SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 PROJECT DESCRIPTION

A. The project consists of installation of nine (9) new Ductless split-systems and one (1) unit heater to provide conditioning for the corridors of Luttrell Elementary School in Union County, TN, as shown on contract documents prepared by West, Welch, Reed Engineers, Inc., Knoxville, Tennessee, dated TBD.

1.3 WORK SEQUENCE

A. The Work will be conducted in limited parts of the building to provide the least possible interference to the activities of the Owner's personnel and to permit continued operation by personnel and students. The contractor shall cooperate in every way possible with the owner to enable owner to be able to continue school functions.

1.4 CONTRACTOR USE OF PREMISES

A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public. Confine operations to areas within Contract limits indicated.

B. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

C. Use of the Existing Building: Maintain the existing building in a weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.5 OWNER OCCUPANCY

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations.

PART 2 – PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION 01 11 00

SECTION 01 22 00

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing handling and processing allowances.

1. Types of allowances required include the following:
   a. Contingency allowance.

2. Procedures for submitting and handling Change Orders are included in Section "Change Order Procedures."

1.3 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed for the Owner's purposes, and only by Change Orders which designate amounts to be charged to the allowance.

B. The Contractor's related costs for products or equipment ordered by the Owner under the contingency allowance, including delivery, installation, taxes, insurance, equipment rental, and similar costs are not part of the Contract Sum.

C. Change Orders authorizing use of funds from the contingency allowance will include the Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related construction activities.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include a contingency allowance of $5,000.00 for use upon the Owner's instructions.

END OF SECTION 01 22 00

SECTION 01 33 00

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.

1.3 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

a. Contractor's construction schedule.
b. Application for Payment form.
c. List of subcontractors.
d. Schedule of allowances.
e. Schedule of alternates.

B. Submit the Schedule of Values to the Engineer at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.

C. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

1. Identification: Include the following Project identification on the Schedule of Values:

    a. Project name and location.
    b. Name of the Engineer.
    c. Project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

    a. Generic name.
    b. Related Specification Section.
    c. Name of subcontractor.
    d. Change Orders (numbers) that have affected value.
    e. Dollar value.
    f. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

5. For each part of the Work where an Application for Payment may include materials or equipment. purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

D. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually on Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and Proportionate share of general overhead and profit margin.

E. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT:

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.

1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is the 10th day of each month. The period of construction Work covered by each Application for Payment is the period ending 10 days prior to the date for each progress payment and starting the day following the end of the preceding Period.

C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 3 executed copies of each Application for Payment to the Engineer by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Engineer.

F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the previous application.

1. Submit final application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.

2. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittal that must precede or coincide with submittal of the first Application for Payment include the following:

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Submittal Schedule (Preliminary if not final).
6. Copies of building permits.
7. Copies of authorizations and licenses from governing authorities for performance of the Work.
8. Initial progress report.
9. Certificates of insurance and insurance policies.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1. Administrative actions and submittal that shall proceed or coincide with this application include:

a. Occupancy permits and similar approvals.
b. Warranties (guarantees) and maintenance agreements.
c. Test/adjust/balance records.
d. Maintenance instructions.
e. Start-up performance reports.
f. Change-over information related to Owner's occupancy, use, operation and maintenance.
g. Final cleaning.
h. Application for reduction of retainage. and consent of surety.
i. Advice on shifting insurance coverages.
j. List of incomplete Work recognized as exceptions to Engineer's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittal which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Assurance that unsettled claims will be settled.
4. Assurance that Work not complete and accepted will be completed without undue delay.
5. Transmittal of required Project construction records to Owner.
6. Removal of surplus materials, rubbish and similar elements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 33 00

SECTION 01 44 00

PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:

1. Coordination.
2. Administrative and supervisory personnel.
3. General installation provisions.
4. Cleaning and protection.

B. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".

1. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.3 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations. included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
3. Make adequate provisions to accommodate items scheduled for later

installation.

4. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

   a. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Delivery and processing of submittals.
3. Progress meetings.
4. Project Close-out activities.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

A. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers. Send a copy to Engineer and owner.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Engineer for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Engineer for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.

2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Radiation.
11. Puncture.
12. Abrasion.
13. Heavy traffic.
14. Soiling, staining and corrosion.
15. Bacteria.
16. Rodent and insect infestation.
17. Combustion.
18. Electrical current.
19. High speed operation,
20. Improper lubrication,
21. Unusual wear or other misuse.
22. Contact between incompatible materials.
23. Destructive testing.
24. Misalignment.
25. Excessive weathering.
26. Unprotected storage.
27. Improper shipping or handling.
28. Theft.
30. Vandalism.

END OF SECTION 01 44 00

SECTION 01 45 00

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction.
b. Bearing and retaining walls.
c. Structural concrete.
d. Structural steel.
e. Lintels.
f. Timber and primary wood framing.
g. Structural decking.
h. Stair systems.
i. Miscellaneous structural metals.
j. Exterior curtain wall construction.
k. Equipment supports.
1. Piping, ductwork, vessels and equipment.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Shoring, bracing, and sheeting.
b. Primary operational systems and equipment.
c. Air or smoke barriers.
d. Water, moisture, or vapor barriers.
e. Membranes and flashings.
f. Fire protection systems.
g. Noise and vibration control elements and systems. Control systems.
h. Communication systems.
i. Conveying systems.
j. Electrical wiring systems.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner. that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

a. Processed concrete finishes.
b. Stonework and stone masonry.
c. Ornamental metal.
d. Matched-veneer woodwork.
e. Preformed metal panels.
f. Window wall system.
g. Acoustical ceilings.
h. Terrazzo.
i. Carpeting.
j. Wall covering.
k. HVAC enclosures, cabinets or covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review. areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
2. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
4. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.
5. Plaster Installation: Comply with manufacturer's instructions and install thickness and coats as indicated.

    a. Unless otherwise indicated provide 3-coat Work.
    b. Finish gypsum plaster with smooth-troweled finish. Sand lightly to remove trowel marks and arrises.

c. Cut, patch, point-up and repair plaster to accommodate other construction and to restore cracks, dents and imperfections.

3.3 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01 45 00

SECTION 01 55 00

PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Progress Meetings.

B. Construction schedules are specified in another Division-1 Section.

1.3 COORDINATION MEETINGS

A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

1. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
2. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.4 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Engineer of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at

these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be colleted within the Contract Time.

2. Review the present and future needs of each entity present, including such items as:

a. Interface requirements.
b. Time.
c. Sequences.
d. Deliveries.
e. Off-site fabrication problems.
f. Access.
g. Site utilization.
h. Hours of Work.
i. Hazards and risks.
j. Housekeeping.
k. Quality and Work standards.
l. Change Orders.
m. Documentation of information for payment requests.

