9 Sheet M2.0

The HVAC System is a ducted system, not a Plenum Return.

END OF ADDENDUM NUMBER TWO

DIVISION 20 – MECHANICAL

SECTION 200100 – GENERAL PROVISIONS - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Advertisement for Bid, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other Contract Documents shall apply to the Contractor's work as well as to each of their Sub-Contractor's work.
- 1.2 All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents of Contract Documents. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination prior to the Bid.
- 1.3 The work included in this Division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical Systems indicated or specified in the Contract Documents.
- 1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the Plans and/or Specifications, shall be included in the Bid as part of this Contract.
- 1.5 It is not the intent of this Section of the Specifications to make any Contractor, other than the General Contractor responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this Section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.
- 1.6 The Architect and Engineer do not define the scope of individual trades, subcontractors, material suppliers and vendors. Any sheet numbering system or specification numbering system used which identifies disciplines is solely for the Architect and Engineer's convenience and is not intended to define a subcontractor's scope of work. Information regarding individual trades, subcontractors, material suppliers and vendors may be detailed, described and indicated at different locations throughout the Contract Documents. No consideration will be given to requests for change orders for failure to obtain and review the complete set of Plans and Specifications when preparing Bids, prices and quotations.
- 1.7 This Section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.
- 1.8 It is the intent of the Contract Documents to deliver to the Owner a new, complete and operational project once the work is complete. Although Plans and Specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.
- 1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Bidder/Proposer own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.
- 1.10 Each Bidder/Proposer shall also be governed by any unit prices and Addenda insofar as they may affect part of their work or services.

1.11 Definitions and Abbreviations:

- Contractor - Any Contractor whether bidding, proposing or working independently or under the supervision of a General Contractor who installs any type of Mechanical Work as specified in the Contract Documents or, the General Contractor.
- Engineer - The Consulting Mechanical-Electrical Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
- Architect - The Architect of Record for the project.
- Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owner, etc.
- Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
- The Project - All of the work required under this Contract.
- Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
- Provide - Furnish and install complete, tested and ready for operation.
- Install - Receive and place in satisfactory operation.
- Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto.
- Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- ADA - Americans with Disabilities Act.
- ANSI - American National Standards Institute.
- ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
- ASME - American Society of Mechanical Engineers.
- IBC - International Building Code.
- NEC - National Electrical Code.
- NEMA - National Electrical Manufacturers Association.
- NFPA - National Fire Protection Association.
- OSHA - Office of Safety and Health Administration.
- SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
- UL - Underwriters Laboratories.

PART 2 – INTENT AND INTERPRETATION:

- 2.1 It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc as necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.
- 2.2 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- 2.3 The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.
- 2.4 The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

PART 3 – PLANS AND SPECIFICATIONS:

- 3.1 The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their Bid accordingly.
- 3.2 The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.
- 3.3 The Plans and Specifications shall be considered to be cooperative and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- 3.4 Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- 3.5 The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- 3.6 Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.
- 3.7 Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.
- 3.8 Each Bidder/Proposer shall review all Plans in the Contract Documents to insure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in particular insure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.
- 3.9 Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- 3.10 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- 3.11 Where within the Contract Documents the word "typical" or "typ." is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.
- 3.12 Each Contractor shall evaluate ceiling heights specified on Architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.

PART 4 – EXAMINATION OF SITE AND CONDITIONS:

- 4.1 Each Bidder/Proposer shall inform their self of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work.
- 4.2 Each Bidder/Proposer shall also fully acquaint their self with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. A proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after Bids are accepted.

PART 5 – EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

- 5.1 When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. Any Plans, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not in any way absolve the Contractor of this responsibility.
- 5.2 Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of this Part met. Requested substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to Bid. If this procedure is not followed, the substitution will be rejected. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.
- 5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineer.
- 5.4 Each Bidder/Proposer shall furnish along with their proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the Specifications and the Contractor fails to state which they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not insure that the Engineer will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.
- 5.5 Ten (10) days prior to the submission of a proposal, each Bidder/Proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Bidder/Proposers signify that they have included the cost of all required items in the proposal and that the Bidder/Proposer will be responsible for the safe and satisfactory operation of the entire system.

PART 6 – CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

- 6.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. in connection with their work. They shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.

- 6.2 Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to their part of the work prior to submission of a proposal.
- 6.3 The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and Plans in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.
- 6.4 All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.
- 6.5 All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.
- 6.6 All plumbing work is to be constructed and installed in accordance with applicable codes, Plans and Specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such Plans are in the possession of the Plumbing Contractor.
- 6.7 All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Building Code and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association.
- 6.8 The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.
- 6.9 Where minimum code requirements are exceeded in the Design, the Design shall govern.
- 6.10 The Contractor shall insure that their work is accomplished in accord with the OSHA Standards and that they conduct their work and the work of their personnel in accord with same.
- 6.11 All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction and the American Disabilities Act.
- 6.12 Work in elevators, elevator shafts and elevator equipment rooms shall comply with the Elevator Code enforced by the Authority Having Jurisdiction.
- 6.13 All work in relation to domestic water systems shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the requirements of the local water utility company.
- 6.14 All work in relation to the installation of sanitary or storm sewers shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the local agency governing such installations.
- 6.15 Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the State Department for Environmental Protection.
- 6.16 Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the Plans and Specifications require better materials, equipment, and construction than these minimum standards, in which case the Plans and Specifications shall be the minimum standards.

PART 7 – QUALIFICATIONS OF CONTRACTOR/WORKERS:

- 7.1 All Mechanical Contractors and their subcontractors bidding this project must have been a licensed company for a minimum of three (3) years to qualify to Bid this project. Individual employee experience does not supercede this requirement.
- 7.2 All mechanical subcontractors bidding the mechanical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.
- 7.3 All mechanical work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workers and unqualified or incompetent workers shall refrain from work in areas not deemed satisfactory. Requests for relief of a workers shall be made through the normal channels of Architect, Contractor, etc.
- 7.4 All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined under State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.
- 7.5 The installation of all Heating, Ventilating and Air-Conditioning Systems (HVAC) by any Contractor, whether in existing or new building construction shall be performed by a Licensed Master HVAC Contractor. This includes any Contractor installing HVAC systems, piping and ductwork.
- 7.6 All sheet metal, insulation and pipe fitting work shall be installed by workers normally engaged in this type work.
- 7.7 All electrical work shall be accomplished by Licensed Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 8 – SUPERVISION OF WORK:

- 8.1 The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineer, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 9 – CONDUCT OF WORKERS:

- 9.1 The Contractor shall be responsible for the conduct of all workers under their supervision. Misconduct on the part of any worker to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that worker. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

PART 10 – COOPERATION AND COORDINATION WITH OTHER TRADES:

- 10.1 The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.
- 10.2 Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4" = 1'-0", clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. Make the necessary changes in the work to correct the condition without extra charge.
- 10.3 The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 11 – GUARANTEES AND WARRANTIES:

- 11.1 The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into their Contract to the best of its respective kind and shall replace all parts at their own expense, which are proven defective within the time frame outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these Specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of their operator or other employees. Refer to other sections for any special or extra warranty requirements.
- 11.2 All compressors shall have five year warranty. (1st year parts and labor, 2nd thru 5th year compressor only).
- 11.3 Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

PART 12 – CHANGES IN MECHANICAL WORK:

- 12.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 14 – CLAIMS FOR EXTRA COST:

- 13.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 14 – MATERIALS AND WORKMANSHIP:

- 14.1 All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Bidder/Proposer shall determine that the materials and/or equipment they propose to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.
- 14.2 Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.
- 14.3 Use extreme care in the selection of equipment and its installation to insure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.
- 14.4 Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.
- 14.5 All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and ampacity. Pumps shall have a data plate indicating horsepower, static pressure head and flow rate.

PART 18 – SURVEY, MEASUREMENTS AND GRADE:

- 18.1 The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations and measurements. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.
- 18.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.
- 18.3 Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the contract documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 19 – PROTECTION OF EQUIPMENT:

- 19.1 The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense. All ductwork with open ends shall be covered with plastic during construction.

PART 20 – REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT:

- 20.1 The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

PART 21 – EQUIPMENT SUPPORT:

- 21.1 Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc. Do not support items from roof/floor deck or bridging.

PART 22 – DUCT AND PIPE MOUNTING HEIGHTS:

- 22.1 All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure. Refer to Plans for minimum heights of ducts and piping above ceiling.

PART 23 – BROKEN LINES AND PROTECTION AGAINST FREEZING:

- 23.1 No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Insulation on piping does not necessarily insure that freezing will not occur.

PART 24 – WEATHERPROOFING:

- 24.1 Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Architect and Engineer before work is performed. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.
- 24.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 25 – ACCESSIBILITY:

- 25.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.
- 25.2 The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.
- 25.3 Whether shown on the Plans or not, the Contractor shall provide in the Bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. Change orders for access panels will not be accepted.

PART 26 – SCAFFOLDING, RIGGING AND HOISTING:

- 26.1 The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

PART 27 – CLEANING:

- 27.1 The Contractor shall, at all times, keep the area of their work presentable to the public and clean of rubbish and debris caused by their operations; and at the completion of the work, shall remove all rubbish, debris, all of their tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.
- 27.2 After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.
- 27.3 Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not "dried-in". If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

PART 28 – TEMPORARY USE OF EQUIPMENT:

- 28.1 The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Engineer. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.
- 28.2 Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

- 28.3 For Indoor Units during all phases of construction:
- At a minimum, four complete sets of filter media are required for each unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in appropriate mechanical room as a spare set for the Owner. All other filters shall be used by the Contractor during construction. Dispose of all construction filter media.
 - On the outside of all return air openings install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
 - At substantial completion of the project the entire unit shall be cleaned to present a like "new" unit for the Owner and all filters shall be replaced with new.

PART 29 – NOISE, VIBRATION OR OSCILLATION:

- 29.1 All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.
- 29.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.
- 29.3 The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineer.

PART 30 – INSPECTION, APPROVALS AND TESTS

- 30.1 Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.
- 30.2 The Contractor shall provide as a part of this Contract any required Agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.
- 30.3 The Contractor shall advise each Inspecting Agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing work. Failure of the Inspecting Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- 30.4 Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such Agency Inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

- 30.5 Approval by an Agency Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
- 30.6 Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the Agency Inspectors to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 31 – INDEMNIFICATION:

- 31.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 32 - OPERATING INSTRUCTIONS:

- 32.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of three (3) days of eight (8) hours each, or as otherwise specified. Refer to Section HVAC EQUIPMENT for additional requirements. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least seven (7) days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.
- 32.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
- 32.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART33 - RECORD DRAWINGS:

- 33.1 The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 200300 - SHOP DRAWINGS, MAINTENANCE MANUALS AND PARTS LISTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall prepare and submit to the Engineer, through the General Contractor and the Architect within thirty (30) days after the date of the Contract, required copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter. Refer to Division 1 requirements for shop drawing submittal requirements.
- 1.3 Each shop drawing and/or manufacturers descriptive literature shall have the proper notation indicated on it and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the Engineer may readily determine what the Contractor proposes to furnish. All data and information schedules indicated or specified shall be noted on each copy of each submittal.
- 1.4 Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.
- 1.5 All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.
- 1.6 The Contractor shall make any corrections or changes required by the Engineer and shall re-submit for final review as outlined above.
- 1.7 It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.
- 1.8 The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.
- 1.9 Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.
- 1.10 If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.
- 1.11 Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.
- 1.12 All submittals for mechanical equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

- 1.13 All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.
- 1.14 Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

PART 2 – SHOP DRAWINGS:

- 2.1 Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

- (2.2.1) Electric Heaters
- (2.2.1) Ductwork Accessories/Volume Dampers
- (2.2.1) Energy Recovery Ventilator
- (2.2.1) Floor Drains
- (2.2.1) Insulation
- (2.2.1) Split Heat-pump Units
- (2.2.1) Plumbing Equipment
- (2.2.1) Plumbing Fixtures, Fittings and Trim
- (2.2.1 & 2.2.2) Temperature Controls
- (2.2.1 & 2.2.2) Register, Grilles, and Diffusers
- (2.2.1 & 2.2.2) Valves

2.2 Special Notes:

- 2.2.1 Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item marked (2.2.1) above. These documents shall include at least:

- 2.2.1.1 Detailed operating instructions
- 2.2.1.2 Detailed maintenance instructions including preventive maintenance schedules.
- 2.2.1.3 Addresses and phone numbers indicating where parts may be purchased.
- 2.2.1.4 Expanded parts drawings, parts lists, service manuals, schematics, wiring diagrams.
- 2.2.1.5 Master air filter list including equipment identification, filter size, filter quantity, and supplier contact information.

