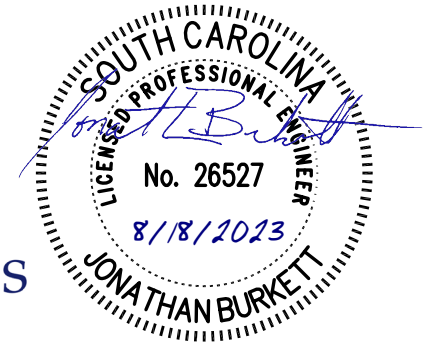
HVAC RENOVATIONS
AT THE YORK COUNTY PRISON

BGA Project Number 22031

AUGUST 18, 2023



Buford Goff & Associates
ENGINEERS AND PLANNERS
EST. 1969

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Contractor Pay Request Certification

Project: _____

Locality: _____ **Contractor:** _____

Provisions: *The contractor hereby certifies that work completed on the above-referenced ARPA Project and Contract during the period for which payment is requested complies with the following required provisions, as applicable in accordance with the contract terms and conditions:*

1. **Contract Work Hours:** Each contractor is required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of the Contract Work Hours and Safety Standards Act, 40 USC 3702 and 3704, as supplemented by Department of Labor regulations at 29 CFR Part 5 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

2. **Safety Standards Act:** Safety Standards and Accident Prevention provisions require contractors to:
   - Comply with the safety standards provisions of applicable laws, building and construction codes, the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970, and the requirements of Title 29, Section 1518.
   - Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.
   - Maintain at the construction office or other well-known place on the job site, all articles necessary for giving first aid to the injured and make standing arrangements for the immediate removal to a hospital or to a doctor's care those persons (including employees), who may be injured on the job site. In no case shall employees be permitted to work at a job site before the employer has made a standing arrangement for removal of injured persons to a hospital or doctor's care.

3. **Debarment and Suspension:** In accordance with 2 CFR Part 180 and Treasury's implementing regulations at 31 CFR Part 19, ARPA funds may not go to individuals or entities that are prohibited from doing business with the federal government. *Debarment status can be checked on the System for Award Management (SAM) website at www.sam.gov.*

CERTIFICATION:

- I certify to the best of my knowledge and belief, that the above referenced project has complied with the applicable provisions of the Contract Work Hours and Safety Standards Act as outlined above during the period for which payment is requested.
- I certify to the best of my knowledge and belief, that all laborers and mechanics employed by contractors and subcontractors during the period for which payment is requested were paid prevailing wages.
- I certify to the best of my knowledge and belief, that I nor my Company or any of my subcontractors on this project as included in the above-referenced Contract are not presently debarred, suspended, or ineligible from participating in transactions by the federal government or local government department or agency.
- I understand that a false statement on this certification shall be regarded as a material breach of the Agreement. I also acknowledge that state agencies or the US Treasury may request any additional information or documentation it deems necessary to demonstrate compliance in the form of an audit or otherwise pursuant to its ability to effectively administer these funds.

This form must be signed by the contractor and submitted as part of every Contractor's Application for Payment involving federal funds as supporting documentation. This form certifies compliance for the period as stated on the Contractor's Application for Payment.

Contractor Signature: _____ **Contractor Printed Name:** _____ **Date:** _____

"General Decision Number: SC20230031 03/17/2023

Superseded General Decision Number: SC20220031

State: South Carolina

Construction Type: Building

County: York County in South Carolina.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be

adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023
1	03/17/2023

* ELEC0379-010 09/05/2022

	Rates	Fringes
ELECTRICIAN	$ 30.28	15.5%+8.35

Work from swinging scaffolds, boson chairs, or raw structural steel: $1.00 per hour additional.

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* SUSC2011-027 08/31/2011

	Rates	Fringes
BRICKLAYER	$ 17.50	0.67
CARPENTER (Form Work Only)	$ 15.53 **	1.76
CARPENTER, Excludes Drywall Hanging, and Form Work	$ 17.14	0.00
CEMENT MASON/CONCRETE FINISHER	$ 14.10 **	0.00
DRYWALL HANGER	$ 16.32	1.50
LABORER: Common or General	$ 11.26 **	0.00
LABORER: Landscape	$ 9.45 **	0.49
LABORER: Mason Tender-Brick/Concrete/Cement/Stone	$ 10.88 **	0.00
LABORER: Pipelayer	$ 14.69 **	2.08

OPERATOR:
Backhoe/Excavator/Trackhoe.....$ 16.05 ** 1.96

OPERATOR: Bulldozer.....$ 17.07 2.65

OPERATOR: Crane.....$ 19.39 2.02

OPERATOR: Grader/Blade.....$ 17.50 1.78

OPERATOR: Loader.....$ 11.64 ** 1.03

PAINTER: Brush, Roller and
Spray.....$ 12.36 ** 0.00

PIPEFITTER.....$ 19.67 9.16

PLUMBER.....$ 19.21 4.56

ROOFER.....$ 12.11 ** 0.00

SHEET METAL WORKER (HVAC Duct
Installation Only).....$ 19.11 0.00

TRUCK DRIVER.....$ 14.05 ** 3.18

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic

violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all

rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described

in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

SECTION 01 1000 – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 MATERIALS AND WORKMANSHIP:

A. Unless otherwise specified, all materials shall be new, of the best quality consistent with the type and grade specified and of a type and quality suitable for the purpose they are to serve. All employees shall be competent, experienced and skilled in their trades. Workmanship throughout shall be of the first quality equal to the best recognized practice in the field concerned.

1.2 APPROVAL OF SUBSTITUTIONS:

A. Specific reference in the specifications to any article, device, product, materials, fixture, form or type of construction, etc., by name, make, or catalog number, with or without the words "or equal", shall be interpreted as establishing a standard of quality.

B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified shall be submitted for approval in writing ten (10) calendar days prior to bid opening date to the Engineer. Requests shall be accompanied by samples, literature, and information as necessary to fully identify and allow appraisal of the material or equipment. Submittals shall be concise, clear, and brief as possible. Incomplete submittals or submittals requiring lengthy research to ascertain quality will not be considered. No substitutions will be considered within ten (10) days prior to the bid opening.

C. Approval of the Engineer to use materials or equipment, if granted, will be in the form of a written addendum.

D. The judgment and decision of the Engineer to approve or reject a request for substitution is final.

E. Submittals for bidding are not required on items specified by model number or when a manufacturer listed by name can provide equipment with no deviations from the specifications. Submit all other items for approval.

F. Items approved shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly indicated in the form of a letter that is enclosed with the submittals.

G. Contractor shall be responsible for verifying all dimensions with available space. If, in the opinion of the engineer, the physical dimensions do not permit the substituted material or equipment to be properly operated, maintained, serviced, or otherwise accessed, or the physical dimension adversely impact other components, a system's ability to be operated, maintained, serviced or otherwise accessed, the material or equipment shall be replaced at the contractor's expense.

1.3 EXAMINATION OF CONDITIONS:

A. The Contractor, subcontractors and material suppliers shall carefully examine the drawings and specifications and all job conditions and call to the attention of the

Engineer any conditions that will interfere with or preclude a first-class and serviceable installation of the product they propose to furnish. The Contractor shall notify the Engineer, in writing, should any conditions exist that would in any way affect a manufacturer's guarantee, warranty or responsibility for proper performance and service of an item.

1.4 FITTING JOB CONDITIONS:

A. The Contractor, subcontractors and material suppliers shall be responsible for inspecting all job conditions affecting the installation of an item and taking all field measurements required prior to fabrication of an item to insure that the item concerned will integrate properly with all adjacent materials and fit all other conditions as they exist or will exist in the finished building.

B. Work in connection with the installation of an item shall be coordinated with all other affected work and trades.

C. Sleeves, anchors and other items that must be embedded in or that otherwise affect other portions of work shall be located and set while such portions of the work are in progress.

1.5 TESTS, CERTIFICATIONS AND APPROVAL BY OTHER AUTHORITIES:

A. Where tests, certificates or approvals by authorities other than the Engineer are required, the Contractor shall have such tests performed and procure such certification or approvals. The contractor shall forward a minimum of four copies of the results of the test, the certificates, or approvals to the Engineer prior to the proceeding with work involved. Such laboratories and/or authorities as are employed for this purpose shall be competent, with a generally recognized reputation in the field concerned, and shall be subject to approval of the Engineer.

1.6 INCLUSION OF ACCESSORIES:

A. Unless otherwise specifically mentioned, all anchors, bolts, screws, fittings, fillers, hardware, accessories, trim and other parts required for or in connection with an item of material to make a complete, serviceable, finished and first quality installation shall be furnished and installed as part of the item whether called for by the specifications or not.

1.7 PROTECTION:

A. All materials shall be shipped and stored and handled in a manner that will afford protection and insure their being in "like new" condition at the time they are incorporated in the work. After installation, they shall be properly protected against damage to insure their being in "like new" condition when the building as a whole is completed and accepted by the Owner.

1.8 INSTALLATION:

A. All items shall be installed in a workmanlike manner in accordance with the best recognized practice in the field concerned. Manufactured items shall be installed in strict accordance with the manufacturer's printed directions, specifications and recommendations for an installation of highest quality.

B. All working parts shall be properly adjusted after installation and left in proper working order.

C. All items in walls exposed to weather or otherwise subjected to flooding or wetting shall be installed so as to shed and not hold water.

D. Items shall in all cases be installed plumb and true and in proper relation to surrounding materials.

1.9 ANCHORING AND TYING:

A. All materials, including but not limited to those mentioned below, shall be securely anchored and/or tied together in accordance with the best recognized practice in the field concerned whether shown, specified or not.

B. Material shall be installed in a permanent manner that will permit expansion, contraction and other minor movements and normal use of the structure without structural features becoming impaired and without any of its parts becoming loose.

C. Ties and anchors shall be best quality for the purpose.

D. All wood, steel, concrete or other framing shall be securely anchored and tied together and to supporting or abutting masonry. All veneers, finished and applied items shall be securely anchored and tied to the backing material.

1.10 REFERENCE TO STANDARD SPECIFICATIONS:

A. When standard specifications such as The American Society for Testing and Materials, Federal Specifications, Department of Commerce (Commercial Standards), American Institute of Steel Construction, or other well known public or trade associations are cited as a standard to govern materials and/or workmanship, such specifications or portions thereof as referred to shall be equally as binding and have the full force and effect as though it was copied into these specifications. Such standards as are mentioned are generally recognized by and available to the trades concerned. The Engineer will, upon request of a bidder or contractor, furnish for inspection a copy of any standard specifications mentioned or direct the bidder or contractor to any easily available copy. Unless otherwise specifically stated, the standard specifications referred to shall be considered as the latest edition and/or revision of such specifications that is in effect on the date of the Invitation for Bids. In case of any conflicts between standard specifications and the written portion of the specifications, the specifications as actually written herein will govern.

1.11 REFERENCES TO MANUFACTURER'S PUBLICATIONS:

A. Unless otherwise specifically stated, all manufacturer's catalogs, specifications, instructions or other information or literature that are referred to in the specifications shall be considered as the latest edition and/or revision of such publication that is in effect on the date of the Invitation for Bids.

1.12 HAZARDOUS MATERIALS:

A. Existing Conditions:

1. In the event the contractor for the project encounters on the site material believed to be asbestos, polychlorinated biphenyl (PCB), lead paints, fuel contaminated soil, or any other material considered hazardous, the contractor shall immediately stop work in the area affected and report the condition to the Engineer in writing by the fastest practical method.
2. The contractor shall not resume work until the contractor is advised in writing that the material is not hazardous and/or does not pose a risk to the contractor.

B. New Materials:

1. Contractors are hereby advised that the use of the following materials or products containing these materials in any quantity or any form is strictly forbidden, even if the products can be purchased and/or legally installed.

a. Asbestos
b. PCB
c. Lead Solder
d. Lead Paint

1.13 EQUIPMENT DELIVERY:

A. Any Contractor receiving equipment or materials that are to be installed under his Scope of Work shall provide personnel and equipment to unload these materials at the time they arrive on site or make provisions for receiving and unloading the shipment.

B. Any shipments arriving on site without proper personnel present to receive and unload the shipment will be instructed to return to the shipping terminal. The Contractor shall be responsible for all additional shipping charges.

1.14 ACCIDENT PREVENTION:

A. Each Contractor shall have an approved written Accident Prevention Program and shall produce it when required by the Engineer.

B. The Contractor shall hold weekly meetings with all subcontractors to monitor compliance with all safety regulations. These regulations shall be provision of the current editions of the State and Federal laws, including but not limited to, the latest amendments of the following: Williams-Steagler Occupational Safety and Health Act of 1970, Public Law 91-956, Part 1910 - Occupational Safety & Health Standards, Chapter 17 of Title 29, Code of Federal Regulations, Part 1926 - Safety & Health Code and Federal and State of (South Carolina) Regulations.

1.15 BARRICADES:

A. The Contractor shall provide all labor and materials necessary to conduct work and protect personnel in accordance with OSHA standards.

B. The Contractor shall furnish, install, and maintain all necessary temporary barricades at the building floor perimeters and openings and to separate the areas of construction from the building occupants at all times.

1.16 PERSONAL PROPERTY:

A. Contractor will be held liable for all damage to personal and real property as a result of their negligence to provide protective measures.

1.17 GUARANTEE OF WORK:

A. The Contractor shall procure and furnish to the Owner all guarantees that are called for by the specifications or that are promised by a manufacturer of an item in his published catalog or literature.

B. Except as otherwise specified, all work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment or workmanship for one year from the date of substantial completion.

C. If, within any guarantee period, repairs or changes are required in connection with guaranteed work which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract, the Contractor shall promptly:

1. Correct all defects and place in satisfactory condition all guaranteed work.
2. Repair all damage to the building, site, equipment, or other components which, in the opinion of the Engineer, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the Contract.

D. Should the contractor disturb any work guaranteed under another Contract, they shall restore such disturbed work to a condition satisfactory to the Engineer and guarantee such restored work to the same extent as it was guaranteed under such other contract.

E. If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expense incurred.

F. There will be one final inspection of project by the Engineer and Contractors between the 11th and 12th month following final acceptance of the building by the Owner. Inspection will be with Owner. Any and all items found will fall in the years' warranty.

1.18 TESTS:

A. Any specified laboratory tests of material and finished articles to be incorporated in the work shall be made by bureaus, laboratories, or agencies approved by the Engineer and the reports of such tests shall be submitted to the Engineer. The cost of the testing shall be paid for by the Contractor, unless otherwise specified.

B. The Contractor shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by them.

1.19 TRANSMITTAL OF DOCUMENTS:

A. Unless stated otherwise, all information shall flow from subcontractors to prime contractor to Engineer and conversely. Reference to a subcontractor submitting to the Engineer in these specifications is not intended to bypass this routing.

1.20 WORK STATED IN OTHER DIVISIONS OF WORK:

A. The specifications in each Division are intended to compliment one another. In case of conflict, the most stringent requirement shall apply.

END OF SECTION 01 1000

SECTION 01 1010 - SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. The work under this contract includes the furnishing of all labor, material, plant and all items and services of every nature whether particularly mentioned or not that is required to complete the replacement of the existing boilers with four (4) new boilers at the Moss Justice Center, York South Carolina.

1.2 RELATED DOCUMENTS:

A. Attention is directed to Division 1, General Requirements and Instructions to Bidders which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship and substitutions.

1.3 SUBSTANTIAL COMPLETION:

A. Project shall be substantially complete within one hundred five (105) calendar days of the Notice to Proceed.

1.4 FINAL COMPLETION:

A. The contractor shall complete all punchlist items within thirty (30) days of substantial completion.

B. Any items the contractor does not agree is the responsibility of the contractor shall be identified in writing by the contractor. These items shall be submitted to the A/E within ten (10) days of receipt of the contractor being notified of the item.

C. Should the contractor fail to complete the punchlist items, the Owner may deduct the following from the contractor's contract amount:

1. Reasonable cost to have work completed by another party.
2. Reasonable cost to have the A/E provide additional review of work.
3. Any other reasonable costs incurred by the Owner as the result of work not being completed.

1.5 OSHA STANDARDS:

A. OSHA Construction Standards shall be applicable to all construction operations.

1.6 CONSTRUCTION SCHEDULE:

A. Contractor shall furnish to the Engineer a construction schedule within fourteen (14) days from the date of the "Notice to Proceed."

B. Schedule shall include all critical path items, start and completion date of each, and project completion date. Additional detail shall be provided by the Contractor if requested by the Engineer.

C. The schedule shall be bar type, computer generated.

D. Work shall be performed Monday through Friday from 7:00 a.m. to 4:00 p.m.

E. The existing boiler shall not be demolished/removed until the new boilers have been received at the site. From the time the first existing boiler is shut down until the new boilers are operational, the Contractor shall have 28 calendar days to complete all work.

F. Depending upon the nature of the work, utility tie-ins, shutdowns, emergency work, and other work may be required to be done during non-regularly scheduled construction hours.

1.7 SCHEDULE OF VALUES:

A. Schedule of values shall include a reasonable breakdown of labor and material for the major categories of work for each trade.

1.8 RETAINAGE:

A. Retainage shall be broken out as a line item or multiple line items on the schedule of values.

B. Retainage shall be withheld at 5% of the total project contract value.

1.9 FINAL PAYMENT:

A. Contractor shall furnish to the Engineer the following prior to approval of final certificate of payment.

1. All manufacturers warranties.

2. Information for "As-Built Drawings" from all sections of these specifications.

3. Affidavit that all materials and labor have been paid in full.

4. Instructions to the Owner.

5. Operation and Maintenance Manuals on all equipment.

6. Submittal of punch list with each item initialed and date completed.

7. Additional information as identified in all sections of these specifications and contract drawings.

1.10 CONTRACT DRAWINGS:

A. Drawings are schematic and are based upon existing documents and engineers' field inspections. Contractor shall field verify locations of all equipment, panels, controls, accessories, wall sections, grades and floor elevations prior to ordering any material

1.11 STORAGE LAYDOWN AREAS:

A. There is limited storage and laydown area available on site. These areas which are available will be coordinated with the Engineer and Owner.