D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

END OF SECTION 01 55 00

SECTION 01 60 00

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

1. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a

part of the Work.

3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.4 SUBMITTALS

A. Product List Schedule: A list of products required is included at the end of this Section. Prepare a schedule in tabular form showing each product listed. Include the manufacturer's name and proprietary product names for each item listed.

B. Completed Schedule: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

C. Engineer's Action: The Engineer will respond in writing to the Contractor within 3 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Engineer,s response will include the following:

1. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.5 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner consult with the Engineer for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and method that will prevent damage, deterioration and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent over crowding of construction spaces. Contractor shall be responsible for furnishing his own storage on site. Owner does not have space available within school for storage of any equipment.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
5. Store products at the site in a manner. that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.

1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:

1. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

   a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

2. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
3. Compliance with Standards, Codes and Regulations: Where the specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
4. Visual Matching: Where Specifications require matching an established Sample, the Engineer's decision will be final on whether a proposed product matches satisfactorily.
   a. Where no product available within, the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another

product category, or for noncompliance with specified requirements.

5. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Engineer will select the color, pattern and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS:

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 60 00

SECTION 01 77 00

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Shop Drawings.
4. Product Data.
5. Samples.

B. Administrative Submittals: Refer to other Division-l Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Permits.
2. Applications for payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of Subcontractors.

C. The Schedule of Values submittal is included in Section "Applications for Payment."

1.03 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery,

other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

   a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow three weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Designer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow three weeks for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Designer sufficiently in advance of the Work to permit processing.

C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

   a. Project name.
   b. Date.
   c. Name and address of Designer.
   d. Name and address of Contractor.

e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.

D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Designer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

E. Transmittal Form: Use AIA Document G 810.

1.04 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.

1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.

2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:

a. Scheduled date for the first submittal.
b. Related Section number.
c. Submittal category.
d. Name of subcontractor.
e. Description of the part of the Work covered.
f. Scheduled date for resubmittal.
g. Scheduled date the Designer's final release or approval.

B. Distribution: Following response to initial submittal, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with

submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.05 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.

C. Sheet Size: Except for templates, patterns and similar full size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".

D. Initial Submittal: Submit one correctable translucent reproducible print and one blue- or black-line print for the Designer's review; the reproducible print will be returned.

E. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.

F. Final Submittal: Submit 3 blue- or black-line prints and 2 additional prints where required for maintenance manuals, plus the number of prints needed by the Designer for distribution. 2 prints will be retained; the remainder returned.

1. One of the prints returned shall be marked-up and maintained as a "Record Document".

2. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.06 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

a. Manufacturer's printed recommendations.
b. Compliance with recognized trade association standards.
c. Compliance with recognized testing agency standards.
d. Application of testing agency labels and seals.
e. Notation of dimensions verified by field measurement.
f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

B. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

C. Submittals: Submit 5 copies of each required submittal; submit 7 copies where required for maintenance manuals. The Designer will retain one, and will return the other marked with action taken and corrections or modifications required.

1. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

D. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of

construction activities. Show distribution on transmittal forms.

1. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.

2. Do not permit use of unmarked copies of Product Data in connection with construction.

1.07 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Designer's Sample. Include the following:

a. Generic description of the Sample.
b. Sample source.
c. Product name or name of manufacturer.
d. Compliance with recognized standards.
e. Availability and delivery time.

B. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

1. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.

2. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

3. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

C. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

1. Preliminary submittals will be reviewed and returned with the Designer's mark indicating selection and other action.

D. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.

1. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

E. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1.08 DESIGNER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Designer will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Designer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. Final Unrestricted Release: Where submittals are marked "Approved," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

2. Final-But-Restricted Release: When submittals are marked "Approved as Noted," that part of the Work covered by the submittal may proceed

provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

3. Returned for Resubmittal: When submittal is marked "Not Approved, Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

   a. Do not permit submittals marked "Not Approved, Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.

C. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01 77 00

SECTION 01 78 36

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-l Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General closeout requirements are included in Section "Project Closeout."

3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -26.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the

Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warrantv: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

A. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties

upon request of the Engineer.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions-2 through 26 for specific content requirements, and particular requirements for submittal of special warranties.

C. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

PART 2 - PRODUCTS (not applicable).

PART 3 - EXECUTION (not applicable).

END OF SECTION 01 78 36

SECTION 23 05 00

GENERAL PROVISIONS - HVAC

PART 1 - GENERAL

1.01 OTHER CONDITIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. The contract scope as set forth in the first division of this specification shall govern requirements of this division. The Contractor shall examine the various other divisions of the specifications and examine the existing conditions at the building site, and familiarize himself with the provisions therein affecting the mechanical work.

1.02 WORK INCLUDED

A. Provide all materials, labor, and tools to construct a complete heating, ventilating, and air conditioning system as herein specified or as shown on the drawings, or both.

B. Provide everything necessary for a complete and satisfactory installation whether or not specifically shown or specified. This is not intended to cover major items of equipment; but, it is intended to include all miscellaneous parts, devices, accessories, controls, and appurtenances which are required to complete the work in proper and safe operating condition and so that the performance characteristics and capacities specified will be obtained.

C. Do all cutting of holes necessary for the installation of work specified under this division.

D. All electrical interlock and control wiring is specified to be furnished and installed under Division 23. The electrical control components shall be furnished and installed by the mechanical installer. The controls installer shall wire and connect the controls complete and in working order in accordance with manufacturer's approved wiring diagram.

1.03 RELATED WORK NOT INCLUDED IN THIS DIVISION

A. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.

B. Provision and patching of all holes required for installation of pipes and ducts, however, furnish a shop drawing showing the location and sizes of all required holes prior to construction of affected areas.

1.04 CODES, PERMITS & FEES

A. Secure and pay for all permits, licenses, and inspections required for work under this division. Give all notices and comply with all laws, ordinances, rules, and regulations applicable to the work.

B. Applicable codes include but are not limited to the State Fire Prevention & Fire Safety Codes; Local Building Codes, and Electric Codes, National Fire Protection Association Standard NFPA No. 90A, and State Department of Public Health Regulations.

C. Where applicable, all materials and equipment shall bear the Underwriters' Laboratories seal or ASME Code stamp. Certificates to this effect shall be furnished to the engineer upon request.

1.05 SUBMITTALS

A. In accordance with Division 1, submit to the Designer for approval a complete list of materials, equipment, and accessories proposed for use, listing the item and the manufacturer's name only.

B. Based on aforementioned approved listing, submit to the Designer for approval three copies, plus the number the Contractor wishes returned to him, of shop drawings or data sheets for materials, equipment and accessories, giving the name of the manufacturer, trade name and catalog number, rating data, and performance features, all in the terms specified hereinafter.