- 2.2.2 Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system. Refer to Specification Section – CONTROLS for additional requirements.

PART 3 – BALANCE REPORTS:

- 3.1 Upon substantial completion of the project, the Contractor shall submit to the Engineers three (3) bound copies of the Certified Air and Hydronic Balance Report.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 201100 - SLEEVING, CUTTING, PATCHING, REPAIRING AND FIRESTOPPING

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall be responsible for all openings, sleeves, trenches, etc., that may be required in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which they are to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.
- 1.3 The Contractor shall plan their work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall then do all cutting and patching required for the installation of their work, or pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workers of the responsible Contractor must be corrected or rectified at their own expense.
- 1.4 The Contractor shall notify other trades in due time where they will require openings or chases in new concrete or masonry. Set all concrete inserts and sleeves for their work. Failing to do this, Contractor shall cut openings for the work and patch same as required at their own expense.
- 1.5 The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly corrected to the satisfaction of the Engineer.
- 1.6 All work improperly performed or not performed as required by the Mechanical Trades in this section, shall be corrected by the General Contractor at the responsible Contractor's expense.

PART 2 – SLEEVES:

- 2.1 Cast iron or Schedule 40 steel sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking between pipe and sleeve for water proofing. Utilize "Link-Seal" at these locations.
- 2.2 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter plus insulation.
- 2.3 Horizontal sleeves passing through exterior walls or where there is a possibility of water leakage and damage shall be caulked watertight. Utilize "Link-Seal" at these locations.
- 2.4 Vertical sleeves in roofs shall be flashed and counterflashed with lead (4 lb.) or 16 oz. copper and welded or soldered to piping, lapped over sleeve and properly weather sealed. Where sleeves pass through roof construction, sleeves shall extend minimum of 12" above the roof.
- 2.5 Sleeves through walls and floors shall be cut off flush with inside surface unless otherwise indicated.

PART 3 – CUTTING:

- 3.1 All rectangular or special shaped openings in plaster, gypsum board or similar materials, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth, even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, louvers, etc.

- 3.2 The Mechanical Contractor shall coordinate all openings in masonry walls with the General Contractor; and, unless otherwise indicated in the Contract Documents, shall provide lintels for all openings required for the mechanical work such as louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:
 - 3.2.1 New Openings under 48" in width: Provide one 3½"x3½"x3/8" LLV steel angle for each 4" of masonry width. Lintel shall have 8" bearing on each end.
 - 3.2.2 New Openings over 48" in width: Consult with structural engineer.
- 3.3 No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.
- 3.4 Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

PART 4 – PATCHING AND REPAIRING:

- 4.1 Patching and repairing made necessary by work performed under this Division shall be included as a part of the work and shall be done by skilled workers of the trade or trades for work cut or damaged. The work shall be performed in strict accordance with the provisions herein before specified to match adjacent surfaces and in a manner acceptable to the Engineer and Owner.
- 4.2 Where portions of existing sites, lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced back to original or better condition to the satisfaction of the Engineer.
- 4.3 Where ducts penetrate fire rated assemblies, fire dampers shall be provided with an appropriate access door whether indicated or not on the Drawings.
- 4.4 Piping and ductwork passing through floors, ceilings and walls in finished areas shall be fitted with chrome plated brass escutcheon trim pieces of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe/duct around which it is installed.
- 4.5 Flanged metal collars shall be provided around all ducts, flues, pipes, etc. at all wall penetrations; both sides. Penetrations through any wall will require the installation of flanged collars. Openings shall not be any larger than 2" in any direction than the piping/duct passing through the wall. Openings larger than this requirement shall also be infilled to match adjacent construction. Fill void with insulation for sound reduction.

PART 5 – FIRESTOPPING:

- 5.1 All mechanical pipes and ducts penetrating fire rated floors and walls shall be firestopped by this Contractor. All firestopping products and assemblies installed shall be UL listed.
- 5.2 Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.
- 5.3 Where the installation of ductwork requires the penetration of non-rated floors, the space around the duct or pipe shall be tightly filled with an approved non-combustible material.
- 5.4 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type of penetration (one hour fire rated gypsum wall board with insulated metal pipe penetration, etc.) Provide copies to the local building inspector.
- 5.5 The manufacturer of the firestopping materials shall provide on site training for the installing Contractor. The training session shall demonstrate to the Contractors the proper installation techniques for all the firestopping materials. Contact the Engineer prior to conducting this training session.
- 5.6 Firestopping materials include (but are not limited to) wraps, strips, caulks, moldable putties, restricting collars with steel hose clamps, damming materials, composite sheets, fire dam caulks, steel sleeves, etc.

- 5.7 The following indicates the 3M penetration detail for uninsulated pipe penetration of various wall and floor construction types:
- 5.7.1 One, two or three hour fire rated concrete floor - 3M #5300-MPC8.
 - 5.7.2 One, two or three hour fire rated solid or block concrete wall - 3M #5300-MPC16 or 3M #5300-MPC26.
 - 5.7.3 One hour fire rated gypsum wallboard - 3M #5300-MPC7.
 - 5.7.4 Two hour fire rated gypsum wallboard - 3M #5300-MPC7.
- 5.8 The following indicates the 3M penetration detail for insulated pipe penetrations of various wall and floor construction types:
- 5.8.1 One, two and three hour fire rated concrete floor - 3M #5300-IMP2.
 - 5.8.2 One, two and three hour concrete block wall - 3M #5300-IMP2.
 - 5.8.3 One hour fire rated gypsum wallboard - 3M #5300-IMP4.
 - 5.8.4 Two hour fire rated gypsum wallboard - 3M #IMP7.
- 5.9 HVAC ducts penetrating a one or two hour fire rated wall or floor shall be firestopped per 3M #5300-HVD1.
- 5.10 Multiple pipes penetrating fire rated floors and walls may be firestopped as a group. Submit 3M details for specific applications if this method of firestopping is chosen.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 201300 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor's attention is also directed to Specification Section HANGERS, CLAMPS, ATTACHMENTS, ETC.
- 1.3 Unless otherwise indicated, all materials shall be new and of the best grade and quality for the type specified.
- 1.4 Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineer prior to submission of the bid.
- 1.5 All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.
- 1.6 The piping indicated shall be installed complete and shall be of the size indicated. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineer. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project.
- 1.7 All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.
- 1.8 All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3" and smaller and ten (10) foot intervals on all other piping. Small vertical pipes (1" and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants.
- 1.9 Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. Refer to Specification Section INSULATION - MECHANICAL.
- 1.10 The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted.
- 1.11 Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation. This includes temporary support required during Construction.
- 1.12 In general, piping shall be installed concealed except in mechanical rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur they shall be kept as close to walls as possible.

- 1.13 Pipe shall be cut accurately to measurements established at the building by the Contractor and worked into place without springing or forcing. All pipes shall be reamed to full pipe diameter before joining and before assembling. All lengths of pipe shall be set vertically and tapped with a hammer to remove scale and dust and inspected to insure that no foreign matter is lodged therein.
- 1.14 All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them.
- 1.15 Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing. If in doubt, consult Engineer.
- 1.16 Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If in doubt, consult Engineer.
- 1.17 Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.
- 1.18 Dielectric unions shall be provided at all connections of dissimilar materials.
- 1.19 Nipples shall be of the same material, composition and weight classification as pipe with which installed.
- 1.20 Apply approved pipe dope for service intended to all male threaded joints. The dope shall be listed for intended use.
- 1.21 Eccentric reducers shall be used where required to permit proper drainage and venting of pipe lines; bushings shall not be permitted.
- 1.22 Installation of pipe shall be in such a manner as to provide complete drainage of the system toward the source. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be 1/2" size ball valves with 3/4" hose thread end and vacuum breaker. Label each drain valve.
- 1.23 Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.
- 1.24 Plastic piping or any material with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief or exhaust plenums.
- 1.25 All increases in vent size at roof shall be by means of service weight cast iron increasers.
- 1.26 Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineer.
- 1.27 When running any type of pipe below a footing, perpendicular to the footing, the area underneath the footing and in the zone of influence shall be backfilled with concrete. The zone of influence is the area within a 45 degree angle projecting down from the top edge of footing on all sides of the footing.
- 1.28 When running any type of pipe below a footing, parallel to the footing, the area underneath the zone of influence shall be backfilled with 4" of crushed stone or sand bedding under the pipe. Each pipe section shall be anchored into unexcavated earth on both ends with deadman anchor system. The remainder of the trench in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45 degree angle projecting down from the top edge of the footing on all sides of the footing.
- 1.29 Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and best practice.
- 1.30 The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State in which the work is being accomplished.

- 1.31 The entire sanitary waste and vent piping system within the building shall be air-tight. If any sewer gases are present within the building, it shall be the Contractor's responsibility to locate and correct any leaks and retest as required. Any sewer odor issues that occur during the Warranty Period shall be corrected by the Contractor.

PART 2 – UNIONS, FLANGES AND WELDED TEES:

- 2.1 Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.
- 2.2 Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.
- 2.3 Tee connections for welded pipe shall be assembled with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.
- 2.4 Weld-o-let, thread-o-let and T-drill branch connections are acceptable.

PART 3 – SPECIFICATIONS STANDARDS:

- 3.1 All piping and material shall be new, made in the United States and shall conform to the following minimum applicable standards:
- Steel pipe; ASTM A-53.
 - Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.
 - Cast iron soil pipe; ASA A-40.I and CS 188-59.
 - Cast iron drainage fittings; ASA B16.12.
 - Cast iron screwed fittings; ASA B16.4.
 - Welding fittings; ASA B16.9.
 - Cast brass and wrought copper fittings; ASA B16.18.
 - Cast brass drainage fittings; ASA B16.23.

PART 4 – PIPE TESTING:

- 4.1 Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- 4.2 Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.
- 4.3 The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 lbs. per sq. inch using a mercury column gauge and shall hold for 15 minutes.
- 4.4 Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.
- 4.5 After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to an air pressure test equivalent to one inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.
- 4.6 The Contractor shall perform all additional tests that may be required by the Department of Health or other governing agency.

- 4.7 Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

PART 5 – PITCH OF PIPING:

- 5.1 All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:
- 5.2 Interior Soil, Waste and Vent Piping: ¼" per foot in direction of flow where possible but in no case less than 1/8" per foot.
- 5.3 Condensate Drain Lines From Cooling Equipment: Not less than ¼" per foot in direction of flow.
- 5.4 All Other Lines: Provide ample pitch to a low point to allow 100 percent drainage of the system.