B. Storage and laydown may have to be relocated during the duration of the project to accommodate construction progress at no cost to the Owner.

1.12 PROJECT RESTRICTIONS AND REQUIREMENTS:

A. No tobacco products permitted on site.

B. No eating or drinking within the building.

C. All contractors shall have identification badges worn at all times or shall wear a shirt bearing the contracting company's name and/or logo.

1.13 GENERAL REQUIREMENTS:

A. If the contractor observes any conditions that they cannot work safely around, the Owner or Engineer should be notified prior to working in that area.

B. The contractor shall take all steps necessary to protect all furnishings from damage at all times during construction.

C. The contractor is not to sit or stand on furniture nor place any materials on furniture other than what is required to protect the furniture.

1.14 PROJECT PRIORITY:

A. The boilers in this facility serve areas where inmates are housed. The Contractor is reminded that all precautions shall be taken to minimize all heating system downtime and to take all measures necessary to ensure that heating is available to the housing unit at all times with the exception for minor disruptions which do not adversely impact the living condition of the inmates.

1.15 LOCKOUT/TAGOUT AND WEILDING AND CUTTING PROCEDURES:

A. The contractor shall be required to follow the Owner’s procedures for lockout/tagout and wielding and cutting procedures.

B. Samples of lockout/tagout and welding and cutting procedures are include in the appendix.

1.16 PERMITS:

A. The contractor is responsible for obtaining the mechanical equipment permit and gas permit. The contractor shall be responsible for all permit costs.

B. The contractor shall be responsible for requesting the boiler inspections. The contractor shall be responsible for cost of the inspection and the Boiler Certificate.

C. The Contractor shall provide a National Board form.

END OF SECTION 01 1010

SECTION 01 2105 - TEMPORARY SERVICE

PART 1 - GENERAL

1.1 WATER FOR USE IN CONSTRUCTION:

A. The Owner shall provide a source of clean potable water for the Contractor. The Contractor shall provide means of distribution.

B. Provide reduced pressure backflow connector at connection to Owner's source of water.

1.2 DRINKING WATER:

A. Each Contractor shall provide their own drinking water.

1.3 POWER:

A. The Owner shall provide a source of power to the extent it is available at the site. The Contractor shall provide means of distribution and connections.

1.4 TOILETS:

A. The Contractor shall be responsible for providing portable toilet facilities. The portable units shall be cleaned and well maintained by Contractor.

B. Coordinate locations with Owner.

END OF SECTION 01 2105

SECTION 01 3100 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide all cutting and patching indicated on the plans and in these specifications and as required to perform all work necessary to complete the requirements of the project.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Use materials that are identical to existing materials except where such materials are prohibited by law or these specifications including, but not limited to, those materials listed in the General Requirements specification. If identical materials are not available or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL:

A. Do not cut or modify structural elements.

B. Do not cut and patch operating elements or safety related components in manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Obtain written prior approval of cutting and patching for operating elements or safety related systems.

C. Do not cut and patch construction exposed on exterior or in occupied spaces, in manner that would, in the Engineer's opinion, reduce building's aesthetic qualities, or result in visual evidence of cutting and patching.

3.2 INSPECTION:

A. Examine existing surfaces before cutting and patching.

B. If unsafe or unsatisfactory conditions exist, take all necessary measures to make conditions safe and satisfactory for the work to be done. Do not proceed if contractor is unsure of conditions or conditions are not safe and acceptable to the contractor.

C. Before proceeding, meet at site with all trades affected by this work. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Where subsurface conditions or systems are unknown or uncertain, contractor shall take all practical steps to ascertain subsurface conditions or systems Contractor shall proceed with caution until conditions and systems are known or uncovered.

3.3 PREPARATION:

A. Provide temporary support of work to be cut.

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

C. Avoid interference with use of adjoining areas or interruptions of free passage to adjoining areas if these areas are to remain in operation.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork which are to remain or to be removed or relocated at a later time.

3.4 PERFORMANCE:

A. General:

1. Employ skilled workmen to perform cutting and patching.
2. Work shall be done in a timely manner in accordance with the construction schedule and in a time frame to minimize damage, hazard, or vandalism to facility.

B. Cutting:

1. Cut existing construction using methods least likely to damage elements.
2. In general, where cutting is required use hand or small power tools designed to cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces.
3. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces.
4. Cut through concrete and masonry using cutting machine such as carborundum saw or diamond core drill.
5. By-pass utility services such as pipe or conduit, before cutting, where lines are indicated to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal remaining portion of pipe or conduit.

C. Patching:

1. Patch with durable seams that are as invisible as possible.
2. Where feasible, inspect and test patched areas to demonstrate integrity of installation.
3. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in manner that will eliminate evidence of patching and refinishing.
4. Patch, repair, replace, or rehang existing ceilings as necessary to provide even plane surface of uniform appearance.

3.5 CLEANING:

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature.

3.6 PENETRATIONS:

A. All penetrations made by any contractor through walls, ceilings and floors shall be sealed by the Contractor to meet the requirements of all building codes and fire codes applicable to this project.

B. All sleeves set in concrete, masonry, or other work shall be furnished and installed by the Contractor requiring them in a timely manner so as not to delay the Contractor doing the concrete, masonry or other work. Should the Contractor requiring the sleeves fail to install them in a timely manner they will be required to bear the cost of cutting and patching to install the sleeves.

C. No penetrations, attachments, or other modifications to load bearing walls, beams, columns or other structural members shall be made without written authorization from the Engineer.

END OF SECTION 01 3100

SECTION 01 3105 - DEMOLITION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Furnish all labor, materials, tools, and equipment and perform all operations to demolish and remove systems, system components, and building components indicated on the plans and in the specifications and as required to perform all work necessary to complete the requirements of the Project.

B. Demolition is required for:

1. Portions of existing building indicated on drawings and as required to accommodate new construction.

2. Removal of existing mechanical, electrical, and plumbing equipment, piping, supports, controls and all associated items as indicated on drawings.

1.2 PROJECT CONDITIONS:

A. Owner may occupy portions of building adjacent to areas of demolition. Conduct demolition work in manner that will minimize disruption of Owner's normal operations.

B. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 GENERAL:

A. The requirements of the structural plans and specifications shall supersede this specification where a conflict exists.

3.2 PREPARATION:

A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

B. Cease operations and notify Owner's Representative and Engineer immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

C. Provide temporary barricades and other forms of protection to protect personnel from injury due to demolition work.

D. Provide protective measures as required to provide free and safe passage of personnel to occupied portions of building.

E. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

F. Provide weatherproof closures for exterior openings resulting from demolition work.

G. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations.

3.3 UTILITIES:

A. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building.

B. Provide minimum of 72 hours advance notice to Owner if shut down of service is necessary during changeover.

C. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

D. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

E. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

3.4 DEMOLITION:

A. Perform demolition work in systematic manner.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

D. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

E. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

F. Maintain fire protection systems during selective demolition.

G. Provide portable fire suppression systems during flame cutting operation.

H. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as flooding and pollution.

3.5 UNFORESEEN CONDITIONS:

A. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of conflict.

B. Submit report to Engineer in written, accurate detail. Pending receipt of directive from Engineer, rearrange demolition schedule as necessary to continue overall job progress without delay.

3.6 DISPOSAL OF DEMOLISHED MATERIALS:

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on project site.

D. Remove protections at completion of work.

3.7 REPAIR:

A. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by demolition work.

END OF SECTION 01 3105

SECTION 01 3110 - PROTECTION OF FLOORS AND FURNISHINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Furnish all labor, materials, tools, and equipment and perform all operations to protect the floors and furnishings in the area of construction of the Project.

1.2 DEFINITIONS:

A. Furnishings include all components of the space such as fixtures, furniture, equipment, casework, shelving, glass panels, and other items typically placed in rooms.

PART 2 - PRODUCTS

2.1 PLYWOOD COVERINGS:

A. Where required, plywood shall be ½" thick minimum.

PART 3 - EXECUTION

3.1 FLOOR COVERING:

A. Where floors can be damaged by movement of the new boilers into the building's boiler room or the floors can be damaged by the demolition and removal of the existing boilers, the floor shall be protected with plywood.

END OF SECTION 01 3110

SECTION 01 3115 - GENERAL CLEANING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Furnish all labor, materials, tools, and equipment and perform all operations to maintain the buildings and site in a standard of cleanliness as described in this section.

1.2 QUALITY ASSURANCE:

A. In addition to the standards described in this Section, comply with pertinent requirements of agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT:

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

B. The Prime Contractor is to allow in his bid for provision of a dumpster service for the duration of the project. The Prime Contractor shall allow for emptying as needed.

2.2 OTHER MATERIALS:

A. Provide other materials, not specifically described, but required for a completed and proper cleaning, as selected by the Contractor subject to the approval of the A/E.

PART 3 - EXECUTION

3.1 GENERAL:

A. Conduct a daily inspection to verify that the cleaning requirements of this specification are being complied with.

B. If the contractor fails to maintain the building and site in a clean condition, the Owner, after written notification, will have the cleaning work performed by other forces with the cost incurred by the contractor.

3.2 PROGRESS CLEANING:

A. General:

1. Retain stored items in an orderly arrangement allowing maximum site and building access, not impeding traffic or drainage, and providing required protection of materials. At no time shall any emergency exit or fire egress be restricted.
2. Do not allow accumulation of scrap, debris, and waste material.

3. At least twice each week, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the environment.
5. All food, food bags and containers, beverage containers and any other organic debris shall be collected and disposed of daily.

B. Site:

1. Maintain the site in a neat and orderly condition at all times.
2. Inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.

C. Building:

1. Inspect the buildings and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Prior to the installation of any materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

3.3 FINAL CLEANING:

A. General:

1. Cleaning shall be to the level typically provided by skilled cleaners using commercial quality building maintenance equipment and materials.
2. Remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste.
3. Additional requirements may be required elsewhere in these specifications.

B. Site:

1. Clean all debris from the site accumulated as a result of the contractor's work.
2. Broom, pressure wash, or steam clean paved areas marred or blemished as a result of the contractor's work.

C. Buildings:

1. Exterior:

a. Visually inspect exterior surfaces and remove traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed materials from exterior surfaces.
c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
d. In the event of stubborn stains not removable with water, the Engineer may require light sandblasting, chemical cleaning, or other methods of cleaning at no additional cost to the Owner.

2. Interior:

   a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
   b. Remove all traces of splashed materials from interior surfaces.
   c. Remove paint droppings, spots, stains, and dirt from finished surfaces.

3. Glass:

   a. Clean inside and outside dirtied beyond what would normally be expected if construction had not occurred.

D. Schedule final cleaning as approved by the A/E to enable the Owner to accept a completely clean project.

END OF SECTION 01 3115

SECTION 01 5100 - PRODUCT HANDLING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Furnish labor, material, tools, and equipment and perform all operations to handle, load, unload, store, and protect all materials and products used on this Project.

1.2 QUALITY ASSURANCE:

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 MANUFACTURERS' RECOMMENDATIONS:

A. Except as otherwise approved by the Engineer, comply with manufacturers' recommendations on product handling, storage, and protection.

1.4 PACKAGING:

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.

B. Maintain packaged materials with seals unbroken and labels intact until the time of use.

C. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

D. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality, and other pertinent information.

1.5 PROTECTION:

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, though which equipment and materials are handled.

B. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.6 REPAIRS AND REPLACEMENTS:

A. In the event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.

END OF SECTION 01 5100

SECTION 01 6100 – INSPECTIONS AND TESTING

PART 1 - GENERAL

1.1 INSPECTIONS:

A. Inspections by various entities including but not limited to the authority having jurisdiction (AHJ), building inspectors, code officials, special inspectors, architects and engineers may be required on this project.

B. The contractor shall fully cooperate with the persons performing the inspections by:

1. Providing the appropriate personnel.
2. Providing ladders and other means of access.
3. Providing other assistance as necessary for the persons performing the inspections to complete their inspections in a timely manner.

1.2 TESTING:

A. Testing by various entities may be required on this project. The contractor shall provide the support required for testing by others similar to that support required for inspections.

1.3 COST FOR INSPECTIONS AND TESTING:

A. Cost for inspections shall not be the contractor's responsibility unless specifically indicated.

B. Costs for Chapter 1 shall not be the contractor's responsibility.

PART 2 - INSPECTIONS

2.1 GENERAL:

A. Inspections shall be requested of the Chapter 1 and the Chapter 17 inspectors as required by:

1. Applicable edition of the IBC.
2. This specification section.
3. Additional requirements indicated on plans.

2.2 IBC CHAPTER 1 BUILDING INSPECTION:

A. HVAC:

1. HVAC rough-in, Chapter 1 inspector, periodically
2. HVAC final inspection, AHJ

B. Electrical:

1. Electrical rough-in, Chapter 1 inspector, periodically

2. Electrical final inspection, AHJ

C. Energy Efficiency:

1. Verification of the applicable requirements of ASHRAE 90.1, Chapter 1 inspector, periodically.

PART 3 – EXECUTION

3.1 INSPECTION SCHEDULE:

A. The contractor shall notify the Chapter 1 and inspectors not less than 48 hours prior to the time of the requested inspection.

END OF SECTION 01 6100

SECTION 23 0501 - GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The Heating, Ventilation, and Air Conditioning (HVAC) work shall include, but not be limited to, the following:

1. Piping for HVAC system
2. Heating systems
3. Air Conditioning
4. Controls and Instrumentation
5. Balancing of Air Systems

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

1.3 DELINEATION OF WORK:

A. Provide all necessary coordination of information to installers who are performing work to accommodate Division 23 installations.

B. Where the Division 23 installer is required to install items which they do not purchase, they shall include for such items:

1. The coordination of their delivery.
2. Their unloading from delivery trucks driven into any designated point on the property line at grade level.
3. Their safe handling and field storage up to the time of permanent placement in the project.
4. The correction of any damage, defacement or corrosion to which they may have been subjected.
5. Their field assembly and internal connection as may be necessary for their proper operation.
6. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastenings necessary to adapt them to architectural and structural conditions.
7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

C. Items which are to be installed by the Division 23 installer but not purchased as part of the work of Division 23 shall be carefully examined upon delivery to the project. The Division 23 installer shall provide all work necessary to properly install these items.

D. If any items have been received in such condition that their installation will require additional work beyond the project scope of the work, the Engineer shall be notified in writing within ten (10) working days of the date of delivery of the items. Any claims beyond 10 days will not be considered by the Engineer.

1.4 QUALITY ASSURANCE:

A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service. Where no specific indication as to the type or quality of material or equipment is indicated, a first-class standard article shall be furnished. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Engineer, be able to furnish proof of their ability to deliver this equipment by submitting affidavits supporting their claim.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

C. All equipment of one type (such as fans, grilles, etc.) shall be the products of one manufacturer unless specifically stated otherwise.

D. Where the specifications do not list a specific model number for a manufacturer, the construction of a product shall be equal to those models specifically listed.

E. All materials with a manufacturers listed shelf life shall be used at least six months prior to the expiration of the materials' shelf life.

1.5 REQUIREMENTS OF REGULATORY AGENCIES:

A. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits, and pay all required fees.

B. Where Codes and Standards are referenced, they shall be the date stated in these specifications or on the drawings. If none stated, they shall be the latest edition.

C. All work shall conform to the following Building Codes:

1. International Building Codes
2. National Fire Protection Association

D. All work shall conform to all federal, state, and local ordinances.

E. Where applicable, all fixtures, equipment, and materials shall be as approved or listed by the following:

1. Factory Mutual Laboratories (FM)
2. Underwriters Laboratories, Inc. (UL)

F. All fuel fired equipment shall meet the requirements of the insurers and agencies listed and also meet the owner's insurer requirements.

1.6 STANDARDS AND PROCEDURES

A. All work shall meet or exceed the standards and procedures of the following:

1. ADC: Air Diffusion Council
2. AGA: American Gas Association
3. AMCA: Air Moving and Conditioning Association, Inc.
4. ANSI: American National Standards Institute
5. API: American Petroleum Institute
6. ARI: American Refrigeration Institute
7. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
8. ASME: American Society of Mechanical Engineers
9. ASTM: American Society of Testing and Materials
10. IBR: Institute of Boiler and Radiator Manufacturers
11. MSS: Manufacturers Standardization Society
12. NBBPVI: National Board of Boiler and Pressure Vessel Inspectors
13. NEMA: National Electrical Manufacturer's Association
14. OSHA: Occupational Safety & Health Administration
15. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.
16. IRM: Improved Risk Mutuals

1.7 APPROVAL OF SUBSTITUTIONS:

A. Specific reference in the specifications to any article, device, product, materials, fixture, form or type of construction, etc., by name, make, or catalog number, with or without the words "or equal", shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction which, in the judgment of the Engineer expressed in writing, is equal to that named. Where quality and other characteristics are very nearly the same, the question of determining equal materials and readily available service sometimes resolves itself to a matter of personal opinion and judgment and in these and all other cases involving the approval of materials, the opinion, judgment and decision of the Engineer shall be final and bind all parties concerned.

B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified shall be submitted for approval in writing ten (10) calendar days prior to bid opening date to the Engineer. Requests shall be accompanied by samples, literature, and information as necessary to fully identify and allow appraisal of the material or equipment. Submittals shall be concise, clear, and brief as possible. Incomplete submittals or submittals requiring lengthy research to ascertain quality will not be considered.

C. Approval of the Engineer to use materials or equipment, if granted, will be in the form of a written addendum. Approved substitutions may be used at the Contractor's option. No substitutions will be allowed if substitutions are requested later than ten (10) days prior to bid opening date.