C. Submittals shall be stamped or noted by the Contractor to indicate that he has examined them and found the information contained to be in accordance with the contract requirements. Any deviations from contract requirements shall be called to the Designer's attention. The Contractor shall specifically check to see that the

equipment proposed will fit into the available space, with proper clearance for filter servicing, and other maintenance operations.

D. All submittals shall be submitted at one time, in one binder for HVAC. Submittals shall be submitted in time to allow four weeks from receipt by Designer to time final approval is required to meet the construction schedule.

E. Submittals shall include affidavits from manufacturers of insulation and duct materials furnished and installed under this section certifying that such materials delivered to the project conform to the requirements of this specification.

F. Submittals, drawings and data are required on all items specified by manufacturer's name, including but not limited to the following:

HVAC
Pipe material,
Valves,
Ductless System,
Insulation,
Dampers,
Support & Anchor Data.

G. Control diagrams, control panel layouts, description of control operation, wiring diagram for safety devices and interlocks, composite wiring diagram for safety devices and interlocks, composite wiring diagram showing safety devices and interlocks between starters and controls shall be submitted, and included in a separate HVAC submittal binder.

1.06 OPERATING INSTRUCTIONS

A. Provide a competent, experienced person for a total of 8 hours to instruct Owner's operating personnel in operation of equipment and control systems at the completion of the work.

B. Provide three (3) complete sets of a compilation of catalog data of each manufactured item of equipment used in the mechanical work. In addition to the catalog data, installation, operating, and maintenance data and bill of materials for fans, controls, motors and all other operating equipment shall be submitted. Each of the three (3) sets of data shall be bound in looseleaf binders and submitted to the engineer before final payment is made. A complete double index shall be provided as follows:

1. Listing the products alphabetically by name.
2. Listing the names of manufacturers alphabetically by name together with their addresses and the names and addresses of local sales representatives.

C. It is the intent of this catalog, operation and maintenance data to provide the Owner with complete instruction on the proper operation and use, lubrication and periodic maintenance, together with the source of replacement parts and service for the items of equipment covered. Instructions shall be submitted to the Designer for approval at least one month in advance of initial start up.

1.07 AS-BUILT DRAWINGS

A. Upon completion of the work, deliver to the Designer contract drawings, showing the actual installed locations of all equipment, piping, and ductwork.

B. Make all necessary field measurements as the work progresses and keep accurate records of the measurements. Show locations by dimensions from permanent, readily identifiable referenced points, such as building walls and columns.

C. Keep at the building site one set of the mechanical drawings for sole purpose of daily recording any changes in the routing of piping and ducts, relocation of any equipment or valves, and similar changes made in the work as it is installed. Note on the prints with red pencil all changes at the time they are made. Upon completion of the mechanical work, the marked-up prints reflecting the work as installed shall be delivered to the Designer. The Designer shall prepare the as-builts from these drawings. For this purpose, if requested by the Contractor, the Designer will provide one set of the contract drawings, paid for by the Contractor at reproduction cost.

1.08 COORDINATION & INTERFERENCES

A. A competent superintendent shall represent the Contractor at all times. All instructions and coordinating problems given to or worked out with the superintendent shall be as binding as if given to the Contractor.

B. The mechanical drawings are generally diagrammatic and, except where specifically dimensioned or detailed, indicate the approximate location and general arrangement of the mechanical work. The Contractor shall examine all contract drawings and documents, as well as the mechanical ones, and shall install his work to conform as nearly as possible to the locations and arrangements shown, with only such minor adjustments as necessary to coordinate the mechanical work with the structural,

architectural, and all other work and to avoid interferences. All offsets, rises, and fittings are not necessarily shown on the drawings but shall be provided as required.

C. All mechanical work which interferes with the structural or other work or which deviates from the drawings and specifications without prior approval of the Designer shall be altered at the Contractor's expense. Mechanical interferences which may be discovered or anticipated shall be reported promptly to the Designer for decision before proceeding with the work. The Designer shall have the privilege of making minor changes without additional cost, provided that such changes are made prior to commencing work on the item involved.

D. All building dimensions shall be taken from actual site measurements. Do not scale dimensions from the mechanical drawings. Rough in and install all equipment provided under the general contract in accordance with the manufacturer's approved shop drawings.

E. All equipment, apparatus, piping, ducts, and similar work shall fit into the available spaces in the building and shall be introduced into the building at such times and in such manner as not to cause damage to the structure. All piping and ductwork shall be installed to provide the maximum clear height underneath. All equipment requiring servicing shall be made easily accessible.

1.09 MATERIALS & WORKMANSHIP

A. Equipment and materials used in the work shall be in accordance with the contract requirements, the approved equipment lists, and shop drawings. After an item has been approved, no substitution will be permitted unless it is considered by the Designer to be in the Owner's best interest. All equipment and materials shall be new and unused.

B. All electrical materials shall be UL approved where such approval is applicable and shall bear the UL label where such labeling is customary.

C. Work shall be under the constant supervision of a competent superintendent and shall be performed by skilled journeymen.

D. All equipment shall be installed in strict accordance with the manufacturer's recommendations. Any conflicts between these recommendations and the plans and specifications shall be promptly reported to the Designer for decision before proceeding. All auxiliary piping, valves, accessories, electrical connections, etc.,

recommended by the manufacturer or required for proper and safe operation shall be furnished and installed complete whether or not such auxiliaries are shown.

E. Ducts and piping shall be run concealed in ceilings throughout all finished spaces except where specifically noted otherwise. Run exposed ductwork and piping in a neat and workmanlike manner and parallel to the principal parts of the building.

1.10 PROTECTION

A. Work shall be protected at all times. Duct and pipe openings shall be closed with temporary caps or plugs during construction until system connections are completed. Equipment shall be covered and protected against dirt, water, chemical and mechanical injury. The installation of equipment liable to damage by subsequent construction operations shall be deferred until authorized by the Designer.

B. No air handling equipment shall be operated, even on a temporary basis, without installation of a "construction" set of filters. The construction set of filters shall be equal in performance to the specified filters. Filter media shall be installed on all supply and return registers to prevent construction dust from entering the ductwork.

1.11 TESTING

A. Each supply and exhaust fan shall be provided with a stamped type greasing instruction label which shall read as follows:

"Use_____ type grease.
Check grease every _____months.
Add grease at least every _____months."

B. All testing may be witnessed by the Designer, his representative or local authorities having jurisdiction. All testing shall be completed and approved before insulation, concealment by furring, ceiling work, or backfilling is started. All equipment required for tests shall be furnished by this Contractor.