PART 6 –PIPING APPLICATIONS:

- 6.1 Soil, Waste and Vent Piping (Below Slab)
- 6.1.1 Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing Code. PVC pipe shall not be installed where waste water applications exceed 140 deg F.
- 6.1.2 Piping below slab shall be a minimum of 2" in size.
- 6.2 Soil, Waste and Vent Piping (Above Slab): Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing Code.
- 6.3 Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab): Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).
- 6.4 Domestic Cold, Hot and Recirculating Hot Water Piping (Below Slab): Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs.
- 6.5 Water Heater Relief Line: Type "M" copper tubing with sweat fittings and 95/5 solder.
- 6.6 Refrigerant Piping: Type "L" copper tubing with forged or wrought copper fittings and silver soldered joints. Solder must have a minimum of 15% silver content.
- 6.7 Condensate Drain Lines: Schedule 40 PVC with solvent welded fittings. Do not utilize in return air plenums.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202100 - VALVES

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing valves, air vents, drain valves, check valves, special valves for special systems, etc., for all Mechanical Systems.
- 1.3 ACCEPTABLE MANUFACTURERS: Lunkenheimer, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Bell & Gossett, Apollo.
- 1.4 The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.
- 1.5 Each type of valve shall be of one manufacturer, i.e., ball valves, one manufacturer, butterfly valves, one manufacturer, check valves, one manufacturer, etc.
- 1.6 All valves shall comply with current Federal, State and Local Codes. All valves shall be new and of first quality. All valves shall be designed and rated for the service to which they are applied. Zinc, plastic, fiber or non-metallic valves shall not be acceptable.
- 1.7 Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

PART 2 – DOMESTIC WATER APPLICATIONS:

- 2.1 Gate Valve (2" and under): Use ball valves as specified.
- 2.2 Globe Valves (2" and under): Globe Valves shall have bronze body, bonnet and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 150 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.
- 2.3 Check Valve (2" and under): Check valve shall have bronze body, disc and hinge. check valve shall be Y-pattern type, horizontal swing, renewable disc and rated for 150 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.
- 2.4 Two Piece Ball Valve (2" and under): Ball valve shall have bronze body, ball and reinforced, water tight seat. Valve shall be two piece construction. Valve shall be "full-port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 180 degrees F water temperature and 150 psi working pressure. Ball valve shall be Nibco T-585 for threaded ends and Nibco S-585 for solder ends.
- 2.5 Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.
- 2.6 Pressure Reducing Valves: Watts #U5B water pressure reading valve with bronze body, bolted bonnet, integral stainless steel strainer and outlet water pressure gauge. Internal disc, diaphragm and stainless steel seat shall all be removable. Valve shall be rated for inlet water pressures up to 300 psi. Water pressure reducing valves shall be provided for all equipment where water pressure exceeds the equipment manufacturer's ratings.
- 2.7 Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.

- 2.8 Reduced Pressure Backflow Preventers: Reduced pressure backflow preventers shall be provided with inlet strainer, two (2) gate valves for isolation, three (3) test ports and air gap fitting. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. RPBP shall be UL listed and meet AWWA C511 standards. Watts #909 or equal by Wilkins or Conbraco. All valves 3" and less in size shall bronze body construction, over 3" in size shall have epoxy coated cast iron bodies. Assemblies 2" and under in size shall have threaded ends, over 2" in size shall have flange ends. Perform backflow preventer test and provide results with closeout documentation.
- 2.9 Balancing Valve: Bell & Gossett "Circuit Setter" Model CB or equal balancing valve. All valves to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts and check valves. Valve bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplates to assure specific valve settings. Valves shall be designed for positive shut-off.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202200 - INSULATION - MECHANICAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.
- 1.3 Application of insulation materials shall be performed in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use.
- 1.4 Insulation shall be installed by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineer shall be removed and properly installed at the expense of the Contractor.

PART 2 – MANUFACTURERS:

- 2.1 ACCEPTABLE MANUFACTURERS: Johns Manville, Keene Corp., Knauf, Owens-Corning, Armstrong World Industries.

PART 3 – FIRE RATINGS AND STANDARDS:

- 3.1 Insulations, jackets, facings, adhesives, mastics, tapes, fitting materials, etc. shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50 and Fuel Contributed 50.
- 3.2 All products and their packaging shall bear a label indicating above requirements are not exceeded.
- 3.3 Duct linings shall meet the Erosion Test Method in compliance with UL Publication No. 181.

PART 4 – GENERAL APPLICATION REQUIREMENTS:

- 4.1 Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.
- 4.2 Where more than one thickness of insulation is required, joints (both longitudinal and transverse) shall be staggered.
- 4.3 All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted. Coordinate work with plumbers, pipe fitters, etc. to assure hanger locations agree with location of insulation inserts.
- 4.4 "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".
- 4.5 Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced as directed by the Engineer.

- 4.6 Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!
- 4.7 All insulation shall be installed with joints butted firmly together.
- 4.8 The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.
- 4.9 Unless otherwise specified or allowed, closed cell type insulation shall not be acceptable.

PART 5 – PIPING SYSTEMS:

- 5.1 Seal insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. This applies to hot water lines only as cold water lines require continuous insulation and vapor barrier.
- 5.2 Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to insure no condensation drip or collection.
- 5.3 Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.
- 5.4 Insulation shall not extend through fire and smoke walls. Pack sleeve at fire and smoke wall with approved fire retardant packing similar to mineral wool.
- 5.5 Metal insulation shields and inserts are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 ° arc. Insulation shields shall be the following size:

Pipe Size	Shield Gauge	Shield Length
2" and less	20	12"
- 5.6 Insulated pipes 2" in diameter and larger shall be additionally supported with wood inserts of sufficient compressive strength to carry the weight of the pipe and fluid. Inserts shall extend beyond extend beyond the hanger and shall be at least 6" in length.
- 5.7 Provide premolded PVC insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. Fittings shall be insulated by applying the proper factory precut insulation insert to the pipe fitting. The ends of the insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The proper thickness of insulation must be applied to keep the jacket temperature less than 150°F. An approved vapor retarder mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover shall then be applied and secured with pressure sensitive tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. On fittings where the operating temperature is below 50°F, two or more layers of the insulation inserts shall be applied with the first layer being secured with a few wrappings of fiber glass yarn to eliminate voids. One additional insert shall be used for each additional 1" of pipe insulation above 1-1/2". All joints shall be fully sealed.

- 5.8 PIPE INSULATION MATERIAL: Insulation shall be Owens-Corning model 25ASJ/SSL or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor not exceeding 0.27 Btu per inch/h.ft² °F at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of 0.02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturer's recommendations. The following pipes shall be insulated with the thickness of insulation as noted.
- 5.8.1 Domestic Cold Water: 1" thick insulation
5.8.2 Domestic Hot Water Lines: 1" thick insulation
5.8.3 Domestic Recirc. Lines: 1" thick insulation
- 5.8.4 Condensate Drain Lines - 1/2" thick
- 5.8.5 Refrigerant Lines:
5.8.5.1 Piping 1-1/2" and less: 1" thick insulation
5.8.5.2 Piping 2" and greater: 1 1/2" thick insulation
5.8.5.3 All exterior piping: 1 1/2" thick with jacketing

PART 6 – DUCTWORK SYSTEMS:

- 6.1 Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.
- 6.2 Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection.
- 6.3 EXTERNAL INSULATION FOR SUPPLY & RETURN AIR DUCTWORK: Owens/Corning, All Service Fiberglass Duct Wrap, "Faced Duct Wrap - Type 75" or approved equivalent, 2" thick fiberglass duct wrap, factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. The installed R value shall be a minimum of 5.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch.
- 6.4 EXPOSED EXTERNAL INSULATION SUPPLY, RETURN AND OUTSIDE AIR DUCTWORK and PLENUMS: Owens/Corning or approved equivalent industrial insulation type 705. 1 1/2" rigid fiberglass industrial board with foil scrim kraft vapor barrier facing, 6.0 PCF density, K=0.23 Btu in/hr.ft² °F @ 75°F. . Use semi-rigid Type 703/704 insulation for round ducts. The installed R-value shall be a minimum of 5.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch. Provide 6oz. canvas jacket with fire retardant lagging and provide a metal corner bead at all duct corners (on the exterior of the insulation) for protection. The corner bead shall be taped in place with foil scrim tape.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202400 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

PART 2 – TAGS AND CHARTS:

- 2.1 Provide and install on each valve 1" in size or greater for all mechanical systems a 1.5" diameter circular bronze or baked phenolic tag fitted to each valve so that it cannot be removed. Each tag shall be embossed consecutively with sequential number identifiers. Number identifiers shall be determined by the Contractor sequentially.
- 2.2 Provide typewritten valve charts indicating each valve identifier, the valves service, normal position and its location. Also furnish one electronic copy on CD in "*.xls" format. One (1) copy of this chart shall be mounted in suitable frame(s) with clear plastic covers in a conspicuous location in each of the major mechanical rooms. Repeat only main valves which are to be operated in conjunction with operations of more than single mechanical room.
- 2.3 All emergency shutoff valves shall be identified with a permanent engraved tag hung from the valve with 1-inch high lettering. Emergency shutoff valves shall be identified as any valve whose closure could create an emergency condition in the facility (i.e. natural gas, water, domestic hot water, main HVAC valves, etc.).
- 2.4 Label all control panels and disconnect switches with service and equipment served.

PART 3 – PIPING IDENTIFICATION:

- 3.1 All piping installed shall be identified according to the chart hereinafter specified. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this contract. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. Piping shall be identified on twelve (12) foot centers. All piping shall be minimally identified once above all room ceilings and where it passes thru walls or floors. At the Contractor's option, Setmark or equivalent manufactured marking system may be substituted for field marking.

- 3.2 The following table describes the size of the color field and size of the identification letters which shall be used for pipes of different outside pipe diameters.

<u>Outside Diameter</u>	<u>Label Length</u>	<u>Letter Size</u>
3/4" – 1 1/4"	8"	1/2"
1 1/2" – 2"	8"	3/4"
2 1/2" – 6"	12"	1 1/4"

- 3.3 The following chart describes the pipe service and label identification which shall be used for various pipes.

<u>PIPE</u>	<u>ABBREVIATION</u>
Domestic Cold Water	D.C.W.
Domestic Hot Water	D.H.W.
Recirculated Hot Water	R.H.W.
Refrigerant Piping	RL/RS

PART 4 – EQUIPMENT IDENTIFICATION:

- 4.1 Unless otherwise specified, all equipment shall be identified. The titles shall be short and concise and abbreviations may be used as long as the meaning is clear. In finished rooms and mechanical rooms, equipment shall be identified neatly and conspicuously with engraved black lamacoid plates (or equivalent) with 1" high white letters on the front of each piece of equipment.
- 4.2 All mechanical equipment shall have the electrical panel number and circuit number identified on the lamacoid plate. Coordinate with the Electrical Contractor.

PART 5 – DUCTWORK IDENTIFICATION:

- 5.1 All ductwork shall be identified as to the service of the duct and direction of flow. Include equipment designator on SA & RA ductwork. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts also need to be identified.
- 5.2

<u>DUCTWORK</u>	<u>ABBREVIATION</u>
Supply Air Ductwork	SA + Equipment Identifier
Return Air Ductwork	RA + Equipment Identifier
Outside Air Ductwork	OA + Equipment Identifier
Exhaust Air Ductwork	EA + Equipment Identifier

PART 6 – ACCESS THROUGH LAY-IN CEILINGS:

- 6.1 Mark each lay-in ceiling panel which is nearest access to equipment, valves, dampers, filters, duct heaters, etc., with colored tape labels located on the ceiling grid.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Each Contractor's attention is also directed to Specification Section PIPE, PIPE FITTINGS AND SUPPORT.
- 1.3 This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.
- 1.4 Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

PART 2 – MATERIALS AND EQUIPMENT:

- 2.1 Hangers, Clamps, Attachments Schedule:
 - ACCEPTABLE MANUFACTURERS: Grinnell, Elcen, Fee & Mason.
 - All hangers, clamps and attachments shall be manufactured products.
 - Pipe Rings (2" pipe and smaller) – adjustable swivel split ring or split pipe ring.
 - Pipe Clevis (2.5" pipe and larger) – adjustable wrought clevis type.
 - Pipe Clevis (All pipe sizes) – steel clevis for insulated pipe.
 - Riser Clamps (All pipe sizes) – extension pipe or riser clamp.
 - Beam Clamps (All pipe sizes) – malleable beam clamp with extension piece.
 - Brackets (All pipe sizes) – medium weight steel brackets.
 - Concrete Inserts (All pipe sizes) – wrought or wedge type inserts.
 - Concrete Fasteners (All pipe sizes) – self-drilling concrete inserts.
 - Rod Attachments (All pipe sizes) – extension piece, rod coupling, forged steel turnbuckle
 - U-bolts (All pipe sizes) – standard u-bolt.
 - Welded Pipe Saddles (All pipe sizes) – pipe covering protection saddle sized for thickness of insulation.
 - Pipe Roll (All pipe sizes) – adjustable swivel pipe roll.
 - Protection Saddle (All pipe sizes) – 180 degree coverage, sheet metal pipe protection saddle.
 - Hanger Rods (All pipe sizes) – Steel, diameter of hanger threading.
 - Concrete Channel Inserts (All pipe sizes) – continuous heavy duty slot inserts unistrut.
 - Adjustable Spot Inserts (All pipe sizes) – continuous heavy duty spot insert unistrut.
 - Miscellaneous steel such as steel angles, rods, bars, channels, etc used in framing for supports, fabricated brackets, anchors, etc. shall conform to ASTM-A-7.