D. Items approved shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly indicated in the form of a letter that is enclosed with the submittals. The Contractor shall be responsible for verifying all dimensions with available space. If, in the opinion of the Engineer, the physical dimensions do not permit the substituted material or equipment to be properly operated, maintained, serviced, or otherwise accessed, or the physical dimension adversely impact other components, a system's ability to be operated, maintained, serviced or otherwise accessed, the material or equipment shall be replaced at the Contractor's expense.

1.8 VERIFICATION OF DIMENSIONS AND LOCATIONS:

A. The Contractor shall visit the facility and become thoroughly familiar with all details of the work, working conditions, dimensions and clearances.

B. Notify the Engineer of any discrepancy between actual conditions and conditions indicated on the contract documents that could cause changes, other than minor ones, to the installation of any systems or equipment.

1.9 EQUIPMENT CONNECTIONS:

A. The contract documents may indicate specific electrical, duct, and piping connection locations to equipment. Each manufacturer approved for bidding may have different connection arrangements. The Contractor is responsible for the modifications to and the extension of connecting components as required for the equipment provided.

B. The Contractor shall bear all costs for required changes in connection to equipment.

1.10 WORKMANSHIP:

A. Workmen shall be thoroughly experienced and fully capable of installing the work. Work shall be in accordance with the best standard practice of the trade. Work that is not of good quality will require removal and reinstallation at no additional expense to Owner.

B. All material and equipment to be installed in accordance with manufacturer's printed recommendations using recommended accessories. Retain a copy on job site and submit others for approval when required.

1.11 GUARANTEES AND WARRANTIES:

A. General:

1. Furnish to the Engineer a guarantee form, included in these specifications, signed by the Contractor and Owner agreeing to the start and end dates of all systems and equipment under warranty.
2. All defective materials or inferior workmanship shall be replaced or repaired as directed by the Owner's representative during the guarantee period.

B. Equipment Warranties:

1. Equipment shall be warranted by the equipment manufacturer. Where labor is included in the warranty, the manufacturer, at their option, may permit the contractor to provide the required repairs on the equipment unless specified otherwise.
2. The equipment manufacturer shall include a written guarantee with the closeout documentation.

C. Duration Period:

1. For work not otherwise specified, the duration shall be one year from substantial completion including all parts, labor, and other charges.
2. The Contractor is responsible for purchasing from the equipment manufacturers any additional warranties to ensure that the equipment is warranted by the manufacturer through the duration period specified.

D. Extended Warranties:

1. Warranty periods shall be extended where specifically stated in these specifications.
2. The extended warranties shall meet the requirements of the base warranty unless specifically noted otherwise.
3. The extended warranty time listed is time in addition to the base warranty period.
4. The following systems or equipment shall be extended warranties:
    a. The building automation system shall have a one-year extended warranty.
    b. All air conditioning compressors shall be provided with an extended 4-year warranty, including parts and delivery charges. Centrifugal and rotary compressors shall include motor, impeller or screw, and drive train.

E. Non-Warranted Items:

1. Nondurable replaceable items such as air filter media do not require replacement after the date of acceptance.

F. Warranty Repair:

1. Repair shall take place as soon as possible but not later than the following:

a. Items not essential for facility operation - 7 days.
b. Items that have a minimal impact on facility operation - 2 days.
c. Items that have a significant impact on the facility operation - immediately begin repairs or work necessary to minimize operational impact to Owner.

2. The determination of the impact on the facility is solely that of the Owner and Engineer.
3. Where life safety issues are impacted, the contractor shall take all steps necessary to ensure the facility can continue to function in a safe manner.
4. If repairs cannot be made in the required time period, temporary systems shall be installed until repairs can be completed.
5. All costs associated with warranty work shall be borne by the contractor.

1.12 EXISTING FACILITIES:

A. The location of existing duct, pipe, fixtures, equipment and appurtenances are shown on plans to indicate the extent of work required. Exact conditions shall be field verified by the contractor.

B. Work shall be performed above existing ceilings except where removal of existing ceilings is specifically identified. Where working above existing ceilings, remove existing tile/grid and reinstall existing tile/grid as necessary. Any damaged tile/grid shall be replaced at the contractor's expense.

1.13 PROJECT COMMUNICATIONS:

A. Where it is indicated that communication is with the Engineer or documents are to be transmitted to the Engineer, this is intended that this be done through the prime design professional. If the Architect is the prime design professional, all communication and documentation shall be sent via the Architect.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRIOR CONDITIONS:

A. Prior to the installation of any equipment or system component, the Contractor shall review any prior work that has been completed to accommodate the equipment or system component to be installed.

B. If the prior work does not make a proper installation of any equipment or system component possible, notify the Engineer prior to installation of any equipment or system component.

3.2 INSTALLATION:

A. Install all equipment and appurtenances in strict accordance with the manufacturer's recommendations and the manufacturer's shop drawings.

B. If any equipment cannot be installed in accordance with Codes, contract documents, manufacturer's recommendations and accepted practices, notify the Engineer in writing prior to installation of equipment.

C. If any system component cannot be installed in accordance with Codes, contract documents and accepted practices, notify the Engineer in writing prior to installation of the system component.

3.3 PROTECTION OF SYSTEMS AND EQUIPMENT:

A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. In the event of damage prior to final inspections, repair or replace damaged items as determined by the Engineer, at no cost to the Owner.

B. Store equipment on elevated supports and cover them on all sides with securely fastened waterproof coverings. All equipment openings shall be securely sealed.

C. Piping shall be protected by storing it on elevated supports and capping the ends.

D. During construction, all open ends of pipe, etc. which could collect construction debris shall be properly capped.

3.4 CLEANING OF SYSTEMS AND EQUIPMENT:

A. All equipment and systems shall be cleaned of all extraneous materials to leave equipment and system finish in a new condition.

B. Where equipment and systems cannot be properly cleaned, take all measures necessary to replace or repair equipment and systems to bring back to a "like new" condition. All costs shall be borne by the Contractor.

C. All extraneous materials shall be removed on the site on a regular basis to provide access to all work as well as a safe working environment.

END OF SECTION 23 0501

SECTION 23 0502 - COMMON HVAC MATERIALS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the installation of the mechanical systems where shown on the drawings and specified hereinafter.

B. Description:

1. Rooftop curbs shall include all supports for rooftop equipment, pipe, duct, air handling equipment and accessories.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. All work shall meet or exceed the standards and procedures (latest edition) of the following:

1. AISC Steel Handbook

B. All work shall be applicable by mechanics normally employed in the trade. All work shall be installed in accordance with the manufacturer's recommendations.

C. Manufacturers:

1. The following caulking manufacturers are acceptable:

a. TREMCO
b. Sonneborn - Contech
c. W. R. Meadows

PART 2 - PRODUCTS

2.1 GENERAL:

A. Unless specifically indicated otherwise, the following products or product accessories shall be provided with the indicated equipment:

1. Filters shall be provided on all air systems to protect heat transfer components from outside air, building return air or other airstreams that could foul heat transfer surfaces and elsewhere as indicated. Refer to Particulate Air Filtration specification.

B. Seacoast construction shall be provided where specified for a product. Refer to Special Coating specification.

2.2 FLASHING:

A. General:

1. Provide flashing and counter flashing on all pipes, ducts, flues, conduits, and other mechanical system components which penetrate exterior walls or roofs.
2. Flashing sizes where shown are minimum sizes but in no case shall they be less than size required by roofing manufacturer.

B. HVAC Ducts:

1. See detail on plans.
2. Flashing of duct shall be fabricated from 20 gauge stainless steel sheets.

C. HVAC Pipe and Conduit:

1. See detail on plans.

2.3 HOUSEKEEPING PADS:

A. General:

1. Housekeeping pads shall be constructed of concrete and shall meet the requirements of the Concrete specifications.
2. Concrete shall develop a minimum strength 3000 psi at 28 days or as specified in the concrete specification, whichever requirement is greater.
3. Housekeeping pads shall extend six inches past equipment and supports in all direction.

B. Pads (exterior):

1. All equipment installed on grade and on the exterior of buildings shall be provided with a reinforced concrete housekeeping pad.
2. Pad shall be minimum six inches thick and four inches above finished grade.

2.4 DRAINS:

A. General:

1. Drain shall be full size of connections, size indicated on drawings, or 3/4" minimum, whichever is largest.

B. Equipment and Miscellaneous Drains:

1. Provide drains with deep seal p-trap for all equipment provided with drain connections, where drain connections are indicated on the drawings, and when drains required for proper operation of a system.

2.5 FASTENERS, ANCHORS, AND ACCESSORIES:

A. Unless indicated otherwise, all fasteners, anchors, and accessories shall be metallic and manufactured in the United States.

B. Materials provided shall be considered industry standard for commercial or industrial use.

C. All materials shall be installed in accordance with the manufacturer's recommendations for the intent use and application.

D. Materials installed outdoors, in attics, in crawl spaces, in tunnels and other areas exposed to ambient temperature or humidity shall be stainless steel or hot dipped galvanized.

E. Unless otherwise specified or required by the manufacturer, bolts shall meet or exceed the following strengths:

1. Proof Load: 74 ksi
2. Yield Strength: 81 ksi
3. Tensile Strength: 105 ksi

2.6 SEALANT:

A. Exterior joint sealant shall be polyurethane base, multi-component; self-leveling type for application in vertical joints; capable of withstanding movement of up to 50% of joint width and satisfactorily handled throughout temperature of 4 to 27 degrees C.; uniform, homogeneous, and free from lumps, skins and coarse particles when mixed; Shore "A" hardness of minimum 15 and maximum 50; non-staining; non-bleeding.

B. Penetrations and fire rated assemblies shall meet the requirements of the Firestopping and Smokestopping specification.

C. Color shall be approved by Engineer.

PART 3 - EXECUTION

3.1 EQUIPMENT STORAGE:

A. Facilities for storing materials and equipment shall be provided by the Contractor.

B. All equipment and materials shall be protected from ambient conditions including freezing and exposure to sunlight when these conditions could affect the product.

C. All stored items shall be elevated off slab or grade.

3.2 HOUSEKEEPING PADS:

A. All exposed surfaces shall be steel troweled smooth with beveled edges.

B. Pad shall be level within 1/16 inch for the length and width of the pad.

C. Provide all required foundation bolts, washers, sleeves, plates, templates, etc., for mechanical equipment. Foundation bolts shall be embedded in concrete, set in place before concrete is poured and securely held in place with templates.

D. Furnish shop drawings showing all required hanger bolts and other appurtenances necessary for the proper installation of this equipment. All such work shall be shown in detail on the shop drawings, showing the complete details of all foundations including necessary concrete and steel work, fasteners and vibration isolation devices.

E. Set all equipment on their foundations and shim level with steel shims and grout up under base for uniform bearing.

F. Equipment shall be fastened to housekeeping pads as required by seismic design.

G. Housekeeping pad shall be anchored to the structural slab as required by seismic design or as indicated by structural or mechanical details, whichever requirement is greater.

3.3 DRAINS AND DRAIN PANS:

A. General:

1. All horizontal gravity drain piping shall be installed with a uniform grade of not less than 1/8" per foot of fall in direction of flow except as noted otherwise.
2. All drain lines installed at floor in mechanical rooms shall be supported by threaded rods and pipe clamps. Rod shall be anchored into the floor slab.

B. Equipment and Miscellaneous Drains:

1. Run drain to roof drain or grade if not indicated otherwise on plans.

3.4 EQUIPMENT AND MISCELLANEOUS VENTS, RELIEFS, AND OVERFLOWS:

A. Run vents and reliefs to location indicated on plans or, if none indicated, to a location where they can discharge safety without presenting a hazard to personnel. Terminate with appropriate fitting.

B. Run overflow similar to drain.

3.5 EXTERIOR SEALANT:

A. Submit color charts to Engineer.

3.6 EQUIPMENT PENETRATIONS:

A. Seal all openings into equipment resulting from installation of equipment such as conduit and flex.

3.7 EQUIPMENT INSTALLATION:

A. Repair all insulation damaged during installation of equipment.

3.8 EQUIPMENT ATTACHMENT:

A. Equipment shall be secured to the building or structure. Where equipment is provided with a method of attachment, that method shall be used to attach the equipment. Where equipment is not provided with a method of attachment, the contractor shall add gussets, angles, or similar material to the unit without affecting the performance or warranty of the equipment, which shall be used to attach the equipment.

END OF SECTION 23 0502

SECTION 23 0503 - DEMOLITION, PATCHING AND REPAIR

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the demolition of all mechanical equipment, piping, duct, and appurtenances where indicated or shown on the drawings and specified hereinafter.
2. Furnish all labor, materials, tools and equipment and perform all operations in connection with the patching and repair of building structure, finishes and building assemblies as specified hereinafter.
3. All existing utilities, water, steam, chemical treatment, controls, etc. shall be reconnected to new systems as required to maintain the same functions as existed prior to new work.

B. Descriptions:

1. Cut openings thru the existing building walls, roof, floors, and finishes to accommodate the installation of Division 23 equipment, controls, piping, and appurtenances.
2. Remove and dispose of existing HVAC equipment, piping, and appurtenances.
3. Patch and repair all building finishes, structural components, or other appurtenances that are removed or damaged as a result of the performance of this contract. Patch and repair work shall include finishes, components, substructure and materials required for the installation of such work in accordance with standard practices.
4. All penetrations thru exterior walls, floors, and roof systems shall be sealed watertight.
5. Patched and repaired work shall be finished to match existing or adjacent construction and conditions.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

PART 2 - EXECUTION

2.1 GENERAL:

A. Post tensioned slabs, beams, columns and other load bearing structures shall not be drilled, cut, or otherwise modified without written approval by structural engineer.

2.2 PROTECTION:

A. Provide barricades and take all other precautionary measures necessary to protect personnel and property.

B. The Contractor shall be responsible for any damages to adjacent areas to the construction area.

C. Areas not included in the scope of work, areas where work is minimal, and, in the case of a phased contract, areas which remain inactive for long periods shall be protected from the area in which the work is being performed by a slab to slab barrier acceptable to engineer and local authorities.

D. Protect the roof at all times. Provide planking, plywood, supports, and other materials and means to ensure damage is not incurred.

E. At no time shall required means of egress be blocked by equipment, materials, permanent or temporary barriers.

2.3 COORDINATION:

A. All demolition work which will interrupt building utilities or cause the disruption of the normal environment in areas of the building not within the scope of this project will be performed at other than the Owner's normal working hours.

2.4 PENETRATIONS:

A. All round penetrations shall be core drilled. All other penetrations shall be saw cut. Openings shall not be larger than required for proper installation of pipe or duct.

2.5 MATERIAL REMOVAL:

A. The Owner shall retain first right of refusal on all existing equipment, piping, and appurtenances which are to be removed as a result of this contract.

B. Coordinate demolition work with Owner using extreme care not to damage existing equipment which Owner elects to retain.

C. Remove Owner retained equipment from existing location and store equipment at a location on the site where specified by Owner.

D. All material, equipment, supports, and appurtenances not required as the result of demolition to or renovation of the building systems shall be removed from the project site and disposed of properly unless retained by Owner.

END OF SECTION 23 0503

SECTION 23 0510 - DOCUMENTATION AND CLOSEOUT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Furnish all labor, materials, tools and equipment and perform all operations in connection with the project documentation and closeout.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL:

A. All reports, forms, and manuals shall be submitted to the Engineer in triplicate unless additional copies are noted or unless the Engineer will accept PDFs in lieu of hard copies.

B. Report, forms, and manuals are to be submitted as soon as possible, but no later than thirty (30) days after the earliest date they can be prepared.

3.2 OWNER TRAINING:

A. The contractor shall schedule the training on equipment and systems at least 21 days before training is to take place. The contractor shall provide multiple dates and times for the training to allow the Owner to coordinate the schedules of their staff to be trained.

B. The contractor shall provide all training aids, manuals, etc. for the Owner’s staff at the training classes. These are in addition to whatever is required for the Operations and Maintenance manuals. The contractor shall coordinate the number required with the Owner but shall include a maximum of 8 sets for the training class.

C. The person providing the training shall be thoroughly knowledgeable in the subject matter and shall be certified by the equipment or system manufacturer.

3.3 PROJECT JOB DRAWINGS AND AS-BUILT DRAWINGS:

A. Keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment on the project job drawings.

B. At the time of final inspection, one corrected set of prints shall be delivered to the Engineer. All drawing costs to be by the Contractor.

C. As built drawings shall have the information transferred from the project job drawings including all addendum, supplemental instructions, change orders, and similar information.

D. Qualified draftsmen shall perform this task.

3.4 OPERATING AND MAINTENANCE MANUAL:

A. Compile and bind three (3) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. Additionally, provide this information on a CD in PDF format.

B. Binder shall be hard cover, three-ring notebook, embossed with the name of the project, 11" x 8-1/2" with heavy duty rings. Maximum binder size shall be 2-1/2". Use multiple binders as necessary.

C. The spine of the binder shall be titled “HVAC Operating and Maintenance Manual, Volume No. X," with the name of the project and the date under the title.

D. The Operating and Maintenance Manual shall include the following:

1. Cover sheet in each binder listing the architect, engineer, and all contractors. List addresses and contact information.
2. List name, address and phone number of organization responsible for warranty work, if other than Contractor, and the specific work for which he is responsible.
3. List name, address and phone number of the nearest sales and the nearest service organization for each product.
4. Schedules of all equipment including identification tag numbers shown on plans cross referenced to field applied identification tag numbers.
5. Performance Curves: For fans and similar equipment at the operating conditions.
6. Lubrication Schedule: Indicating type and frequency of lubrication required.
7. List of Spare Parts: Recommended for normal service requirements. Each piece of equipment shall have this list clearly marked or attached to this submittal.
8. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
9. Instruction Books: May be standard booklets but shall be clearly marked to indicate applicable equipment and characteristics.
10. Wiring Diagrams: Generalized diagrams are not acceptable; submittal shall be specifically prepared for this Project.
11. Automatic Controls: Diagrams and functional descriptions.
12. All start-up reports for all equipment.