C. Should inspection or tests show defects, such defective work or material shall be replaced and inspected and tests repeated. All repairs to piping shall be made with new material. No caulking or screwed joints or holes will be acceptable.

1.12 CLEANING

A. General:

1. Upon completion of the contract and progressively as the work proceeds, clean up all dirt, debris, oil, materials, etc., and remove it from the site, keeping premises in a neat and clean condition to the satisfaction of the Designer. See General Conditions.
2. Thoroughly clean all ducts, air distribution devices and apparatus casings before fans and filters are operated. Clean or renew all filters after the equipment has been tested.
3. All factory applied finishes, if not to be repainted, shall be touched-up, covering all bare places, scratches, etc.
4. Any stoppage, discoloration, or other damage to parts of the building, its finish, or furnishings due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor without cost to the Owner.

1.13 OPERATIONAL CHECKOUT

A. After the heating, ventilating and air conditioning systems have been placed in operation, the mechanical installer shall:

1. Balance air-flows as described in Section 230593.
2. Check the systems for proper operation of equipment, controls, interlocks, and safeties on both the cooling and heating cycles.
3. Correct all vibration and/or noise deficiencies.

B. Furnish the Designer a written report on the operational checkout, including rpm, volts, and amperes on each motor, entering and leaving temperatures and pressures on each coil, temperature readings in space, airside readings as described under Section 230593, and a report on the procedure followed in the operational checkout. This report shall be submitted in triplicate.

1.14 OBSERVATIONS

A. The Designer's office may make periodic visits to the site to observe the progress and quality of the construction work and to determine, in general, if the results of the construction work are in accordance with the drawings and specifications. The Designer's office will also observe certain tests required of the mechanical installer as are called for in other portions of the specifications.

B. It should be understood that the plans and specifications represent the work to be done by the Contractor in view of the total project requirements. The final routing of piping, ductwork, etc., to eliminate conflict with other trades is his responsibility. The Contractor is to furnish all necessary supervision required for his personnel, as well as his mechanical installer, to insure that the installation is made in accordance with plans and specifications and that all safety rules and regulations are observed. In the event of conflicts of work on the job with other trades affecting this Contractor and/or his mechanical installers, he shall make every reasonable effort to resolve the conflict through meetings and discussions with the other parties involved by preparation of drawings or by other appropriate action. Only after this has been done shall the Designer's assistance be requested.

C. When the Designer is requested to visit the job to aid in the resolution of conflicts or for witnessing tests, he shall be given a minimum of 24 hours notice prior to the time his presence is required at the job site.

1.15 WARRANTY & SERVICE

A. In addition to manufacturer's warranty of each item of equipment, the Contractor shall warrant the equipment for one year after acceptance and make good any defect of material or workmanship occurring during this period without expense to the Owner.

B. Upon final acceptance of work, Owner will assume responsibility of supervising, operating, and maintaining equipment. He will lubricate motors and other operating components, clean strainers, make minor adjustments for proper operating conditions and report defective materials or workmanship to Contractor. Owner will make emergency repairs only if Contractor is unavailable, and such repairs will in no case void a warranty or guarantee.

C. Contractor is to replace defective material, parts, and equipment. He will also correct defective workmanship without delay and without cost upon being notified of such defect.

D. Upon expiration of each of these limits noted herein, the maintenance will be at the Owner's expense, including labor and materials costs.

E. The Contractor is to provide for his test and balance representative and the controls representative to return to the job at the change of seasons (Summer to winter or winter to summer) for the first year only, to adjust the air conditioning system and recheck or recalibrate cooling to heating or vice versa.

1.16 AIR SYSTEM, AIR DISTRIBUTION TEST & BALANCE

A. Perform testing and balancing in complete accordance with current standards of the Associated Air Balance Council (AABC).

B. Submit to the Designer for approval three copies, plus the number the Contractor wishes returned to him, of complete test reports.

1.17 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. The Contractor assumes responsibility for proper arrangements of pipes, changes in electrical requirements, ducts, etc., or changes in layout to connect "approved substitute" equipment in a proper approved manner. The contractor shall pay all costs associated with these changes without additional costs to the owner.

PART 2 - PRODUCTS

2.01 STANDARD PRODUCTS

A. Equipment, fixtures & materials furnished shall be new & unused, fabricated by manufacturers regularly engaged in their production and shall be their standard and current offering for which replacement parts are available. Mechanical equipment shall be substantially the same equipment of a given manufacturer which has been in successful commercial use and operation for at least one year.

B. Equipment & materials are shown or specified by a single or by multiple manufacturers, to indicate quality, material and type of construction desired. When one manufacturer's product is shown or specified and has been used as basis for design, it is the Contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications, size, and arrangement to that used for design, and that the alternate is suitable for installation and compatible with other system components.

PART 3 - EXECUTION

3.01 PROJECT CLOSEOUT

A. Before requesting final inspection, the following items must be completed in accordance with appropriate sections of Division 1 and 23:

1. Complete all work required under this division of the specifications except as may be permitted hereinafter.
2. Submit test and balance report for all air and water systems.
3. Submit letter from an authorized representative of each equipment manufacturer stating that he has observed the installation and that his equipment is installed and operating per the manufacturer's requirements.
4. Submit specific warranties and any maintenance agreements.
5. Deliver tools, spare parts, extra stock, and similar items.
6. Install all items of identification on all ductwork, piping, and equipment.

B. Before requesting final payment, the following items must be completed:

1. Submit operating instructions and maintenance manuals.
2. Demonstrate to owner's representative the proper operation of all equipment and systems. A minimum of 8 hours of training time will be provided. The Contractor shall video tape all training sessions for use in educating future maintenance personnel. The contractor shall conduct the training sessions in a manner that will be easily video taped and informative when use in the future.
3. Submit as-built drawings.

END OF SECTION 23 05 00

SECTION 23 05 10

BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 WORK INCLUDED

A. The work required under this section of the specifications consists of basic materials and methods and is applicable to all work under Division 23.

B. The work of this section is subject to the requirements of the General Provisions-HVAC section of the specifications.

1.03 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

B. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

C. NEMA: National Electrical Manufacturers Association.

D. OSHA: Occupational Safety & Health Administration.

E. ASTM A53, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."

F. ASTM B88, "Standard Specification for Seamless Copper Water Tube."

G. ASTM A106, "Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service."

H. ASTM A126, "Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings."

I. ASTM A536, "Standard Specification for Ductile Iron Castings."

J. ASTM B62, "Standard Specification for Composite Bronze or Ounce Metal Castings."

K. MSS SP-71, "Gray Iron Swing Check Valves, Flanged and Threaded."

L. MSS SP-80, "Bronze Gate, Globe, Angle and Check Valves."

M. MSS SP-85, "Cast Iron Globe & Angle Valves, Flanged and Threaded Ends."

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical Insulation is specified under Section 23 07 00.