PART 3 – INSTALLATION:

- 3.1 Unless otherwise specified, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be performed by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs.
- 3.2 Supporting and hanging shall be done so that excessive load will not be placed on any one hanger so as to allow for proper pitch and expansion of piping.
- 3.3 Hangers and supports shall be placed as near as possible to joints, turns and branches.
- 3.4 For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer.

- 3.5 Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. Do not support piping from bridging or metal decking.
- 3.6 When piping is routed in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger. Do not support piping or ductwork from bridging angles.
- 3.7 Trapeze hangers are not allowed, unless specifically approved by the Engineer.
- 3.8 Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.
- 3.9 Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.
- 3.10 Where piping, etc., is routed vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.
- 3.11 Where piping is routed along walls, knee braced angle frames, etc. pipe brackets with saddles, clamps, and rollers mounted on structural brackets fastened to walls or columns shall be used.
- 3.12 Support all ceiling hung equipment with approved vibration isolators.
- 3.13 Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.
- 3.14 Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.
- 3.15 All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.
- 3.16 Under no conditions will perforated band iron or steel wire driven hangers be permitted.
- 3.17 Support steel and copper piping at a minimum of eight (8) foot intervals for piping 3" and smaller and ten (10) foot intervals for larger piping. Provide additional support at end of the branches and change of direction.
- 3.18 Support plastic pipe at intervals not to exceed four (4) feet and at the end of the branches and at the change of direction and shall be installed as to permit freedom of movement. Vertical piping shall be supported at their bases and all upward movement shall not be restricted. Hangers shall be at least one (1) inch wide and shall not compress, distort, cut or abrade the piping to allow free movement at all times.
- 3.19 Where fireproofing is dislodged/damaged from the building structure due to Contractor's installation of hangers, clamps, etc., it shall be the Contractor's responsibility to repair all dislodged/damaged fireproofing to original fireproofing rating. This shall also include all work performed by their contractors sub-contractors.
- 3.20 Insure that all bolts and nuts are tightened.

END OF SECTION.

DIVISION 20 - MECHANICAL

SECTION 203100 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Engineer, or authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these Specifications or required by others.
- 1.3 Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow the work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

PART 2 - HEATING, VENTILATING AND AIR CONDITIONING TESTING:

- 2.1 The test and balance of this system shall be by a Contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The Test and Balance contractor shall report all deficiencies to the Engineer.
- 2.2 The test and balance contractor shall bid directly to the Mechanical Contractor.
- 2.3 Mechanical Contractor shall provide all start-up documents to Test and Balance Contractor prior to any test and balance services.
- 2.4 The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test of not less than one hundred pounds and shall be proven tight after a twenty-four (24) hour test.
- 2.5 All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated.
- 2.6 System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.
- 2.7 All fan belts shall be adjusted for proper operation of fans.
- 2.8 Testing shall occur after completion of the ceiling systems installation.
- 2.9 All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.
- 2.10 Refer to Specification Section – GENERAL PROVISIONS – MECHANICAL for startup requirements.
- 2.11 Provide a preliminary test report to the Engineer immediately after the system is air balanced, or any initial phases are balanced. This report may be hand written. Any systems that are not found to operate within the design tolerances by the Test and Balance Contractor shall be immediately be reported to the Engineer via telephone call to attempt to determine a resolution while the Test and Balance Contractor is still on site. Additional compensation will not be accepted for additional trips.
- 2.12 Anticipate visiting the site again after the Engineer has reviewed the report. The Engineer may request up to two (2) additional site visits for onsite troubleshooting where additional measurements may be required.

- 2.13 For the purpose of placing the Heating, Ventilating and Air Conditioning systems in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council.
- 2.14 The following systems shall be tested and balanced:
- AC Unit total air flow and discharge and inlet pressures, including filters. Measure outside air flow at each unit and balance to given values.
 - Energy Recovery Unit air flow and discharge and inlet pressures, including filters
 - Balance all supply, return and exhaust air grilles to within 10% of design air flow rate.
- 2.15 Balance the water flow rate of each domestic hot water recirculating pump. Set the flow rate for each balancing valve in the recirculating hot water system. If flow rates are not indicated, contact the engineer for each balance valve GPM.
- 2.16 Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.
- 2.17 Test and Balance agency shall provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor shall purchase and install all sheaves and belts as required. This includes new and existing equipment.
- 2.18 Three (3) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.
- 2.19 The Contractor shall provide and coordinate work to provide sufficient time before final completion date so that tests and balancing can be accomplished and provide immediate labor and tools to make corrections when required without undue delay.
- 2.20 The Contractor shall put all heating, ventilating and air conditioning systems and equipment and rangehood system into full operation and shall continue the operation of same during each working day of testing and balancing.
- 2.21 The Test and Balance Contractor shall be present during the Engineer's final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

END OF SECTION.

DIVISION 22 – PLUMBING

SECTION 220100 - PLUMBING SPECIALTIES

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall provide all equipment and specialties complete with trim required and connect in a manner conforming to the State Plumbing Code.
- 1.3 The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of the rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.
- 1.4 All equipment and specialties shall be new. All equipment and specialties shall be installed as recommended by the manufacturer.
- 1.5 Prior to final inspection, test by operation at least twice, all equipment. Also, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from equipment and specialties and thoroughly clean same.
- 1.6 All equipment and specialties shall be installed in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost.
- 1.7 Provide all drainage specialties indicated, specified and/or required to provide complete and acceptable removal of all storm, sanitary, waste, laboratory waste, etc. from the building and into approved receptors. Drainage specialties shall be on non-electrolytic conduction to the material to which they are connected. Drainage specialties shall be installed in a manner so as to insure no leakage of toxic or odorous gases or liquids and shall have traps and/or backflow preventers where required. Nor shall they allow backflow into other or existing systems.

PART 2 - CLEANOUTS:

- 2.1 Cleanouts: In addition to cleanouts indicated on the drawings, provide cleanouts in soil and waste piping and storm drainage at the following minimum locations:
 - At base of each stack.
 - At fifty (50) foot maximum intervals in horizontal lines.
 - At each change of direction of a horizontal line.
 - As required to permit rodding of entire system.
 - As required by current State Plumbing/Building Codes.
- 2.2 Water closets, mop sinks/basins and other fixtures with fixed traps shall not be accepted as cleanouts.
- 2.3 Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.
- 2.4 Access panels for cleanouts shall be of the Zurn 1460 series or equivalent by Josam or Wade. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes.
- 2.5 Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.
- 2.6 Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.

- 2.7 Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction.
- 2.8 In finished walls, floors, etc., insure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.
- 2.9 Exterior Cleanouts (ECO): Provide exterior cleanouts where indicated for all sanitary and storm lines leaving the building within 5'-0" of building perimeter. Permanently locate all exterior cleanouts with 12"x12"x12" solid finished concrete marker slightly above grade in grass areas or flush in concrete or pavement areas. Label "CO". Zurn Z-1400-HD cleanout with tractor cover for exterior locations. Provide concrete supporting pad crowned to shed water.
- 2.10 Cleanouts shall be as manufactured by Zurn, Josam, Wade, Ancon, Jay R. Smith, similar to the following:
- Zurn Z-1440 or Z-1445 cleanout tee at base of exposed stack and at change in direction of exposed lines.
 - Zurn Z-1440 cleanout or Z-1445-1 cleanout tee where stacks are concealed in finished walls.
 - Zurn ZN-1400-T cleanout with scoriated top in finished concrete and masonry tile floors.
 - Zurn ZN-1400-Tx cleanout with square recessed top for VCT and linoleum finished floors.
 - Zurn ZN-1400-Z cleanout with round recessed top for poured floors.
 - Mueller D-731 or D-714, Nibco, Flage or equivalent for cleanouts in copper waste with cover plates and/or access panels listed for other cleanouts.
 - Threaded hex head type cleanouts of same materials as pipe for piping 2" and smaller.
 - Zurn cleanout with round top with adjustable retainer for carpet area. Install flush with carpet.

PART 3 – FLOOR DRAINS:

- 3.1 Floor Drains: Provide floor drains at locations indicated and/or as required by State Plumbing/Building Codes. Install in a neat and workmanlike manner. Install floor drains in strict accordance with manufacturer's recommendations and the State Plumbing and Building Codes. Coordinate locations with General Contractor to insure floor pitch to drain where required.
- 3.2 Insure by coordination with the General Contractor that spaces served with floor drains on all floors above the lowest level have a water seal extending at least three (3) inches from the floor. Also, for these locations, provide a 36"x36", four (4) pound sheet lead flashing sheet and clamping collar or a 30 mil chlorinated polyethylene shower pan liner. Lead pans shall be given a heavy coat of asphaltum on bottom and sides before installation and a heavy coat on any exposed surfaces. After installation, provide one ply of fifteen (15) pound roofing felt beneath each pan.
- 3.3 The floor drains shall be Zurn, Josam, Smith, Wade, Watts Drainage, Ancon, similar to the following:
- FD-1 - Zurn, ZN-511 floor drain with 9"dia. nickel bronze strainer, dura-coated cast iron deep sump with 4" bottom outlet, seepage pan and sediment bucket. Provide with Sure Seal Model SS preassembled Inline Floor Drain Trap Sealer. 2", 3", or 4" as scheduled. Commercial grade ABS plastic housing and neoprene rubber diaphragm with 1 soft rubber sealing gaskets. Floor rating ASSE – 1072 AF-GW.
 - FD-2 - Zurn, ZN-415 floor drain with 6"dia. nickel bronze strainer, Type "B", dura-coated cast iron body with bottom 3" outlet.

PART 4 – FREEZEPROOF WALL HYDRANTS:

- 4.1 Freezeproof Wall Hydrants: Provide code approved wall hydrants at each location indicated in a neat and workmanlike manner. Affix tight to walls and insure that the feed piping is on the heated side of the building insulation blanket. Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in accordance with the manufacturer's recommendations and the Building Code. Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.

- 4.2 Wall hydrants shall be Zurn 1320 or equivalent, 3/4", with half-turn ceramic cartridge, encased, flush, non-freeze, anti-siphon, automatic draining wall hydrant with key lock and combination backflow preventer/vacuum breaker.
- 4.3 Mount all wall hydrants at least twenty (20) inches above finished exterior grade. Where this is not possible or practical, contact Engineer for direction.
- 4.4 Turn over for each hydrant, an operator key in an envelope labeled "Exterior Wall Hydrants" to Owner upon completion of the project. Where hydrants have lockable boxes, turn over an operator key for each in an envelope labeled "Exterior Wall Hydrant Locks" to Owner upon completion of project.

