SECTION 15000

MECHANICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, and other pertinent documents issued by the Architect are a part of these specifications and shall be complied with in every respect; certain paragraphs included in this section are supplemental to similar paragraphs in the above documents and are not intended to supersede those paragraphs.

B. Each Subcontractor shall be responsible for reading all sections of the specifications and reviewing all drawings in order to understand thoroughly the nature of the entire project, the requirements for coordination among the several trades, and items in other sections which apply to mechanical and electrical work.

1.02 CONTRACT DOCUMENTS

A. All contract documents are on file in the Architect's office and shall be inspected by all bidders.

B. The scale of each drawing is relatively accurate, but the Contractor is warned to obtain the necessary dimensions for any exact takeoffs from the Architect. No additional cost to the Owner will be considered for failure to obtain exact dimensions where not clear or in error on the drawings. Any device or fixture roughed in improperly and not positioned on implied centerlines or as required by good practice must be repositioned at no cost to the Owner.

C. The mechanical and electrical drawings and specifications are intended to be used together as construction documents forming an integral part of the contract documents. They are intended to define, not limit the required construction and delivery to the Owner of complete systems, in perfect operating condition. Special items required may be shown or mentioned in either the drawings or the specifications, or both; however, it is the intent of the Contract that these systems shall be constructed completely and correctly and shall include all elements necessary to this end.

D. The drawings are generally diagrammatic and the Contractor shall coordinate the work so that any interference is avoided and the Codes are satisfied. Provide all necessary offsets in piping, fittings, etc., required to properly install the work. Exposed work must be kept as close as possible to walls, ceilings, columns, etc., so as to take up the minimum amount of space; all offsets, fittings, etc., required shall be provided without additional expense to the Owner.

E. Offsets, transitions and changes in direction in pipe and ducts shall be made as required to maintain proper headroom and pitch of graded lines. Provide all necessary traps, air vents, sanitary vents, etc., required as a result of these offsets, transitions and changes in direction.

F. Symbols for various elements and systems are shown on the drawings. Should there be any doubt regarding the meaning or intent of the symbols used, an interpretation shall be obtained from the Architect. The decision of the Architect shall be final.

G. It shall be the responsibility of each Contractor to examine the Contract Documents carefully before submitting his bid, with particular attention to errors, omissions, conflicts with provisions of laws and codes having jurisdiction, conflicts between drawings or drawings and specifications, and ambiguous definition of the extent of coverage between Contracts. Any such discrepancy shall be brought immediately to the attention of the Architect for correction. Change Orders will only be accepted for changes in scope. A “change in scope” is defined as work other than what was shown or intended. Costs for Change Orders will be reviewed and processed based on the standard labor rates for the area (either Union or non-Union) and these cost rates shall take precedence over any other contractual or agreed upon rates. All Change Order work shall be executed on a straight time basis (as opposed to overtime or premium time) unless specifically authorized in writing prior to the start of the work. The change order pricing shall be submitted in PDF format. The change order shall be broken down in cost to match the written description issued by the engineer (with full backup). The per line item breakdown shall show labor, material, total costs. A sample of the change order form is shown below:

Cinergy _____
MEP, Delta 5, CCD #03
Thursday, April 6, 2017

The following is a summary of all the changes in the documents. The pricing is to be submitted on a per line item basis (to match this write-up) with total cost, material cost, labor cost with backup.

DWG #	Description of Revisions to Drawings	Cinemark Request	A/E coordination	Clarification	Contractor requested change	Sub-Contractor Cost		
						Labor	Material	Total
E3.1	1. Remove "Ticket" signage	X						
	2. Removed (2) floor boxes for ATMS, power and data to be moved to the adjacent column.	X						
	3. Relocated (2) Ticket exchange kiosk circuit / receptacles	X						
E3.2	1. Add (2) 120V circuits and (2) receptacles for DBOX equipment cabinets	X						
E3.3	1. Auditorium #10 - Add (5) 120V circuits and (23) receptacles for DBOX seats	X						
	2. Auditorium #7 - Add (6) 120V circuits and (24) receptacles for DBOX seats	X						
	3. Add DBOX details	X						
E8.1	1. Removed floor boxes for ATMS. Data to be run up column into projection booth	X						
	2. Relocated (2) ticket exchange kiosk data receptacles.	X						
E8.2	1. Add low voltage for DBOX seats at Auditorium 7 and 10	X						
5					Sub-Total:			
sheets					GC Profit:			
					GC Change Order Total			

H. Should any of these errors, omissions, conflicts, or ambiguities exist, the Contractor shall have them explained and adjusted in writing before signing the Contract or proceeding with the work; otherwise, he shall, at his own expense, supply the proper materials and labor to make good any damage or defects in his work or the results obtained therefrom, caused by such discrepancy.

I. Wherever conflicts occur between different parts of the Contract Documents, the greater quantity, the better quality, or larger size shall prevail unless the Architect informs the Contractor otherwise in writing.

J. When drawing revisions are issued, a written description of the changes will be issued with the revisions. The contractor is to provide pricing on a line item basis (with backup) to match the description of the written changes.

I. The contractor shall have prior written approval to proceed with work that will result in additional cost to the owner

1.03 EXAMINATION OF THE SITE

A. Prior to submitting bid, the contractor shall visit the site and thoroughly investigate locations, connections and details of all services and systems which would in any way affect or tie-in with work of these drawings. No extras will be allowed for work resulting from conditions that would have been evident upon a thorough examination of the site. Notify the engineer prior to bid closing date of any discrepancies or points of doubt or contention. Failing this action, include in the bid for the most expensive course of action.

1.04 PERMITS AND FEES

A. All necessary permits, licenses, and fees required to carry out the work shall be procured by the Contractor. Also, all necessary certificates of approval which must be delivered to the Architect before final acceptance of the work shall be obtained by the Contractor at his expense.

1.05 CONTRACTORS QUALIFICATIONS

A. Each individual employed by the Contractor or by any Subcontractor or Contractor's Consultant shall be experienced, qualified and

competent to correctly perform all work required of him on this project and to the satisfaction of the Engineer.

B. Technical, supervisory and administrative personnel shall have knowledge of the engineering principles involved in the design of the systems required by the Contract Documents and shall be experienced and qualified in the correct interpretation of the requirements of these Documents to the satisfaction of the Engineer.

C. Any firm or individual not having the necessary experience and/or qualifications shall not be used on this project.

D. HVAC contractor must be certified by the Environmental Protection Agency (EPA) to handle refrigerant and maintain records of their certification throughout the duration of the project and during the subsequent one year warrantee period.

1.06 CODES, ORDINANCES AND STANDARDS

A. The Contractor is expected to know or to ascertain, in general and in detail, the requirements of all Codes and Ordinances applicable to the construction and operation of systems covered by his Contract. He shall know or ascertain the rulings and interpretations of Code requirements being made by all authorities having jurisdiction over the work to be performed by him.

B. In preparing his bid, the Contractor shall include the cost of all items and procedures necessary to satisfy the requirements of all applicable Codes, Ordinances and Authorities, whether or not these are specifically covered by the drawings and specifications. All cases of serious conflict or omission between the drawings, specifications and codes shall be brought to the Architect's attention as hereinbefore specified. The Contractor shall carry-out his work and complete his construction as required by applicable Codes and Ordinances and in such manner as to obtain approval of all authorities whose approval is required without additional cost to the owner.

C. The Contractor shall confine the storage of materials and the operation of his workmen to the limits provided by law, ordinances, permits or as directed by the Architect.

D. Except as modified by this specification, all work shall conform to the applicable provisions and recommendations of the standards listed below. The following standards are incorporated into and made a part of these specifications:

1. City of Amarillo Building, Mechanical, Plumbing and Fire Codes, with local amendments.
2. NFPA- National Fire Protection Association.
3. AGA - American Gas Association.
4. ASME - American Society of Mechanical Engineers.
6. ASTM - American Society Test Materials.
7. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
8. NSF - National Sanitary Foundation.
9. PDI - Plumbing Drainage Institute.
10. UL - Underwriters' Laboratories.
11. NEC - 2011 National Electrical Code.
12. NEMA - National Electrical Manufacturers Association.
13. SMACNA - Sheet Metal and Air conditioning Contractors National Association.
14. OSHA- Occupational Safety and Health Act of 1990.
15. ARI - American Refrigeration Institute.
16. ANSI - American National Std. Institute.
17. 2011 Life Safety Code.
18. American Disability Act (ADA).

1.07 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, tools, machinery, equipment, accessories, hardware, fasteners, layout, supervision, hoisting, scaffolding, shop drawings, cleanup, detailing, packaging, trucking, freight, delivery, permits, insurance and all services necessary to complete the mechanical work under this contract in accordance with all codes. All work shall be coordinated with the work of other trades so as to resolve conflicts without impeding job progress. All out of sequence work shall be included.

B. The work includes but is not limited to the following systems, equipment and services:

1. Self contained air conditioning units consisting of components indicated on the drawings or specified herein, including:
   a. Rooftop Units.
   b. Temperature controls.
2. Air distribution system consisting of components indicated on the drawings or specified herein, including:
   a. Sheet metal ductwork.
   b. Grilles, registers, duct insulation, control dampers and fire dampers, etc.
3. Plumbing system consisting of components indicated on the drawings and specified herein, including:
   a. Plumbing fixtures.
   b. Domestic hot water supply piping.
   c. Domestic cold water supply metering and piping.

d. Drinking water fountains with coolers.
e. Sanitary waste piping.
f. Vent piping.
g. Domestic water heaters.
h. Floor drains.
I. Pipe Insulation
j. Gas metering and piping
k. Grease Traps.

4. Furnishing of shop drawings and brochures.
5. Furnishing of "as-built" drawings.
6. Balancing and adjusting of mechanical systems.
7. Furnishing operating and maintenance manuals.
8. Miscellaneous items as required for complete and functioning systems as indicated on the drawings and specified herein.
9. All systems, equipment, and services specified herein shall be furnished and installed complete and ready for use.
10. Installation of a new and complete combination standpipe/sprinkler system.
11. Installation of seismic restraints.

C. The subcontractors understand and agrees that time is of the essence, and in the event overtime or premium is required to maintain pace with the construction schedule due to the subcontractor's lack of progress, it will be performed at no additional cost.

D. The work included herein may not be performed in a continuous cycle but in various stages as determined by the General Contractor, the Owner, or delivery of Owner furnished items or equipment. This contractor shall perform the work out of sequence as directed without any additional cost to the Owner or the General Contractor. The subcontractor shall include any required overtime expense at no additional cost to the Owner or General Contractor to meet the milestone dates and occupancy dates in accordance with the General Contractor's schedule.

E. On union projects, the contractor is to be responsible for employing the proper tradesmen per union jurisdiction, past, present, and future. The subcontractor is also responsible for taking whatever measures that may be necessary, including composite crews, to settle any labor disputes and insure job continuity at no additional cost to the Owner. Should questions of union jurisdiction arise, the contractor shall immediately take steps to settle such disputes and will use such labor as may be determined to have jurisdiction, at no additional cost to the Owner or General Contractor. Should he fail to take expeditious action, he will be responsible for the time lost and monetary damages because of delays arising from such disputes.

F. Provide one HVAC and one plumbing technicians for 24 hours each (exact schedule to be determined by the Owner's project managers) at the time of the theatre opening.

1.08 COORDINATION OF WORK

A. The Contractor shall coordinate work of this Division with that of other Divisions so that all systems, equipment and other components of the building will be installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. This means adequate access to all equipment, not just that installed under this Division.

B. Any components of the Mechanical Systems which are installed without regard to the above shall be removed and relocated as directed by the architect, at no additional cost to the Owner.

C. Where various items of equipment and materials are specified and scheduled, the purpose is to define the general type and quality level, not to set forth the exact trim required to fit the various types of ceiling, wall or floor finishes. The Contractor shall provide materials which will fit (both dimensionally and color) properly the types of finishes actually installed.

D. In the event of conflict with other trades or work, the following priority shall be followed: lighting, HVAC, plumbing, sprinklers. The HVAC, plumbing, and sprinkler contractors shall provide what ever materials, offsets, labor etc. required to provide the required coordination and the priorities listed above.

E. Where the word verify is used on the documents, the contractor shall field verify the existing conditions and modify the scope of the installation as required to meet the verified conditions without additional cost to the Owner..

PART 2 - PRODUCTS

2.01 STANDARD PRODUCTS

A. Each item of equipment furnished under this specification shall be essentially the standard product of the manufacturer. Where two or more units of the same kind or type of equipment are required, these shall be the products of a single manufacturer. All equipment shall be U.L. approved (labeled) and shall be manufactured in the U.S.A.

B. All material and equipment shall be new, and of the best quality used in good commercial practice and shall be the product of a reputable manufacturer. Each major component shall bear a name plate giving the name and address of the manufacturer and the catalogue number of designation.