B. Hydronic Piping is specified under Section 23 21 13.

PART 2 - PRODUCTS

2.01 PIPE

A. Copper pipe: Hard or soft drawn, ASTM B88 Type "K" or "L". Joints with 95-5 solder above ground. Joints with silver solder or phos-copper below floor.

B. Black steel pipe: Welded, grooved, or seamless Schedule 40 or 80, ASTM A-53.

2.02 VALVES

A. Ball valves shall be full port, three-piece bolted body construction with solder end connections in sizes to and including 2" size. Valves shall be designed for service without removing from line and have full post and Teflon seats. Valves shall be Hammond 8604, Watts, Apollo, or approved substitute.

B. Valves 2 1/2" and larger shall be butterfly valves Hammond 5200, Watts, Apollo, or approved substitute, with bronze disc, EPT seat, lug type cast iron body, extended neck, and Auto-lok handle. They shall be rated "bubbletight" at 200 psig WP. Provide lever handles with infinite throttling and memory stops for valves 6" and smaller. Valves 8" and larger shall have worm gear operator with hand wheel and indicator. Where gear operator is greater than 8 feet above the floor or work surface, the hand wheel shall be replaced with a chain wheel, chain and guides.

2.03 MOTORS

A. Furnish and install (or arrange for installation) all electric motors for all equipment specified under this section requiring same in accordance with the following:

1. All motors shall be NEMA standard designed for ample size to operate at their proper load and full speed continuously without causing noise or vibration or temperature rise in excess of their rating.
2. Motors 1/2 HP and less shall be designed & nameplated for 120 volt, 1 phase, 60 cycle operation; shall be permanent split capacitor type, 40 degrees Celsius continuous rise, open dripproof type; and shall be equipped with ball bearings.

B. The above shall apply to all motors unless otherwise specified with equipment.

2.04 TEST STATIONS - PRESSURE/TEMPERATURE

A. Install a 1/4" or 1/2" NPT temperature/pressure test plug fitting of solid brass as specified or indicated on drawings. Test plug shall be capable of receiving either a pressure or temperature probe 1/8" o.d. Valve core shall be neoprene for temperature to 200 degree F., and Nordel for temperatures to 350 degrees F. and shall be rated zero leakage from vacuum to 1000 psig. Test plugs shall be as manufactured by SISCO, Watts, or OMEGA.

B. HVAC installer shall also furnish the following: pressure gauge adapters with 1/8" o.d. probe, 5" stem pocket testing thermometers for 25 degrees to 125 degrees F. (tower & chilled water) for 0 degrees to 220 degrees F. (hot water) for 50 degrees - 500 degrees F. (temperatures above 220 F.).

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. In general, install all piping as neatly as practicable as indicated and detailed on the drawings. Arrange and install piping straight, level, plumb, and as direct as possible. Form right angles and parallel lines with the structures. Keep pipes close to walls, partitions, ceilings, and slabs where possible. Where two or more pipes are located together, run parallel to each other and space at distances which will permit application of full insulation and access for servicing.

B. Unless noted otherwise, connect all apparatus and equipment in accordance with the manufacturer's standard details as approved. Provide necessary piping, such as vent, relief, etc., wherever equipment is provided with connections for such piping. Unions or flanged connection shall be placed where necessary to permit easy dismantling of piping and apparatus and in connections to all equipment between shutoffs and the equipment. Each control valve shall have union or flanged connection immediately adjacent or be flare connected. All piping and apparatus connections shall be so installed as to avoid interference with access doors, and to allow for removal of an item of equipment without disturbing other items of equipment. Ream all pipe ends after cutting. All pipe size changes shall be made with pipe reducer fittings or, if applicable, with reducing fittings. Piping shall be carefully installed to provide for expansion and for proper alignment. Pipe lines shall be guided and pipe shall be supported in such a manner that it will not creep, sway, or buckle. Anchors and supports shall be provided wherever necessary to prevent misalignment. Wherever possible, long radius elbows shall be used and not short radius. Eccentric reducers shall be used wherever necessary or indicated; concentric reducers and reducing fittings shall not be used where air trapping may occur. All pipe fittings shall be factory fittings.

C. Joints:

1. Sweat joints in copper tubing shall be with approved alloys. Lead free solders and fluxes that contain not more than 0.2 percent lead (per the Safe Water Act Amendments of 1986, Public Law 99-339) shall be used when joining copper to copper. Silver solders (95 tin - 5 silver) shall be used when joining copper with bronze or steel, and when joining Type K copper to copper, and for any copper joint below floor slab.
2. Dielectric brass adapters, brass unions, or brass bushing shall be used wherever dissimilar metals subject to galvanic activity are joined together, such as equipment connections, tank connection, etc.
3. Piping installer shall use neoprene gasketed compression joints on cast iron pipe.

D. Pipe Sleeves:

1. Fabricate from steel pipe having internal diameter not less than 1" larger than outside diameter of pipe. Length of sleeve shall extend full depth of construction pierced, and in the case of floor slabs, additionally extend 2" above top of slab.
2. Insert sleeves in forms before pour of floor & roof slabs, install sleeves as wall goes up for concrete block walls. Securely fasten sleeves to structure.

E. Nipples:

1. All steel pipe nipples shall be threaded steel nipples, galvanized or black to match pipe.
2. All nipples used in conjunction with copper pipe shall be brass.

3.02 CLEANING

A. Exercise care to keep all ductwork and piping clear and free from foreign matter at all times.

B. After reaming, if cutting of pipe is required, clean each piece of all loose scale, dirt, etc.

C. Keep installed ductwork and piping free from dirt and scale and protect open ends to prevent foreign matter entering. Use temporary plugs, caps, wraps, or other approved method of open and closure.

D. Defective, leaking, or otherwise unsatisfactory joints or material shall be remade or replaced. Peening, caulking, doping, etc., will not be permitted.

3.03 PAINTING OF MECHANICAL PIPING & METAL SURFACES

A. The equipment installer shall touch up all scratches, abrasions, etc., in either the prime or finish coats of all equipment and material furnished and installed by him. All rust and corrosion shall be removed from pipe, fittings, and other metal surfaces. All surfaces shall be left in a clean "factory-new" condition.

END OF SECTION 23 05 10

SECTION 23 05 29

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes hangers and supports for mechanical systems piping and equipment.

1.03 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

B. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

C. ASME: American Society of Mechanical Engineers.

D. SMACNA: Sheet Metal and Air Conditioning Contractor's National Association.

E. Terminology: As defined in MSS SP-58, "Pipe, Hangers, and Supports-Materials, Design, Manufacture, Selection, Application, and Installation."