PART 5 – INTERIOR HOSE BIBBS AND DRAIN VALVES:

- 5.1 Hose Bibbs and Drain Valves: Provide code approved hose bibbs and drain valves at each location indicated in a neat and workmanlike manner. Affix hose bibbs tight to walls. Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in accordance with the manufacturer's recommendations and the Building Code. Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.
- 5.2 Hose Bibbs (HB): Provide code approved hose bibbs with vacuum breakers and male threaded spouts at each location indicated (toilet rooms, mechanical rooms, etc.). The hose bibbs shall be Woodford Model 24 (or equal) with loose key handle polished chrome finish, brass construction. Hose bibbs shall be mounted at eighteen (18) inches above finished floor. Do not install hose bibbs in spaces which do not have floor drains. Do not install hose bibbs in ADA accessible toilet stalls.
- 5.3 Drain Valves: Install 3/4 inch bronze body drains, similar and equivalent to Nibco, No. 72 or 73, as indicated and at the following locations:
 - At the low point and isolatable section of the plumbing system.
 - At each low point and isolatable section of the hydronic system.
 - At each isolatable pipe section.
 - At each water heater.
 - At each storage tank.
 - At each boiler.
 - At each heat pump.
 - At each water-to-water unit.
 - At each chiller.
 - At each pump suction.
 - Install a code approved vacuum breaker where installation on to domestic water system.

PART 6 – WATER HAMMER ARRESTORS (WHA):

- 6.1 Water Hammer Arrestors (WHA): Provide water hammer arrestors at each location indicated and/or as required to eliminate hydrostatic on the domestic water system. Install in an accessible location and in a neat and workmanlike manner. Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in accordance with the manufacturer's recommendations and the Building Code. Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.
- 6.2 Water hammer arrestors shall be Zurn, Z-1700, Shoktrol, Smith, Josam, Wade or equivalent. Water hammer arrestors shall be stainless steel, bellows type. Field fabricated capped cylinders shall not be acceptable. Provide insulating unions where arrestors are of dissimilar material from the piping served (unless piping is non-conducting, such as ABS or PVC).
- 6.3 Multiple Fixtures – Branch Line Less Than 20' Long: The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures served when the branch lines do not exceed 20' in length, from the start of the horizontal branch line to the last fixture supply on this line.
- 6.4 Multiple Fixtures – Branch Line More Than 20' Long: On branch lines over 20' in length, use two Shoktrols whose capacities total the requirement of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

- 6.5 Provide at least one water hammer arrestor at all quick acting valve locations including:
- Clothes Washers – Type “A”
 - Sterilizers – Type “B”
 - Mop Basins, downstream of check valves – Type “A”
 - Flush valve fixtures – Type “B”, each toilet room with 1-3 flush valve fixtures shall have its own Type “B” water hammer arrestor.

6.6 Arrestor Schedule:

<u>Mark</u>	<u>Zurn Model</u>	<u>Fixture</u>	<u>P.D.I.</u>
	<u>Z-1700</u>	<u>Units</u>	<u>Size</u>
Type “A”	#100	1-11	A
Type “B”	#200	12-32	B
Type “C”	#300	33-60	C
Type “D”	#400	61-113	D

PART 7 - GENERAL SPECIALTIES:

- 7.1 Vacuum Breakers and Back Flow Preventers: Where required by the Building Code, whether indicated or not, provide approved vacuum breakers or backflow preventers at the following locations.
- Where domestic water system connects to a limited area fire protection system.
 - Where domestic water system connects to hydronic system.
 - At any threaded hose tap on the domestic water system.
 - At all mop basins, provide check valves to the hot and cold water supply upstream of the faucet.
- 7.2 Roof Flashings: All plumbing vents or other plumbing passing thru the roof shall be flashed as approved by the State Plumbing and Building Codes and as recommended by the roofing manufacturer and/or Contractor.

END OF SECTION.

DIVISION 22 - PLUMBING

SECTION 220200 - PLUMBING FIXTURES, FITTINGS AND TRIM

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 The Contractor shall provide all fixtures complete with trim required and connect in a manner conforming to the State Plumbing Code.
- 1.3 The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of the rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.
- 1.4 All fixtures and trim shall be new. All fixtures and trim shall be installed as recommended by the manufacturer. All fixtures shall be set level and true and shall be grouted into finished walls, floors, etc. in a neat and workmanlike manner with an approved waterproof non-yellowing grout for such service. All fixtures and trim shall be installed in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost. Pay particular attention to flush valves and bracket concealed portion to building structure during rough-in. Loose, shaky flush valves, lavatories, etc. shall not be acceptable.
- 1.5 Handicapped accessible fixtures shall be mounted as recommended by the Building Code and ADA. Special Note for Handicap Grab Rails: Coordinate top of shower valves, flush valves, flush tank, etc., with location of grab rails as shown on the architectural plans. The Contractor shall install all items to allow for installation, removal and service without removal of the grab bar.
- 1.6 Fixture seats shall be Church model 2155CTJ, elongated open front less cover w/ JUST-LIFT, STA-TITE check hinge and DuraGuard Antimicrobial Agent, or approved equal.
- 1.7 All exposed piping, stops, traps, tailpieces, etc. shall be code approved chrome plated brass unless otherwise indicated or specified. Where acid resistant piping is indicated on the drawing or the specifications, all piping and ancillary components from the sink/lavatory to dilution basin shall be acid resistant as specified and required by code.
- 1.8 Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws. In general, furnish drinking fountains, wall-hung lavatories and hose bibbs with manual loose key stop valves. For all other fixtures, furnish with manual permanent-key stop valves (i.e. sinks in casework, etc.). When in doubt, contact Engineer prior to installation.
- 1.9 Coordinate all stainless steel sinks with architectural casework shop drawings for appropriate fit. Do not order sinks until this has been coordinated. Change Orders will be immediately rejected for lack of coordination during construction.
- 1.10 Test for appropriate operation at least twice, ALL fixtures and trim including hands-free trim. Open all faucets and allow to run for fifteen (15) minutes, then remove all faucet aerators and thoroughly clean until smooth flow is obtained. Test by operation at least twice, adequate flow of water at flush valves including appropriate adjustment of hands-free devices, faucets including appropriate adjustment of hands-free devices, hose bibbs, fixture drains, shower heads, etc.
- 1.11 Remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from plumbing fixtures and thoroughly clean same.

PART 2 – PLUMBING FIXTURE SPECIFICATIONS:

- P-1 Water Closet – Flush Valve, Floor Mounted – ADA Height
Zurn model Z5655-BWL, vitreous china, 18" high, siphon jet, 1-1/2" top spud, elongated bowl, china bolt caps and white open front plastic seat with check hinge. Install flush valve on "open" side of water closet. Water closet flush valve shall be Manual ADA flush valve shall be Zurn model Z6000-WS1. Top of flush valve handle shall be a maximum of 31-1/4" A.F.F.
- P-2 Lavatory – Wall-hung, Backsplash
Zurn model Z5344, 20"x18" vitreous china lavatory with backsplash, rectangular basin, splash lip, front overflow, and 4" center faucet holes. Provide with concealed arm support and wall carrier. Provide lavatory drain with integral perforated strainer, 3/8" angle rigid supplies with stops and P-trap. Lavatory trim shall be as single handle faucet shall be Zurn model Z81000-3M with polished chrome-plated cast brass faucet body on 4" centers with single lever control. Furnish with 0.5 GPM vandal-resistant aerator.
- P-2A Lavatory – Countertop, Drop-in – ADA Compliant
Zurn model Z5114 20"x17" vitreous china lavatory with oval basin, front overflow and 4" center faucet holes. Provide lavatory drain with integral perforated strainer, 3/8" angle rigid supplies with stops and P-trap. Install insulation on the supply lines and P-trap similar to Brocar "Trap Wrap" vinyl plastic covering per ADA Standards. Mounting height to be per ADA. Lavatory trim shall be single handle faucet shall be Zurn model Z81000-3M with polished chrome-plated cast brass faucet body on 4" centers with single lever control. Furnish with 0.5 GPM vandal-resistant aerator.
- P-3 Single Compartment Sink – 19"x18"
Elkay LR-1918, single compartment stainless steel sink, 19" x 18" O.D., 18 gauge with 3-hole, 8" center faucet punching. Provide with grid strainer, 3/8" chrome supplies stops, tailpiece, P-trap, drain and escutcheons. Sink trim shall be as follows:
 - Single handle faucet shall be Zurn model Z81000-3M with polished chrome-plated cast brass faucet body on 4" centers with single lever control. Furnish with 0.5 GPM vandal-resistant aerator.
 - Plaster trap shall be Zurn Z-1184, Bottom Access solids interceptor.
- P-3A Double Compartment Sink – 33"x22"
Elkay LR-3322, compartment stainless steel sink, 33" x 22", each bowl, 18 gauge with 3-hole, 8" center faucet punching. Provide with grid strainer, chrome supply stops, tailpiece, 17 gauge P-trap, drain and escutcheons. Sink trim shall be as follows:
 - Single handle faucet to be Chicago Faucet 2300-8CP 10" cast brass spout, ceramic mixing cartridge, integral water hammer preventer, chrome finish. Provide with hose spray.
- P-4 Mop Basin
Fiat MSB-24 24, 24" x 24" 10" high molded stone mop service basin in #231 white drift color and #874, 3" drain, Provide Chicago Faucet model 897-CP faucet, #832-AA hose and hose bracket, #889-CC mop hanger and #E-77-AA vinyl bumperguard. Provide with MSG stainless steel wall guards. Provide check valves on the hot and cold water supplies to the faucet.

END OF SECTION.

DIVISION 23 - HVAC

SECTION 231200 - SHEET METAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's Duct Manual and Sheet Metal Construction for Low Velocity Ventilating and Air Conditioning Systems. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.
- 1.3 Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not "dried-in". If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.
- 1.4 Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new and existing conditions. Notify the Engineer if there are any discrepancies for resolution.
- 1.5 For healthcare projects, provide a SMACNA duct cleanliness level "C" per the latest SMACNA standards.

PART 2 – LOW VELOCITY DUCTWORK:

- 2.1 Ductwork, plenums and other appurtenances shall be constructed of one of the following: Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating. Aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14. Utilize Aluminum in MRI Scan Rooms.
- 2.2 Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2" W.G. Standard or below table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum.

<u>Round Diameter</u>	<u>Duct Gauge</u>	<u>Rectangular Width</u>	<u>Duct Gauge</u>
3-12 Inches	26 Ga.	3-12 inches	26 Ga.
12-18 Inches	24 Ga.	13-30 inches	24 Ga.
19-28 Inches	22 Ga.	31-54 inches	22 Ga.
29-36 Inches	20 Ga.	55-84 inches	20 Ga.
37-52 Inches	18 Ga.	85 inches and up	18 Ga.

- 2.3 All ductwork connections, fittings, joints, etc., shall be sealed. Seal with high velocity, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15"wg. Apply per manufacturer's recommendations. Contractors shall insure no exposed sharp edges or burrs on ductwork.
- 2.4 Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.
- 2.5 All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.

- 2.6 Cross-break all ducts where either cross sectional dimension is 18" or larger.
- 2.7 Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from purlins or other weak structural members where no additional weight may be applied. If in doubt, consult the Structural Engineer.
- 2.8 Double turning vanes shall be installed in square turns and/or where indicated.
- 2.9 Provide a "high efficiency" type take-off with round damper (Flexmaster STOD-B03 or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements.
- 2.10 Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.
- 2.11 Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc. Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.
- 2.12 The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.
- 2.13 Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.
- 2.14 All fans and other vibrating equipment shall be suspended by independent vibration isolators.
- 2.15 Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.
- 2.16 Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.
- 2.17 The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.
- 2.18 Insulated Flexible Air Duct: Thermaflex G-KM or equal. Flexible air duct shall be one (1) inch thick fiberglass insulation with CPE liner permanently bonded to a coated spring steel wire helix supporting a fiberglass scrim and fiberglass insulating blanket. Flexible air duct shall be listed under UL Standard 181 as a Class I flexible air duct complying with NFPA 90A and 90B. Maximum flame spread = 25 and maximum smoke developed = 50. Minimum insulating value is R-6.0. Flexible duct shall be used only for GRD runouts and no section shall be more than five feet in length.
- 2.19 Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.