2.02 MANUFACTURER'S DIRECTIONS

A. All manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturers, unless herein specified to the contrary.

2.03 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. In general, no substitutions will be allowed. The Contractor shall submit with each request for approval of substitute material or equipment, sufficient data to show conclusively that it is equivalent to that specified. Acceptance or rejections of the substitutions when permitted shall be subject to the approval of the Engineer. Under no circumstances will the Engineer be required to prove that an item proposed for substitution is equal to the specified items. It is mandatory that the Contractor submit (email) prior to bid to the Engineer in writing all evidence required to support his contention that the item proposed for substitution is equal to the item indicated in the plans and specifications. All requests for substitution must be made at least 2 weeks prior to bid and shall be approved via email.

B. Requests for substitution shall include the Contractor's reason for the request.

C. If the Engineer does not consider the items equivalent to those specified, the Contractor shall furnish those specified.

2.04 EQUIPMENT INSTALLATION

A. When the Architect has reviewed equipment submittals it shall be the responsibility of the Contractor to install the equipment to operate properly and in accordance with the intent of the drawings, specifications, and codes.

B. Work and equipment shall be supported plumb, rigid and true to line. The Contractor shall study the general, structural, mechanical and electrical drawings, shop drawings and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be installed, and shall provide foundations, bolts, inserts, stands, hangers, brackets and accessories for proper support whether or not shown on the drawings. When directed, the Contractor shall submit for review drawings showing foundations and supports.

C. DRIVES AND BELT GUARDS: The Contractor shall provide for each V-belt drive or rotating shaft a protective guard which shall be constructed around an angle iron frame, securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements. Hinged access doors not less than 6" x 6" shall be provided for access to motors and fan shafts for test purposes. Guards shall not interfere with lubrication of equipment.

D. All equipment shall be installed with adequate maintenance access. Any equipment installed without adequate access shall be relocated at the contractor's expense.

2.05 NAMEPLATES AND EQUIPMENT IDENTIFICATION

A. NAMEPLATES: Each major item of equipment shall have the manufacturer's name, address, serial number and model number on a plate securely attached to the item.

B. EQUIPMENT IDENTIFICATION: Unless specified otherwise, all items of equipment, except those in finished areas shall be identified as to number, name, function, capacity and other pertinent data with securely attached laminated plastic name tags of an appropriate size with white letters and black background. Generally, the number and name shall be at least 1/4" high and other data at least 1/8" high. Rooftop equipment shall have the number neatly stenciled on the unit with black 5" high numerals.

2.06 ELECTRICAL REQUIREMENTS

A. ELECTRICAL WIRING: Electrical wiring for mechanical equipment is separated into two main wiring divisions: "Power Wiring" and "Control Wiring".

B. Power wiring shall be the energy source and includes circuit protective devices, motor starters or controllers, conduit, wiring and safety disconnects beginning at the Power Supply and terminating at the motor or terminals on equipment.

C. Control wiring comprises conduit and wiring not included in "Power Wiring" including automatic temperature control wiring, interlock wiring, pilot light and signal wiring, energy management system wiring, etc., that is not included as part of prewired equipment but is necessary for the proper operation or safety of the equipment. Approved "point to point" wiring and interlock diagrams shall be furnished under Division 15 and by all equipment suppliers.

D. Unless otherwise noted, "Power Wiring" and "Control Wiring" shall be furnished and installed under Division 16 of the specifications, under the advisement of the equipment supplier and mechanical contractor in accordance with Division 15 of these specifications.

E. MOTORS AND EQUIPMENT CONTROL: Each motor, each item of electrically driven equipment and each manufactured combination of motors and equipment shall be provided with controllers and pilot devices that will perform the functions as specified. Controllers and pilot devices shall conform to NEMA Standard ICL and UL Standard for Industrial Control Equipment.

F. Starters: All starters shall be provided by the electrical contractor.

G. Controllers shall have overload relays in all ungrounded conductors. Overload relays shall be sized to protect the motor, with consideration being given to the ambient temperature in which the motor and controllers are located.

H. Starters, motor controls, push-button stations, selector switches, pilot lights, relays, automatic temperature controllers, safety devices, solenoids and similar devices that are normally included as an integral part of the equipment shall be furnished by the Contractor furnishing the equipment. Starters that are not provided as integral parts of the equipment shall be furnished under Division 16. All starters shall be installed under Division 16.

I. Disconnect switches, except where furnished factory mounted, shall be supplied and installed under Division 16.

J. Starters, pilot lights, controllers, push buttons, and similar devices located in finished spaces shall be flush mounted in a surface painted to match surrounding finish.

PART 3 - EXECUTION

3.01 SUBMITTALS

A. The purpose of these submittals is to aid the Contractor in such a manner that improper or unacceptable materials are not delivered to or installed on the job, and that all materials and equipment are properly installed.

B. Equipment, materials, layout, and fabrication submittals must show sufficient data to indicate complete compliance with Contract Documents as follows:

1. Proper sizes and capacities.

2. The item will fit in the available space in a manner that will allow proper service.

3. Construction methods, materials and finishes.

C. Catalog data must be clearly marked to indicate the items or mode. All information on a catalog sheet not pertaining to the item being submitted must be marked out.

D. All submittals must be bound in one Adobe PDF file with a table of contents listing all items in that specific submittal. Loose catalog sheets or drawings will not be acceptable. A separate brochure will be required for each type of equipment.

E. For any item to be installed in or on a finished surface (such as tee bar acoustical ceiling, plaster wall), the submittal certifies that the contractor has checked all applicable Contract Documents and that the item submitted is compatible with the surface finish and color on which it is to be installed.

F. See the chart on sheet MEP0.1 for the list of submittals.

G. All submittal drawings must be submitted electronically. All drawings must be submitted (emailed) in AutoCad DWG format. All cut sheets must be submitted in Adobe .PDF format (as one file per submittal) . Do not submit paper, binders or notebooks. Include the AutoCad STB file (pen weights) with the submittal.

H. One email per shop drawing submittal.

I. One PDF file per submittal..

J. Email directly to the Engineer with copy to the architect. Use the project name in the subject line.

3.02 CONTRACTOR'S DRAWINGS

A. The Contractor shall submit to the Engineer for approval prior to beginning this work one electronic copy in DWG format on the equipment proposed to be furnished and installed. Equipment cut sheets shall be submitted via email as one electronic copy in Adobe ".PDF" format (one PDF file per submittal).

3.03 RECORD DRAWINGS

A. The Contractor shall obtain, at his expense, a set of white prints and keep these on the jobsite during construction. During the course of construction, the Contractor shall mark on these prints deviations from the contract documents, noting particularly locations of those items which will need to be located for servicing.

B. Upon completion of the installation, obtain from the Engineer a complete set of vellum transparencies. Enter thereon, in a neat and accurate manner, a complete record of all revisions of the original drawings, as actually installed. All revisions are to be identified in a professional manner equal to the presentation of the original Contract Documents; however all deviations shall be clearly identified. Submit one (1) set of vellum transparencies and black and white prints of these revised transparencies to the Engineer for review. The cost for transparencies and for making required changes to be borne by the appropriate Subcontractor.

3.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall follow the manufacturer's directions completely in the delivery, storage and handling of equipment and

materials.

B. Equipment and materials shall be tightly covered and protected against dirt, water, chemical or mechanical injury and theft. At the completion of the work, fixtures, equipment and materials shall be cleaned and polished thoroughly and shall be in a condition satisfactory to the Architect.

3.05 UTILITIES, REGULATIONS, METERS

A. Locations and elevations of utilities have been obtained from shell building drawing or to other sources and are offered as a general guide only, without guarantee as to accuracy. The Contractor shall verify the exact location and elevation of utilities and their relation to the work before entering into a contract.

B. The Contractor shall arrange with the landlord and utility companies for service connections, purchase of meters and vaults, verifying locations and patching pavements, sidewalks, and other surfaces, and restoring them to their original condition.

C. The Division 15 contractor shall be responsible for final connection of domestic water service, storm system, sanitary system, and fire service to the building utilities.

3.06 PROTECTION OF WORK AND PROPERTY

A. The Contractor shall take proper precautions to protect adjacent property, as provided by law and the Contract Documents, with which his work comes in contact, or over which he may have occasion to transport, hoist or move materials, equipment debris, etc., and shall satisfactorily repair and make good any damages caused by him during construction operations.

B. The Contractor shall provide and maintain suitable temporary sidewalks, fences or other structures as required by law, or as otherwise necessary for the protection of workmen and passersby and as necessary to prevent obstruction or interference with traffic in public streets or sidewalks, or private right-of-way. He shall leave access to all fire hydrants, provide temporary walkways around any obstructions made in any public place on account of his work and maintain sufficient lights and barricades to protect passersby at night. All streets, curbs and sidewalks shall be maintained in good condition and so left at the completion of the work. The Contractor shall make all necessary arrangements and perform all services required in connection with or as occasioned by his work for the care, protection and maintenance of all public utilities, including fire hydrants, pipe lines and electrical and/or telephone, telegraph and all other items of similar character on or adjacent to the site, assuming all responsibility and payment of all cost incidental to such care and protection or rectification of damage done for which the Owner might otherwise be liable.

3.07 CLEANING UP AND REMOVAL OF RUBBISH

A. The Contractor shall be responsible for keeping the premises (including the outside area) free of all rubbish, debris and waste materials of every kind at all times during the Contract period. This requirement is mandatory and shall apply regardless of whether such rubbish, etc., accumulates in consequence of his work of his Subcontractors operations.

3.08 PROTECTIVE COATINGS

A. Exterior surfaces of pipes, ducts, louvers, hangers and other metal accessories run in or through concrete floor, underground or in crawl spaces, and surfaces in contact with masonry or mortar shall be painted two coats of acid resisting bituminous base paint.

B. Exterior surfaces of pipes, ducts, hangers and other metal accessories exposed to the weather shall be painted with two coats of epoxy enamel paint of a color selected by the Architect in accordance with the Painting Section.

3.09 LUBRICATION

A. The Contractor shall provide lubrication for the operation of all equipment until it has been accepted. The Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the equipment. The Contractor shall be required to protect all bearings during installation and shall grease steel shafts thoroughly to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction.

3.10 VALVE AND PIPE IDENTIFICATION

A. VALVES: Not Used

B. PIPING:

1. All visible piping located in accessible spaces such as equipment rooms, spaces, shall be identified with all temperature pipe markers as manufactured by W. H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.

2. Generally, markers shall be located on each side of each partition, on each side of each tee, on each side of each valve and/or valve group, on each side of each piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested areas, markers shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection to each piece of equipment and automatic control valve.

3. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed. The surface of all insulation shall be sealed with clear lacquer before applying markers.
4. After the installation of the marker, the label and pipe shall be coated with clear lacquer.
5. All piping must be identified in the manner required by the governing authorities.

3.11 CATALOG DATA FOR OWNER

A. The Contractor shall provide in loose-leaf binders a compilation of catalog data of each manufactured item of equipment used in the mechanical work and shall present this compilation to the Architect for transmittal to the owner before final payment is made. Descriptive data and printed installation, operation and maintenance instructions for each item of equipment shall be included. A complete double index shall be provided as follows:
   1. Listing the products alphabetically by name.
   2. Listing the names of manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the names and addresses of the local sales representatives.

3.12 CHARTS, DIAGRAMS AND SCHEMATICS: Not Used

3.13 EQUIPMENT START-UP AND TESTING

A. The Contractor shall conduct start-up and operating tests of each major item of equipment in accordance with these specifications and the drawings.

3.14 REQUESTS FOR INFORMATION (RFIs):

A. RFIs to be emailed directly to the Engineer.
B. One email per RFI
C. One RFI per shop email.
D. Use the project name in the subject line.

3.15 MEP SITE OBSERVATION REPORTS

A. The Engineer will distribute periodic Site Observation reports. The report will list deficiencies in the construction.
B. The General Contractor will have 5 business days to respond to the report and a total of 10 days to make corrections.

3.16 GUARANTEE

A. The Contractor shall and does hereby guarantee for a period of one year from date of final acceptance by the Architect all work as called for in the various Divisions of these specifications. When such work is performed by Subcontractors, and where special guarantees are required by Subcontractors, the Contractor shall secure warranties from said Subcontractors and deliver copies of same to the Owner upon completion of the work.
B. The Contractor shall replace with new materials and/or equipment any material failing to give satisfactory service during the guarantee period and shall replace any refrigerant or oil lost during the guarantee period. Replacement of materials, equipment, oil or refrigerant, including all labor involved, shall be at no cost to the Owner.
C. Nothing in the above intends or implies that this guarantee shall apply to work which has been abused or neglected by the Owner.

END OF SECTION

SECTION 15034

HVAC TESTING AND BALANCING

PART 1 - GENERAL

l.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 15.

B. All other Divisions of the Contract Documents. Refer to each Division's specifications and drawings for all requirements.