13. Test and balance report.
14. Filter size list for each piece of equipment. Identify filter type, size, efficiency, and equipment tag.
15. Ceiling marker schedule.

E. The following diagrams, schematics, and lists shall be provided:

1. Automatic control diagrams
2. Sequences of operation

F. When the test and balance report is over 50 pages, they shall be provided in a separate manual.

3.5 ENGINEERING FIELD REPORTS AND FINAL INSPECTION REPORTS:

A. The Engineer will review the Contractor's work periodically throughout the project. A report will be submitted to the Contractor.

B. The reports shall be responded to within ten days of receipt by the Contractor. Each item shall be addressed with comments written on the inspection report if possible. Contractor's response shall address the status of each item and all discrepancies.

3.6 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. After all final tests and adjustments have been completed, the Owner's Representatives shall be instructed in all details of operation and maintenance for the systems installed.

B. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive.

C. Fifty percent of instructions shall be in a formal classroom setting.

D. Instruction shall be provided as follows:

1. Equipment: Trained factory representative
2. System: Competent employee of the Contractor

3.7 CONTROLS OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Upon completion of Operation and Maintenance instructions, the Owner's representative shall be instructed in all details of operation and maintenance for the controls installed.

B. Controls Operation and Maintenance Instruction shall include the entire control system including control sequences that are inherent to equipment provided by the Equipment Manufacturer including economizer cycles, burner operation, low ambient operation, freezestats and similar sequences. Provide sufficient personnel equipment, walkie-talkies, gauges, and other accessories for this work.

C. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive.

D. Fifty percent of instructions shall be in a formal classroom setting.

E. Instruction shall be provided as follows:

1. Controls System: Competent employee of the controls installer

3.8 ACCEPTANCE:

A. Upon notification by the Contractor and after completion of Operation and Maintenance Instructions, the Engineer will visit the project for a demonstration of the building system and an inspection of the completed work.

B. Items which do not comply with the Contract Documents or which function incorrectly will be listed. The list will be provided by the Engineer to the Contractor for correction of the installed work.

C. After all corrections have been made, the Contractor shall notify the Engineer who will recheck the systems for compliance of all items listed.

PART 4 - STANDARD FORMS

4.1 GENERAL:

A. All forms shall be completely filled out by the Contractor prior to acceptance of the project by the Engineer.

4.2 HVAC CLOSEOUT LIST:

HVAC CLOSEOUT DOCUMENT

PROJECT: York County Prison

BGA PROJECT NO.: 22031

DOCUMENT	DATE REVIEWED	COMMENTS
Test & Balance (Airside)		
HVAC O&M Manuals (3 sets plus CD)		
As installed Control Drawings		
HVAC marked-up As-Builts (1 set red lined)		
Equipment Start-Up Reports		
Filter List		
Duct Leakage Test		
Punchlist dated _____		
Punchlist dated _____		
Walk-Through with Owner		

NOTE: Not all closeout documents may be listed. See other sections of specifications for additional requirements.

4.3 HVAC INSTRUCTIONS TO OWNER:

HVAC INSTRUCTIONS TO OWNER

PROJECT: York County Prison
BGA PROJECT NO.: 22031

INSTRUCTIONS	DATE/TIME SCHEDULED	MINIMUM SPECIFIED HOURS	ESTIMATED HOURS OF INSTRUCTION	PERSONS ATTENDING	COPY OF SIGN-IN LIST SENT TO BGA
Controls					
Packaged Units					
HVAC General					

NOTE: Not all instructions may be listed. See other sections of specifications for additional requirements. Up to 8 sets of training material required. Provide per number of persons indicated. Where no minimum specified hours indicated, training shall be provided as necessary for technician to provide the Owner a good understanding of the operation, function, and maintenance requirements of the equipment or system installed.

4.4 HVAC SPARE MATERIALS:

HVAC SPARE MATERIALS LIST

PROJECT: York County Prison

BGA PROJECT NO.: 22031

ITEM	DATE DELIVERED	ACCEPTED BY	COPY OF RECEIPT SENT TO BGA
Spare Filters			

NOTE: Not all spare materials may be listed. See other sections of specifications for additional requirements.

4.5 INSTRUCTIONS TO OWNER:

OWNER INSTRUCTIONS SIGN-IN SHEET

PROJECT: York County Prison

BGA PROJECT NO.: 22031

SYSTEM/EQUIPMENT:	DATE	TIME		LOCATION:
		START	FINISH	

INSTRUCTORS (PRINT NAME AND SIGN)

1. _____

2. _____

ATTENDEES (PRINT NAME AND SIGN)

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

WRITTEN MATERIALS PROVIDED TO ALL ATTENDEES: _____ YES _____ NO

INSTRUCTIONS IN CLASSROOM: _____ YES _____ NO

INSTRUCTIONS IN FIELD: _____ YES _____ NO

END OF SECTION 23 0510

SECTION 23 0511 - SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL:

A. Refer to Division 1 specification for information and shop drawings and submittals requirements. When conflicts exist, the more stringent requirements shall apply.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

1.3 PREPARATION OF SUBMITTALS:

A. Before preparing submittals, consult all contract drawings and specifications in detail, obtain manufacturer's recommended installation instructions, and have shop drawings prepared based on specific equipment and material intended for installation. Obtain all drawings and submittals from other trades as necessary to coordinate submittals.

B. Sign all shop drawings indicating conformance with contract documents before submitting to the Engineer.

1.4 SUBMITTALS:

A. General:

1. Submittals are required on all items of equipment and materials.
2. Submittals shall include but not be limited to:

    a. All requirements of Division 1.
    b. Complete information pertaining to appurtenances and accessories.
    c. Information properly marked with service or function identification as related to the project.
    d. Where the submittal consists of catalog sheets displaying other items which are not applicable, the proper features shall be clearly identified.
    e. External connections properly marked, as related to the specific use intended, on standard factory assembly and field installation drawings.
    f. All performance characteristics and physical characteristics.
    g. Wiring and control diagram.
    h. All requirements listed in the specific section of specifications.

i. Electrical data on all motors greater than one horsepower. Data shall include horsepower unit served, power factor, efficiency and product of P.F. x EFF.

B. Field Fabricated Components:

1. When field fabricated components are permitted by the specifications, scaled detailed drawings shall be submitted, clearly showing the materials used, dimensions, sizes, and means of assembly. For example, drawings shall be submitted for pump housings (insulation), support stands, etc.

C. Submittal Summary:

1. A submittal summary shall be prepared by the contractor within (10) (30) (60) days of project award.
2. The summary shall include all products and samples to be submitted along with the date the submittal will be received by the prime contractor.

1.5 REVIEW OF SUBMITTALS:

A. Review of shop drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless the Contractor has, in letter form, called attention to such deviations at the time of submission and secured written approval of the specific deviations.

B. Any materials and equipment listed which are not in accordance with the equipment shown on the schedule shall be of size and physical arrangement to allow unobstructed access, when installed, for routine maintenance, coil removal, shaft removal, motor removal and other similar operations. Deviation from the characteristics of that equipment or layout system components will not necessarily be cause for rejection. Review of submittal does not relieve the Contractor of his responsibility. Should an installation not meet the intent of the contract documents, the Contractor may be required by the Engineer to modify or replace equipment or system components with all costs, direct and indirect, borne by the Contractor.

C. It is strongly recommended that the Contractor not purchase or install any equipment or system components prior to receipt of reviewed shop drawings.

D. Reviewed with notations on the submittal shall not prohibit the Contractor from purchasing equipment. If the Contractor does not comply with the notations, the submittal shall be deemed rejected.

1.6 EQUIPMENT DIMENSIONS AND WEIGHTS:

A. The contract documents may indicate specific equipment dimensions. The Contractor is responsible for verification of the dimensions for the equipment submitted prior to submitting shop drawings. Equipment larger than the equipment indicated on the contract documents may not be acceptable by the Engineer's.

B. The contract documents may indicate specific equipment weights. The Contractor is responsible for verification of the weight of the equipment submitted prior to submitting

shop drawings. Equipment weighing more than the equipment indicated on the contract documents may not be acceptable to the Engineer.

C. Equipment shall not exceed maximum weight indicated on the schedules. If the equipment weight exceeds that indicated on the schedule, even where the manufacturer is an approved manufacturer, that equipment can not be bid on for this project.

D. If equipment is not acceptable to the Engineer due to dimensions or weights exceeding those indicated on contract documents, the Contractor shall accept all responsibility and costs for providing equipment that meets the dimension and weight requirements of the contract documents.

1.7 ELECTRICAL CHARACTERISTICS:

A. Electrical characteristics for mechanical equipment are generally indicated on the mechanical documents. The electrical documents generally indicate power and wiring requirements to each piece of mechanical equipment.

B. It shall be the mechanical installer's responsibility to verify prior to submitting shop drawings that the equipment submitted meets the electrical requirements of both the mechanical and electrical documents. If there is a discrepancy, the contractor shall bring the discrepancy to the Engineer's attention prior to submitting shop drawings.

C. If the discrepancy is brought to the Engineer's attention prior to ordering the mechanical equipment or electrical materials associated with that equipment, the Engineer will issue additional instructions to the Contractor.

D. If the discrepancy is not brought to the Engineer's attention prior to ordering the mechanical equipment and electrical materials (i.e., Contractor does not verify electrical requirements), the Contractor shall be responsible for all costs except those that would have been incurred if the discrepancy was determined prior to ordering the mechanical equipment and electrical materials.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRODUCT SUBMITTALS:

A. The following list may be used as a checklist for the contractor and Engineer. All products may not be listed.

PRODUCT SUBMITTALS

BGA NO.	PRODUCT	NO.	DATE		STATUS				ITEMS TO RESUBMIT	DATE ITEMS RESUBMITTED
			In	Out	App.	AAN	Resub.	Rej.		
	Air Filters									
	Control Drawings & Sequences									
	Gas Valves, regulators, and gauges									
	Duct Accessories									
	Equipment & Pipe Identification									
	Metal Duct									
	Packaged Equipment (Heat Pump)									
	Pipe and Fitting Material									
	Pipe and Pipe Fittings									
	Pipe Hangers and Supports									
	Supports									

3.2 TEST AND REPORT SUBMITTALS:

A. The following list may be used as a checklist for the Contractor and Engineer. All tests may not be listed.
   1. System start-up
   2. Test and Balance Agency Construction report

3.3 CONTROL SUBMITTAL:

A. Control submittals shall include the following:

   1. All information necessary for a clear representative of the system to be provided.
   2. All control components.
   3. Graphical representative of all systems to be controlled.
   4. I/O summary sheets.
   5. Floor plan indicating panels.
   6. Sequence of operation. All devices referenced in the sequence shall be indicated on graphic representation.
   7. Large scale (75% reduction maximum) of all control panel faces.
   8. Wiring diagrams including interface with equipment (terminal strip, contactor, etc.).

B. All drawing submittals shall be CADD generated drawings.

C. Submit a floor plan locating all thermostats, sensors, lighting override switches, and control panels. Contractor must receive approval in writing before roughing in controls.

3.4 SHOP DRAWING SUBMITTAL COVER SHEET:

A. A separate cover sheet shall be submitted with each product type (i.e., valves can be submitted together, etc.)

3.5 SHOP DRAWING SUBMITTAL COVER SHEET

(Provide one page for each group of shop drawings.)

PROJECT NAME: York County Prison BGA FILE NO. 22031-3-33

PRODUCT: _____ BGA SHOP DWG. NO. _____

NOTE TO CONTRACTOR

1. All shop drawing comments by Buford Goff & Associates shall be complied with or the shop drawings shall be declared rejected.
2. If this form is not completed and signed by the Contractor and items 1 to 8 below are not answered YES or N/A, the shop drawings shall be declared rejected.
3. Dampers, grilles, valves, etc., are reviewed for characteristics but not for size and quantity. It is the Contractor's responsibility to verify sizes and quantity.

SHOP DRAWING SUBMITTAL (Contractor to complete this section)

1. Does the submittal comply with the contract documents? ☐ Yes ☐ No

   If no, list all deviations on an attached page.

2. Have the electrical characteristics (i.e., volt/phase/amps, MOP, MCA, and connection location) been reviewed with the electrical schedules and the electrical circuit sizing meet the requirements of that equipment? ☐ Yes ☐ No ☐ N/A
3. Is product an approved manufacturer listed in the specifications or addendum? ☐ Yes ☐ No ☐ N/A
4. Does the product submitted meet the manufacturer's recommended service clearance for the space in which it is to be installed? ☐ Yes ☐ No ☐ N/A
5. Have the control components of the product been reviewed and do they meet with the requirements of the controls contractor? ☐ Yes ☐ No ☐ N/A
6. Have the equipment connections been reviewed (size and locations) and has the Contractor included all provisions to make the required connections? ☐ Yes ☐ No ☐ N/A
7. Has the seismic engineer reviewed and approved the method of connecting seismic restraints to equipment? ☐ Yes ☐ No ☐ N/A
8. Is the equipment within the weight limitations specified, if any? ☐ Yes ☐ No ☐ N/A

BGA'S SHOP DRAWING STAMP (Engineer to complete this section)

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Contractor is responsible for specific compliance with the information given in the Contract Documents; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades, and the safe and satisfactory performance of his work.

☐ Reviewed ☐ Reviewed as Noted ☐ Revise and Resubmit ☐ Revise and Resubmit Items Listed
☐ See attached for additional comments ☐ Reject

Comments: _____

_____

_____

_____ Reviewer: _____ Date: _____

END OF SECTION 23 0511

SECTION 23 0523.03 - GAS VALVES FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of valves and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 2113 - HVAC Piping (General)

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All valves shall meet or exceed the following federal and ANSI standards (latest edition).

ANSI B1.1	Unified screw thread standard (thread tolerance)
ANSI B2.1	Pipe thread taper
ANSI B16.1	Cast iron pipe flanges and flanged fittings (Class 125 and 250)
ANSI B16.10	Face-to-face and end-to-end dimensions (ferrous valves)
ANSI B16.18	Valve and fitting solder ends
ANSI B 16.34	
MSS SP-25	Standard markings for valves, fittings, flanges, and unions
MSS SP-78	Gray iron plug valves, Flanged and Threaded Ends
MSS SP110	Ball valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends
MSS SP-110	Bronze, brass, and carbon steel ball valves
WW-V35	Ball valves

2. All valve materials shall meet or exceed the following ASTM standards (latest edition):

ASTM B-16.33	(Gas valves)
ASTM B-16.34	Materials standard

3. All gas ball valves shall meet or exceed the following standards (latest edition).

CGA CR91	Indoor use, (32 deg. F to 125 deg. F, 5 psi)
CGA 9.1	Appliance valves, (32 deg. F to 300 deg. F, 1/2 psi)
ANSI Z.21-15	Appliance valves, (32 deg. F to 300 deg. F, 1/2 psi)
CAN/CGA	Appliance and equipment valves, (32 deg. F to 300 deg. F, 125 psi.)
UL 125	Ammonia and LP gas, (600 psi)

4. All work shall meet or exceed the standards and procedures (latest editions) of the following:

   a. API 602 - Material Thickness
   b. API 607
   c. API 608
   d. API 609
   e. Relief Valve and Automatic Gas Shut-Off Devices. ANSI Z21.22
   f. Gas Regulator. ANSI Z21.80.

B. All valves furnished under this section shall be new, first quality of approved manufacturer, and shall be tight at the specified test pressure.

C. Valve manufacturer and pressure rating shall be cast on side of valve body.

D. Manufacturers:

1. The following gas valve manufacturers are acceptable:

   a. Rockwell
   b. Nordstrom
   c. Walworth
   d. Powell
   e. Crane
   f. Resun

PART 2 - PRODUCTS

2.1 VALVES:

A. General:

1. Leave packing for all valves in good condition, replacing as necessary at completion of work. Packing shall be of approved non-asbestos material suitable for required service.
2. The pressure-temperature rating of valves shall be not less than the design criteria applicable to all components of the system.
3. All valves used only for shut-off shall be the size of the line in which it is installed unless noted otherwise.

2.2 GAS VALVES:

A. General:

1. Gas valves with bronze trim are for non-corrosive gas only. Valves used with corrosive gas shall be suitable for application.

B. Ball valves:

1. General:

a. Ball valves shall have brass body, chrome plated brass ball, brass trim, teflon stem packing and ball seat, blow-out proof stem, adjustable stem packing gland, and vinyl coated zinc coated steel handle with SWP of 150 psi and CWP of 600 psi.

2. Ball valves used for (2 psig and less):

a. Valves, 1/4" to 3", shall be full port, 2 piece, threaded end.

1) Hammond 8909

PART 3 - EXECUTION

3.1 VALVES (INSTALLATION):

A. All valves in horizontal lines shall be installed with the stem upright and within 15 degrees of vertical where possible.

B. Threaded valves shall have a union installed adjacent to those valves.

END OF SECTION 23 0523.03

SECTION 23 0548 – SOUND, VIBRATION, AND SEISMIC CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of mechanical sound, vibration, and seismic control required on all mechanical equipment, systems, and appurtenances where shown on the drawings and specified hereinafter.

B. All foundations and supports of Division 23 equipment shall be furnished and installed by Division 23 installer except where specifically noted otherwise.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All seismic equipment and design shall comply with all local codes and ordinances and meet or exceed the standards and procedures (latest editions) of the following:

a. International Building Codes
b. SMACNA Seismic Restraint Manual
c. ASHRAE
d. ASTM E 488 (Anchor locations)

B. Mechanical sound, vibration and seismic control equipment shall be sized and provided by the approved manufacturer only. Seismic bracing shall be a factory manufactured item listed in the manufacturers catalog for the intended use.