- 2.20 Turning Vanes: Fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.
- 2.21 Access Doors in Ductwork: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 2" thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils and downstream side of VAV boxes and CAV boxes.
- 2.22 Architectural Access Doors in Ceilings or Walls: Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 16 gauge galvanized steel for door and frame. Provide with primer finish to accept specified finish. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- 2.23 Volume Dampers (Rectangular): Ruskin MD35 or Air Balance, Pottorff, rectangular volume dampers. Frames shall be 18 gauge galvanized steel. Blades shall be opposed blade 18 gauge galvanized steel with triple crimped blades on 6" centers. Linkage shall be concealed in jamb. Bearings shall be 1/2" nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point. Security Architectural Access Doors in Ceilings or Walls: Provide Kees SSAP Panel, Cesco, Milcor or equal. Panels shall be 24"x24" in size and constructed with 12 gauge steel for door and frame. Provide with primer finish to accept specified finish. Door shall include key-operated cylinder dead bolt lock (coordinate cylinders and keys with Owner to match facility standards) and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer's standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to insure a complete project.
- 2.24 Volume Dampers (Round): Ruskin MDR525 or Air Balance, Pottorff round volume dampers. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 22 gauge steel and 5" long. Damper blades shall be 20 gauge crimped galvanized steel. Axle shall be 3/8"x5" square plated steel. Bearing shall be 3/8" nylon. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.
- 2.25 Fire Dampers: Fire dampers shall be Ruskin 1BD2 1 1/2 hour rating U-215B vertical 1 1/2 hour rating or United Air Type U-255B for a 3 hour vertical rating. Other acceptable manufacturers are Air Balance, Pottorff or Greenheck. Fire dampers shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1 1/2 or 3 hour fire protection rating as required by fire wall. Damper shall have a 165 degrees F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing minimum 20 gauge steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Blade and frame thickness shall be a minimum of 24 gauge. Installation shall be in accordance with the damper manufacturer's instructions. The blades shall be out of the air stream. Provide an access door for fire damper reset at all fire damper locations. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

END OF SECTION.

DIVISION 25 – BUILDING AUTOMATION SYSTEM

SECTION 250400 - CONTROL - DIRECT DIGITAL

PART 1 – GENERAL:

- 1.1 The Contractor's attention is directed to all other Contract Documents as they may apply to his work.
- 1.2 The Contractor shall provide and install all software required so that the Engineer can remotely monitor the DDC system for a minimum of one year from the Engineer's Indiana Office. The Contractor shall configure the software and make this remote access fully functional. The Contractor shall provide on-site training to Engineer at time of software installation in Indiana.
- 1.3 All controllers, control interface hardware, associated software, services, installation, warranty, training, etc., shall be included as hereinafter specified.
- 1.4 Acceptable Manufacturer: Johnson Controls (Eric Nesbitt – eric.r.nesbitt@jci.com)

PART 2 – CONTROL CONTRACTOR/MANUFACTURER QUALIFICATIONS:

- 2.1 The Control Contractor shall have an established working relationship with the control manufacturer of not less than five years and shall have prior approval from the Engineer and are the only allowed suppliers and/or installing contractors.

PART 3 – QUALITY CONTROL – CODES AND STANDARDS:

- 3.1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids for the following codes:
 - 3.1.1 National Electric Code (NEC)
 - 3.1.2 International Building Code (IBC)
 - 3.1.3 Underwriters Laboratories (UL)
 - 3.1.4 ANSI/ASHRAE 135-1995 (BACnet™)
 - 3.1.5 National Electric Manufacturers' Association (NEMA)
 - 3.1.6 National Fire Prevention Association (NFPA)
 - 3.1.7 American Society Of Heating, Refrigeration, And Air Conditioning Engineers (ASHRAE)
 - 3.1.8 Instrument Society Of America (ISA)
 - 3.1.9 National Institute of Standards and Technology (NIST).
- 3.2 Meet all of the local authorities and State Fire Marshal code requirements for normal operating and smoke mode functions.

PART 4 – SUBMITTALS:

- 4.1 Shop drawings and submittals: The Contractor shall not start the project until the Shop Drawings have been submitted and approved.
 - 4.1.1 All submittals shall be provided in electronic files. (Visio 2000 or AutoCAD v. 14 or higher versions).
 - 4.1.2 All drawings shall be labeled TC (temperature control) rather than being referenced within the mechanical or electrical divisions. Sheets shall be consecutively numbered.
 - 4.1.3 Floor plans depicting DDC control devices (control units, network devices, LAN interface devices, and power transformers as well as static pressure sensor in duct and temperature sensors in rooms) in relation to mechanical rooms, HVAC equipment, and building footprint.

PART 5 – PRODUCTS:

- 5.1 Wiring, Cable Trays, Conduit and Hangers
- 5.1.1 To supply, install and connect all conduits, boxes and wires between all the different components related in this section including all line voltage to the sensors, actuators, and other control devices.
- 5.1.2 Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.
- 5.1.3 Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided by the construction plans for the building.
- 5.1.4 All wiring and fiber optic cable in mechanical and electrical rooms shall be in conduit or a cable tray/bridal ring system. No wiring or conduit can be exposed to view in any other area. Conceal all wiring in wall from thermostats. Route wiring directly to cable tray from control points above the ceiling. All wiring shall be continuous runs whenever possible. Any junctions must be made in metal enclosure.
- 5.2 Unit Control Panels (installation and fabrication)
- 5.2.1 All panels must be NEMA type 1 enclosures, with a hinged door.
- 5.2.2 Provide flush mounted key lock. All temperature control panels are to be keyed the same. All control panels must be painted the same color and identified. Primered panels will not be acceptable. The boxes are to be made from 16-gauge material.
- 5.2.3 Grounding terminals shall be color coded green and yellow and shall be compatible with the other specialty terminals specified above and shall mount on the same DIN rail system. Units shall be arranged so that the wiring connected to them is grounded to the enclosure via the mounting rail. These terminals shall be provided for grounding cable shields at the points where the cables enter a control panel and terminate on the control panel terminal strip. Terminals shall be Entrelec M 4/5.3A.PI or equivalent by Weidmuller, Phoenix, or Allen Bradley.
- 5.2.4 Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 15 A at any panel location containing electronic control components. This receptacle may be served from the control panel 120 VAC power source. Label on receptacles shall read "Use for laptop only." The TCC shall route the power from the nearest acceptable panel and circuit. Coordinate with the electrical contractor.
- 5.2.5 All panels, switches and indications are to be labeled with lamacoid plates.

PART 6 – MATERIALS, COMPONENTS, AND EQUIPMENT:

- 6.1 SENSOR RESOLUTION: All temperature sensors shall have a minimum resolution of 1/10th of 1 degree F. (0.1 degree F.) Sensors stability shall be .24 degrees over a year period. Space sensors must be tested and accurate to within .75 degrees F. Outside air, water and duct sensors must be tested and accurate to within 2.0 degrees F.
- 6.2 SPACE SENSORS: All thermostat/sensors must be provided with temperature indication. (Except as noted below) Programmed set-point shall be locally adjustable limited to 2 degrees above set-point and 2 degrees below set-point (in one degree increments) for supervised areas. Unsupervised areas shall have non-adjustable set point.
- 6.3 Thermostat shall be installed 48" (to top of thermostat) above the finished floor unless otherwise noted.
- 6.4 All "thermostats" shall be provided override capabilities for the corresponding zone. The unoccupied override period shall be programmed to allow (4) hours of occupied run time.
- 6.5 OUTDOOR AIR SENSOR: The outdoor air sensor will be installed on the north wall in the shade as not to be effected by sunlight, building ventilation or weather. If not installed to provide "accurate" temperature it must be relocated (at the temperature control contractors expense) until such a location is found. This location must be indicated on the control drawings. There will be no exceptions to this unless approved by the consulting engineer.

- 6.6 MIXED AIR SENSORS: These sensors must be bendable averaging, type made of copper or aluminum elements. For Air Handling Units the sensors must be at least 20 feet in length.
- 6.7 DISCHARGE AIR SENSORS: May be rigid insertion type. In all applications care must be taken to insure that the sensors are securely mounted as not to allow any vibration and installed in such a manner as to indicate the truest possible temperature.
- 6.8 CURRENT SENSING DEVICES: The Hawkeye models #735, #705 or #908 may be used for central station air handlers. For compressor status the Hawkeye #800 or #900 may be used. These devices may not be used for pump/loop status.
- 6.9 DAMPERS: Dampers for various units requiring field mounting shall be tight closing, "ultra low leakage", opposed blade with side and edge seals. They must be sized and furnished under this section. Installation of dampers will be by the sheet metal contractor, coordinated by the TCC. Damper blades shall be no less than 16 gauge-galvanized steel with maximum blade width of 8 inches. Blades shall be secured to 1/2 inch zinc plated axles and hardware with nylon bearings. Provide thrust bearings at the end of each blade.
- 6.10 ACTUATORS: All damper and valve actuators must be fail safe spring return type with sufficient force to operate the dampers or valves under all normal operating conditions. They must return to the normally open position upon a loss of power.
- 6.11 "ALL" actuators must be manufactured by Belimo. Actuators sold with another name that are manufactured by Belimo are acceptable. They shall have internal feedback circuitry to provide a positive action to insure proper positioning of the damper or valve through the entire sequence. Actuators must have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators must also utilize the same input signal (6-9 VDC, 2-10 VDC, 4-20 MA) in order to maintain some consistency in the control application. No Tri-State actuators will be acceptable, unless pre-approved by OWNER. Actuators may be factory installed.
- 6.12 RELAYS: Relays for starting and stopping fractional horsepower motors shall be rated as follows: For 1/4 horsepower motors or less use 15 ampere rated relays.
- 6.12.1 For 1/3 horsepower motors use 20 ampere rated relays.
- 6.12.2 For 1/2 horsepower motors use 30 ampere rated relays.
- 6.12.3 Relays used for pilot duty service shall be rated at a minimum of 10 amperes.

PART 7 – SYSTEM ARCHITECTURE:

- 7.1 The network controller/supervisor links the primary, secondary, and application control units with the host computers for central reporting and system communication via the Wide Area Network (WAN).
- 7.2 The system shall be configured as a distributed processing network with expansion as specified in this section.
- 7.3 The system architecture shall consist of a multi-level Wide Area Network (WAN), which supports Control Units, networked Operator Workstations, and LAN Interface Devices. The following indicates the functional description of the system structure.
- 7.3.1 Interbuilding LAN: Used for communication between Primary Controller LANs located in each building, and multiple networked Operator Workstations located in selected buildings. This WAN will consist of using the Ethernet backbone with TCP/IP protocol. BAS/DDC workstations and the LAN Interface Device shall employ native TCP/IP protocol with the Ethernet 10BaseT (IEEE802.3) physical layer standard for connection to Ethernet/ATM routers. BAS/DDC workstations shall not require third party routers, gateways or translators for TCP/IP protocol. Providing access to the Primary Control Units via the Internet is acceptable and preferred.
- 7.3.1.1 Control Contractor shall coordinate with computer personnel on acceptable LAN protocol and interfacing.
- 7.3.2 Primary Controller LAN: Used to connect Primary Control Units (Primary Control Units-which generally control central plant equipment, air handlers) within a building.

- 7.4 Dynamic Data Access: Any data throughout any level of the network shall be available to and accessible by all other devices, Control Units, LAN Interface Devices, and Operator Workstations whether directly connected (via campus backbone) or connected remotely.
- 7.5 The DDC shall automatically place calls to workstations and other devices, if required, to report alarms.
- 7.6 The communication speed between the Control Units, LAN interface devices, and MWS computer shall be sufficient to ensure fast system response time under the maximum future loading condition.
- 7.7 The Operator Workstations shall provide for overall system supervision, operator interface, management report generation, alarm annunciation, remote monitoring and back up and loading of software and data to be stored in control unit volatile memory.
- 7.8 The primary and secondary control units shall monitor, control, and provide the field interface for all field points. Each Primary Control Unit or Secondary Control Unit shall perform DDC functions independent of other Primary Control Units or Secondary Control Units and operator interface devices.
- 7.9 Interruptions or fault at any point in the primary LAN shall not interrupt communications between other nodes on the network.
- 7.10 All line drivers, signal boosters, repeaters, and signal conditioners etc. shall be provided as necessary for proper data communication.