1.03 SCOPE

A. All air handling systems are to be balanced to accomplish flows and other conditions shown or indicated on the drawings and/or specified herein to the complete satisfaction of the Architect.

B. The balance contractor shall provide all instruments, materials and labor to perform the balancing and to obtain and record all measurements. However, the preparation for and the corrections necessary for the testing, adjusting, balancing (including the replacement of sheaves) are the responsibility of the HVAC contractor. At the completion of the project, the theatre test and balance contractor shall furnish and install (replace) all of the RTU factory variable sheaves with new fixed sheaves.

C. The balance contractor shall furnish one electronic copy of reports to the Engineer for all reports required for this project.

D. Final values obtained from the test and balance shall meet (5%) the conditions shown or indicated on the drawings. Equipment not delivering values meeting or exceeding the stated values shall be corrected until such specified values are obtained. Note that the air flows shown on the plans, drawings, and schedules are actual air flows (non-standard CFM) which have been corrected for local conditions including altitude. The reported air flow values from the test and balance are also to be actual air flows (non-standard CFM).

E. The Test and Balance (TAB) Contractor shall be independent of the installing HVAC Contractor and shall be contracted directly to the General Contractor. The TAB Contractor shall be certified by either National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC). Qualifications, procedures and sample of forms shall be submitted for approval before beginning work.

F. Air Balancing: All space conditioning and ventilation systems shall be balanced to the quantities specified in these plans, in accordance with the National Environmental Balancing Bureau (NEBB) Procedural Standards (1983) or Associated Air Balance Council (AABC) National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems, fifth edition 1989.

PART 2 – PRODUCTS : Not used.

PART 3 - EXECUTION

3.01 General

A. Test all equipment and make all final adjustments and replacements necessary to place the system in proper operating condition, Operate the system under normal operating conditions for a minimum of 8 hours, and instruct the owner's mechanic in the operation and maintenance of the system.

B. Contractor shall provide for a second start-up of each unit at the beginning of the season opposite that in which the system is first operated and tested. Report initial and final values.

C. Air Handling, Exhaust and Distribution: Balance the individual rooftop to equipment and adjust dampers, registers, and diffusers so that air distribution will be uniform for the entire system, with tests showing air quantities indicated for each inlet, outlet; quantities shall not vary by more than -5 % from those indicated on the schedule. For smoke control fans, SEF in smoke zone 1 balance to 0.05 inches water across smoke and non-smoke zone.

   a. Determine air velocity at outlets with a velometer or anemometer, or determine cubic feet per minute with a test hood.
   b. Obtain approval of the desired method of taking velocity readings before starting balancing or tests,
   c. All instruments shall be calibrated accurately before use.
   d. Submit report of final tests, giving fan RPM, CFM. at each outlet, instrument readings, voltage chips and other pertinent operating data as directed. Report shall be neatly bound.

D. Projector exhaust fans: Balance to the CFM indicated on the drawings +5% or 95 degrees discharge temperature. Air flow shall be measured by duct traverse with all ducts and equipment connected and operating. The air temperatures in and out shall be

reported.

E. All other exhaust: All other exhaust grilles and registers shall be balanced to 5 percent of the valves indicated on the drawings.

F. The methodology for properly adjusting the RTU fan speed and total air flow is as follows:
   1. Determine the proper diameter of the replacement sheave to achieve the specified air flow.
   2. Replace the variable sheave.
   3. With all volume dampers 100% open, slow the fan speed to the lowest possible RPM to achieve to total specified air flow or as close as possible.
   4. Proportionally balance the diffusers in the auditorium.

G. Barometric Relief Dampers:
   1. Adjust the damper counter balance to allow the damper to open at .050" w.c.

3.02 CONTROLS:

A. The ATCS Control vendor shall calibrate and adjust all thermostats (and sensors) and other controlling devices; he shall place control systems in satisfactory operating condition; he shall also instruct the Owner's assigned operating personnel in the operation and maintenance of these controls.

B. The ATCS Control vendor shall furnish diagrammatic layouts of automatic control systems and a set of printed instructions to the Owner, for both operation and maintenance.

3.03 SYSTEM OPERATING TESTS

A. After the successful completion of all equipment start-up and test requirements, the following formal testing and balancing shall be performed on the complete mechanical system:

   1. Testing and Balancing by the Contractor: The Contractor shall prove the operation of the mechanical system and of each individual item in the system. At least 10 days' notice shall be given to the Architect of such tests. Should any item of the system fail to perform in an approved manner, this test shall be repeated until the operating test is approved by the Architect.

   2. Checking by Owner and Architect: Following the successful completion of the first operating tests by the Contractor and submission of the completed test and balance report, the Owner and the Architect shall have the privilege of making such tests as they may desire during a period of three weeks to ascertain in detail if any corrections are to be made to the system. At the end of testing by the Owner and Architect the Architect shall direct the Contractor in writing to make such corrections to the systems as are within the scope of the contract.

   3. Contractor's Corrections to System: The HVAC Contractor shall make all required corrections to the systems and shall notify the Architect in writing that he has completed the corrections outlined and shall give at least seven days' notice of a final operating test. Revised test and balance reports shall be submitted after the corrective action is completed.

   4. Final Operating Test: An operating test shall be performed by the Contractor to the satisfaction of the Architect and the Owner for a period of one day. Should any element of the system not perform properly, the Contractor shall make all required corrections, and the test shall be repeated until successfully performed.

B. Instruments: The Contractor shall provide all instruments, materials and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms as approved by the Architect.

C. The HVAC Contractor shall furnish to the TAB Contractor complete shop drawings and catalog data for all air moving equipment and apparatus, including fan curves.

D. The HVAC contractor shall install new filters and filter media prior to the final air balance.

E. The test and balance contractor shall perform all tests and generate reports required by the governing authorities for all life safety and HVAC systems, including, but not limited to smoke detectors and combination fire/smoke dampers, etc. If required by the governing authorities, the Test and Balance contractor shall retain an approved third party inspector to perform these tests.

3.04 Final Test and Balance Report

A. Proposed forms and the qualifications of the TAB contractor, including AABC/NEBB Certification proposed by the Contractor shall be submitted to the Architect for approval at least four weeks prior to the start of testing. Approval for all of the above shall be obtained prior to the start of testing.

B. Reported Measurements and Data:
   1. Electrical: Running amperes and voltage of each motor 3/4 horsepower or larger.
   2. Blower speed
   2. Static pressure gains or losses at entrance and exit of each filter, coil, fan and damper.
   3. Air temperatures in each heated or air conditioned space, at the entrance and exit of each coil, and unit, downstream from each pair of dampers where air of two different temperatures is mixed and outside the structure.

4. Air flows at each fan.
5. Air flows at each grille, register, and diffuser.
6. Maximum and minimum air flows at each terminal box.
7. V-Belt drive: driven sheave diameter and RPM; motor sheave diameter and RPM; belt size and quantity; and center to center distance, maximum, minimum and actual.

C. Presentation of the report shall be four neatly bound copies of a typed report of the final operating test shall be submitted to the Architect for approval and subsequent transmittal to the Owner.

D. The report shall include a title page stating the following information: TAB Company name, company address, company telephone and fax numbers, project name, project location, General Contractor Name, Certifying TAB Engineer.

E. The report shall be sealed by an engineer registered in the state in which the project is constructed.

3.04 FINAL JOB MEETING:

A. At job completion, all Division 15 and 16 representatives shall meet at the job site and shall jointly inspect, check and test each control circuit, interlock circuit and power circuit to each piece of equipment. The Architect, Engineer and Owner shall be advised in writing of the time and date of this inspection in sufficient time to allow them to make arrangements to have a representative present if desired.

END OF SECTION

SECTION 15300
FIRE PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Conditions, apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 15.

B. All other Divisions of the Contract Documents. Refer to each Division's specifications and drawings for all requirements.

1.03 SCOPE

A. Design, furnish and install a new fire protection system for the building as specified, as shown on the drawings, and as required by all Authorities having jurisdiction over this project. Install new fire sprinkle system in all new or remodeled areas. Install a new fire entry, including all valves, fittings, test stations, headers and controls, Extend and connect the new fire sprinkler system to the site or the building main.

B. The requirement that the entire fire protection installation shall be as required by and subject to the approval of the Authorities, shall govern the installation for this project. The design documents are intended as a guide for the installation; omission of specific indication of any item or apparently contradictory statements shall not relieve the Contractor of the responsibility of furnishing and installing that item if it is required by the Authorities. The design documents state the minimum requirements of the system.

C. Upon completion of the work, this Contractor shall be responsible for obtaining from the Authorities a certificate of approval or other indication of such approval and acceptance by said Authorities.

D. It is the responsibility of the Contractor to ascertain exact and complete design and installation requirements, in compliance with all applicable codes and the requirements of the governing authorities, prior to submitting bid proposal.

E. It is the responsibility of the Contractor to ascertain the available water pressure and include in his bid the complete cost (including electrical) of the furnishing and installing of a fire pump system if required to meet the requirements of this specification.

F. At the completion of the project, the contractor shall submit a complete set of “as-built” autocad files in dwg format.

1.04 CODES AND STANDARDS

A. All aspects of design, securing approval of design and construction, shall be in accordance with the current National Fire Protection Standards, City of Amarillo (or local fire marshal), Local Fire Protection District, and the State of Texas. The design in accordance with the standards shall be in addition to the specifications.

B. The officials listed above shall be, at a minimum, the relevant authorities. The contractor shall confirm the design criteria with all other authorities having jurisdiction.

C. All materials and equipment provided under this section of the specifications shall be Factory Mutual (FM) Global Approved for the specific application.

1.05 PERMITS

A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of his work.

1.06 SCHEDULING

A. The Contractor shall cooperate with all reasonable scheduling requests established both prior to commencing work and as the work progresses to the final completion date.

1.07 COORDINATION WITH OTHER WORK

A. The Contractor shall examine the architectural, structural, electrical and mechanical drawings and specifications, in order to become familiar with the general building and details as they apply to the work of fire protection.

B. The accompanying drawings show the general run of plumbing air conditioning, pipe, ductwork and apparatus. The Contractor shall coordinate this work with all other construction to the end that there shall be no conflict as to space required. The ductwork and electrical work shall, in general, take precedence over sprinkler work, except where it is absolutely necessary to maintain required coverage.

1.08 CONTRACTOR'S SHOP DRAWINGS

A. Approval

1. Before proceeding with the work, the Contractor shall make complete drawings of all services, piping, new sprinkler head locations and shall prepare hydraulic calculations and volumetric calculations.
2. Drawings shall be made in such scope and detail as to receive approval of the local Fire Prevention Bureau (Fire Marshal), and the Landlord's insurance underwriter as well as to indicate all coordination with other work.
3. The drawings shall be submitted to the engineer as DWG files for drawings and Adobe PDF files for hydraulic calcs and cut sheets for approval prior to submission to the governing authorities.

B. Approved Drawings
1. Upon obtaining preliminary approval from the Engineer, the Contractor shall make any corrections to the drawings which may be required by the Engineer.
2. The corrected drawings shall then be submitted to the Fire Prevention Bureau, in the manner which they prescribe.

C. The initial submittal to the Architect shall be made complete as one package and shall include:
1. Cut sheets on all sprinkler heads, equipment and piping (electronic PDF).
2. Hydraulic calculations (electronic PDF)
3. Email with all of the submittal drawings in Adobe PDF (grey scale, not color) AutoCad DWG format and all cut-sheets and hydraulic calculations in Adobe .PDF format directly to the engineer prior to sending to the fire department.
4. Drawings shall clearly show ceiling heights in each area.
5. Drawings shall show typical building sections with pipe tight to steel.
6. Drawings to be prepared by NCET level II or greater.
7. Drawings to show sprinkler legend with manufacturer, type, color, temperature on each sheet.
8. Drawings to show all sprinkler piping sizes, heads on one sheet. No separate RCPs.
9. Incomplete submittals will be rejected.

1.09 DESIGN CRITERIA

A. Automatic Sprinklers
1. Complete automatic sprinkler protection will be provided throughout the area in accordance with all sections of the current edition of NFPA as well as the local, state, and NFPA codes referenced above.
2. Provide sprinklers between the screens and the wall in the auditoriums. Please note that the screen and associated valances are to be treated as obstructions (fixed partitions) to sprinklers.
3. Except in the auditoriums (below 30 ft ceilings) and lobbies, extended coverage heads are not acceptable.
4. All unprotected openings between floors shall be protected with a water curtain (heads six feet on center) and a draft stop.
5. All rooms, enclosures, soffits, overhangs, canopies, etc. which are sprinkled and are subject to freezing shall be provided with a dry-pipe system (no anti-freeze) or freeze-proof sprinkler heads.
6. The light fixture locations shown on the electrical drawings shall be used for sprinkler head placement.

B. Piping
1. No piping shall penetrate the demising walls between two auditoriums.
2. The sprinkler main serving the promenade shall include capped tees to allow for the future addition of sprinklers below the stadium seating.
3. No flex piping shall be used.
4. Piping is to be routed as high as possible, tight to the steel.