C. Manufacturer:

1. The following sound, vibration, and seismic control (except flexible pipe connectors) manufacturers are acceptable:

a. Mason Industries
b. Korfund Dynamics Company

c. Vibration Mountings and Controls, Inc.
d. Peabody
e. Amber Booth
f. Vibration Eliminator, Inc.
g. Vibro-Acoustics Corporation
h. Kinetics

PART 2 - PRODUCTS

2.1 GENERAL:

A. All equipment and piping shall be mounted on or suspended from approved foundations and supports as specified herein and as shown on the drawings.

B. The vibration isolation systems shall be guaranteed to have the deflection recommended by the manufacturer for the specific application but no less than shown on the schedule. Mounting sizes shall be determined by the mounting manufacturer and mountings shall be installed in accordance with the manufacturer's instructions.

C. The installed vibration isolation system for slab or roof supported equipment shall have a maximum lateral motion under equipment start-up or shut down conditions of 1/4 inch. Motions in excess of this amount shall be restrained by approved spring type mountings.

D. Components not exposed to ambient:

1. Steel components shall be powder coated. All nuts, bolts, and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

E. Components exposed to ambient or inside air handlers:

1. All components shall be PVC coated steel, hot-dip galvanized, stainless steel, or heresite coated.

2.2 WIND LOAD DESIGN:

A. General:

1. Specifications and plans shall indicate minimum requirements and general intent. The actual requirements shall be determined by the contractor’s structural engineer but those requirements shall not be less than indicated on the plans and in these specifications.
2. The structural engineer shall be a professional engineer registered in the state in which the facility is to be constructed. The structural engineer shall be responsible for:

a. Submittals (drawings and calculations)

3. All equipment located outdoors shall be designed to meet or exceed the requirements of the current IBC wind load requirements.
4. Calculations shall be based on the ASCE determined design pressure, exposure class, building height, and building type.

B. All rooftop curbs shall be anchored sufficiently to the roofing members to withstand the IBC wind load requirements.

C. All outdoor equipment located on equipment pads shall be anchored to the equipment pads to withstand the IBC wind load requirements. Equipment pads shall be designed to withstand these requirements.

D. Where additional bracing or tie downs are required, they shall be provided at no additional cost to the Owner.

E. Coordinate the restraints required for wind loading with the seismic and vibration requirements indicated on the drawings and specifications.

2.3 ANCHORAGE TO BUILDING STRUCTURE:

A. General:

1. Anchorage to the building structure shall meet the requirements of the latest edition of:

a. International Building Code (Chapter 19)
b. ASCE Standard 7 (Chapter 13)
c. American Concrete Institute (ACI) 318

2. Requirements of this section of specifications are minimum requirements. When other requirements are indicated, the greater requirement shall be met or exceeded.

B. Anchorage in Concrete or Masonry:

1. Calculation of anchorage forces shall be provided by the seismic engineer for all installations in Seismic Design Category C, D, E, and F.
2. The following anchorage and attachments are not permitted:

a. Power driven fasteners for tension load applications in Category D, E, and F unless specifically approved for this application.
b. Friction clips.

C. Post Installed Anchors:

1. Post installed anchors for Seismic Design Category C, D, E, and F shall meet the requirements of ACI 318.

D. Threaded Rod Supports:

1. Rod supports shall be designed to resist bending moments.

2. Threaded rod supporting duct, piping, equipment, or other components shall connect to structure by use of a swivel, eyebolt, vibration isolation hanger or other connection

2.4 VIBRATION AND SEISMIC ACCESSORIES:

A. Provide all necessary brackets, bolts, fasteners, predrilled bases, oversized bases, accessory components and materials to install systems in accordance with manufacturer's requirements.

2.5 OUTDOOR EQUIPMENT:

A. Roof Mounted Equipment:

1. Equipment shall be direct anchored if design permits unless isolation is required.
2. Curbs and equipment supports shall be attached to building structure.

B. Slab Mounted Equipment (outdoor):

1. Equipment shall be direct anchored if design permits unless isolation bases are required.
2. If no other isolation is indicated for outdoor equipment (not including cooling towers), 3/4" neoprene waffle pads shall be provided.

PART 3 - EXECUTION

3.1 GENERAL:

A. If the equipment to be mounted or restrained is not furnished with integral structural frames and external mounting lugs (both of suitable strength and rigidity), approved members shall be installed in the field which shall provide means of attaching required vibration and seismic devices.

B. The members include, but not limited to the following: gussets, rails, brackets, angles, channels and similar components. These members should be sized by the vibration and seismic vendor to provide an acceptable installation.

C. All field installed components shall be neatly installed and be of materials and/or finish suitable for the installation.

3.2 SUBMITTALS (WIND LOAD):

A. Wind Restraints:

1. Submit drawings and calculations showing wind loading, location of anchors, ties and bracing, and types and sizes of restraints.

2. Submit calculations for shear, pull-up, primary overturning, and secondary overturning.
3. Submit drawings indicating auxiliary supports and method of attachment.
4. Submit drawings indicating size and type of attachment (i.e., welding, bolting, etc.) for:

    a. Attachment of equipment to adapter curb and adapter curb to the existing curb.
    b. Attachment of equipment to housekeeping pads or slab.

B. Calculations shall be submitted and signed by a licensed professional engineer in the state where the project is located.

3.3 SUPERVISION:

A. The manufacturer, or his qualified representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the Engineer in writing certifying the correctness of installation and compliance with approved submittal data.

3.4 EXISTING CURBS:

A. After the existing unit is removed from the existing curb, the seismic engineer shall determine the best method to secure the existing curb to the existing building structure to meet the HVAC system’s seismic requirements.

END OF SECTION 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of mechanical identification on all mechanical equipment, systems, and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work furnished and installed shall comply with all local codes and ordinances and shall meet or exceed the standards and procedures (latest editions) of the following:

a. ANSI A13.1 for the identification of piping systems.
b. ANSI/NEMA Standard Z535.1.

B. Manufacturer:

1. The following nameplate manufacturers are acceptable:

a. Seton Name Plate Corporation
b. T&B/Westline Products
c. Brady
d. MSI
e. Brimar

PART 2 - PRODUCTS

2.1 NAMEPLATES:

A. General:

1. Nameplates shall be black plastic with white engraved lettering.
2. All information shall be provided on a single nameplate per device if practical.
3. Nameplates shall have screw holes and screws for mounting unless screws would damage the intended use of the product to which it is attached (i.e., NEMA4 panel, etc.). In that case, provide stick-on nameplates.
4. Nameplates shall be 1/16" thick.

B. Size:

1. Two inch (2") high nameplate when located on outdoor HVAC equipment.

2.2 MECHANICAL EQUIPMENT:

A. Devices to be identified include all mechanical equipment.

B. Where equipment is located above a lay-in ceiling, a nameplate shall also be provided on the metal grid in close proximity to the equipment.

C. Nameplate shall include (example):

1. Equipment description: EF #1, etc.
2. Owner's identification number

PART 3 - EXECUTION

3.1 NAMEPLATES:

A. Submit listing of all nameplates with associated information to the Engineer for approval before fabrication.

B. Coordinate method of attachment and location of nameplate with contractor who is responsible for the installation of the device (i.e., control panel, air handler, etc.).

END OF SECTION 23 0553

SECTION 23 0592 - SYSTEM START-UP

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the start-up of all building mechanical systems where shown on the drawings and specified hereinafter.

B. Description:

1. These systems shall include:

a. Air systems (heating, ventilating, air conditioning, exhaust and recirculation)
b. Hydronic systems
c. Steam systems
d. Condensate systems
e. Refrigeration systems

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following (latest edition):

a. AABC National Standards
b. SMACNA

B. Start-up of equipment shall be by manufacturer's representative unless noted otherwise.

C. Tests, in addition to those specified herein, required to prove code compliance, to meet insurance requirements, and to verify proper installation by the Engineer, owner, or authorities having jurisdiction shall be provided by the Contractor.

D. All tests, instruments, and procedures shall be in accordance with the AABC National Standards and system test and balance specifications.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All concealed work must remain uncovered until required tests have been completed. Sections of the system may be tested prior to concealing as outlined hereinafter.

B. The Owner and the Engineer shall be notified in writing a minimum of three working days prior to any tests being performed.

C. Local, state and federal authorities having jurisdiction shall be notified in writing with sufficient time to schedule inspection as required by the authority.

D. In no case shall a system be started or operated in such a manner that the system or component pressure or temperature ratings, or the pressure or temperature to which a system or component has been tested, be exceeded.

2.2 START-UP:

A. Systems shall be started up by the Contractor except as required in specific portions of the mechanical specifications.

B. The following systems shall be started up by a factory certified technician:
   1. Heating and air conditioning equipment
   2. Bipolar ionization

2.3 AIR DISTRIBUTION SYSTEMS:

A. General:

   1. Cleaning and leakage testing are not required for existing duct systems unless indicated otherwise.

B. Cleaning of Duct System:

   1. Upon completion of duct and before installation of any outlets, the contractor shall clean entire duct system of all rubbish, plaster, dirt, etc.

2.4 STARTING THE PIPING SYSTEMS:

A. Prior to putting any piping system in service, it shall be tested and thoroughly cleaned according to the procedures as specified below and as required by the equipment manufacturer, whichever requirement is more stringent.

B. Dehydration of Refrigerant Piping Systems:

1. Dehydrate refrigerant piping systems using a vacuum pump with check valve.
2. The systems shall be evacuated to (300) (500) microns or to whatever level required by equipment or system manufacturer, whichever is most stringent, and held there for three hours.
3. The vacuum shall be broken with dry refrigerant.
4. After approved by the third party inspector, fill the system with its operating charge of refrigerant.
5. Variable refrigerant systems shall be tested in accordance with manufacturer's requirements. System shall be evacuated to the level indicated in this specification or what is required by the manufacturer, whichever is most stringent.

2.5 PIPING SYSTEM TESTS:

A. General:

1. Upon completion of each system of work under this Division and at a designated time, all piping shall be pressure tested for leaks.
2. Sections of the system shall be tested prior to concealing the piping in walls, chases, false ceilings, etc.
3. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests repeated at no additional cost to Owner. Make tight any leaks. Repeat tests until system is proven tight. Caulking of leaks is not permitted.
4. All equipment not capable of withstanding the test pressure shall be valved off during test.
5. Provide all gauges, valves, caps and accessories to properly test system.
6. At no time shall a system be tested at a pressure greater than the piping system or component is rated.

B. Refrigerant Piping:

1. Refrigerant piping shall be tested in accordance with the equipment manufacturer's recommended pressure.
2. All joints and equipment shall be leak tested using a halide or electronic leak detector.
3. The test shall be for the length of time recommended by the manufacturer or thirty minutes, whichever is greater, without leakage.

C. Gas Piping:

1. Gas piping shall be tested in accordance with these specification, the current edition of the International Fuel Gas Code (IFGC), or the local authority have jurisdiction, whichever is greater. If the contractor does not have a copy of the section of the International Fuel Gas Code, Buford Goff & Associates will provide a copy upon request.
2. Piping shall be tested to 1 ½ times working pressure but not less than 5 PSIG.
3. Testing shall be performed before painting. If the piping is painted before testing, test pressure shall be 1 ½ times working pressure but not less than 90 PSIG.
4. Tests shall run for ½ hour for each 500 cu ft of pipe volume and for a minimum of 2 hours.
5. Pressure shall be measured with a manometer.
6. The test gas shall be air, nitrogen, carbon dioxide or an inert gas.
7. Connection between new and existing pipe shall be tested by an approved leak detection method.
8. Isolate appliances or plug lines as required by the IFGC.

2.6 SYSTEM START-UP:

A. General:

1. System shall be started and checked to ensure safe and proper operation.
2. Minimum requirements are listed for each system and are in addition to manufacturer start-up requirements and the requirements stated in the specific sections of the specifications.
3. Control systems installed complete and operable.
4. Proper thermal overload protection in place for electrical equipment.

B. Air Systems:

1. Verify proper fan rotation.
2. Verify full load amps are below nameplate amps.
3. Verify control dampers operating.
4. Verify balance dampers and fire and smoke dampers are open.
5. Remove all duct restrictions.
6. Verify clean filters are installed.
7. Verify access doors are closed and duct end caps are in place.
8. All outlets shall be installed and connected.

2.7 SYSTEM PRESSURES:

A. Observe the start-up of systems to verify that no dangerous conditions exist as the result of high (supply) or low (return/exhaust) pressure. If excessive pressures are observed, report the observed condition and shut down or modify system operation to avoid damage.

PART 3- EXECUTION

3.1 SUBMITTALS:

A. Submit to the Engineer all test results including a minimum of the following information:

1. System tested
2. Location of test
3. Date, time, and ambient temperature at test startup and completion
4. Persons present for test
5. Duration of test
6. Test equipment
7. Test results

B. Partial system may be done at the Contractor's option except tests shall be completed:

1. For each phase designated by contract documents
2. In accordance with building construction schedule for completion
3. As required to turn over portions of the system for the Owner's use

C. Reports shall include but not be limited to:

1. Tests during construction
2. Manufacturer's factory test reports
3. Equipment start-up reports

D. Reports shall be submitted within ten days of test completion.

3.2 ENGINEER REVIEW:

A. The Engineer shall, at his discretion, recheck any or all of the test work. Provide ample number of technicians and test equipment to perform the tests required.

B. All systems not accepted shall be retested.

C. Systems shall be retested and rechecked until accepted by all parties.

END OF SECTION 23 0592

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the testing and balancing of all mechanical systems where shown on the drawings and specified hereinafter.

B. Description:

1. Systems shall include all equipment, operators, controls, accessories, and appurtenances.
2. These systems shall include:

   a. Air systems (heating, ventilating, air conditioning, exhaust and recirculation distribution systems)
   b. Hydronic systems (heating and cooling systems)
   c. Domestic water systems
   d. Condensate systems
   e. Vibration isolation systems
   f. Cooling tower airflow

3. Air inlets and outlets shall include:

   a. Exhaust
   b. Relief
   c. Outside Air
   d. Supply
   e. Return

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0592 - System Start-Up

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following (latest editions):

a. AABC National Standards
b. NEBB Standards
c. NBC Standards

2. Testing and balancing shall be performed by an agency certified by the AABC, NEBB, or the National Balancing Council.
3. All technicians shall have a minimum of three years testing and balancing. Each test and adjustment shall be under the direct supervision of a qualified technician.
4. Testing and balancing shall be performed by one agency.

PART 2 - PRODUCTS

2.1 GENERAL BALANCING PROCEDURES:

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

B. Any abnormal conditions in the mechanical systems or conditions which prevent total system balance, as observed by the Test and Balance Agency, shall be reported as soon as possible to the Engineer.

C. If, for any reason, a system cannot be properly balanced, it shall be reported to the Engineer by the Test and Balance Agency as soon as observed.

D. Should additional balancing devices be required, the Test and Balance Agency shall bring it to the attention of the Contractor as quickly as possible.

E. The Test and Balance Agency shall leave all system components in proper working order including:

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

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

G. Systems shall be tested in each specified mode of operation. See equipment Sequence of Operation.

2.2 INSTRUMENTS:

A. All Test and Balance work shall be performed using the required instrumentation to obtain proper measurements.

B. Instruments shall be properly maintained and transported in such a manner as to provide protection against damage due to vibration, impact, moisture or any other condition that may render them inaccurate.

C. Instruments shall have been calibrated within a period of six months prior to starting the project.

D. Proof of calibration shall be maintained with the instruments.

E. Instruments shall be calibrated upon completion of the work when required by the client to prove reliability.

2.3 AIR SYSTEMS:

A. General Requirements:

1. Total system balance shall not begin until the Test and Balance Agency has verified that start-up procedures have been performed and filters have been changed.
2. The Test and Balance Agency shall measure the amperes of all fan motors before total system balance is started and shall take proper steps to correct and report any overloads.
3. The Test and Balance Agency shall not continue total system balance if any conditions are observed that are hazardous to the air system. This shall be reported and corrected before proceeding further.
4. The Test and Balance Agency shall verify all outlets for compliance with design requirements and shall report any variations before starting total system balance.
5. If during total system balance, the Test and Balance agency detects any inlet or outlet conditions that will not allow proper balancing to be performed, the Engineer shall be notified immediately.
6. Reports shall indicate airflow measured at unit and inlet and outlet totals.

B. Air Outlets:

1. The systems shall be balanced so that the total supply air quantity to each space shall be within -5% to +5% of the design amount.
2. The pattern for all adjustable outlets shall be adjusted for proper distribution to minimize drafts.
3. Outlet dampers shall not be used to provide proper branch airflow to space.
4. The test and balance contractor shall indicate on the test and balance report that the grilles provide the proper directional throw where direction throws are indicated.

C. Air Inlets:

1. Inlets on systems shall be adjusted to the required quantities with a tolerance of ±5%.
2. At completion of total system balance, at least one inlet of every branch shall be fully open and at least one branch balancing damper in the system shall be fully open.
3. Return air inlets installed in ceilings where the space above the ceiling is used as a return air plenum are to be fully opened and are not to be measured or adjusted except where a specific airflow is indicated.

D. Zone Dampers:

1. Dampers installed in main trunks and branches and dampers required for system control shall be balanced within -5% to +5% of the design amount.

E. Filters:

1. Under final balanced conditions, the Test and Balance Agency shall measure and record static pressure entering and leaving each filter bank.

F. Fans:

1. The Test and Balance Agency shall set the fan RPM to provide design total CFM and the required static pressure to operate the system.
2. If proper airflow is not achieved, the Contractor shall change the belts and drives. The new drives shall be calculated by the Test and Balance Agency. The Test and Balance Agency shall reset the fan RPM to provide design total CFM.
3. Fan speed shall not exceed the maximum allowable RPM as established by the fan manufacturer.
4. The final setting of fan RPM shall not result in overloading the fan motor in any mode of operation. Dampers shall be modulated, and the amperes of the supply fan motor shall be measured to ensure that no motor overload can occur. The amperes shall be measured in the full cooling, heating, dehumidification, and economizer modes to determine the maximum brake horsepower.
5. After total system balancing, the following values shall be recorded:

    a. Fan RPM
    b. Motor voltage and amperes
    c. Entering static pressure
    d. Leaving static pressure

6. Final RPM of the constant volume supply fan shall be set to supply the required CFM with filters artificially restricted to simulate 100% loading. The Test and Balance Agency shall verify that the fan motor will not be overloaded when the system is operating with unrestricted, clean filters in place.
7. When applicable, final supply fan settings shall be based on rated wet cooling coil resistance.