PART 8 – NETWORK CONTROLLER/SUPERVISOR:

- 8.1 The Network Controller shall be a fully user-programmable supervisory controller. The Network Controller shall monitor and communicate the network of distributed primary, secondary, application-specific control units, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers/Supervisors.
- 8.2 Controllers shall be microprocessor-based with a maximum program scan rate of one (1) second. They shall be multi-tasking, multi-user, and real-time digital control processors. Controller size and capability shall be sufficient to fully meet the requirements of this Specification.
- 8.3 Each Network Controller/Supervisor shall support/communicate with a minimum of 100 primary/secondary control units with no more than 90% of maximum use. Memory size shall have at least 20% of availability free for future use.
- 8.4 Each controller shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control units. In addition, if memory for historical data trending is not on primary and/or secondary control units, then sufficient memory is required on the network controller to capture and record historical trending data.
- 8.5 Network Controller/Supervisor shall interact with printers, pagers, and host workstations.
- 8.6 The Network Controller/Supervisor shall have an integrated real-time clock.
- 8.7 Error detection, correction, and re-transmission to guarantee data integrity.
- 8.8 Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The network controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
- 8.9 In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
- 8.9.1 During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.

- 8.9.2 Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
- 8.9.3 Shall a primary/secondary controller memory be lost for any reason, the operator's workstation shall be able to reload the program with back-ups provided by TCC. **There will be back-ups made by TCC, available for every piece of equipment that contains "downloaded" software. These two copies shall be presented on compact disk.**
- 8.9.4 USB flash drives also accepted.
- 8.10 UNITARY CONTROLLER UNITS: Primary control units are stand-alone units able to control HVAC equipment per the specified sequence of operation.
- 8.10.1 Each controller shall perform all specified control functions independently.
- 8.10.2 Systems utilizing controllers that operate in a default mode only will not be acceptable. (Application specific.)
- 8.10.3 Each Primary Control Unit shall be equipped with firmware resident self-diagnostics for sensors and shall assess an open or shorted sensor circuit, and sensor input signal out of range conditions and taking an appropriate control action (close valve, damper, etc.).
- 8.10.4 Unitaries must have direct control capabilities in order to upload and download software, and view all points.
- 8.10.5 Power Failure Protection:
- 8.10.5.1 All Primary Control Units shall be protected from any memory loss due to a loss of power by one or a combination of the following:
- 8.10.5.1.1 Volatile RAM shall have a battery backup using a lithium battery with a rated service life of 50 hours, and a rated shelf life of at least 5 years. Self-diagnostic routine shall report an alarm for a low battery condition.
- 8.10.5.1.2 EPROM, EEPROM, or NOVROM non-volatile memory
- 8.10.5.2 Shall the duration of a loss of power exceed the specified battery back-up period or the Primary Control Unit panel memory is lost for any reason. The panel shall automatically report the condition (upon resumption of power) and shall receive a download from any operator workstation via the LAN or telephone line dial-up modem. In addition, the Owner shall be able to upload the most current versions of all sequence of operation and database parameters in the memory of each Primary Control Unit to any operator workstation via the LAN, via the telephone line dial-up modem, or to the laptop PC via the local RS-232C port.
- 8.11 Portable Operator Workstation (Laptop) Provisions:
- 8.11.1 Provisions shall be made for plug type connection to all control modules or zone control sensors using a portable computer for a site interface with the system to allow repair and maintenance personnel to perform diagnostics, interrogate any point, and reprogram in the field.

PART 9 – TIME SCHEDULES (ALL TIMES SHALL BE USER ADJUSTABLE):

- 9.1 Outside air system (ERU-1): Occupied mode: 7:30 AM-6:00 PM, (adj.) Monday through Friday.
- 9.2 Split Systems: Occupied mode: 7:30 AM-6:00 PM, (adj.) Monday through Friday.

SEQUENCES OF OPERATION

PART 10 - CONSTANT VOLUME OUTSIDE AIR SYSTEMS:

- 10.1 There one constant volume outside air systems in this facility.
- 10.2 The system shall operate under the control of a local, stand-alone, microprocessor based DDC controller with integral keypad and display.

- 10.3 Each system shall be placed into the occupied/unoccupied mode based upon the user adjustable schedule at the Global Control Panel. These systems shall be in the occupied mode during regular school hours only.
- 10.4 If communication is lost between the Global Control Panel and the Outside Air System Controller, then the Outside Air System shall be placed into the unoccupied mode until communication is restored.
- 10.5 In the unoccupied mode:
 - 12.5.1 The supply fan and exhaust shall be off.
 - 12.5.2 The energy recovery wheel shall be off.
 - 12.5.3 The outside air damper and exhaust air damper shall be fully closed.
- 10.6 When placed into the occupied mode, the following shall occur:
 - 12.6.1 The energy recovery wheel shall start and operation shall be proved via current switch.
 - 12.6.2 The outside air damper and exhaust air damper shall fully open and be proved via current switch.
 - 12.6.3 The supply fan and exhaust fan shall start and operation shall be proved via current switches.
- 10.7 If the outside air temperature is between 65 deg F (adj.) and 75 deg F (adj), the energy recovery wheel shall be off.

PART 11 - SPLIT UNITs WITH UNITARY CONTROLLER:

- 11.1 Each unit shall operate under the control of a local, stand-alone, microprocessor based DDC controller field installed adjacent to unit.
- 11.2 Each unit shall be placed into the occupied/unoccupied mode based upon the user adjustable schedule at the Global Control Panel.
- 11.3 If communication is lost between the Global Control Panel and the Heat Pump Controller, then the Heat Pump Controller shall be placed into the occupied mode until communication is restored.
- 11.4 During the occupied mode, the heat pump fan and compressor(s) shall cycle as required to satisfy space sensor setpoint. The unit shall automatically changeover from heating to cooling.
- 11.5 The units operate with a wall mounted temperature sensor. The space temperature shall be set at master set point on computer as previously described.
- 11.6 During the unoccupied mode, the heat pump shall not operate unless the space temperature falls below 60 deg F (adj.) or rises above 85 deg F (adj.).

PART 12 - ELECTRIC UNIT HEATERS:

- 12.1 The units shall maintain the user defined set point 65 degrees F (adj.). The DDC system shall monitor unit status and space temperature.

DIVISION 27 - COMMUNICATION

SECTION 270710 - DATA/VOICE SYSTEM

PART 1 - GENERAL

- 1.1 The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- 1.2 The use of proprietary or copyrighted names or reference to patented trade items within this specification or elsewhere in the Contract Documents is meant to establish a standard of quality and performance. All materials and equipment proposed for installation must meet or exceed all specified requirements. The manufacturer of all wiring components and patch panels shall be Amp, Inc. or Panduit. The manufacturer of wire management components shall be Panduit.
- 1.3 Specialty Contractor shall be BICSI certified to work with Category 6 cable and will be expected to provide a SPIN number as provided by the FCC.

PART 2 - SCOPE OF THE WORK

- 2.1 The Contractor shall furnish all materials, labor, consulting services, purchasing, testing of completely installed systems, etc., that are indicated or required to provide a complete data distribution wiring network to passive patch panels from wallplates.
- 2.2 Provide passive patch panel and associated rack or support system, coordinate with Owner.
- 2.3 The data distribution network shall be designed and installed in a format and construction equivalent to the Ethernet Ten Base "T" system as it is commonly known and in use throughout the world. The actual means for segmenting of the network shall be determined by the owner as he installs wiring concentrators.
- 2.4 The data distribution system shall be installed complete, except as hereinafter described. The system shall be provided with all input plates, wiring, equipment racks and supports, equipment, connections, wire terminations and identifications, 120 VAC power outlets, etc., for a completely functioning premises wiring network.
- 2.5 The system hubs and software shall be installed by the Owner.
- 2.6 A number of data ports shall be provided, as indicated on the plans. The data ports shall be configured as follows:
 - 2.6.1 Installed and wired data jacks, that are connected to the patch panels in individual star home runs.
 - 2.6.2 Data ports shall be completely ready to receive a connection from data generating or receiving device, enabling such device to run on the network in an unrestricted fashion, meeting all network performance parameters, except as may be limited by the connected device itself.
 - 2.6.3 Provide single, double, triple or 4-way data jacks as indicated on the plans. Outlet boxes and conduit runs shall be sized appropriately for 40% fill of conductors used. An outlet plate shall be provided with four positions for snap-in jacks. Provide blank inserts for unused positions.
 - 2.6.4 Special Note: In the design and layout of the individual segments, backbones, routing of cable, connections between segments, wiring concentrators, etc., the current conventional 100 meter limitation of physical wiring distance shall be included for all ports. Additional equipment, wiring, etc., shall be included in the system as needed to ensure all performance criteria can be met in the final installation, when all indicated ports are activated. If this distance requirement cannot be maintained, an additional wiring closet or remote hub shall be incorporated into the project by the system supplier.
- 2.7 This Contractor shall coordinate with other trades in the furnishing of "mixed service" wallplates, such as "teachers' wallplate" for voice/data and voice/data wallplates in offices. The completed installation shall be coordinated with all services incorporated into "mixed-service" plates. Contact other suppliers prior to bid or as needed to effect this coordination.

PART 3 - TESTING AND WARRANTIES

- 3.1 The data distribution network, upon completion of the installation, shall be tested in its entirety. This testing shall completely check each new data port, thru the wiring to the terminations. Each and every data port shall have a system address.
- 3.2 Testing shall encompass all system performance parameters of each port, including N.E.X.T., continuity of wiring to D.C., EMI/RFI levels, capacitance, length and all significant performance parameters related to Category Six, 350 mb/sec 10 base T transmission and as outlined in the K.E.T.S. Wiring Standard.
- 3.3 All of the network cabling that is installed shall be checked after all terminations are complete with an approved test instrument such as the Microtest "Pentascanner" or approved equivalent instrument. The testing device shall have an inboard memory that is capable of retaining testing parameters and actual results. The Contractor shall provide a printout summary, cable by cable, using the actual cable I.D. format to allow future comparison testing or circuit tracing. Provide the printout summaries on 8-1/2" X 11" paper, three complete sets mounted in a ring binder as part of the project's closeout documentation. Submit the printout summaries to the Engineer for review.
- 3.4 Contractor shall provide a written Time Domain Reflectometer (TDR) test report on each cable.
- 3.5 The test results shall be in a form and format that can be easily understood. The results shall be recorded port by port, identified room by room so the results can be traced and repeated if necessary, or checked for performance drift.
- 3.6 **Before labeling any device or port or doing any testing, verify the actual room numbers for each school. Always use the actual room name/numbering scheme.**
- 3.7 Contractor shall certify in writing that tests were performed in accordance with KDOE and KETS Standards and signed by person performing the test.
- 3.8 The completed data distribution system, in its entirety, shall be unconditionally warranted for a period of one year from the completion of testing and system acceptance by the Engineer and/or Owner.

PART 4 - DATA DISTRIBUTION SYSTEM EQUIPMENT AND PERFORMANCE REQUIREMENTS

- 4.1 The cable and connector system shall be capable of operating at up to 350 megabit/second speed, with capability to handle ISA, EISA, Microchannel and all other currently available bus architectures. It shall be compliant with EIA/TIA568A Standards, latest version, all Category six construction.
- 4.2 The system shall be capable of interfacing with or transparent to IBM, Apple and other common brands of computer equipment.
- 4.3 Lengths of cabling shall not exceed the published criteria for this type of system. LAN repeaters shall not be considered or used in cabling design.
- 4.4 The selection and location of patch panels shall be made with 10%, or minimum of ten additional ports for future growth in addition to the ports indicated on the drawings and required for the project.
- 4.5 Patch panels shall be rack mounted at indicated or required locations. The Contractor shall indicate the final locations on the project record drawings. Provide for any needed general construction in bid. Patch panels shall be entirely Category Six construction, A.T. & T 110-Style with RJ-45 jacks as needed, maximum 48 jacks per panel, EIA/TIA 568A compliant.
- 4.6 The Contractor shall evaluate the geography of the building and cable layout prior to bid and satisfy himself that the design intent can be met. The design shall be based on the indicated wiring closet locations as shown. If pre-bid analysis indicates the need for additional equipment, wiring, etc., contact the Engineer 10 days prior to bid for clarification by written addendum.