C. Zoning
1. There shall be a minimum of two sprinkler zone with flow switches and isolation valves.
2. The exact number and configuration of zones shall be as required by the authorities.
3. The zones shall be split left and right, not vertically.

PART 2 – MATERIALS & EQUIPMENT

2.01 PIPING

A. Sprinkler Piping:
1. Sprinkler piping may be welded, screwed, or grooved at contractor's option. "Pulled Tees" are not acceptable.
2. Piping weights, fittings, ratings and method of assembly shall be provided in accordance with NFPA-13, and the Authorities having jurisdiction.
3. Sprinkler piping shall be steel, no lighter than Schedule 10.
4. All sprinkler piping shall be supported from the building steel, as high as possible.

2.02 VALVES

A. Except as hereinafter specified, furnish and install valves approved by NFPA and suitable for fire protection use where indicated on the Drawings or as required in accordance with the following:

1. Interior gate valves 2" and smaller shall be approved indicating type with bronze bodies, for 125 lbs. WWP, bronze trim, wedge discs, rising stems and screwed ends.
2. Interior gate valves 2-1/2" and larger shall be approved indicating type of OS&Y pattern with iron bodies for 125 lbs. WWP, all bronze trim and flanged ends.
3. Interior check valves 2" and smaller shall be all bronze swing check valves with screwed ends, for 125 lbs. WWP.
4. Interior check valves 2-1/2" and larger shall be iron or semi-steel bronze trim, swing check valves with flanged ends for 125 lbs. WWP.
5. Drain and test valves shall be 125 lb. V.O.G., bronze threaded globe valves with renewable composition disc.

2.03 SPRINKLERS

A. Sprinklers shall be provided throughout the entire project except (when approved by the local authorities) in rooms containing electrical generators, electrical transformers, or electrical switchboards. The sprinklers shall be quick response sprinklers, with a minimum temperature rating of 175ºF.
1. THEATER AUDITORIUMS: Recessed or exposed pendant,, 175°F, flat black heads and flat black escutcheons. Note that these can be standard (recessed) or extended coverage (pendants) heads.
2. THEATER LOBBY AREA WITHOUT CEILINGS: Pendant, 175°F, with color as selected by the architect.
3. THEATRE LOBBY AND PUBLIC AREAS WITH CEILINGS: Recessed 175°F, white in white ceilings, black in black or dark ceilings. Centered in tiles one way.
4. PROJECTION BOOTH AND MEZZANINE AREAS: with Ceilings: Recessed, 175°F, white heads and white escutcheons, black in black or dark ceilings. Without ceilings: Upright, black brass pendants.
5. NON-PUBLIC AREAS: Recessed pendants, 175°F, white heads and white escutcheons
6. ALL ELECTRIC ROOMS: When required by the local authorities, heads are to be located in the electric room and shall be 212°F.
7. Any special sprinklers required by UL shall be provided.
8. Upright heads to be provided in rooms without ceilings.
9. Piping in areas having a ceiling shall be concealed.
10. Unless noted otherwise, sprinklers shall be centered in the tile in one direction, located no closer than 6" to the edge of tile in the other direction.
11. No extended coverage sprinklers shall be used, except in the auditoriums and main lobby, and only upon permission of the authorities having jurisdiction.
12. Sprinkler heads in the vestibule shall be the extended barrel, freeze-proof type, recessed.
13. Trash alcoves and all other ceilings or soffits 8 ft and lower shall have concealed heads with custom color cover plates to match the surrounding ceiling color.
14. Lobby gyp soffits and ceilings: 8 ft and lower shall have concealed heads with custom color cover plates to match the surrounding ceiling color.

B. Hangers: Shall be installed as required and shall be listed by the Underwriters' Laboratories for use in a sprinkler system. Hangers shall be spaced in accordance with the requirements of the NFPA.

C. Sprinkler Cabinet:
1. One cabinet with a minimum of twelve (12) sprinklers and a head wrench shall be installed in the concession work room.
2. Included in the cabinet shall be a minimum of two (2) sprinklers for each special temperature or configuration.
3. The cabinet shall be so located that it will not be subject to an ambient temperature exceeding 100ºF.

2.04 FIRE DEPARTMENT CONNECTIONS

A. Furnish and install fire department connections with check valve and approved automatic drip where indicated on the plans or as required by the authorities as follows:
1. Wall siamese inlet shall be Allenco's No. 276, flush type with clapper valves, straight way body and caps with chains, ball drip piped to spill on grade thru wall and check valve. Threads shall match Local Fire Department. Exposed finish shall be polished brass. Lettering shall be as required.
2. Sidewalk siamese shall be Allenco's No. 231-90o sidewalk siamese, cast brass body and escutcheon, 18" sleeve, body inlets with clapper valves, plugs and chains. Threads to match Local Fire Department requirements. Exposed finish shall be polished brass. Lettering shall be as required.

2.05 STANDPIPES: Furnish and install as required by the authorities.

A. Install as indicated on the drawings or required by the authorities at each floor level on each standpipe not more than 5'-0" from finished floor an indicating control valve, and a 2-1/2 inch fire department connection with 2-1/2" polished brass valve with cap and chain. Threads shall conform to the local fire protection district standards.

B. Provide valve cabinet in finished areas.

2.06 WATER FLOW SWITCHES

A. Water Flow Detectors:

1. Vane-Type Waterflow Detectors shall be installed on mains as one per zone.
2. The detector shall be designed for mounting on either vertical or horizontal piping, but shall not be mounted in a fitting or within 12 inches of any fitting that changes the direction of water flow, and shall have a sensitivity setting to signal any flow of water that equals or exceeds 10 gpm.
3. Detector switch mechanisms shall incorporate an instantly recycling pneumatic retard element with an adjustable range of 0 to 60 seconds.
4. Switches shall be suitable for operation on 24-volt, D.C., and shall be actuated by a vane extended into the waterway of the piping (Coordinate exact electrical characteristics with electrical contractor).
5. Detectors shall be of dust tight construction.
6. Detector switch enclosures shall be secured with a tamper proof bolt that requires the use of a special wrench for removal.
7. Vane-Type Waterflow Detectors shall be Underwriters' Laboratories listed or Factory Mutual approved.
8. The detector shall be furnished and installed under this section and wired completely under Division 16.

B. Water flow detectors in non-conditioned areas or damp locations shall be suitable for damp conditions and shall not corrode.

2.07 TAMPER SWITCHES

A. Tamper switches shall be installed on each valve inside the building.

1. Switches shall be mounted so as not to interfere with the normal operation of the valve control or when the stem has moved no more than one-fifth (1/5) of the distance from its normal position.
2. The mechanism shall be contained in a weather-proof die cast aluminum housing which shall provide a 3/4 inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valve.
3. Switch housings;
   a. Red baked enamel.
   b. The switch mechanism shall have a minimum rated capacity of one amp, 125 volt A.C. - 0.25 amp, 24 volt D.C. (Coordinate exact electrical characteristics with electric al contractor).
   c. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
4. Supervisory Switches and Gate Valve Switches shall be Underwriters' Laboratories listed and Factory Mutual approved.
5. Supervisory Switches shall be furnished and installed under this section and wired completely under Division 16.

B. Tamper switches located in non-conditioned or damp locations shall be suitable for damp conditions and shall not corrode.

2.08 SIGNS

A. Approved enameled metal signs shall be securely attached at all main drains, auxiliary drains, inspectors' test connections and control valves.

2.09 DETECTOR CHECK VALVE

A. Detector check valve shall consist of an automatic compound lever valve and an external bypass with disc type water meter, gate valve, check valve and necessary fittings.

B. The detector check valve shall be installed in accordance with the Local Fire Department and Local Water Department rule and regulations.

2.10 FIRE HOSE VALVE CABINET: Not Used

2.11.1 FIRE EXTINGUISHER CABINET: Not used, refer to the architectural specifications

PART 3 – EXECUTION

3.01 EXCAVATION AND BACKFILL

A. All trenches shall be dug to a line and the bottom cleaned and shaped to provide support of the pipe through its entire length.

B. Bracing shall be provided as necessary to maintain excavations.

C. As soon as underground work has been completely installed and tested, all excavations shall be backfilled with gravel to 1'-0"

of finished grade and with clean earth (free from bricks, rocks, cinders, or any foreign matter) to grade.

D. Minimum depth of the top of pipe shall be 5'-0" below grade.

E. Backfill below concrete or asphaltic slabs shall be gravel to paving based.

3.02 UNDERGROUND PIPING

A. All bends and tees in underground piping shall be provided with concrete thrust blocks of sufficient size to prevent rupture of joints due to movement of pipe.

B. All underground piping shall be installed in accordance with NFPA-24, 1987, Standard for Outside Protection.

C. All underground piping shall be flushed in accordance with NFPA-24, 1987, Standard for Outside Protection.

3.03 SPRINKLER PIPING

A. It shall be a specific requirement that insofar as possible, all sprinkler system mains and branches shall be installed as close as possible to the structural members, not the ceiling.

B. All piping for all systems shall be coordinated with lighting fixtures, air conditioning ducts, piping and air diffusers. The coordination shall be made with the sheet metal shop drawings and reflected on the sprinkler shop drawings prior to submission for approval.

C. Pipe shall be protected from freezing where it might occur as determined by the final pipe routing.

D. No piping shall penetrate the demising walls between auditoriums.

E. A corrosive-resistant placard should be placed on each riser, stating the design criteria and resulting demand at the base of the riser, including hose stream allowance.

F. All sprinkler piping with welded outlets or connections should be inspected prior to the installation to ensure that the pipe is free of welding slag and cutouts, and that the welded fittings do not protrude into the path of the water flow.

G. Piping shall be held tight to the bottom of the steel in all areas.

3.04 HANGERS AND SLEEVES

A. All hangers shall be of approved materials and spaced in accordance with NFPA No. 13.

B. Sleeves shall be set for all pipes passing through concrete floors and masonry walls.

C. Provide primered escutcheon plates at all exposed wall penetrations.

3.05 AUXILIARY DRAINS

A. Trapped sections

1. Auxiliary drains consisting of plugs, or globe valves and plugs where the capacity of a trapped pipe section exceeds 5 gallons, shall be provided to drain all points in the system that cannot be drained back to a main riser as shown on the plans.

2. Field conditions may dictate additional drains which could be determined for bidding purposed which shall be provided as required by NFPA No.13.

B. Drain Termination

1. Drains are to be piped to a Code approved open-site sanitary drain.

2. If no open-site drain is readily available, the fire protection contractor shall notify the Engineer in writing at least two weeks prior to bid, otherwise, the sprinkler contractor shall include all costs (labor, materials, excavation, etc.) for the installation of a suitable open site sanitary drain.

3.06 INSPECTORS' TEST CONNECTIONS

A. Furnish and install inspectors' test connections as required.

3.07 CONCEALED WORK

A. No work shall be concealed unless inspected and approved by the authority having jurisdiction.

3.08 TESTING

A. All systems:

1. All systems including site piping shall be tested hydrostatically at not less than 200 pounds per square inch pressure for two hours or at 50 pounds per square inch in excess of maximum pressure when the maximum

pressure to be maintained in the system is in excess of 150 PSI.

2. The inside sprinkler and standpipe piping shall be installed in such a manner that there will be no visible leaks when the system is subject to hydrostatic tests.
3. Submit a copy of contractor's material and test certificate signed by installer and Owner's representative after the installation is tested successfully and accepted by all authorities having jurisdiction.
4. Following sprinkler installation, a Contractor's Material and Test Certificate per NFPA 13 should be completed and submitted to FM Global to verify that proper hydrostatic testing (200 psi for 2 hrs) has been performed.

3.09 GUARANTY-WARRANTY

A. The sub-contractor shall furnish a written warranty, counter-signed and guaranteed by the General Contractor, stating that all work executed under this section will be free from defects of materials and workmanship for a period of one (1) year from the date of final acceptance.

B. The above parties further agree that they will, at their own expense, repair and replace all such defective work and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 WORK DESCRIBED IN THIS SECTION

A. All material, labor and test systems.

B. Complete plumbing system including soil waste and vent piping; floor drains; hot and cold water piping; gas piping, plumbing fixtures; water heater; pipe insulation; pipe; valves and hangers.

C. Furnish manufacturer's submittal data for all major equipment including plumbing fixtures, water heater, drains, and clean-outs.

D. No piping shall penetrate the demising walls of the auditoriums.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Automatic fire protection sprinkler system - Section 15300

B. Wiring and electrical connections to equipment - Division 16.

C. Other Sections of 15000

1.03 MATERIALS FURNISHED AS DESCRIBED IN THIS SECTION BUT INSTALLED AS DESCRIBED ELSEWHERE

A. Furnish and deliver complete to other trades as required in connection with Work of this section: Inserts, hangers, sleeves, and lead flashing for pipes passing through roof.