8. Final RPM of the supply fan in systems having mixed air dampers shall be set to provide required CFM with the system in a logical non-modulating mode, for example, minimum outside air.

G. Coils:

1. Under final balanced conditions, the Test and Balance Agency shall measure and record static pressure entering and leaving each coil bank.

H. Relief Valves:

1. Verify the proper application, pressure, and flow rate of each relief valve.

2.4 TEMPERATURE CONTROL SYSTEM:

A. In the process of Total System Balance, the Test and Balance Agency shall:

1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding to intended control performance.
2. Verify that all control devices are properly connected.
3. Check the calibration of all controllers.
4. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
5. Check the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media.
6. Check that the sequence of operation for any control mode is in accordance with approved shop drawings.
7. Verify that all controller set points meet the design intent.
8. Perform all system verification to assure the safety of the system and its components.
9. Determine if resonance exists in a system.
10. Check imbalance or eccentricity in shafts.

2.5 EXISTING SYSTEMS:

A. General:

1. All air systems which are to remain but are modified in any manner or are listed to be tested shall be tested before demolition begins.

B. Balancing Requirements

1. The Engineer shall provide direction on any changes to be made to the existing equipment’s air balance. After renovation work is completed, the existing equipment shall be rebalanced or, if no changes are required, equipment shall be retested.

C. Locations shall include, but not be limited to, the following:

1. Equipment airflows indicated on the plans.
2. Fan total flows and pressures.
3. Air flow at points where new duct ties in.
4. Other requirements where indicated on the plans or elsewhere in the specifications.

D. Reports:

1. A test and balance report shall be submitted after renovation is completed for all systems which are required to be measured.

2.6 TEMPERATURE MEASUREMENT:

A. General:

1. Air and water temperatures at hydronic coils must be taken in the same relative timeframe. For example, when measuring coil entering and leaving air temperatures, the coil entering and leaving water temperature must be taken in close timeframe to the measurement of the air.
2. Where outside air temperature is a variable affecting other readings (such as a mixed air temperature), the outside air reading shall be given at the time of the mixed air reading.

B. Air Temperatures:

1. Provide entering and leaving air temperatures for each cooling coil, heating coil, energy recovery and heat transfer device.
2. Temperatures shall be measured in heating, cooling, dehumidification, and neutral modes of operation.

PART 3 - EXECUTION

3.1 SUBMITTALS:

A. The Contractor shall submit to the Engineer the following information within thirty days after the award of the contract:

1. The name of the Test and Balance Agency.
2. Name and registration number of the certified testing technician.

B. The Contractor shall submit to the Engineer the following information within ninety days after the award of the contract.

1. Detailed testing procedures including list of instruments, task performed, model and serial number and date last calibrated.

2. Agenda including schedule of work with approximate duration of each phase, approximate date of field inspections, and required start date to meet scheduled completion date.
3. Report forms.

C. An approved copy of each submittal must be received by the Test and Balance Agency before work is begun.

D. If complete submittals are not received by the Engineer within the specified times, the Engineer reserves the right to select the Test and Balance Agency with any additional costs incurred by the Contractor.

3.2 REPORT SUBMITTALS:

A. Provide a preliminary typed report for engineers' review.

B. After receiving Engineers' review comments and address issues, submit three copies of the Test and Balance report. Report shall have systems, subsystems, and individual readings in a sequential format.

C. Reports can be submitted in phases such as air systems, water systems, vibration, etc.

D. Reports shall be submitted after all modifications required by these specifications to balance system (i.e., replace impellers, belts, drives, dampers) have been made. Reports will not be accepted with comments such as damper missing, new drive required, etc.

3.3 DRAWING SUBMITTALS:

A. Test and Balance Agency shall submit plans indicating:

1. All traverse locations referencing values shown in reports.

3.4 COORDINATION OF WORK:

A. Test and Balance Agency shall not begin work on a system until system is started as required in SYSTEM START-UP specifications.

3.5 CONTRACTOR REVIEWS AND INSPECTIONS:

A. The Test and Balance Agency shall perform one pre-construction plan check and submit comments to Engineer.

B. The Test and Balance Agency shall perform construction inspections at the following stages of each construction phase and submit comments to Engineer:

1. 50% completion
2. 90% completion

3.6 BELTS, DRIVES, IMPELLERS AND DAMPERS:

A. If it is determined by the Test and Balance Agency that drive changes are required, the Contractor shall change belt and drive.

B. Drives for constant volume air handlers shall be selected for a minimum of 100% filter loading.

C. Drives for variable volume air handlers shall be selected for a minimum of 100% filter loading.

D. The Test and Balance Agency shall rebalance system after changes have been made.

3.7 ENGINEER REVIEW:

A. The Engineer shall, at their discretion, recheck any or all of the test and balance work within 120 days of receipt of report. The Test and Balance Agency shall provide ample number of technicians and test equipment to perform the tests required.

B. Upon completion of the Engineer's recheck, the testing and balancing report, or portions thereof, shall be accepted or rejected. All parts not accepted shall be retested and rebalanced.

C. Systems shall be tested, rebalanced and rechecked until accepted by all parties.

3.8 EXISTING SYSTEMS:

A. Balance systems as directed by Engineer after renovation work is completed and provide renovation test report.

3.9 MOTOR CAPACITY:

A. At no time shall the motor exceed full load amps. Motor shall load into service factor only if written permission is received from the engineer.

END OF SECTION 23 0593

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of insulation required for thermal and acoustical installation on all mechanical equipment, piping, ductwork, and appurtenances where shown on the drawings and specified hereinafter under applicable sections of this specification.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0713 - Duct Insulation
2. Section 23 0716 - HVAC Equipment Insulation
3. Section 23 0719 - HVAC Piping Insulation

1.3 QUALITY ASSURANCE:

A. Flame and Smoke Spread Ratings:

1. All insulation materials must have a maximum 25/50 flame/smoke rating as tested by ASTM E-84, NFPA 255 and UL 723 except where specifically noted otherwise.
2. Flame/smoke rating shall be a minimum of 25/250 in equipment rooms where the room is not used as a plenum.
3. Flame/smoke rating shall be a minimum of 25/450 in tunnels, crawl spaces, and outdoors.

B. Insulation thickness shall equal those recommended by ASHRAE 90.1 or as scheduled, whichever is greater. Surface temperatures shall be below 140 degrees F.

C. Accessories such as adhesives, mastics, cements, and tapes for fittings shall have the same component rating as listed above.

D. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facing to impart flame and smoke safety shall be permanent. The use of water soluble treatments is prohibited.

E. Installation and materials shall meet the requirements of the International Building Codes.

F. All insulation work shall be applied by mechanics normally employed in the trade. All insulation shall be installed in accordance with the manufacturer's recommendations.

G. All insulation furnished under this Division of the specifications shall be the product of one manufacturer except for special applications.

H. Manufacturers:

1. The following manufacturers of sealants, adhesives, and mastics shall be:

a. Foster
b. Childers
c. Mon-Eco

PART 2 – PRODUCTS

2.1 MASTICS, SEALANTS, AND ADHESIVES:

A. General:

1. Materials shall be as recommended by the insulation manufacturer.
2. Products shall be applied as recommended by the manufacturer for that specific application.
3. The number of coats and thicknesses shall meet or exceed the manufacturer’s recommendation or as indicated in these specifications or on the plans, whichever is greatest (coats and thickness).
4. Materials shall meet LEED requirements for low emitting products.

B. Finish:

1. When material is applied where it is to be painted, the material shall be coated, if necessary, to allow the material to be properly painted without use of special paints or primers.

PART 3 - EXECUTION

3.1 GENERAL:

A. All insulation materials shall be delivered and stored in manufacturer's container and kept free from dirt, water, chemical and mechanical damage.

B. Insulation shall be applied by experienced workmen in a workmanlike manner.

C. Insulation shall not be applied until all pressure testing has been completed, inspected and released for insulation application.

D. Surfaces to be insulated shall be clean and dry.

E. All insulation joints shall be butted firmly together and all jackets and tapes shall be smoothly and securely installed.

F. Insulation shall be run continuously through all building assemblies except where the listed fire rated assembly does not allow insulation to be used.

G. Items that are factory insulated shall not receive additional insulation where not otherwise specified.

3.2 INSTALLATION:

A. Insulation on cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal.

B. Insulation on equipment that must be opened periodically for inspection, cleaning, and repair must be constructed so insulation can be removed and replaced without damage.

END OF SECTION 23 0700

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of insulation required for thermal and acoustical installation on all sheet metal duct and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0700 - HVAC Insulation

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Federal Specification HH-I-558C Mineral Fiber Boards, Blankets and Pipe Covering
2. ASTM C553 Standard Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications
3. ASTM C547 Standard Specification for Mineral Fiber Performed Pipe Insulation
4. ASTM G12 Standard Specification, Mineral Fiber Block and Board Thermal Insulation
5. ASTM C1136 Barrier Material, Vapor (Jacket Only)
6. ASTM C916 Liner Adhesive
7. ASTM G21, G22 Fungi and Bacteria Resistant Tests
8. ASTM C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
9. UL 723 Duct Tape

B. Duct wrap shall not exceed 25% compression.

C. Manufacturers:

1. The following fiberglass duct insulation manufacturers are acceptable.

a. Owens/Corning
b. Certainteed
c. Knauf
d. Johns Manville

PART 2 - PRODUCTS

2.1 GENERAL:

A. Duct insulation shall comply with the requirements of International Energy Conservation Code or these specifications, whichever is greater.

B. If no other specific direction is provided, the spaces for duct insulation are defined as follows:

1. Concealed:

a. Above ceiling.
b. In mezzanines.
c. In mechanical rooms.
d. Other spaces not generally considered regularly occupied spaces.

2. Exposed:

a. Indoor locations generally considered regularly occupied spaces and where duct can be visible to occupants.

3. Outdoor:

a. Exposed to ambient conditions including sunlight and weather.

4. Unconditioned spaces:

a. Exposed to ambient temperatures but not to sunlight and weather. Typical spaces may be attics, crawl spaces, utility tunnels, chases open to the exterior, etc.

5. Return air plenum:

a. A space is only considered a return air plenum if the unducted air returning from a space or above the ceiling of the space is from the same air handler supplying that space.

2.2 TYPES OF FIBERGLASS INSULATION:

A. Fiberglass Duct Wrap:

1. Blanket type insulation composed of glass fibers bonded with a thermosetting resin and faced with an FSK vapor retarder. The facing shall be a glass scrim reinforced laminate of aluminum foil and kraft paper bonded with a fire retardant adhesive.
2. Insulation shall be 1.0 lb./CF density, .28K @ 75 degrees F and a facing vapor transmission of .02 perms max.
3. Basis of design insulation shall be:

a. Owens Corning Type 100

2.3 MINIMUM THERMAL VALUES REQUIRED FOR INSULATION (UP TO 9000 CDD50 AND UP TO 9000 HDD 65, CLIMATE ZONE 3):

A. General:

1. This section is intended to indicate minimum as installed "R" values.
2. Where specific duct insulation thicknesses are indicated elsewhere in this specification or on the plans, the greater thickness or insulating value shall be provided.
3. If no other requirements are indicated and an R-0 is indicated, no insulation is required.

B. Supply Duct:

1. Outdoor: R-8 as installed
2. Unconditioned Space: R-8 as installed
3. Exposed: R-6 as installed
4. Concealed: R-6 as installed

C. Return Duct:

1. Outdoor: R-8 as installed
2. Unconditioned Space: R-8 as installed
3. Exposed: R-6 as installed
4. Concealed: R-6 as installed
5. Return Air Plenum: R-0

D. Outside Air Duct:

1. See requirements for supply duct.

E. Plenums (Exhaust, Outside Air, Relief):

1. See requirements for supply duct.

2.4 APPLICATION OF FIBERGLASS DUCT WRAP:

A. Fiberglass duct wrap shall be provided for all ducts and plenums required to be insulated in the following locations except where dual wall duct specified, elastomeric insulation or another type insulation required, or duct specified to be uninsulated:

1. Concealed ducts
2. Exposed ducts in mechanical and utility rooms
3. Exposed ducts in occupied spaces

2.5 TAPE FOR FIBERGLASS DUCT INSULATION:

A. Tape shall be pressure sensitive joint sealing tape specifically made for the specific application in which it is used.

B. Tape shall be 3" wide minimum and shall match the insulation finish.

2.6 DUAL WALL DUCT:

A. No additional insulation is required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIBERGLASS INSULATION:

A. Fiberglass Duct Wrap Insulation:

1. Duct wrap insulation seams shall be stapled 6" on center with outward clinching staples. All seams are to be sealed with pressure sensitive tape matching the facing.
2. Where rectangular ducts are 24" in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced 18" on center (max.) to prevent sagging of insulation.

B. Tape and Mastic Installation:

1. After the pressure sensitive tape is applied, a coat of mastic shall be applied to the tape overlapping the insulation by 2" minimum.
2. Tape and mastic shall also be applied to all tears, rips, punctures, penetrations, mechanical fasteners, access doors, and all other locations as necessary to ensure a continuous vapor tight system.
3. Mastic must also be applied to any factory applied tape such as on factory insulated supply grilles, etc.

3.2 INSTALLATION OF ELASTOMERIC INSULATION:

A. Insulation shall be adhered to the sheet metal with 100% coverage of adhesive.

B. Provide 4" wide tape to match finish of elastomeric insulation.

END OF SECTION 23 0713

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the installation of insulation required for thermal and acoustical installation on all piping including valves, mechanical couplings, fittings, flanges, strainers, expansion joints, and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0700 - HVAC Insulation

1.3 QUALITY ASSURANCE:

A. Manufacturers:

1. The following fiberglass piping insulation manufacturers are acceptable:

a. Owens/Corning
b. Knauf
c. Johns Manville

2. The following elastomeric pipe insulation manufacturers are acceptable:

a. Armacell
b. K-Flex
c. Aeroflex
d. Nomaco

3. The following pipe insert (for elastomeric pipe insulation) manufacturers are acceptable:

a. Aeroflex
b. Armafix

c. Armacell

PART 2 - PRODUCTS

2.1 GENERAL:

A. Pipe insulation shall comply with the International Energy Conservation Code or these specifications, whichever is greater.

2.2 TYPES OF INSULATION:

A. Fiberglass Insulation:

1. Physical properties:

a. Thermal conductivity (k) is .25 at 100 degrees F.

2. Jacket:

a. ASJ jacket with or without self-sealing adhesive system

3. Basis of design insulation shall be:

a. Owens/Corning Heavy Density Fiberglass Insulation ASJ/SSL or ASJ

B. Elastomeric Insulation:

1. General:

a. The insulation shall have a factory applied adhesive closure system.

2. Physical properties:

a. Thermal conductivity (k) is .27 at 75 degrees F.
b. Water transmission is .08 perms – inch.
c. Will not significantly contribute to fire.

3. Basis of design insulation shall be:

a. Armacell type AP Armaflex or type AP/SS

2.3 PIPE INSULATION APPLICATION:

A. General:

1. All fittings, valves, and accessories in the piping system shall be insulated similar to the piping system.

B. Fiberglass Pipe Insulation:

1. Fiberglass pipe insulation is required for all piping systems required to be insulated except where other types of pipe insulation are specified.

C. Elastomeric Pipe Insulation:

1. Elastomeric pipe insulation shall be provided on all refrigerant piping requiring insulation.

2. Elastomeric pipe insulation not permitted on the following:

a. Where not UL approved for fire rated assemblies.
b. Where details or notes specifically require another insulation type.

2.4 FITTINGS:

A. General:

1. Fittings shall be factory molded except where indicated otherwise.
2. Fittings shall have a factory installed vapor barrier or have a field installed vapor barrier equal to the pipe vapor barrier.

B. Fiberglass Pipe Insulation:

1. Piping (up to 1-1/4"):

a. Fittings may be mitered at contractor's option.

2. Piping (1-1/2" and larger):

a. Fittings shall be insulated with 3/4 PCF density, all service faced FSK duct wrap, 2" thick.

C. Elastomeric Pipe Insulation:

1. Piping (up to 3/4"):

a. Fittings may be mitered at contractor's option.

D. All Other Insulation:

1. Piping (all sizes)

a. Per manufacturer's recommendations.

2.5 JACKETING:

A. Aluminum Jacketing:

1. General:

a. Jacketing shall be manufactured from Type 1100, 3003, 3105 and 5005 alloys.
b. Jacketing on piping shall be (smooth) (embossed) (corrugated. Corrugation shall be 3/16 inches).
c. Jacketing on equipment shall be smooth.

2. Thickness:

a. Pipe jacket shall be .020 inches.
b. Equipment jacket shall be .024 inches.

3. Vapor Barrier:

a. Continuous lamination to jacket.
b. Three (3) mil polyethylene film with 40 lb. virgin kraft paper.

2.6 FINISH:

A. Outdoor Piping and Accessories (except soft drawn refrigerant piping):

1. Aluminum jacketing.

2.7 FINISH (OUTDOOR SOFT DRAWN REFRIGERANT PIPING):

A. Outdoor refrigerant piping shall be wrapped with a prefabricated, self-adhering protective membrane.

B. The outer layer shall be UV resistant.

C. The inner layers shall be high density cross linked polymer film with a layer of asphalt adhesive.

D. The basis of design wrap shall be

1. MFM FlexClad-400 or equal

2.8 ADDITIONAL INSULATION REQUIREMENTS:

A. Accessories subject to condensation:

1. This shall include but not be limited to:

a. Piping to gauge
b. Valve stems

2. Wrap component subject to condensation with self-stick neoprene insulating tape.

B. Where insulation is specified for piping, insulate similarly all connections, vents, drains, fitting, valves, mechanical couplings, expansion bellows and any appurtenances and piping connected to system subject to heat loss or gain. Unions, couplings, or flanges provided at equipment for removal of heat exchanger, condenser, or evaporator heads shall be insulated with removable molded blocks.