- 4.7 The Contractor is to prepare shop drawings for review prior to purchasing or installing any equipment or wiring. Provide ten sets for review, bound neatly. The review drawings should consist of floor plans indicating all port locations, their style, routings, port address nomenclature, wiring distances, etc. The shop drawing submittal for the system shall include all components, wiring, plates, details, etc., involved in the system.
- 4.8 Submit documentation outlining system testing procedures and equipment for review prior to beginning testing. Testing documentation shall include the proposed formats for cable testing summary and hub throughput testing as applicable.
- 4.9 All system wiring to and from ports is to be Category Six, unshielded twisted pairs. The installation of the wiring shall be thru sleeves, conduit, bridal rings and along backboards as indicated on the drawings. The Contractor shall consider the possibility of RFI/EMI in the installation and take all necessary precautions or provide physical separations to ensure proper system performance. Wiring shall be 4 pairs, 23 AWG, all pairs certified Category Six, plenum type. If necessary, wiring is to be installed within conduit or other enclosed raceway in plenum ceiling areas. Coordinate all requirements for plenum and non-plenum spaces with other trades and the contract documents or by site verification prior to bidding the work.
- 4.10 Cable shall be as follows:
- Data and Voice Cables plenum cable - Category 6, 4 pairs, 23 AWG, all pairs Siemen, Berk-Tek LANmark – 1000 Plenum-Rated, AMP Inc., Superior Essex, AT&T, Bertek, General or West Penn equivalent.
- Color of Cable: Voice = Red
Data = Blue
- 4.11 All data port plates for outlet boxes shall be installed with all wiring terminated per the manufacturer's recommendations. All plates shall be Category Six, A.T. & T 110 style with RJ-45 jacks. All jacks shall be beige for data and red for voice.
- 4.12 Plates shall be configured for the number of data outlets shown. For certain plates marked voice/data style, provide one data port, RJ-45 style and an additional telephone voice jack, style as needed. Clearly label the "voice" and "data" jacks with black-filled engraved letters, permanent plastic labels, plastic-shielded tags. All jacks shall be non-keyed. Coordinate provisions for multi-service plates with each other potential project supplier prior to bid or as needed after bids, to ensure all needed components are provided in the contract.
- 4.13 Provide 120 volt surge-suppressed AC line power to all system equipment whether indicated on the plans or not. Refer to other sections of these specifications for electrical requirements.
- 4.14 All system wiring shall be neatly draped, labeled, properly supported and terminated at all locations. Provide permanent labeling indicating room number and address. Each patch panel termination for an individual port shall be permanently marked. See other requirements this section (M. below) for more specific labeling information.
- 4.15 All system installations shall be made in full compliance with the following:
- National Electrical Code
Indiana Building Code
ANSI C2-1981 National Electrical Safety Code
47 CFR Part 68
NFPA 75
EIA/TIA 568A
Other EIA Standards that Apply to such Installations
- 4.16 All cable shall be carefully routed and connected to avoid ground loops and EMI. All racks and equipment enclosures shall be effectively grounded to the nearest ground point provided in electrical spaces. Use only solid copper, green color wiring, #6 awg minimum for grounds. Avoid sharp bends in wiring.

4.17 At the patch panel locations, provide a plexiglas framed or shielded permanently-mounted chart showing the cable schedule for the system, highlighted to show the cables and equipment at that location. This schedule shall include:

4.17.1 Cable Number

Each cable shall have a unique identifier. This number shall be up to 5 characters in length. The first two characters MAY be ALPHA characters, the last three characters MUST be numeric.

4.17.2 Drop ID

The drop id. identifies the cable drop location. This field may be up to six characters in length. This identification shall represent a room number, floor plan grid location, or wiring closet location. Note: It is imperative that the final version of the building room numbering system be utilized in all cable identifications. Verify room numbering system with the Architect or Owner.

4.17.3 Jumper From

This field shall identify whether the drop/grid cable is terminated in THIS wire closet or patched from a device. A drop/grid cable shall terminate on a distribution panel. A patch cable shall jumper from a device unit number.

4.17.4 Termination Point

Grid/riser cable termination point in a rack and panel. This termination is in the DESTINATION wire closet "Jumper From" location.

4.17.5 Length

Cable length in feet.

4.17.6 Jumper To

This field may be up to 11 characters and shall be used to identify the "jumper to" point in THIS wire closet. "Jumper to" may be a device and unit number or distribution panel position. The owner will insert these identifications. Leave a blank space on charts.

NOTE: Identify fiber optic cables in similar fashion, as applicable and differentiate their codes by an "FO" prefix. Also, all cable ID configurations shall be verified with owner and shall match the owner's existing labeling schemes.

4.18 Fiber Optic patch panels shall be Amp P/N 559561-1 with Amp P/N 559515-1 couplers for 12 ports. ST style or equivalent by Panduit.

PART 5 - INSTALLATION

5.1 Provide permanent labeling as shown in the sequence chart.

5.2 Provide cable installation of Category Six UTP 4 pair cable, installed per the cable lists. Cable lengths shown in cable lists should be verified before cutting and terminating cables. Data cables shall be terminated in back of each distribution panel.

5.3 Provide cable/connector/hub testing, as appropriate, to satisfy system installation requirements and verification of proper function.

5.4 The Cabling System shall be installed in a professional manner by persons skilled in the trades represented and in accordance with local building codes and applicable provisions of the National Electrical Code (NEC), except where specifications for the system design and specifications exceed NEC requirements, where the more stringent standard shall apply. The electrical contractor shall not pull in or make connections for the data cabling system

5.5 All electrical materials and equipment installed shall be of one manufacture, and approved by Underwriters Laboratories, Inc., and shall bear the UL label.

- 5.6 Drawings generally indicate work to be done, but do not show all bends, transitions or special fittings required to clear beams, girders, or other work already in place. Contractor shall carefully investigate conditions where wiring conduit and bridal rings are proposed or installed, and furnish and install any required fittings, offsets, etc. All cutting and patching necessary to install the system shall be provided as a part of this contract, in accord with the established or prevailing standards.
- 5.7 Contractor shall install labels as follows:
- 5.7.1 One label at each end of each cable at the end of the cable sheath, after stripping.
- 5.7.2 One label or marking of port address and/or cable drop I.D.# on the inside of each active outlet plate. Plates shall be provided with permanent, typed plastic labels for each jack Amp #558088 and associated material.
- 5.7.3 One label on the front of the distribution panel centered below each associated cable connect.
- 5.7.4 All markings shall be done in a manner that presents a neat, professional appearance.
- 5.8 Contractor shall bond together cable grounds to distribution rack, and bond rack to building electrical panel ground for ground continuity. Continuity shall be checked with an ohmmeter between adjacent components, to a maximum of one OHM. Provide additional jumpers if necessary.
- 5.9 All cables from overhead shall be neatly dressed behind distribution panels, providing adequate working space in back of the panels, allowing rack movement and working space.
- 5.10 Contractor shall terminate the pairs of each cable on the patch panels with RJ-45 Category Six EIA/TIA 568A data connectors.
- 5.11 Equipment racks shall be grounded to building ground using an appropriate size ground wire (minimum #6 AWG). Route to the nearest available panelboard ground bus, preferably the panel that feeds receptacles at the equipment location. Route the ground wire in E.M.T. conduit, with redundant ground bushings.
- 5.12 The equipment racks shall be completely installed before or just as cables are pulled.
- 5.13 Contractor shall use basket grips or other wire pulling apparatus as recommended by the wire manufacturer wherever possible, and exercise care while pulling cable so as not to exceed the maximum allowable pulling strength of any cable.
- 5.14 Contractor shall economize on the use of cable by limiting excess length on runs to one foot at the outlet, and four feet at the distribution panel(s), unless longer lengths are needed to make up terminations with the necessary amount of slack. Leave sufficient slack to allow moving of racks away from wall for easy service access.
- 5.15 Insulated throat conduit fittings shall be used for ends of raceway or sleeves at all locations. Provide 3/4" x 4' x 8' high fire retardant plywood backboard(s) as needed at each wiring closet location. Backboards shall be painted with white, fire resistant paint prior to installing any devices. Mount ground wire and surge-suppressing ANSI Category "A" 120 volt outlets at bottom of backboard. Provide quadruplex outlets as needed (minimum of two), with each quad on a dedicated 20 amp circuit from panel, leaving 25% spare outlets for the Owner's future use. Equipment racks shall be mounted at no more than 60" to top.
- 5.16 Requirements for grounding, bonding, structural supports, relieving of sharp edges, etc., shall be in accordance with local codes and accepted building practices.
- 5.17 Cable Separation from Power Wiring: (Note: These are recommended guide distances only. The Contractor is responsible for minimizing RFI/EMI problems in the wiring and equipment installations to the point that they do not affect system performance.)

5.17.1 The following distances are a guide for separation of data wiring from power voltages up to 480 volts:

	<2kva	2-5kva	>5kva
Unshielded power lines	2.5 in.	39 in.	48 in.
Unshielded power lines enclosed in grounded conduit	5 in.	12 in.	24 in.
Power lines with grounded metallic sheath enclosed in conduit	5 in.	6 in.	12 in.

5.17.2 Between the data wiring and any fluorescent, neon, or high intensity discharge (HID) lamp fixtures, the minimum clearance shall be five inches, or greater if recommended by the cable or hardware vendors.

5.17.3 Cables may be installed closer to lighting and convenience outlet power cables (single phase 120V, 20A. maximum), in metal cable channels for limited distances, if the following are observed:

5.17.3.1 Parallel runs of no more than fifteen feet are permissible if a one inch separation between the power cable and the data cable is maintained by separators or suitable retention hardware.

5.17.3.2 Parallel runs of no more than thirty feet are permissible if a two inch separation is maintained. The separation may be less than two inches for a run of up to twelve inches, if no contact occurs between the data cable and the power cable.

5.17.4 Contractor shall correct all cables which malfunction due to proximity to power cable, or other interference source revealed by checking or electronic network testing.

5.17.5 **Contractor to verify all listed cable clearances with the system supplier prior to installing any cable and perform his work in accord with the suppliers' requirements.**

5.17.6 Wiring Concentrator Equipment

5.17.6.1 To be provided by the Owner, outside this contract.

5.17.7 Project Completion

5.17.7.1 Contractor's work shall be considered complete after the following has been accomplished:

5.17.7.1.1 Installation is complete, all system testing has been completed and Contractor certifies in writing that the entire system is in working order.

5.17.7.1.2 All system labels have been put in place.

5.17.7.1.3 All construction debris and scrap materials have been removed from the premises.

5.17.7.1.4 All marked up record drawings have been returned to the Architect/Engineer.

5.17.7.1.5 All unused materials have been returned to the Owner, as Owner directs.

5.17.7.1.6 The Engineer has accepted the installation.

5.17.7.1.7 The Engineer has accepted the system wiring in its entirety in writing. Forward a copy of this communication to the Architect and Engineer for their records.

5.17.8 There shall be no visible slack or sags in cables. Contractor shall provide additional supports as required to correct and also as required to maintain cable tension limits. Cable shall not be installed with sharp bends that may damage cable. Coordinate installation requirements with cable manufacturer.

5.17.9 All fiber optic cable shall be ran in innerduct in cable tray or conduit. Innerduct shall be 1 - 1/4" corrugated. Carlon or equal.

5.17.10 All multi-pair cables shall be Category 5E, in 25 pair multiples as required.

END OF SECTION.