1.04 MATERIALS INSTALLED AS DESCRIBED IN THIS SECTION FURNISHED BY OWNER

A. Make final connections to and install complete: Concession and Work Room equipment.

B. Refer to the drawings for additional scope.

1.05 PERMITS, FEES AND INSPECTIONS

A. Secure and pay for all permits and inspection by city, county and state authorities.

B. Pay all fees and costs for connections.

C. Perform work in accordance with all city, county and state regulations.

1.06 CUTTING AND PATCHING

A. Cutting and patching shall be the responsibility of the General Contractor.

1.07 EXCAVATION AND BACKFILL

A. Excavate and backfill for installation of pipes and equipment.

B. On pier supported buildings (buildings with structural slabs, no slab on grade), backfill material shall be gravel with a minimum of 24” on each side where the pipe exits the building.

1.08 DRAWINGS

A. Plumbing work as shown on drawings.

B. Supplementary drawings or details will be furnished if necessary. -Refer to Architectural interior details, floor plans, elevations structural, and other sub contract drawings.

C. Coordinate work to avoid interference.

D. Do not scale plans; they are diagrammatic.

E. Check all dimensions at buildings.

PART 2 - MATERIALS AND INSTALLATION

2.01 MATERIALS AND INSTALLATION - GENERAL

A. All materials new and of first grade.

B. All materials and joints shall be in accordance with the Building and Plumbing Code requirements.

C. In preparing his bid, the Contractor shall include the cost of all items and procedures necessary to satisfy the requirements of all applicable Codes, Ordinances and Authorities, whether or not these are specifically covered by the drawings and specifications. The Contractor shall carry-out his work and complete his construction as required by applicable Codes and Ordinances and in such manner as to obtain approval of all authorities whose approval is required without additional cost. The contractor shall include all fittings, vents,. traps, offsets, equipment, cleanouts, etc. as required to install the plumbing in a code approved manner. Any changes to the design shown on the drawings will be brought to the attention of the Engineer and reflected on the as-built drawings.

2.02 SANITARY SEWER SYSTEM

A. Install soil, waste and vent piping to collect drainage from all fixtures and floor drains as shown.

B. Vent these pipe lines through roofs and extend and connect to site sewer mains as shown.

C. Piping shall be PVC except where the governing authorities or code require cast iron with "no-hub" fittings. Piping located in return air plenums shall be cast iron.

D. Vent piping shall be installed through a roof sleeve and flashed not less than 8" above the roof. Refer to architectural drawings for flashing details.

E. PVC piping is allowed (except in return air plenums) if accepted by the local authorities, otherwise use cast iron.

F. Vents shall be located a minimum of 10 feet away from building openings or outside air intakes. Vents through the roof shall be cast iron.

G. Piping serving concession areas shall be cast iron with glass lining (or PVC below grade if allowed by code).

H. Vents through the roof shall be cast iron.

I. Material Specifications

1. Hubless (No-Hub) Cast Iron Soil Pipe and fittings.

a. Conforming to CISPI 301.

b. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

c. All joints shall be constructed using standard duty Hubless (No-Hub) Couplings conforming to CISPI 310, manufactured in the United States, and be certified by NSF International . Heavy Duty and Medium Duty couplings shall conform to ASTM C 1540, shall be manufactured in the United States, and shall be used if indicated.

2. PVC Pipe and Fittings

a. Pipe shall be manufactured from virgin rigid PVC (polyvinyl chrloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866. All pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to NSF International Standard 14.

b . Installation shall comply with the latest installation instructions published by the manufacturer and shall conform to all applicable plumbing, fire, and building code requirements. Buried pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products or other aggressive chemical agents not compatible with PVC compounds. The system shall be hydrostatically tested after installation. DO NOT AIR TEST

c. ABS or cellular core PVC or non-pressure rated pipe shall not be used.

2.03 COOLING CONDENSATE DRAIN LINE

A. Exterior cooling coil condensate drain lines are to be copper and to be installed in accordance with code, whether shown on the drawings or not. Drain lines shall be routed full size from the equipment (all connections) to the roof drain or sanitary sewer connection as required by the governing authorities. Terminate with an air gap fitting.

B. Interior cooling coil condensate drain lines are to be copper (type M copper) with 1" insulation and is to be installed in accordance with code, whether shown on the drawings or not. Drain lines shall be routed full size from the equipment to a code approved indirect waste receptor with an air gap fitting.

C. All fittings are to be sanitary type (DWV) with cleanouts every 50' or at a change in direction. Pipe shall be 1" minimum.

D. Traps shall be vented and shall have a minimum 2" trap seal.

E. Condensate drain piping shall be routed at 1/4" per foot or increased one pipe size and routed at 1/8" per foot.

2.04 STORM DRAINAGE SYSTEM

A. Where shown on the drawings, install service weight cast iron pipe with "no-hub" fittings.

B. Extend and connect to the building or site storm drain mains.

C. Piping shall not penetrate demising walls and shall be run perpendicular to the building line.

D. When allowed by local authorities, and installed in accordance with applicable codes, Schedule 40 PVC may be used. PVC may not be used in return air plenums or in auditoriums.

E. Minimum exterior depth shall be 18" below normal freeze depth.

F. Furnish and install cleanouts as required by the local authorities.

G. In the auditoriums, only cast iron piping may be used.

H. The roof overflow drains (or over flow scupper) are not to be located in a common sump with the primary roof drains. The inlet to the overflow drain is to be 2" higher than the adjacent roof level, not the elevation of the roof in the sump or the inlet to the primary roof drain.

I. The first pipe support shall be within 24" of drains.

J. Material Specifications

1. Hubless (No-Hub) Cast Iron Soil Pipe and fittings.

a. Conforming to CISPI 301.

b. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

c. All joints shall be constructed using standard duty Hubless (No-Hub) Couplings conforming to CISPI 310, manufactured in the United States, and be certified by NSF International . Heavy Duty and Medium Duty couplings shall conform to ASTM C 1540, shall be manufactured in the United States, and shall be used if indicated.

2. PVC Pipe and Fittings

a). Pipe shall be manufactured from virgin rigid PVC (polyvinyl chrloride) vinyl compounds with a cell class of 12454 as identified in ASTM D 1784. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866. All pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to NSF International Standard 14.

b). Installation shall comply with the latest installation instructions published by the manufacturer and shall conform to all applicable plumbing, fire, and building code requirements. Buried pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1668. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products or other aggressive chemical agents not compatible with PVC compounds. The system shall be hydrostatically tested after installation. DO NOT AIR TEST

c). ABS or cellular core PVC or non-pressure rated pipe shall not be used.

2.05 HOT AND COLD WATER PIPING SYSTEM

A. Copper type "L" hard drawn above floor on interior of the building.

B. Copper type "K" soft temper under ground or under floor slabs. (No joints), except PEX may be used from trap primer valves to floor drains and for the water supplies below grade to the trash compactor.

C. Extend and connect to site or building water main.

D. For each restroom group or bank of fixtures, provide ball cut-off valves above the layin ceiling of the corridor.

2.06 CHLORINATED POLYVINYLCHLORIDE (CPVC) – FOR DOMESTIC WATER SYSTEMS ONLY

A. At the contractors option, CPVC may be used for water lines 1" and greater where said water lines are not located in restroom or toilet room wet walls.

B. Pipe and fittings shall be manufactured from virgin rigid CPVC (chlorinated polyvinyl chloride) vinyl compounds with a cell class of 24448 as identified in ASTM D 1784. FlowGuard Gold CTS CPVC pipe and fittings shall conform to ASTM D 2846. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer. All pipe and fittings shall be manufactured in the United States. Pipe and fittings shall conform to National Sanitation Foundation (NSF) Standards 14 and 61.

C. Installation shall comply with the latest installation instructions published the manufacturer and shall conform to all applicable plumbing, fire, and building code requirements. Buried pipe shall be installed in accordance with ASTM F 1668. Solvent cement joints shall be made using CPVC cement conforming to ASTM F 493. If a primer is required by local plumbing or building codes, then a primer conforming to ASTM F 656 should be used. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products or other aggressive chemical agents not compatible with CPVC compounds. The system shall be hydrostatically tested after installation.

2.07 COPPER PIPE AND FITTINGS

A. Soft copper tubing - Type K, soft temper. Fittings soldered, streamline type, wrought.

B. Hard copper pipe - Type L, hard drawn. Fittings soldered, streamline type, wrought.-Fed. Spec. WE-T-799 or ASTM B-88.

2.08 VALVES

A. Ball, globe and check: 125 psig working steam pressure.

B. 3" and smaller, bronze body, soldered joints for copper shall be ball valves.

C. Ball and globe with operating wheels, packing glands, stuffing boxes, union or bolted bonnets,rising stems; capable of being repacked while fully open and under pressure.

D. Hammond, Stockham, Walworth,or Jenkins.

E. Larger than 3" shall be gate, globe, or butterfly valves..

F. Globe, straightway or angle pattern, renewable composition discs.

F. GAS COCKS:

1. Cocks on 2" lines and smaller shall be Jenkins 30A or Crane No. 324.
2. Cocks on 2-1/2" line and larger shall be Emco-Nordstrom No. 143 flanged pattern.

G. Flow Indicating Balance Valves:

1. Equal to Taco Accu-Flo.
2. Ball valve construction, all brass interior parts, venturi design, built-in drain port, blow-out proof stem.

2.09 UNIONS

A. Screwed pipe, up to and including 2" - Cast iron or malleable iron ground joint with brass inserts.

B. In copper pipe - brass or bronze.

C. 2" and smaller, ground joint type.

D. With integral socket for soldering to copper tube in copper tube pipe lines.

E. Dielectric Unions: Provide dielectric unions at all piping connections between dissimilar metals and all equipment. Union shall be "Devlin" as manufactured by Pipeline Seal and Insulator Co. and shall have nylon insulation.

2.10 INSTALLATION OF PIPE:

A. Ditches - at least 16" wider than pipe diameter.

B. Pipe barrels and joints bedded on firm soil.

C. Install pipe in accordance with pipe and fitting manufacturer's published recommendations.

D. Use no cracked or broken pipe.

E. Laterals to be turned up at 45 angle.

F. Backfill to be placed and tamped firmly to half height of pipe in one layer and to top of pipe in next layer; ditch backfilled and tamped in successive layers of 12" thickness. On pier supported buildings (buildings with structural slabs, no slab on grade), backfill material shall be gravel with a minimum of 24" on each side where the pipe exits the building.

2.11 SLEEVES

A. Large enough on interior to permit free passage of bare pipe or pipe and insulation where piping passes through walls, floors or ceilings.

B. Floor sleeves: galvanized steel extending to 1/2" above rough floor.

C. Wall sleeves: oversize steel pipe.

D. Calk sleeves installed below grade.

E. Cast iron pipe passing through concrete slab, wire brushed, wrapped with 15 lb. asphalt saturated roofing felt.

F. Do not install sleeves on pipe supplies through walls to fixtures.

2.12 JOINTS

A. In plated brass piping - Screwed joints made with red lead and linseed oil applied to male threads only. Parallel screw up to shoulder of fittings; in exposed work no threads are to show beyond fittings.

B. In copper tubing- Full soldered joints. Pipe joints shall not contain any lead.

2.13 HANGERS, SUPPORTS, ANCHORS AND GUIDES

A. Supports, hangers, anchors and guides shall be provided for all horizontal and vertical piping. Submit shop drawing details, before construction, of all piping 8" diameter and over and all piping in shafts. Shop drawings are to show locations and details of anchors, guides, expansion loops and joints, hangers, etc. The hanger design shall conform to the ASA Code for Pressure Piping.

B. All pipe supports shall be of type and arrangement as hereinafter specified. They shall be arranged as to prevent excessive deflection and avoid excessive bending stresses between supports.

C. All bracket clamp and rod sizes indicated in this specification are minimum sizes only. The Contractor shall be responsible for structural integrity of all supports. All structural hanging materials except variable spring units shall have a safety factor of 5 built in.

D. Anchor points and pipe guides as shown on drawings or as required, shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions away from the anchored points.

E. Guide points for expansion joints shall be located and constructed wherever required or shown on drawings and at each side of an expansion joint or loop, to permit only free axial movement in piping systems but shall not be further than 3 pipe diameters on each side of joint. Guides for pipe with expansion joints shall be of the four roller heavy duty type securely welded to structural steel.

F. Variable spring hangers shall be located and constructed for points subject to vertical movement. The first four hangers on horizontal piping at the pump suction and discharge and at the air handling unit coil connection shall be spring loaded from the building.

G. Maximum spacing between pipe supports for steel or copper pipe to prevent excessive stress: (This does not apply where there are concentrated loads between supports.)