F. MSS SP-69, "Pipe Hangers and Supports - Selection and Application."

G. MSS SP-89, "Pipe Hangers and Supports - Fabrication and Installation Practices."

H. ASME B31.9, "Building Services Piping."

I. ASTM A36, "Standard Specification for Carbon Structural Steel."

J. ASTM A780, "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings."

K. ASTM C150, "Standard Specification for Portland cement."

L. ASTM A36, "Standard Specification for Aggregates for Masonry Grout."

M. American Welding Society, AWS D-1.1, "Structural Welding Code - Steel."

1.04 SUBMITTALS

A. General: Submit the following in accordance with conditions of contract and Division 1 specification sections.

B. Product data, including installation instructions for each type of support and anchor.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

B. Qualify welding processes and welding operators in accordance with AWS Dl.l "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

C. Qualify welding processes and welding operators in accordance with ASME Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.

1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installing until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers.

B. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Field-Fabricated, Heavy-Duty Steel Trapezes. Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS D-1.1.

E. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded.

H. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
3. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

PIPE SIZE	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060

4. Pipes 8 inches and larger shall have wood inserts.
5. Insert material shall be at least as long as the protective shield.
6. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.03 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.

C. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.04 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

3.05 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.

B. Fit exposed connections together to form hairline joints.

3.06 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Touch-Up Painting: Immediately after erection of anchors and supports, clean abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

C. For galvanized surfaces clean bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 23 05 53

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-23 Basic Materials and Methods section, and is part of each Division-23 section making reference to identification devices specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of mechanical identification work required by this section is indicated on drawings and/or as listed below:

1. Refrigerant piping.
2. Mechanical equipment.

B. Type of identification devices specified in this section include the following:

1. Plastic Pipe Markers.
2. Engraved Plastic-Laminate Signs.

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of the equipment assembly in other Division-23 sections.

D. Refer to Division-26 for sections for identification requirements of electrical work; not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division-1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:

1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Industrial Safety Supply Co., Inc.
4. Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

A. Snap-On-Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 deg F (52 deg C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 deg around pipe at each location, fastened by one of the following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
2. Laminated or bonded application of pipe marker to pipe (or insulation).

D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Designer in cases of variance with names as shown or specified.

1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.04 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.05 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. IH, Standpipe F12).

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
2. At access doors, manholes and similar access points which permit view of concealed piping.
3. Near major equipment items and other points of origination and termination.
4. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
5. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.03 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Fans, blowers, primary balancing dampers and mixing boxes.

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices.

END OF SECTION 23 05 53

SECTION 23 05 93

TESTING & BALANCING

PART 1 - GENERAL

The contractor shall obtain the services of a qualified independent AABC or NEBB certified testing organization to perform the testing, adjusting, and balancing (TAB) work required. The testing organization may be an independent TAB firm or may be any organization submitting satisfactory and acceptable proof of qualifications for doing the work.

1.01 JOB CONDITIONS

A. The heating, ventilating, and air conditioning equipment shall be completely installed and in continuous operation before the initial work specified herein shall begin. TAB work shall begin whenever suitable outside conditions exist for the season or cycle in effect (cooling or heating mode).

1.02 SUBMITTALS

A. The contractor shall submit for approval a detailed proposal containing the following:

1. Qualifications of supervisory and TAB personnel. Included should be special training and number of years experience in this field which qualifies the employee for this work.
2. List of test instruments to be used.
3. Examples of test reports or report forms which will be used to produce the final report.
4. List of five most recent TAB jobs of comparable complexity.

B. Before the start of any work, the TAB contractor shall submit for approval an outline for the proposed method of accomplishment and schedule for doing the work.

C. After the work is complete, a final report, on approved forms, shall be submitted.

1.03 INSTRUMENTS

A. The TAB Contractor shall use instruments which are normally used for this type of work. Each instrument shall be properly maintained and frequently checked for calibration. Calibration dates of instruments used to be shown on test report forms.

1.04 PRIOR TO TESTING REQUIREMENTS

A. Before any testing or balancing is started, an inspection of all HVAC equipment and systems shall be performed jointly by the TAB Contractor and the Contractor. The inspection shall establish that all systems are ready for testing and balancing, and have been operated for a minimum period of 24 hours.

B. The TAB Contractor shall familiarize himself with all systems to be tested and balanced and the test points required. Any test openings tests wells, or other items required for the tests, as proposed by the TAB Contractor, shall be furnished at no additional cost to the Owner.

1.05 PERFORMANCE TESTS

A. General: Conduct capacity tests on all equipment. Tests shall be made during a period of stable operations and minimum load fluctuation. A performance report shall be submitted for each item tested which includes a comparison of installed capacity and design capacity. Guidelines for the required tests and reports are as follows:

B. Air Handling Unit: After air outlets have been balanced, determine total air flow. Then:

1. Adjust fan speed to give design air flow.
2. Record static pressure entering and leaving unit.
3. Record air temperatures entering and leaving each coil.
4. Record water flow rates, pressure and temperatures, as described for coil.
5. Complete approved report forms required to describe performance.

C. Heating Coil: For each coil, the following information shall be recorded:

1. Air flow rate.
2. Air temperature entering and leaving.
3. Complete approved report.

D. Fans: After air outlets have been balanced, determine total air flow. Then:

1. Adjust fan speed to give design air flow.
2. Record static pressure entering and leaving unit.
3. Complete approved report forms required to describe performance.

E. Motors: Observe and record the following:

1. Voltage - nameplate vs measured.
2. Amperage - nameplate vs measured.
3. Motor Speed.
4. Frame Number.
5. Overload Heater Size.

1.07 TEMPERATURE CONTROL SYSTEM

A. In cooperation with the representative of the mechanical control manufacturer installer, verify the setting of automatically operated devices to achieve the required sequence of operation and operate each device through its full range. Record and report temperature and humidity on a continuous recorder for a minimum of seven days. Make minor adjustments as required.

1.08 PROJECT PERFORMANCE REPORT

A. The completed Project Performance Report shall be submitted upon the conclusion of the balancing and testing work. The report shall contain but not be limited to the following:

1. Table of Contents.
2. Summary Report of all systems for mode tested (heating or cooling).
3. Summary Report of all systems upon reverification of ensuing season operation.
4. Comparison of installed equipment capacity to design capacity.
5. Records of all reading taken.
6. List of test equipment used for each test with calibration dates.

END OF SECTION 230593

SECTION 23 07 00

MECHANICAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Section 23 05 10, "Basic Materials and Methods" apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:
   Fiberglass.
   Flexible Unicellular.