C. Liquid Refrigerant Lines:

1. Insulate liquid refrigerant lines similar to suction refrigerant lines in the following systems:

a. Ductless split systems
b. Variable refrigerant systems
c. Where required by equipment manufacturers

2.9 PIPE INSERT (FOR ELASTOMERIC INSULATION):

A. General:

1. Insert shall be a closed cell, high compressive strength, foam insulating pipe support.
2. The insert shall be lined with a closed cell EPDM foam rubber and encased in a zero perm weatherproof membrane.

B. Properties:

Compressive Strength (at yield)	314 PSI
Thermal Conductivity	.312K
Water Absorption (by weight)	<7%
Water Vapor Permeability	0.0 Perm

C. Insert shall be sized for the pipe on which it is installed and the thickness of the adjacent insulation.

D. Basis of design manufacturer shall be:

1. Aerofix-U

PART 3 - INSULATION THICKNESS SCHEDULES

3.1 GENERAL:

A. Specific insulation requirements may be indicated elsewhere in these specifications or on the contract drawings.

B. Insulation for piping exposed to ambient conditions based upon 90 degrees F, 90% RH, and 7 MPH wind speed.

3.2 FIBERGLASS INSULATION SCHEDULE:

A. Condensate Drains (not outdoors):

1. All pipe - 3/4" thk.

3.3 ELASTOMERIC INSULATION SCHEDULE:

A. Refrigerant Suction Lines, Hot Gas Reheat Lines, and Liquid Lines:

1. All pipe - 1" thk.

B. Condensate Drains (not outdoors):

1. Up to 2" pipe – ¾" thk.

PART 4 - EXECUTION

4.1 INSTALLATION:

A. Apply adhesives, sealants, coatings, and other materials as recommended by the manufacturer.

B. Outward clinching staples shall be used on ASJ jacketing and be sealed with vapor barrier sealer on cold pipe. Piping not easily accessible for repair or maintenance shall be banded with three aluminum bands per section.

C. All penetrations through vapor barrier shall be sealed with vapor barrier sealer. Where metallic jacketing is used, all penetrations through jacket and at termination of jacket shall be sealed.

D. Butt joints and seams of elastomeric insulation shall be sealed with contact adhesive as recommended by the insulation manufacturer. Where possible, insulation shall be used without slitting and slipped over tubing. All fittings shall be covered and sealed with fabricated pieces of the same insulation and adhesive.

4.2 ANCHORS AND SUPPORTS:

A. Anchors and supports that are secured directly to cold surfaces shall be adequately insulated and vapor sealed to prevent condensation.

B. Jacketing shall be carried through hanger on inside of 16 gauge sheet metal shields and sealed to maintain continuous vapor barrier.

4.3 METALLIC JACKETING:

A. Jacketing shall be held in place with a friction type, Z lock, or 2" overlap joint. Joints shall be completely sealed along the longitudinal seam and shall be installed to shed water. Circumferential joints shall be sealed by use of 2" wide butt strips. ½" bands shall secure jacketing. Space as recommended by the manufacturer.

B. Straps shall secure jacket. Straps shall be the same material as jacket. Provide 1/2" straps for jackets up to 12" in diameter. Provide 3/4" straps for 14" and larger diameter jackets.

4.4 FIRERATED ASSEMBLIES:

A. Insulation shall run through all building assemblies except where the listed fire rated assembly does not allow insulation to be used.

4.5 MULTI-LAYER INSTALLATION:

A. Joints shall be staggered.

4.6 ELASTOMERIC INSULATION:

A. Inserts:

1. Center insert on hanger or pipe support.
2. Insert shall be installed using the insert manufacturer’s adhesive to seal the insert to the adjacent pipe insulation.
3. The insert and adjacent insulation shall be wrapped with the insert manufacturer’s tape to seal and finish the installation. The tape shall wrap the insulation/insert two complete times.

B. Coatings:

1. When installed outdoors without a metallic jacket, the insulation shall be coated with a UV resistant coating.
2. The coating shall provide a minimum of 5 years protection against deterioration.

C. Tape:

1. 3/4" longitudinal tape specifically listed for use on elastomeric insulation shall be installed along every longitudinal seam/joint.

END OF SECTION 23 0719

SECTION 23 0900 - INSTRUMENTATION AND CONTROLS FOR HVAC (GENERAL)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of the building environmental controls shown on the drawings and specified hereinafter.

B. Description:

1. Control and instrumentation work shall include:

a. Temperature control
b. Humidity control
c. Airflow control
d. Equipment interlock and controls
e. Wiring for automatic controls

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
1. Section 23 0904 - Building Automation System

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All environmental controls shall comply with all local codes and ordinances, and meet or exceed the following standards:

a. Underwriters Laboratories
b. NEMA Standards
c. National Electrical Code
d. Scientific Apparatus Makers Associates Standard PMC 20.1 for Process Measurement and Control Terminology
e. Scientific Apparatus Makers Associates Standard PMC 20.2 for Process Control Performance
f. NFPA 90A

B. Control circuit wiring shall meet NFPA Standard 70, Article 725, for remote control, low energy power, low voltage power and signal circuits.

C. All control equipment shall be the product of one manufacturer whenever practical.

D. Manufacturers:

1. The following Building Environmental Controls Contractors are acceptable:

a. Johnson Controls, Columbia, Charleston, or Greenville, South Carolina

2. The following control manufacturers are acceptable:

a. Johnson Controls, Inc.

3. The following needlepoint bipolar ionization manufacturers are acceptable:

a. GPS
b. Phenomenal Aire
c. Plasma Air
d. Approved Equal

PART 2 - PRODUCTS

2.1 GENERAL:

A. The building environmental controls shall be provided by the (Building Environmental Controls Contractor) (equipment manufacturer) (mechanical contractor).

B. The Building Environmental Controls Contractor shall have a local office within a 75 mile radius of the job site, staffed with factory trained engineers. The engineers shall be capable of providing instructions and maintenance service on all system components.

C. The Building Environmental Controls Contractor shall have a 5-year successful history in the design and installation of building systems and automatic temperature controls similar in performance to that specified herein and shall be prepared to evidence this history as condition of acceptance and approval prior to bidding.

D. The Building Environmental Controls system shall be installed by competent controls mechanics who are full time employees of the Building Environmental Controls Contractor.

E. The Building Environmental Control Contractor shall be responsible for the quality and satisfactory operation of the devices within the system and for the overall performance of the specified air flow control system.

2.2 SYSTEM:

A. Provide all thermostats, humidistats, sensors, transmitters, controllers, actuators, control panels, conduit, wiring, accessories and appurtenances for a complete building environmental control system.

B. Provide switches, fuses, disconnects and all other devices necessary for protection and convenient operation of system.

C. The contractor shall be responsible for providing power wiring, conduit, breakers and final connections for all control devices, panels, components, and the following equipment unless specifically shown on electrical plans:

1. Control devices
2. Bipolar Ionization

D. The control system shall be on normal power.

2.3 CONDUIT:

A. General:

1. All control conduit shall be furnished and installed under this division except where specifically indicated otherwise.
2. All line voltage and control wiring in new construction shall be run in conduit.
3. All control wiring in existing construction shall be (run in conduit) (run in j-hooks spaced no greater than 3 ft. oc).
4. Conduit shall be provided in accordance with the Electrical Division of this specification unless noted otherwise in these specifications.
5. Outdoor conduit shall be GRC.
6. Indoor conduit shall be EMT.
7. Conduit shall be 3/4".

B. Below slab or below grade conduit:

1. Metallic conduits installed in or below slabs or below grade shall be galvanized rigid steel or IMC and shall be protected against corrosion with two field coatings of asphaltum black varnish or approved equal.
2. All metallic conduits installed below slab or below grade shall be provided with watertight couplings.
3. Conduits passing through concrete foundation walls or floor slabs below grade or below ground water level shall be provided with waterproof conduit entrance sealing sleeves.

C. Exposed Conduit (Indoor):

1. All exposed (in corridors and all other spaces where visible without removing ceiling tile but not in mechanical or electrical spaces) conduit shall be prepainted conduit.

2. Conduit shall be prepainted (green).

2.4 CONTROLS WIRING:

A. Wiring for low voltage circuits generally shall be No. 18B and S gauge or larger RSH-2 heat resistant.

B. Cables of two or more conductors, not smaller than 22 B and S gauge if shielded or No. 18 B and S gauge if not shielded, may be used for low voltage d-c and electronic circuits carrying less than 1.50 amperes, in lieu of individual wires.

C. Cables carrying a-c circuits sensitive to external fields shall be shielded.

D. Cables having fewer than 12 conductors shall have thermoplastic or rubber insulation for 300 volts or more and a heavy outer braid or thermoplastic sheath. Shields shall be grounded to building's grounding system, using wire not smaller than No. 14 B and S gage. Shields shall not be grounded to conduit systems or building piping.

E. Cables shall terminate in solder or screw type terminal strips. All terminal strips shall be numbered.

F. Cables shall not be tapped at intermediate points.

G. All wires, whether individual or in cables, shall be color coded and numbered for identification in accordance with the National Electrical Code.

H. Wire, where specifically permitted to be installed without conduit, shall be plenum rated.

2.5 TRANSFORMERS:

A. Transformers shall be furnished and installed for supplying current to control equipment as required.

B. Transformers shall conform to NEMA standards, shall be capable of supplying 125 percent the connected load, shall be enclosed in U.L. listed cabinets, ventilated, with conduit connections, and provided with fused disconnect switches on primary side and on secondary side.

2.6 CONTROL VOLTAGE:

A. Voltage shall not exceed 24V.

2.7 SPEED SWITCHES:

A. Speed switches, rheostats, and other fan speed control devices may be furnished by either the equipment manufacturer or the controls contractor.

2.8 DDC THERMOSTATS:

A. General:

1. The electronic thermostat shall allow the following functions:

a. Temperature setpoint adjustment.
b. Override switch (from unoccupied to occupied).

2. The electronic thermostat shall allow the following to be programmed from the building control system:

a. Space occupied and unoccupied temperatures.
b. Space occupied and unoccupied times.
c. Allowable space setpoint adjustment.
d. Length of override duration.

3. The electronic thermostat shall have the following features:

a. Digital display.

4. Thermostats shall connect to unit controller via communication cable with a standard jack. The thermostat shall also have a connection available for field monitoring.
5. Devices installed in duct system shall be specifically designed for duct systems.

B. Construction:

1. Device shall be polymer construction.
2. Circuit boards shall be coated.

C. Technical Specifications:

1. Ambient Operating Conditions: 32 deg F to 140 deg F, 0 to 100% RH
2. Accuracy: ± .34 deg F @ 70 deg F (thru film nickel)

2.9 DDC HUMIDISTAT:

A. General:

1. Provide electronic humidistat without setpoint adjustment.
2. Humidistat shall connect to unit controller via communication cable with a standard jack. The humidistat shall also have a connection available for field monitoring.
3. Devices installed in duct system shall be specifically designed for duct system.
4. Where humidistat and thermostat are located adjacent to each other and both are providing input for the same piece of equipment, a combination humidity transmitter and temperature sensor may be provided at the contractor's option.
5. The humidistat shall be a separate device from other control sensors/devices when input is not used to control one specific piece of equipment.

B. Construction:

1. Devices shall be polymer construction.
2. Circuit boards shall be coated.

C. Technical Specification (@ 77 deg F):

1. Ambient operating conditions: 32 deg F to 140 deg F, 0 to 100% RH
2. Accuracy: ± 3% RH for 20-80% RH
   ± 5% RH for 5-20% and 80-95% RH
3. Temperature Coefficient: .12% RH/deg F
4. Response: less than 120 sec between 50-90% RH
5. Offset Adjustment: ± 5

2.10 SENSORS, TRANSMITTERS, AND OTHER CONTROL DEVICES:

A. General:

1. Provide the type device specified for the specific application. Where the device is not specifically indicated, provide the device best suited to provide the control specified.

B. Location of device:

1. Device shall be located as indicated on the drawings or as stated in the specifications.
2. Where no device location is indicated or specified, the device shall be located as recommended by the manufacturers to provide the best practical results.
3. Where the location indicated on the drawings or stated in the specifications does not provide the best practical results, the manufacturers shall provide recommendations for relocating the device.
4. It shall be the responsibility of the contractor to identify all conflicts between indicated device locations and manufacturers recommended locations prior to installation of any related components (i.e., sensor wells, conduit, etc.).

2.11 SAFETY DEVICES:

A. General:

1. Safety devices including, but not limited to, the following shall be hard wired to perform their required function:

   a. Condensate overflow switch
   b. Duct high (and low) pressure switch(es)
   c. Smoke alarm, via unit duct detector, where shutdown sequence is specified to be by mechanical.

2. Status, where specified, shall be monitored by the building automation controls system and initiate other sequences where required.

2.12 CONTROL PANELS:

A. General:

1. All controllers, relays, switches, etc., for equipment shall be mounted in enclosed control panels with key lockable, piano hinged door.
2. Location of each panel shall be where indicated on plans, approved by Engineer, and convenient for adjustment and service.
3. Label each panel properly identifying function or service of panel and all surface mounted devices.
4. Control panels shall be extruded or formed, cold-rolled steel, enamel surfaced, with full length mounting brackets, drilled wall mounting holes.
5. The control panel shall be key lockable.
6. Provide a 24V control transformer.

2.13 FLOAT SWITCH:

A. General:

1. Float switch shall include a sealed, waterproof reed/magnet float switch with no exposed electrical contacts.
2. Float shall be prewired with 6 ft. long, 18 ga. lead cables.
3. Switch shall be tested to UL 508 and UL listed for 24V AC.
4. Float shall attach to drain pan with stainless steel clips.

B. Locations:

1. All drain pans.

C. Basis of design manufacturers shall be:

1. SMD Research Safe-T-Switch Model SS3.

2.14 EQUIPMENT STATUS:

A. Equipment status shall be provided by solid state current sensors.

B. Sensor shall have non-polarity sensitive outputs, trip point adjustment, trip LED, and power LED.

2.15 THREE PHASE VOLTAGE MONITOR:

A. Monitor shall be autoranging type that detects single phasing, low voltage, phase reversal or voltage unbalance When a harmful condition exists, the output relay shall deactivate. When the harmful condition is removed, the relay shall reactivate.

B. The three phase voltage monitor shall be field or factory installed on all three phase equipment.

C. If three phase protection is already provided with the equipment via the VFD or other means, the control contractor does not have to provide additional three phase protection.

2.16 BIPOLAR IONIZATION:

A. General:

1. The electrodes shall be needlepoint type. Needlepoints shall not protrude into the airstream.
2. The bipolar ionization system shall be capable of:

a. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
b. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
c. Reducing space static charges.
d. Reducing space particle counts.

3. The bipolar ionization system shall produce equal amounts of positive and negative ions.
4. Relative humidity from 0 – 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.

5. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 2998.

6. The operation of the electrodes or bipolar ionization units shall conform to UL 2998 with respect to ozone generation.

B. Electrodes:

1. Each plasma generator shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
2. Ionization output from each electrode shall be a minimum of 5 million ions/cc when tested at 2" from the ion generator.

C. Air Handler Mounted Units:

1. The entire cooling coil shall have equal and adequate ionization distribution across the face of the coil.
2. Ion generators shall be mounted in a linear configuration to minimize space required. The ion generators and mounting bar shall be 4" deep or less.
3. The power supply shall accept the following voltages: 12V DC; 24V AC; 120V AC; or 230V AC. Power from the power supply to the ionization generators shall be 12V DC.
4. Unit shall be autocleaning.

D. Electrical:

1. Generators shall include internal short circuit protection, overload protection, and automatic fault reset.
2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
3. The power supply shall have an On/Off switch and power indicator LED.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:

1. The (Building Environmental Controls Contractor) (mechanical contractor) shall be responsible for a complete operational system.
2. The installation shall include:

a. Drawings
b. Supervision
c. Interlocks
d. Adjustments
e. Verification

3. Location of sensing elements shall be the responsibility of the installer.

B. Wiring splices shall not be permitted in electrical panelboards, junction boxes and switchgear.

3.2 THERMOSTATS, HUMIDISTATS AND SWITCHES:

A. General:

1. Install all devices as recommended by manufacturer.
2. When device is provided by the control contractor, the control contractor shall be totally responsible for all coordination with the equipment supplier to ensure compatibility of components to meet the requirements of the equipment manufacturer and the control sequence.

B. Installation:

1. Mount thermostats, sensors, and switches 4'-0" above finished floor to the top of the device’s control mechanism unless noted otherwise.
2. Mount humidity sensors 7'-0" above finished floor unless noted otherwise or when a combination temperature and humidity sensor is permitted.
3. Thermostats mounted on exterior walls shall be mounted on a thermally insulated sub-base.

4. When location is not shown, Contractor shall assume the most remote location served by unit. Coordinate exact location with Engineer.
5. Contractor shall coordinate location of thermostat, humidistats, and switches with final architectural plans and actual field conditions to avoid locating them inside cabinets, bookcases, casework, chalkboards, tackboards and behind door swings and similar obstructions that would limit access or limit the ability to properly sense space conditions.

3.3 WIRING:

A. All control wiring within starters (and motor control centers) shall be installed in a workmanlike manner and neatly laced.

B. All wiring installed in below grade, or below ground water level shall be made up with waterproof connections.

3.4 CONDUIT:

A. Conduit sleeves thru non-waterproofed walls and floors shall be grouted and caulked on both sides of the wall and floor. See detail for fire rated or smoke tight assemblies.