Pipe Size	Max. Span/Ft.	Pipe Size	Max. Span/Ft.
1/2"	5	4"	14
3/4"	6	5"	16
1"	7	6"	17
1-1/2"	9	8"	19
2"	10	10"	22
2-1/2"	11	12" & Over	23
3"	12		

H. Maximum weights on hanger rods assuming maximum operating temperature of 450 F shall be such that stress in tension shall not exceed 9000 psi, using root area of threaded portion. In no case shall hanger size be less than 3/8" for pipe up to 2", 1/2" for pipe 2-1/2" to 3-1/2", 5/8" for pipe 4" to 5", 3/4" for pipe 6", 7/8" for pipe 8" to 12".

I. Double bolt riser clamps shall be F & S, F & M, Grinnel or approved equal.

J. Back-to-back channel loads shall be limited to the following:

3" (4.1#) channel 2900 lbs. up to 36" C to C
3" (4.1#) channel 1700 lbs. over 36" C to C

4" (5.4#) channel 5100 lbs. up to 36" C to C
4" (5.4#) channel 3000 lbs. over 36" C to C

K. Roller type supports shall be used for pipes (larger than 2") subject to axial movement. They shall be braced so that movement occurs in roller rather than support rods.

L. Hangers for copper pipe, copper or heavily copper plated, Grinnell No.97c

M. Provide all steel required for support of pipes other than steel shown on structural engineer's drawings.

N. On insulated domestic cold water, storm drain, chilled water, condenser water, etc. hangers are to be sized to fit outside insulation and saddle.

0. In general, all piping shall be supported from only structural building members or approved steel inserts imbedded in stone concrete pours. Where revisions require and are approved, piping 3" and smaller may be supported at intermediate points by "Phillips" 3/4" expansion bolts with lead shields, provided main supports are welded from structural steel and are no less than twenty feet on centers. Intermediate supports for pipe 4" and larger on concrete beams or columns shall be attached to by means of 4" x 4" x 3/8" clip knee angles with 3/4" expansion bolt in shear and supporting rod at 90o from another bolt. Note that an all insert job is permitted only for stone concrete floors. For all other types of construction, obtain approval of the Architect.

P. Hangers for PVC pipe - Grinnell No. 104, for steel pipe, 104c plastic coated. Use rods or hooks attached to structural elements. Size rods to pipe sizes.

Q. Anchoring hangers to support weight of vertical risers shall be adequately sized to support loads.

R. Hangers supporting insulated pipe shall have saddles installed between the hanger and the insulation.

S. Hangers are to be sized and located outside the insulation.

T. On pier supported buildings (buildings with structural slabs, no slab on grade), All piping below slab shall be supported from the structural slab, not buried, until the pipe exits the building.

2.14 INSULATION

A. Horizontal cold water above ceilings, all hot water piping (except runouts); horizontal storm lines and interior condensate drains. Where water piping is installed in an exterior wall or structure, the cold or hot water runout shall also be insulated. Tempered water lines need not be insulated.

B. Molded glass fiber sectional, 1/2" thick (cold water), 1" thick (hot water, condensate piping, and storm lines) with factory applied - vapor barrier with joints sealed with vapor barrier cement and joint sealer strips.

C. Insulate fittings with mineral wool cement to same thickness as sectional insulation, trowel to smooth finish and coat with 1/16" thickness of mineral stabilized asphalt weathering compound. On exposed hot water piping, cover fitting insulation with 6 oz. canvas cemented in place with "Arabol" or "Lagfas". PVC insulation jackets may be used.

D. The under side of roof drains shall be 1" thick fiberglass insulation with vapor barrier (3 lb./cu. ft.) extending beyond pipe 12" in all directions. All edges of insulation shall be sealed with mastic to provide vapor barrier. Secure to under side of roof construction. Vapor barrier shall be complete.

E. At the contractor's option, Armstrong "Armalok" may be used in thermally equivalent thicknesses where codes permit.

F. All insulation in return air plenums, including jackets, adhesives, coatings, mastics, etc., shall not exceed 25 flame spread or 50 smoke developed under ASTM Specification E-84 procedure.

G. All insulated pipes shall have galvanized sheet metal saddles between the insulation and the hanger.

H. All pipe insulation shall satisfy the State Energy Code requirements.

I. Where water lines are installed in an exterior wall or adjacent to an exterior wall, the runouts shall be insulated as well.

J. Storm drain piping run in the auditorium shall be insulated with 2 layers of insulation, both layers sealed vapor tight. The outer layer shall be 1" of Armaflex. The inner layer shall be 1" of fiberglass insulation.

K. Pipes insulated with fiberglass shall have the elbows covered with the pre-molded jackets designed for such an application.

2.15 ESCUTCHEONS

A. Chrome plated brass at all visible places on pipes passing through walls, ceilings and floors.

2.16 Water Hammer Arrestors

A. Installed at ends of each group of fixture connections, both hot and cold water, and elsewhere as required to prevent water hammer.

B. Locate above ceilings.

2.17 CLEANOUTS

A. Locate as required by code but not where exposed to public view.. Provide sanitary tees, tapped tees, quarter bends and extend pipe to surface as follows:

In walls: Wade W-8450-R with plug and polished stainless steel cover

In floors: Wade Series W-6034 with nickel bronze cover

B. Cleanouts shall not be installed in public spaces (except restrooms). Where cleanouts are required, and they would land in a public space, extend the cleanout arm back into a storage room or other similar, non-public space.

2.18 ROOF - FLASHING

A. Vent stack covers etc. coordinate with and as recommended by roofing manufacturer whose materials are installed.

B. Sheet lead weighing not less than 3 lbs per sf.

C. Base not less than 18" square for vent stacks passing through roof.

2.19 DRAINS:

A. Refer to schedule on drawings

B. All drains to have same size outlet (unless noted otherwise) as connected piping, shall have deep seal traps or trap primers as required by the local authorities. Trap primers shall have backflow preventers as required by the local authorities.

C. All drains shall have deep-seal traps.

D. Contractor shall furnish and install Sure Seal Model SS3000 preassembled inline floor drain trap sealer. The trap seal shall consist of five pieces: commercial grade ABS housing, keeper pin, neoprene rubber diaphram, (2) soft rubber gaskets. Floor rating ASSE-1072 AF-GW.

2.20 GRADES

A. Horizontal, soil, waste and vent piping, drain in direction of flow, a minimum of 1/4" per foot inside building, unless otherwise noted on drawings.

B. Water piping, a minimum of 1/8" per foot in either direction, but if possible, back to main cut-off valve and toward fixture outlets. Provide drains at all low points.

C. Condensate drains at 1/4" per foot toward approved waste receptor.

2.21 PLUMBING FIXTURES - GENERAL

A. GENERAL

1. Provide plumbing fixtures as shown and scheduled on the drawings complete with all equipment, fittings, trimmings, etc. , as described.

2. All fixtures grade "A". Name and trademark of the manufacturer printed or pressed on all fixtures, and a label which cannot be removed without destroying it, containing manufacturer's name or trademark and quality or class of the fixture affixed to all fixtures and not removed until after work has been accepted.

3. All exposed metal on each plumbing fixtures shall be chromium plated finish.

4. Fittings and trim below handicapped accessible lavatories and sinks shall be insulated with Truebro Lav Guard or Brocar Trap Wrap. Hot water stop valves and associated lavatory piping shall be insulated.

5. All tubing and traps shall be chrome plated 17 gauge, except as specifically noted.

2.22 GREASE TRAP

A. Furnish model shown on drawings complete with vents and sampling ports. The installation shall be in accordance with all local codes and ordinances.

B. Extension rings shall be used.

C. Cover shall be heavy guage aluminum or as detailed.

2.23 ELECTRIC WATER COOLERs or DRINKING FOUNTAINS

A. Refer to schedule on the drawings.

B. 3/8" IPS Union supply with stop at each EWC.

C. Install in accordance with ADA requirements.

2.24 WATER HEATER:

A. Provide five year written warranty for the tank. Submit written warrantee with equipment submittal. Water heater submitted without written warranty will be rejected.

B. Furnish complete with automatic thermostat. Set at 140 maximum.

C. Temperature and pressure relief valve, Watts lOXL, with discharge piped as shown on drawings.

D. Unit shall meet State Energy Code requirements.

2.25 PROTECTION OF FIXTURES

A. Against damage until accepted by Architect.

B. Damaged fixtures are to be replaced with no cost to Owner.

C. Pipe openings, etc. , against the entrance of foreign materials.

D. "Acid Resisting" stamp to be left until after final inspection.

E. Provide stops on supply pipes to all fixtures.

2.26 GAS PIPING SYSTEM

A. Black steel pipe, Schedule 40, with black malleable iron screwed fittings for 2-1/2" and smaller. Pipe sizes 3" and larger shall be welded.

B. All gas piping and fittings exposed on exterior of building treated with 2 part epozy paint, yellow (or color required by the authorities) prior to installation and all scuff marks touched-up after installation. The entire pipe is to be painted (bottom and beneath clamps).

C. Support pipe with no sags or air pockets. Piping 2" and smaller shall be mounted on fabricated supports as detailed on the drawings. Pipes larger than 2" shall be mounted on roller supports as follows: up to 4": Miro Industries Model 24R. Above 4":Miro Industries Model 48R.

D. Drain to drip legs 6" long at low points in system and at base of risers and drops.

E. Install lever handle cock and union at each item of gas burning equipment. Allow 3" clear below the cap at the base of the drip leg.

F. Vents on regulators are to be directed down.

G. Clamp all pipe.

2.27 TESTS

A. Storm drainage, soil, waste, vent and water piping shall be tested by the contractor and approved before acceptance. Underground soil and waste piping shall be tested before backfilling. All equipment required for testing shall be furnished by the contractor at no additional cost to the Owner. Tests required by the authorities shall be in addition to the tests described herein.

B. Defective Work: If inspections or tests reveal defects, such defective work or material shall be replaced or repaired as necessary and inspections and tests shall be repeated. Repairs to piping shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

C. Drainage (waste and storm) and venting system piping shall be tested with water or air before the fixtures are installed. After the plumbing fixtures have been set and their traps filled with water, the entire drainage and venting system shall be submitted to a final test with smoke or peppermint.

1. The water test shall be applied to the drainage and venting system either in its entirety or in sections. If the entire system is tested, all openings in the pipe shall be tightly closed except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening except the highest opening of the section under test shall be tightly plugged, and each section shall be filled with water and tested with at least 10 foot head of water. In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested so that each joint or pipe in the building except the uppermost 10 feet of the system has been submitted to a test of at least a 10 foot head of water. The water shall be kept in the system, or in the portion under test, for at least 15 minutes before the inspection starts; the system shall then be tight to all joints.
2. Air Test: If tests are made with air, a pressure of not less than 5 pounds per square inch shall be applied with a force pump and maintained at least 15 minutes without leakage. A mercury-volume gauge shall be used in making the air test.

3. Final Test: When the smoke test is employed, the smoke shall be produced by a smoke machine, and a pressure equal to 1 inch water column shall be maintained for I5 minutes before inspection starts, When the peppermint test is used, 2 ounces of peppermint shall be introduced into each line or stack.
4. The contractor shall rod the waste system just prior to completion.

D. Domestic Water System
1. When the roughing-in is completed and before insulation is applied or fixtures are set, each pressure zone of the hot and cold water piping system shall be tested at a hydrostatic pressure of not less than 100 pounds per square inch gauge at the top of the riser, and proved tight at this pressure for not less than 30 minutes in order to permit inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately to the pressure which would be imposed upon it if it were tested as part of a zone, as herein before specified.
2. Cleaning and Adjusting: Equipment, pipes, valves, fittings and fixtures shall be cleaned of grease, metal cuttings, and sludge that may have accumulated from operation of the system during the test. Any stoppage, discoloration or other damage to the finish, furnishing or parts of the building, due to the Contractor's failure to properly clean the piping system, shall be repaired by the Contractor without cost to the Owner. When the work is complete, the water systems shall be adjusted for uniform circulation. flush valves and automatic control devices shall be adjusted for proper operation.
3. Sterilization: After pressure tests have been made, the entire domestic water-distribution system shall be thoroughly flushed with water until all entrained dirt and mud have been removed, and shall be sterilized by chlorinating material. The chlorinating material shall be either liquid chlorine conforming to Federal Specification BB-C-120 or hypochlorite conforming to Federal Specification 0-C-114, Type II, Grade B, or Federal Specification 0-S- 602, Grade A or B, The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system in an approved manner. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 ppm of chlorine at the extreme end of the system at the end of the retention period. All valves in the system being sterilized shall be opened and closed several times during the contact period. The system shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period all valves and faucets shall be opened and closed several times. Samples of water shall be taken from several points in the system in properly sterilized containers for bacterial examination. The sterilizing shall be repeated until tests indicate the absence of pollution for at least two full days. The system with not be accepted until satisfactory bacteriological results have been obtained. The contractor shall submit test results for approval.