C. Refer to Section 23 05 29, "Supports and Anchors" for protective saddles, protective shields, and thermal hanger shields; not work of this section.

D. Refer to Section 23 05 53, "Mechanical Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.03 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

B. NFPA: National Fire Protection Association.

C. ASTM C534, "Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form."

D. ASTM C547, "Standard Specification for Mineral Fiber Pipe Insulation."

E. ASTM C553, "Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications."

F. ASTM C612, "Standard Specification for Mineral Fiber Block and Board Thermal Insulation."

G. ASTM C921, "Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation."

H. ASTM E84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

I. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials."

1.04 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 3 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 [NFPA 255] method.

1.05 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Armacell Enterprise GmbH.
CertainTeed Corp.
Knauf Fiber Glass GmbH.
Johns Manville Corp.
Owens-Corning Fiberglas Corp.
Pittsburgh Corning Corp.
Aeroflex USA, Inc.
Rubatex Corp.

2.02 PIPING INSULATION MATERIALS:

A. Fiberglass Piping Insulation: ASTM C 547, Type 1 unless otherwise indicated.

B. Flexible Unicellular Piping Insulation: ASTM C 534, Type I (Tubular).

C. Cement: As recommended by insulation manufacturer for applications indicated.

D. Jackets for Piping Insulation: ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

1. Encase pipe fittings, valves, strainers, etc. with insulation with glass fabric and vapor barrier mastic applied as per manufacturer's recommendations.

E. Encase the following with 0.016" smooth aluminum jacket.

1. All interior piping insulation within 7'-0" of floors or work surfaces.
2. All valves, fittings, etc. within 7'-0" of floors or work surfaces.
3. All fittings within 7'-0" of floors or work surfaces to be covered with factory formed aluminum elbow covers.

F. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

G. Tees and elbows for insulated piping shall be factory premolded insulation fittings, similar to that manufactured by Hamfab.

H. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 HVAC PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on cold piping within unit cabinets provided piping is located over drain pan.

B. Hot or Low Pressure Piping (to 250°F):

1. Insulate each piping system specified above with one of the following types and thicknesses of insulation with a thermal conductivity with a range of 0.27 to 0.30 BTU • in/(h • ft ^{2} • ^{0}F):

a. Fiberglass: 2-1/2" thick for pipe sizes up to and including 4", 3" thick for pipe sizes over 4".

3.03 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.04 EXISTING INSULATION REPAIR:

A. Repair damaged sections of existing mechanical insulation, damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing. If existing insulation that has been previously damaged is discovered during construction, Contractor shall notify Designer.

3.05 PROTECTION AND REPLACEMENT:

A. Replace damaged new insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 07 00

SECTION 23 81 00

REFRIGERATION & ELECTRIC HEAT PUMP

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work required under this section of the specifications consists of heating and air conditioning equipment as shown on drawing.

B. The work of this section is subject to the requirements of the Mechanical General Provisions section of the specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Materials & Methods, Section 230510.

B. Insulation, Section 230700.

C. Metal Ductwork, Section 233113.

1.03 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

B. ASHRAE: American Society of Refrigeration and Air-Conditioning Engineers.

C. ASTM B280, "Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service."

D. ASHRAE 62.1, "Ventilation for Acceptable Indoor Air Quality."

E. ARI 310, "Standard for Packaged Terminal Air-Conditioners and Heat Pumps."

1.04 CERTIFICATION

A. All electrical components shall be U.L. labeled.

B. Units shall be rated under the ARI certification program.

1.05 GUARANTEE

A. Provide manufacturer's warranty for one year for parts and labor.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING SYSTEM

A. The refrigerant piping shall be ASTM-B-280 Type ACR copper with wrought copper fittings and high temperature solder joints, sil-fos, or approved substitute. The piping system shall include but not be limited to the following: Liquid line solenoid valves, hot gas by-pass and control where noted, charging valves, sight glass with moisture indicator, liquid line filter drier, and flexible connectors where required. The piping shall be installed according to the diagrams furnished by the manufacturer's authorized agent. These diagrams shall be submitted to the Engineer for approval prior to installation. The piping system shall be tested at 650 pounds with dry nitrogen until all leaks have been made tight. After the pressure test use suitable vacuum pump to evacuate the system to at least 500 microns, then charge the system with refrigerant and oil as required. Prior to running the refrigerant equipment, all safety and operating devices and controls shall be properly adjusted and tested for proper operation and protection of the equipment.

B. Refrigerant piping extending through the wall or roof shall be sleeved, waterproofed and be flashed watertight.

C. Insulate all refrigerant suction lines in accordance with Section 23 07 00, "Mechanical Insulation."

D. Systems shall also include: TXV or EEV refrigerant control, replaceable core filter drier with shut-off valves on both sides and liquid line solenoid valve(s).

2.02 DUCTLESS SPLIT SYSTEM

A. Condensing Unit Materials of Construction

1. Cabinet:

a. Fabricated of G-60 galvannealed steel
b. Finished with corrosion inhibiting, high-gloss, powder coated

2. Fan Guard:

a. Heavy-gauge, vinyl dipped wire

B. Compressor - Hermetically sealed, high efficiency rotary or reciprocating type, depending on unit capacity. Motor shall be PSC type with internal overload protection. Compressor shall be installed on resilient mountings.

C. Refrigeration Circuit - The unit shall be delivered with precharged refrigerant for the condenser coil and evaporator. Charging of the field installed piping is required.

D. Condenser Coil - Condenser coil shall be seamless, copper tubing, arranged in staggered configuration, with enhanced aluminum fins. The tubes shall be mechanically expanded for secure bonding to fin shoulder. Hail guards shall be provided to cover all condenser coils.

E. Condenser Fan/Motor - The condenser fan shall be a large diameter, high efficiency, three blade propeller type, directly connected to the totally enclosed, 8 pole, PSC motor. Internal, thermal protection of the motor shall be supplied.

F. Controls/Components

1. Controls installed at the factory shall include:

a. Compressor and fan motor contactor
b. Capacitor
c. Low voltage transformer
d. Low voltage terminals for interconnection with evaporator
e. High pressure control

G. Indoor Unit Materials of Construction

1. Cabinet:

a. Fabricated of galvanneal steel, with structural stiffeners
b. Powder coated finish

2. Discharge Grille Assembly:

a. 4-way adjustable, white painted
b. Anodized aluminum, adjustable

3. Condensate Drain Pan:

   a. Galvanized steel with anti-corrosion coating

4. Cabinet Color:

   a. Designer White

H. Air Systems - Fan shall be tangential type, directly mounted to the motor shaft. Motor shall be PSC type with overload protection. Air stream surfaces shall be insulated with 1/4" fiberglass or 1/8" volara. Filter shall be permanent, washable, and user accessible.