E. Materials and fixtures shall be tested by the manufacturer before shipment.

F. Tanks and heaters not tight under test shall be replaced with new heaters and tanks.

G. Furnish to the Architect certificates of tests and final acceptance as issued by the local Plumbing Inspector.

2.28 BACKFLOW PREVENTER

A. Double check valve assembly consisting of two independently operating, spring loaded check valves, two gate valves, and four test cocks for field testing, Febco Model 792, CLA-VAL Model D, Jenkins FM Assembly, or approved equal.

B. Provide indirect drain to indirect waste receptor as required by the governing authorities.

2.29 Hose Bibs and Yard Hydrants

A. Exterior Wall : Josam Series 7100 Hydrasan I non-freeze hose bib with vacuum breaker. Satin Finish Nikaloy hinged latching cover. Length as required to suit wall thickness, verify wall thickness with architectural drawings.

B. Rooftop: Josam Series 4728 non-freeze hose bib with vacuum breaker (or yard hydrant as detailed) Satin Finish Nikaloy finish and plastic handle. Length as required to suit wall thickness, verify wall thickness with architectural drawings.

C. 3/4" HPT outlet, integral vacuum breaker-backflow preventer, pressure relief valve, 3/4" female NPT inlet. Furnish control key with faucet.

D. Yard hydrants shall meet ASSE 1057, equal to Woodford sanitary yard hydrant model s3, freezeless, automatic draining, backflow protected. The bury depth shall be 12” below the freeze line.

2.30 GUARANTY-WARRANTY

A. The sub-contractor shall furnish a written warranty, counter-signed and guaranteed by the General Contractor, stating that all work executed under this section will be free from defects of materials and workmanship for a period of one (1) year from the date of final acceptance.

B. The above parties further agree that they will, at their own expense, repair and replace all such defective work and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION

SECTION 15500

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 15.

B. All other Divisions of the Contract Documents. Refer to each Division's specifications and drawings for all requirements.

C. Section 16900

1.03 SCOPE

A. Provide a complete heating, ventilating and air conditioning systems including all air distribution, as indicated on the drawings and in these specifications.

B. Meet or exceed the minimum requirements of local heating, ventilating and air conditioning codes.

C. Provide shop drawings and submittal data for approval. Refer to Section 15000. No work is to be installed without approved shop drawings.

D. HVAC Contractor must be certified by the Environmental Protection Agency (EPA) to handle refrigerant and maintain records of their certification throughout the duration of the project and during the subsequent one year warrantee period.

E. The HVAC Contractor shall closely coordinate the locations of all roof top equipment with the steel erector/fabricator and the structural drawings. The contractor shall verify all roof (and slab) penetration sizes and modify the sizes and or the locations of the penetrations such that the ducts and the associated duct fittings fit within the structural members. The contractor shall locate the openings dimensionally from the closest structural member. These requirements apply to both the Owner furnished equipment and the equipment furnished by the HVAC contractor.

F. The HVAC Contractor shall make the preparation for and corrections necessary for the testing, adjusting and balancing of the HVAC systems.

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G. Parts and labor warranty for the Owner furnished equipment is to be furnished by the Owner for a period of one year. All other products and the labor associated warranty is the responsibility of the contractor. The service calls for the HVAC shall be made on a 24-hour, seven days a week basis.

H. The contractor shall perform the start-up of the all furnished HVAC equipment.

I. At the completion of the project, the test and balance contractor shall furnish and install (replace) all of the RTU factory variable sheaves with new fixed sheaves.

1.04 PERMITS - INSPECTIONS

A. Secure and pay for all permits and inspections by regulating authorities.

B. Perform work in accordance with all governing regulations.

1.05 CONTRACT DRAWINGS

A. Heating, ventilating and air conditioning work shown on drawings.

B. Supplementary drawings or details will be furnished if necessary.

C. Refer also to Architectural interior details, floor plans and elevations, structural and other sub-contract drawings.

D. Coordinate work to avoid interference with other trades.

E. Do not scale plans. They are diagrammatic.

F. Check all dimensions at building.

1.06 CUTTING AND PATCHING

A. Cutting and Patching shall be the responsibility of the General Contractor. However, this Contractor is referred to the General Conditions.

1.07 SHOP DRAWINGS AND SUBMITTALS

A. Refer to Section 15000 for additional submittal requirements

B. Sheet Metal Shop Drawings are not required. The contractor is to check all clearances prior to fabrication. The routing of the ducts, particularly in the auditorium and projection booth is to be followed.
   1. The Contractor is verify all structural and architectural clearances prior to fabrication of the duct work.
   2. The design intent must be followed, including the equal friction design of the branch ductwork in the auditoriums.
   3. No deviation from the auditorium or projection booth duct work is allowed except for coordination with the allowable space and only after RFI.

C. Cut sheets:
   1. Cut sheets: Submit via email electronic cut sheets in Adobe .PDF format (one PDF file per submittal).
   2. Do not submit binders or notebooks.

PART 2 - MATERIALS AND INSTALLATION

2.01 MATERIALS AND INSTALLATION - GENERAL

A. New and first grade; Refer to Article 3 of the General Conditions.

B. During construction furnish and install a filter medium over all open return air ducts. Cut to size and clip on. Just prior to test and balance, remove the filter media and replace unit filters .

C. The ductwork drawings represent the performance arrangement of the material to convey hot, cold, ventilation or exhaust air from one point to another point.
   1. The drawings of the ductwork represent the general routing intended.
   2. The ductwork may be shown as single line or double line. When shown as double line, it is for the purpose of conveying concept and it assists the designer in estimating pressure drop for the purpose of sizing fans and air handling equipment. The dimensions given on the single line or the double line ductwork are given for the purpose of establishing velocity, pressure drop, aspect ratio and performance standards. The ductwork size is not intended to be absolute or specific. It is intended to give the Contractor a general scope from which he can estimate quantities of sheet metal and labor for the work.
   3. The drawings do not and are not intended to show in detail all transitions, elbows or turns. It is to be understood that this ductwork shown occupies, along with other trades, the void spaces within the building above and below structural work. The exact routing location and position of this ductwork is the responsibility of the Contractor.
   4. The Contractor is not to use the drawings for direct fabrication of material.

D. All exposed elements above or behind return air grilles are to be painted flat black.

2.02 DUCTWORK

A. METAL
   1. Galvanized steel fabricated and installed in accordance with "HVAC Duct Construction Standards - Metal & Flexible, First Edition, 1985", published by SMACNA, and in accordance with NFPA Pamphlet #90A .
   2. Low pressure duct work shall be constructed to comply with the requirements for 2" water gauge (W.G.) As listed in the SMACNA Narrowscope Duct Construction Table 1-5 EX (Copy Attached). "Ductmate '25"' with metal cleats is also acceptable. No other duct construction standard or method will be approved. Duct guage shall be 24 minimum.
   3. Elbows shall be long radius turns and shall be used only where shown on the drawings. Square elbows with turning vanes are not acceptable, unless specifically shown on the drawings. Transitions shall be increased or decreased 1" in 7 lineal inches; in no case shall transitions be greater than 30 degrees. If square elbows are used (only where allowed on the drawings) turning vanes must be installed. The first elbow from the rooftop unit or air handling unit shall be long radius with turning vanes.
   4. Spin-in connections equal to Genflex SM-IDEL.
   5. Interior painted dull black inside at all grilles.
   6. Provide suitable access for cleaning.
   7. Transverse duct joints shall be sealed in acordance with SMACNA standards.
   8. All duct dimensions and sizes noted on the drawings are air stream unless specifically noted otherwise.

B. DUCTWORK, FLEXIBLE

1. Flexible ductwork be installed for supply to single ceiling diffusers. Size as shown for round ducts. Avoid 90 degree or greater turns.
2. Class One as rated by UL-181.
3. Size to be as shown on drawings, maximum length 7 feet.
4. 1" thick, 3/4 pound density (R-factor = 4.2) fiberglass insulation with polyethylene vapor barrier jacket.
5. Duct connectors shall be nylon and cinched tight.
6. Duct collars shall have a 5/8" flange and 3" shaft.
7. Flex duct shall meet the following minimum requirements:

Working Press:	Inches Water
Positive	6"
Negative thru 16" dia.	4"
Neg. 18" & 20"	1"
Maximum Press:	
Positive	15"
Negative thru 16" dia.	10"
Negative 8" & 20"	2.5"

8. Acceptable Manufacturer and Model:
   Flexmaster Type 8 - insulated
   Thermaflex G-KM

9. Projector exhaust duct to be Flexmaster NI-4

C. DUCTWORK, FIBER GLASS: Not Acceptable, except for the boots over the return air grilles.

D. Materials, installation, etc., shall conform to NFPA Pamphlet No. 90A as minimum requirements.

E. Interior exposed ductwork shall be metal with 1" internal lining.

F. Ductwork exposed to the weather (exterior) shall be metal with 2" thick internal lining, with 2" wrapped exterior insulation protected by an aluminum jacket. Total 'R' value shall exceed 16. Aluminum jacket shall be 24 gauge fastened with sheet metal screws at 6" O.C. and sealed with silicon.

2.03 DUCTWORK ACCESSORIES

A. Spin-in connectors:
   1. Spin-in type connector with damper with quadrant. Auditoriums shall have duct taps as detailed or noted..
   2. Seal metal to metal connections air tight with SMACNA approved sealer.
   3. Connector is to have internal insulation guard.
   4. Flexible duct connections are to be cinched tight.

B. Volume controls
   1. Heavy plate splitters where indicated.
   2. Volume controls on square rod turning axles.
   3. Locking quadrants on exposed duct.
   4. Young Regulator flush operators on concealed duct over inaccessible ceilings. Color to match ceiling tile.

C. Access Doors
   1. Provide access doors at each fire damper, fire/smoke damper, where control devices occur within ductwork, and as indicated on the drawings.
   2. Access doors shall be hinged so that the air pressure holds the door in the closed position.
   3. Provide hinges and catches and where duct is lined internally, provide collar and double thickness door.

2.04 GRILLES, REGISTERS AND DIFFUSERS

A. As scheduled on the Drawings.

B. Approved Manufacturer's: Titus, Price, Nailor Industries. No other manufacturers will be accepted.

2.05 DUCT INSULATION

A. Internal ductliner shall have a thickness of 1 (minimum) or two inches as indicated on the drawings or as required by the authorities or code. The duct liner shall meet or exceed the following Sound Absorption Coefficients (Type 'A' Mounting, ASTM C 423-81 and ASTM E 795 test methods):

Sound Absorption
Octave Band Center Frequencies

Thickness:	125	250	500	1000	2000	4000	NRC
1"	0.17	0.35	0.59	0.81	0.90	0.94	0.65
2"	0.34	0.64	0.96	1.03	1.0	1.03	0.90

(The 1" values are based on Knauf E-M,1.5 lb, 1.5 lb. . The 2" values are based on Knauf E-M,1.5 lb..)

B. All duct dimensions shown on the drawings are air stream dimensions.

C. Stiklip attachment, "buttered ends". Use ASTMC type A method of lining attachment.

D. All rectangular ducts in, to, or from auditoriums and in the projection booth, auditoriums shall have internal lining, thickness as noted. The auditorium round ducts shall be externally lined with 3/4# density external insulation. This applies to all of the RTU or AHU duct work in the projection booth ceiling and in the auditoriums.

E. In all rooftop unit ducts not in or serving auditoriums, the first 15 feet of supply and return ducts to and from rooftop units or air handlers shall be internally lined with 1.5" thick internal lining.

F. In the non-auditorium ducts past 15', install external duct insulation or internal lining at the contractor's option..

G. External duct insulation shall be 3/4 lb/ft^3 density external insulation with foil facing, galvanized wire wrapping, stiklips on bottom on ducts over 24" wide, joints lapped and mastic sealed for complete moisture barrier. Over-lap lined duct 6" minimum. Insulation thickness shall be as required for an installed minimum R Value = 6 (aged) or as required by code.

2.06 FLEXIBLE CONNECTIONS

A. Flexible connections on inlet and outlet each fan and rooftop unit, 4" long, minimum 1" slack.

B. Ventglas fire resistant, waterproof, mildew proof fabric or equal.

C. External unit connections shall not have flex duct connections.

D. Install additional flex duct connections as indicated on the drawings.

2.07 FIRESTATS

A. All fans with capacity of 2000 cfm or less to have fixed temperature firestats. Exhaust fan firestats to have a setting of 125 F. Locate in airstream in fan housing.

B. Rooftop units shall have firestats set at 200° F. above the maximum operation temperature. Locate within the unit in the main duct on the downstream side of the filters.

C. The reset of the thermostatic device to be manual type, easily accessible inside unit.

D. Firestats shall be Honeywell L4029E or equal by Johnson Control or Barber-Coleman.

E. The firestat shall be field installed and wired by the mechanical contractor

2.08 SMOKE DETECTORS

A. The smoke detection system (SDS) shall be furnished and installed as indicated on the drawings in all rooftop units in the supply and return ducts.