I. Coil - Coil shall be seamless, copper tubing, arranged in staggered configuration, with enhanced aluminum fins, tested to 460 psig. The tubes shall be mechanically expanded for secure bonding to fin shoulder.

J. Controls

1. The unit shall include an IR receiver for wireless remote control flexibility.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8F -9.0F adjustable deadband from setpoint.
4. Indoor unit shall include no less that four (4) digital inputs capable of being used for customizable control stragtegies.
5. Indoor unit shall include no less that three (3) digital outputs capable of being used for customizable control strategies.

PART 3 - CONTROLS

3.01 OVERVIEW:

A. The control system shall consist of a low voltage communication network and a web-based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each pc connected to the network. Operators shall be able to perform all normal operator functions

through the web browser interface.

B. Furnish energy conservation features such as optimal start, request based logic, and demand level adjustment of overall system capacity as specified in the sequence.

C. System shall be capable of email generation for remote alarm annunciation.

3.02 ELECTRICAL CHARACTERISTICS

A. GENERAL:

1. Controller power and communications shall be via a common non-polar communications bus and shall operate at 30VDC.

B. WIRING:

1. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
2. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

C. WIRING TYPE:

1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the System Builder output.
2. Network wiring shall be CAT-5E with RJ-45 connection.

3.03 NETWORK CONTROLS

1. The Controls Network (CN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, person web browsers, tenant billing, online maintenance support, and integration with building management systems (BMS) using either LonWorks or

BACnet interfaces. The below figure illustrates a sample CN System Configuration.

3.04 GRAPHICAL USER INTERFACE

A. The graphical user interface (integrated centralized control web) shall require a field supplied PC or Tablet.

B. ICCW :

1. The integrated centralized control web system (ICCW) interface shall enable the user to control multiple AE-200, AE-50, EW-50's and shall provide additional functions such as energy apportionment from a single network PC configured with the charge calculation tool. The ICCW shall be capable of controlling with a maximum of 2,000 indoor units across multiple outdoor units.
The ICCW shall be required if the user wants to simultaneously control more than 1 AE-200/AE-50/EW-50 centralized controllers from a single PC or Tablet using a single web browser session.
Licensing per function, per AE-200/AE-50/EW-50 centralized controller shall be required for the ICCW including energy apportionment and personalized web. These optional software features shall require the ICCW, advance purchase from the customer, and licensing from ICCW.

3.05 CN: SYSTEM INTEGRATION

A. The CN shall be capable of supporting integration with building management systems (BMS) via industry standard communication protocols including BACnet and LonWorks.

3.06 CN: REMOTE CONTROLLERS

A REMOTE CONTROLLER:

1. The backlit simple Remote Controller shall be capable of controlling up to 16 indoor units.
2. The backlit simple Remote Controller shall only be used in same group with wireless Remote Controllers or with other backlit simple Remote Controllers with up to two remote controller per group.

3.07 CENTRALIZED CONTROLLER (WEB-ENABLED)

A. CENTRALIZED CONTROLLER:

1. The Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple outdoor units with the use with the use of three (3) expansion controllers. The centralized controller shall be 11-5/32"x7-55/64"x2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the Centralized Controller shall include on/off, operation mode selection (cool, heat, auto, dry, setback series only) and fan), temperature setting, fan speed setting, and airflow direction setting. Since the provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.
2. All Centralized Controllers shall be equipped with two RJ-45 ethernet ports to support interconnection with a network PC via a closed/direct local area network (LAN) or to a network switch for IP communication to up to three expansion controllers for display of up to two hundred (200) indoor units on the main interface.
3. The Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.
4. Standard software functions shall be available so that the building manager can securely log into each controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional optional software functions of personal browser for PCs and MACs and energy shall be available but are not included. The Energy Apportionment function shall require integrated system software in conjunction with the Centralized Controllers.

B. EXPANSION CONTROLLER:

1. Expansion Controller shall serve as a standalone centralized controller or as an expansion module to the Centralized Controller for the purpose of adding up to 50 indoor units to either the main touch screen interface. Up to three (3) expansion controllers can be connected to the Centralized Controller via a local IP network to allow for up to two hundred (200) indoor units to be monitored and controlled via the Centralized Controller.
2. The expansion controllers have all of the same capabilities to monitor and control their associated indoor units as the features specified above. Even when connected to the Centralized Controller and configured to display their units on the main controller, the individual indoor units connected can still be monitored and controlled from the interface of the expansion controller. The last command entered will take precedence, whether at the wall controller, expansion or Centralized Controllers.

3.08 CN REMOTE CONTROLLER: SYSTEM INTEGRATION

1. The CN shall be capable of supporting integration with building management systems (BMS).

A. BACNET INTEGRATION:

1. The Cooling & Heating BACnet hardware, which is built into all networked central controllers, shall be compliant with BACnet protocol (ANSI/ASHRAE 135-2010) and be certified by the (BLT) BACnet testing laboratories. The BACnet interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

B. LICENSES:

1. LIC-BACnet Master: Master controller license for master centralized controller and non touch screen, networked centralized controller. LIC-BACnet Expansion: Expansion controller license for expansion controller and non touch screen, networked centralized controller.
2. LIC-BACNET Specifications:

   a. Control up to 50 groups.
   b. 1 to 16 indoor units can be collectively controlled in a group.

c. Supports dual set point functionality (connected model dependant)
d. BTL compliant.
e. BACnet communication specifications are based on ANSI/ASHRAE standards 135-2010.

C. PC REQUIREMENTS:

1. CPU: 1GHz or higher.
2. Memory: 1GB or more.
3. HDD space: 100 MB or more.
4. Screen Resolution: 1024 x 768 or higher.
5. OS: Microsoft Windows 7 32 bit/64-bit, Microsoft 8. 1 32-bit/64-bit. Not compatible with Window Vista.
6. Execution Environment: Microsoft. NET Framework 4.5 or later.
7. Others: Pointing device such as a mouse, internet connection (required when installing a .NET Framework).

PART 3 - EXECUTION

4.01 INSTALLATION

A. Mount units as shown on the drawings.

B. Provide competent factory-trained engineer for start-up testing and instructions to operating personnel.

C. The manufacturer's authorized agent shall be responsible for all installation and control wiring supervision, mounting instructions, sizing refrigerant piping, specialties, and all such details. His agent shall be responsible for start-up and final checkout. He shall, upon job completion, notify the Owner, Architect and Engineer that all units have been checked out, are operating properly and are satisfactory in every respect.

D. Install wall thermostats, controllers and control wiring in accordance with manufacturer's instructions and state and local codes. All control wiring to be concealed.

END OF SECTION 23 81 00