B. SDS, when activated, shall stop fans and sound alarm.

C. The detector and the entire SDS installation shall conform to NFPA Pamphlet No. 90A, including remote test switches and indicating lights.

D. The mechanical contractor shall cut the hole in the duct for the installation of the detector in fans other than rooftop units.

E. The mechanical contractor shall make the appropriate wiring connections within the fan to stop the unit when the smoke detector is activated.

2.09 DAMPERS

A. Manual multiblade larger than 8": galvanized steel, heavy gage frames and blades, blade shafts in bearings, blades interlocked, accessible quadrant and locking device.

B. Motor operated multiblade larger than 8": galvanized steel, heavy gage frames and blades, blade shafts in bearings, all properly interlocked for accurate modulating control.

C. Fire dampers, galvanized steel, UL label fire equal to Ruskin DIBD2 Style 'B' with the blades out of the air stream.

1. Provide UL approved and labeled fire dampers where shown on the drawings and required by NFPA-90A and/or the Fire Marshall. Install damper as required for UL and local authorities' approval.
2. Provide 160°F fusible links for all dampers plus 10% extra quantity.
3. Provide an access door at each damper location for resetting the fire damper.
4. Downstream of all fire dampers in ducts handling velocities of 2000 FPM or greater, provide a combination

access opening, viewing window, and vacuum relief panel equal to United Type AR-W.

D. Where fire dampers are integral with the diffuser, they shall be furnished with the diffuser.

E. All motorized dampers not integral with equipment shall be furnished and installed by the Mechanical Contractor.

F. All motorized dampers shall be of extremely low leakage with edge seals.

G. Combination Fire/Smoke dampers, galvanized steel, UL label fire equal to Ruskin FSD60 with TS150. Coordinate the exact power requirements with the electrical contractor.
   1. Provide combination fire and smoke dampers where shown on the drawings. Dampers shall meet all requirements of fire dampers and additionally shall include an operating shaft, which, when rotated 90° causes the damper to operate between closed and open.
   2. Each damper shall be furnished complete with factory sleeve and damper operator (electric to conform to control system) factory installed on exterior of sleeve and properly linked to damper operating shaft. Operators shall be UL listed and labeled as Fire Damper Operators.
   3. Provide access doors for fire and smoke dampers as specified for fire dampers.
   4. The fire dampers shall be normally closed, held open with 120V power. Upon loss of power, the dampers shall shut, upon regaining power, the damper shall open.

H. Mark all air balancing devices in balanced position with permanent paint. Tie a ribbon around the exposed handle.

I. All duct connections shall have balance dampers whether shown on the drawings or not.

2.10 FANS

A. Furnish and install the fans as scheduled on drawings.

B. Rated and labeled by AMCA.

C. Switched as shown on Electrical drawings.

D. Equipped with manual reset firestats.

E. Furnish fans pre-wired thermal disconnect switches and 16" high factory curb or height as scheduled. The motorized dampers shall be shipped pre-wired from the factory or field wired by the mechanical contractor.

F. Direct drive fans shall be furnished with SCR variable speed controllers factory wired internal to the fan.

G. Fans to be as manufactured by Cook, Acme, or Greenheck.

2.11 ROOFTOP UNIT

A. Units and curbs shall be furnished as specified on the drawings.

B. Install heating and cooling units as scheduled and detailed. Units shall be factory assembled and tested complete and ready for operation, except for the economizer components (and/or outside air intakes) which shall be field installed by the mechanical contractor.

C. Each unit shall be provided with 16" high 14 gauge galvanized steel fabricated roof-mounting frame. Curbs formed as detailed with corners riveted or welded as required for strength. Curbs shall be self-supporting and shall be sloped to match the roof slope and maintain the units level. Curbs shall be the acoustic type shown on the drawings (factory installed acoustic fill) as manufactured by ThyBar. Curbs to be mounted on wood blocking, 1-1/2" minimum thickness.

D. Units shall contain hermetic multi-cylinder compressors, which shall have positive constant pressure lubrication. Units shall contain indoor and outdoor coils, of non-ferrous construction with aluminum plate fins mechanically bonded to seamless copper tubing with all joints brazed. Compressor warranty to be 5 years.

E. The supply fans shall be capable of delivering required cfm of air against external static pressure scheduled. The supply fans shall be centrifugal type, belt driven by permanently lubricated motors and variable sheaves.

F. Condenser fans shall be propeller type, direct driven by permanently lubricated motors.

G. Refrigeration system shall be protected by high and low pressure stats, loss of charge and indoor coil freeze-up protection devices, current and temperature sensitive compressor motor protectors, and a device which prevents starting of compressor more than once every five minutes.

H. Rooftop units as scheduled shall be combined heating, electric cooling units with ARI certified rating.

I. Units as scheduled will have economizers, motorized outside air dampers and motorized relief dampers. The mechanical contractor shall field install the economizer hood shipped with the unit.

J. Prior to final acceptance, unit manufacturer shall furnish, in triplicate, certification that rooftop units are installed and operating in accordance with plans and specifications and all safety controls are functioning satisfactorily.

K. Certain units shall have a factory installed GFI weather proof convenience receptacle. The receptacle shall be powered by the electrical contractor.

L. The units shall have factory installed filter racks and access doors with one set of filters installed. The filters shall 2" pleated media (refer to the filter paragraph below for specification). Refer to the schedule for additional options and accessories.

M. Theatre rooftop units shall be as scheduled. The outside air controller (from the CO2) shall be proportional, not stepped.

2.12 EQUIPMENT ELECTRICAL REQUIREMENTS

A. All equipment with integral heaters, motors and devices which require electrical voltage or phase voltage different from primary service voltage to the unit shall be internally equipped with transformers so only a single electrical service is required to the unit.

B. If the electrical characteristics of the equipment actually furnished differs from that scheduled, the HVAC contractor is responsible for:
   1. Coordinating the changes with the electrical contractor
   2. The cost incurred by the electrical contractor associated with the change.
   3. Design costs associated with the change required for resubmission to the governing authorities.

2.13 INSTRUCTION AND INSTRUCTION BOOKLETS

A. Instruct Owner or representative thoroughly in proper operation of systems.

B. Provide at least two copies of instruction booklets, including simple step instructions for normal operation, minor maintenance suggestions and control diagram.

C. After compliance with above, secure letter from Owner acknowledging same, give letter together with two additional instruction booklets to Architect for his permanent file.

2.14 TESTING AND BALANCING

A. The Section 15034 Test and Balance (TAB) Contractor shall balance the entire system for proper operation. Refer to Section 15034 for additional information.

B. Contractor shall provide for a second start-up of each unit at the beginning of the season opposite that in which the system is first operated and tested.

C. The HVAC contractor shall make any changes or replacements to the sheaves, belts, dampers, valves, etc. required for correct balance as advised by the TAB Contractor, at no additional expense to the Owner.

2.15 START-UP OF OWNER FURNISHED ICE MACHINES AND WALK-IN COOLERS:

A. The Contractor shall coordinate and assist in the start-up and check out of the owner furnished ice machines by the area authorized manufacturer's representative.

2.16 VIBRATION ISOLATION

A. The Contractor shall provide a complete, properly adjusted and effective system of vibration isolation, vertical piping support, and sound control as shown or indicated on the drawings and/or as specified.

B. The system of vibration isolation, vertical piping support, and sound control shall include, but not be limited to, the following:
   1. Support isolation for motor-driven mechanical equipment.
   2. Flexible ductwork connections.

C. Isolators for equipment suspended from structure: Model SLF free standing and laterally stable spring mounts complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8" of compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

D. FLEXIBLE DUCT CONNECTORS: Laminated flexible sheet of cotton duct and sheet elastomer (butyl, neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure indicated. Form connectors with full faced flanges and accordion bellows to perform as flexible isolation unit, and of manufacturer's standard length for each size unless otherwise indicated. Equip each unit with galvanized steel retaining rings for airtight connection with ductwork.

E. Curbs for roof mounted equipment shall be isolated with 1/2" fiberglass pads, Type 'E' density, as manufactured by Kinetics Noise Control, Inc. Fiberglass board to be supplied in 48" long lengths. Field cut pads to fit the top of curb (continuous) and adhere to curb with a mastic adhesive. Exposed cut edges of pads to be sealed with a 20 year clear silicone caulk. - Note: Lead time is 4 to 6 weeks. The Kinetics isolation pads are in addition to the fiberglass pad or seal shipped with the rooftop unit.

2.17 RELIEF HOODS

A. Furnished and installed as indicated on the drawings.

B. Barometric center pivot dampers with edge seals and adjustable counter balance.

C. Furnish 16" high curbs with hood.

2.18 D/X SPLIT SYSTEMS

A. D/X split systems shall be furnished and installed as indicated on the drawings.

B. Approved manufacturers are Trane, Carrier, York and Lennox.

C. “Smart” electronic thermostats shall be furnished and installed as indicated on the drawings. Thermostats to be Honeywell T7300 series or approved equal.

D. The contractor shall furnish and install filter racks and filters for 2" pleated media (Farr 30/30).

2.19 EQUIPMENT START UP

A. All HVAC equipment shall be shall be started and commissioned by the contractor.

B. Contractor shall provide for a second start-up of each unit at the beginning of the season opposite that in which the system is first operated and tested.

C. Temperature Control (ATCS) start-up and commissioning: The mechanical contractor shall assign one service technician to assist the ATCS vender in the ATCS startup.

D. The Owner’s rooftop unit supplier shall provide an operational checkout of the rooftop units after the mechanical contractor has performed the required startup.

2.20 AIR FILTERS

A. Filters are to be Farr 30/30, 2", Class 2, pleated media filters, 30% efficient.

B. Install filters in all AHUs, FCU’s and RTU’s

C. If the AHUs, FCU’s or RTU’s are started and operated prior to .4 weeks before opening (or substantial completion), the contractor shall protect the evaporator coils from becoming dirty or shall be back charged for cleaning the coils. The protection can include filter changes on a weekly or by weekly basis.

D. There shall be a minimum total of two filter changes by the mechanical contractor: one prior to test and balance, and one on opening day. If the rooftop units or air handlers are operated during construction, the contractor is responsible for covering the return air duct openings with filter media and additional filter changes as required to keep the coils clean.

2.21 SOUND ATTENUATORS (DUCT) (not applicable on all projects)

A. Furnish and install where shown on the drawings.

B. Sound attenuators to be IAC FLS or pre-approved equal.

C. Sound attenuators to be sized at maximums: .1”wc pressure drop or 500 FPM, whichever is greater.

D. Provide duct transitions on each side of the attenuator.

2.22 TEMPERATURE CONTROLS

A. Furnish and install Lennox ‘L-Connection’ central temperature control system.

B. The network interface panel shall enable the owner to read and adjust the temperature of any zone or rooftop unit from one central location.

C. Furnish and install all software and license. Furnish 4 backup copies of the program to the owner.

2.23 GUARANTY-WARRANTY

A.. The subcontractor shall furnish a written warranty, countersigned and guaranteed by the General Contractor, stating all work executed under this section shall be free from defects of materials and workmanship for a period of one year from the date of final acceptance.

B. The above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

2" W.G. STATIC POS. OR NEG.	TABLE 1-5 RECTANGULAR DUCT REINFORCEMENT							
		MINIMUM RIGIDITY CLASS ON MINIMUM GAGE DUCT						
DUCT DIMENSION	NO REINFORCEMENT DUCT GAGE	REINFORCEMENT SPACING						
		10′	8′	5′	4′	3′	2½′	2′
10″ dn.	26 ga.							
11, 12″	24 ga.		A-26	→	→	→	→	→
13, 14″	22 ga.		A-24	A-26	→	→	→	→
15, 16″	20 ga.	A-22	A-24	A-26	→	→	→	→
17, 18″	20 ga.	A-22	A-24	A-26	→	→	→	→
19, 20″	18 ga.	B-20	B-22	A-26	→	→	→	→
21, 22″	16 ga.	B-20	B-22	A-26	→	→	→	→
23, 24″	16 ga.	C-20	C-22	B-26	→	→	→	→
25, 26″		C-20	C-22	B-26	→	→	→	→
27, 28″		C-18	C-20	C-24	B-26	→	→	→
29, 30″		D-18	D-20	C-24	C-26	→	→	→
31–36″		E-16	E-18	D-22	D-24	→	→	→
37–42″			E-16	E-22	E-24	→	→	→
43–48″			G-16	F-20	E-22	E-24	→	→
49–54″				G-18 F+rod	F-20	F-24	→	→
55–60″				H-18 F+rod	G-20 F+rod	G-22 F+rod	G-24 F+rod	→
61–72″	NOT			I-16 F+rod	H-18 F+rod	H-22 F+rod	→	H-24 F+rod
73–84″	ALLOWED				J-18 F+rod	I-20 F+rod	→	I-22 F+rod
85–96″					K-16 G+rod	K-18 G+rod	J-20 F+rod	→
97″ UP							H-18t	→

See page 1-15.

END OF SECTION