B. After installation, any painted pipe which is damaged shall be touch-up painted.

3.5 EXISTING CONSTRUCTION:

A. Control wiring and conduit shall be installed in existing walls, slabs, and ceilings.

B. Where conditions do not permit installation of conduit and wiring in existing walls, slabs, and ceiling; and, when approved by the engineer, wire mold and similar finished enclosures may be provided.

C. Conduit and wiring shall be installed above existing ceilings except where removal of existing ceilings is specifically identified in other dimensions of work (if any). The Contractor shall be responsible for removal of all other existing tile/grid and replacement of the tile/grid as necessary. Any damaged tile/grid shall be replaced by the Contractor at the Contractor's expense.

3.6 DEVICES ON EXTERNALLY INSULATED DUCTS:

A. Devices mounted on externally insulated ducts shall be mounted on standoff brackets to allow proper installation of duct. If device must be mounted directly to duct for proper operation, standoff bracket may be deleted.

3.7 FLOAT SWITCH:

A. Secure bracket to drain pan with screw.

B. Verify float is properly positioned.

END OF SECTION 23 0900

SECTION 23 0900.02 - CONTROLS FOR HVAC (FLOW MEASUREMENT)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of flow measurement devices shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0900 – Instrumentation and Controls for HVAC (General)

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All environmental controls shall comply with all local codes and ordinances, and meet or exceed the following standards:

a. Underwriters Laboratories
b. NEMA Standards
c. National Electrical Code

B. All flow measurement equipment shall be the product of one manufacturer whenever practical.

C. Manufacturers:

1. The following airflow measurement (thermistor) manufacturers are acceptable:

a. Ebtron
b. Fluid Components International
c. KURZ Instruments
d. Sierra Instruments
e. NJK

PART 2 - PRODUCTS

2.1 AIRFLOW MEASUREMENT (THERMISTOR):

A. General:

1. Device shall be thermistor type capable of continuously monitoring airflow volume and temperature. Each sensor point shall be independently reported to the transmitter.
2. Device shall be suitable for insertion in mounting, standoff mounting, or internal mounting to meet specific application.
3. All components shall be provided by the sensor manufacturer.
4. The entire sensor and transmitter assembly shall be UL listed.

B. Sensor Probe:

1. Probe shall be (gold anodized 6063 aluminum alloy) (316 stainless steel).
2. Probe shall have a UL plenum rated connecting cable.
3. Probes shall be "plug and play" and not have to be matched to a specific transmitter.
4. All hardware shall be stainless steel.

C. Sensor:

1. Sensor shall use thermal dispersion technology with two hermetically sealed industrial grade thermistor probes at each measurement location.
2. Sensor calibration shall be stored in the sensor probe and be calibrated in the factory to NIST traceable airflow and temperature standards.
3. The sensor shall not require field calibration when installed in accordance with manufacturer's requirements.
4. Sensor shall be sealed in a glass filled (polypropylene) (kynar) housing.
5. Performance:

a.	Sensor accuracy	-	± 2% of Reading
b.	Temperature accuracy	-	± .15 degrees F
c.	Operating temperature range	-	-20 to 160 degrees F
d.	Operating humidity range	-	0 to 99% RH
e.	Calibration range	-	0 to 5000 FPM
f.	Duct airflow accuracy	-	± 3% of Reading
g.	OA intake airflow accuracy		± 5% of Reading

6. Sensors shall be provided (min.) as follows:

a.	Area less than 1 sq. ft.	-	2 sensors
b.	>1 to 2 sq. ft.	-	4 sensors
c.	>2 to 4 sq. ft.	-	6 sensors
d.	>4 to 8 sq. ft.	-	8 sensors

e.	>8 to 12 sq. ft.	-	12 sensors
f.	>12 to 14 sq. ft.	-	14 sensors
g.	Area greater than 14 sq. ft.	-	16 sensors
h.	Fan inlets	-	2 sensors

D. Transmitter:

1. Transmitter shall utilize industrial grade components.
2. Transmitter shall include:
    a. Inputs and outputs shall be fused, protected, and internally isolated form the power supply.
    b. Serial RS-485 interface with field selectable protocol.
    c. Output signal offset/gain with digital adjustment.
    d. Adjustable digital filter.
    e. 4-20 ma or 0-10 VDC, field selectable, scalable and isolated analog signals.
3. Transmitter shall be capable of performing sensor and transmitter diagnostics and shall perform a full system checkout on power up.
4. Transmitter shall have a sensor detection system to ignore malfunctioning sensors and provide a visual alarm.
5. Transmitter shall be capable of displaying individual sensor airflow and temperature readings.
6. Display shall be 16 character alpha numerical.
7. The operating temperature range for the transmitter shall be -20 to 120 degrees F.
8. 24V AC power connection internally fused.
9. If exposed to ambient conditions, enclosure shall be NEMA 4.
10. Basis of design transmitter shall be:
    a. Ebtron model GTx116

PART 3 - EXECUTION

3.1 AIRFLOW MEASUREMENT:

A. Manufacturers shall submit detailed drawings of the system component (duct, air handler, etc.) in which the airflow measurement device is to be installed.

B. Submittal shall include test data to verify compliance with accuracy at all required airflows in the configuration the assembly to be installed.

C. If the test and balance airflow measurements and the sensor airflow measurements disagree by an amount determined to be unacceptable by the Engineer, the sensor manufacturer shall visit the jobsite to review the installation of each location of airflow measurement in question. The manufacturer shall re-calibrate the sensors in the field if necessary to provide accurate readings.

END OF SECTION 23 0900.02

SECTION 23 0904 - BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of the building automation system shown on the drawings and specified hereinafter.

B. Description:

1. The work shall include, but not be limited to, the following:

a. Field programmable digital system controller(s).
b. Digital transmission system.
c. Field programming to perform monitoring and control functions specified herein and on point schedule.

2. All sensors, actuators, transducers, solenoids, transformers, wiring and appurtenances shall be provided for a complete building automation system.
3. Digital controller shall include the distributed microprocessors.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0900 - Instrumentation and Control for HVAC (General)

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All equipment and components shall comply with all local codes and ordinances, and meet or exceed the following standards:

a. American Society for Testing and Materials ASTM
b. Institute of Electrical and Electronic Engineers IEEE
c. National Electrical Manufacturers Association NEMA
d. Underwriters Laboratory, UL (UL 916)
e. FCC Regulation, Part 15, Section 156

f. National Fire Protection Association NFPA

B. All the equipment shall have the UL label.

C. Manufacturers shall be:

1. Johnson Controls

PART 2 - PRODUCTS

2.1 GENERAL:

A. The control system shall consist of high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Operators shall be able to perform all normal operator functions through the web browser interface including downloading memory, parameters, and schedules to any module. The system shall be capable of interfacing with Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA).

B. The system shall support Wb services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher.

C. The system shall be capable of future expansion to include monitoring of occupant card access, fire alarm, lighting control systems, cameras and security systems.

D. The control algorithm shall be proportional and integral. Derivative functions are required where stability of the controller is not likely with PI algorithms.

E. A control panel used to control equipment on a floor shall typically not be used to control equipment on any other floor (i.e., panel for terminal units for first floor terminal units shall not be used to control second floor terminal units).

2.2 BacNet COMMUNICATION PROTOCOL:

A. The system shall use the BacNet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms shall be BacNet objects and shall conform to ANSI/ASHRAE Standard 135-2004, BacNet.

2.3 DIGITAL CONTROLLER COMPONENTS:

A. General:

1. Each controller shall consist of the following:

a. Enclosure with keyed hinged door and mounting brackets
b. Power assembly

c. System microprocessors
d. Communications board
e. Field termination board

B. Power Assembly:

1. The power assembly shall consist of :

a. Transformer
b. Filter to eliminate transients
c. Power regulator/surge suppresser
d. Battery charging circuit
e. Battery with 24 hour backup for RAM

C. Display:

1. The digital display shall be programmed to display analog variables, binary conditions, off normal scans and other analog and binary information required for analysis and adjustment of the system being controlled.

2.4 COMMUNICATIONS:

A. General:

1. All digital devices shall be assigned a numeric address.
2. Communications, commands and responses shall be digital.
3. Communications hardware shall include all encryption, filtering, amplifications diagnostics and error lodging.
4. Provide surge suppresser.

2.5 DIGITAL CONTROLLER CAPABILITIES:

A. Field Programmable:

1. The controller shall contain all necessary mathematics, logic, utility functions and all standard energy calculations and control functions in ROM to be available in any combination for field programming the unit. These routines shall include but not be limited to:

a. Math routines:

1) Basic arithmetic
2) Binary logic
3) Relational logic
4) Fixed formulas for psychrometric calculations

b. Utility routines for:

1) Process entry and exit

2) Keyboard functions
3) Variable adjustments and output
4) Alarm indication

c. Control routines for:

1) Signal compensation
2) Loop control
3) Energy conservation
4) Timed programming

2. Final field programs shall be stored in battery backed up RAM.

B. Calibration Compensation:

1. The digital controller shall sense the voltage being supplied to the resistance sensing element and through firmware and shall compensate for power supply changes due to ambient temperature changes at the power supply.

C. Diagnostics:

1. The digital controller shall continuously perform self diagnostics. All malfunction shall alarm the front end system.

D. Default Operating Procedure and Alarms:

1. All variables shall be identified as being reliable or unreliable. When a calculation is required to use a value (sensed or calculated), which is identified as being unreliable, the unreliable data value will flash. The calculation will use a default value programmed into the unit.

2. All alarms shall be indicated at the digital controller and at the front end system.

E. Energy Management Functions:

1. The controller shall be capable of performing the following energy management functions:

a. Time of day scheduling
b. Start/Stop optimization
c. Peak demand limiting
d. Duty cycling (temperature compensated)
e. Occupied/Unoccupied mode

F. User Specified Programs:

1. The controller shall be capable of generating programs specified by the user including:

a. Intermediate season control (dead zone)
b. Trending of variables

c. Historical data storage
d. Totalizing
e. Holiday and event programming

G. Control Loop Compensation:

1. Control loop compensation shall include:

a. Hysteresis correction
b. Limited control output
c. Ramp output
d. Anti-reset windup

H. Access Levels:

1. The controller shall have a minimum of three levels of passwords as follows:

a. Level One - Read all setpoints
b. Level two - Program occupied periods
c. Level Three - Program all setpoints and programs

2.6 GRAPHICS:

A. Graphics shall operate thru the microprocessor and shall be dynamic and animated.

B. The graphic software shall display and update current control point data.

C. Notification of alarms from the panels must be provided on the graphic display while the system is in graphics mode.

D. The graphic display shall indicate alarm conditions for each air handling unit.

E. The graphic display shall display a global graphic for each building which shall include status of air handling units, smoke exhaust fans, exhaust fans, dampers and alarm conditions.

F. The following graphics shall be generated and installed under the contract:

1. Site location
2. Building sites
3. Floor plan
4. Equipment rooms
5. Each heating and cooling unit
6. Each terminal unit
7. Each exhaust fan
8. Ambient conditions

2.7 SURGE PROTECTION:

A. Surge suppression shall be provided on communications lines and power sources at each control panel.

B. Surge suppression shall be type recommended by manufacturer to provide maximum protection of system components.

2.8 OWNERS WITH EXISTING BUILDING AUTOMATION SYSTEMS:

A. When this facility is brought on-line, the existing software and hardware shall be upgraded as necessary to support the graphics, sequences and other functions of the building automation system.

B. The data, information and graphical representations of the systems at this facility shall be equal to or greater than that installed for other facilities (in the District) or as indicated in these specifications, whichever is greater.

2.9 VARIABLE FREQUENCY DRIVE (VFD) COMMUNICATION:

A. Building automation system must be able to fully communicate and change setpoints with variable frequency drives. Communication must be direct without gateway or other external translating devices.

2.10 BACK-UP POWER:

A. Provide a UPS for all panels in this specification.

2.11 SETPOINT CHANGES:

A. Setpoints shall be changed on function blocks. User must also be able to change setpoints without having to go to the function blocks. Acceptable methods include changing setpoints on a “Properties Page” or on the system graphics.

PART 3 - EXECUTION

3.1 OPERATION:

A. Upon restoration of power, equipment shall be sequentially started and shall at no time exceed last demand limit setting.

END OF SECTION 23 0904

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS AND POINTS LIST

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

B. Description:

1. Points shown for equipment shall be for each item of equipment except:

a. When noted otherwise.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0900 - Instrumentation and Control for HVAC (General)
2. Section 23 0993.1 - Sequence of Operation (Central Air Handling Equipment)
3. Section 23 0993.2 - Sequence of Operation (Air Handling Equipment)
4. Section 23 0993.6 - Sequence of Operation (Single Zone Packaged Equipment)
5. Section 23 0993.9 - Sequence of Operation (Various Systems)

PART 2 - SEQUENCE OF OPERATION

2.1 GENERAL:

A. These sequence descriptions and definitions shall apply to all sequences unless sequence specifically indicates otherwise.

2.2 SETPOINTS:

A. In general, the specification indicates setpoints or range of setpoints for most devices.

B. Temperatures shall be field settable to any temperature.

C. Time of day operations shall be field settable to any time.

D. Time delays shall generally be field settable as follows:

1. 0-60 second delay: settable from 0-300 seconds.
2. 0-5 minute delay: settable from 0-60 minutes.

E. The contractor shall adjust setpoints in the following manner:

1. As required to start-up, test, debug and otherwise ensure equipment and system is operating as intended.
2. Dampers, actuators, and similar devices should be left in their optimum operating position.
3. Thermostats, humidistats, and similar devices should be left as indicated on drawings or in specifications. If no value is indicated, contractor should set at a reasonable value.
4. Equipment and system schedules should be reviewed with the Owner and Engineer prior to initiating the schedule.

2.3 MORNING WARM-UP/COOL-DOWN:

A. This mode is the mode between night setback and normally occupied mode and is used to bring area served from unoccupied conditions to conditions required for occupancy.

B. This mode typically will operate with outside air systems closed or de-energized.

C. The start time of this mode shall be determined by the building automation system based upon space temperatures, building characteristics, outside temperature, and historical ability of each system to warm up or cool down the building.

2.4 NIGHT SETBACK:

A. This mode is the unoccupied mode.

B. This mode is a timed function of adjustable duration.

C. This mode typically will operate with outside air systems closed or de-energized and is used primarily to maintain unoccupied space temperature (adjustable) or space humidity level (adjustable).

D. All HVAC equipment required to maintain space conditions shall be energized in this mode.

2.5 OVERRIDE:

A. When override is activated, the system shall operate with that zone, equipment, or system in the occupied mode.

B. At the end of the override time period, the zone equipment or system shall return to the mode scheduled at that time.

2.6 OUTSIDE AIR CONTROL:

A. Where motorized dampers are specified, the dampers shall open to maintain the airflow quantity indicated on the equipment schedule.

2.7 FAILURE MODES:

A. General:

1. Initiating devices shall each be hard wired.
2. Manual reset of temperature alarm and pressure alarm shall be required. Other alarms shall automatically reset unless manual reset indicated.

B. Smoke and Fire Alarm:

1. The fans shall be de-energized and smoke dampers shall shut. The fan shall de-energize as fast as practical and smoke dampers shall begin closing after fan is de-energized.

C. Low Temperature (Recirculating System):

1. A low temperature condition may be caused by coil freezestat, mixed air low limit or leaving air low limit.
2. Unless sequences specifically identify alternative modes of operation, the following shall be provided:

a. The system shall operate in occupied mode.
b. Outside air dampers shall be closed or outside air supply fans shall be de-energized.
c. Heating system shall energize including heat sources and distribution system.
d. Cooling distribution system shall energize.

3. Alarm shall be indicated at building automation system.

D. High Condensate Level:

1. Upon a rise in condensate level in the condensate pan, the float switch shall de-energize the unit.

E. Duct Pressure:

1. Discharge and return air static pressure sensors shall de-energize fans.

2.8 SYSTEM OPTIMUM START:

A. The building automation control system shall provide an optimum start sequence for the HVAC system.

B. Optimization shall be determined by a comparison of indoor and outdoor environmental conditions and system capacities.

C. At the completion of optimum start, the building shall be at design temperatures. This is not necessarily, and in most cases will not be, the same time as the start of the occupied period. For example, the completion of optimum start could be set at 7 am and the occupied mode set at 9 am. The occupied mode is typically when ventilation air would be energized.

2.9 ALARMS:

A. In addition to the alarms indicated, all temperatures and other monitored or sensed conditions that fall above or below the normal range shall be alarmed.

B. Alarms shall be assigned a level of alarm (minimum three levels - low (maintenance), high (important), and critical).

2.10 REMOTE NOTIFICATION:

A. Critical alarms shall be sent via text and/or email to up to six (6) Owner identified recipients.

PART 3 - POINT SCHEDULE

3.1 DEFINITION OF POINTS:

A. Binary Output:

1.	Control Relay	-	Energize/de-energize
2.	Solenoid	-	Steam Valve Gas Valve
3.	Hand/Off/Auto	-	Starter

B. Analog Output:

1.	Cooling	-	Control Valve
2.	Heating	-	Control Valve SCR Heater
3.	Humidification	-	Control Valve
4.	Economizer	-	Dampers
5.	Position Adjust	-	Fan Drives Pump Drives Dampers VAV Damper

C. Binary Input:

1.	Differential Pressure	- Fan Status Pump Status
2.	Pressure Switch	- Pressure
3.	Flow Switch	- Fan Status Pump Status
4.	Fire/Smoke	- Smoke Detector Fire Sensor
5.	Freeze	- Low Limit
6.	Filter	- Filter Pressure
7.	Setback Override	- Night Setback Override

D. Analog Input:

1.	Humidity	- Humidity
2.	Temperature	- Temperature
3.	Static Pressure	- Static Pressure
4.	Fan Speed/Load	- Fan Drives
5.	Air Flow	- Air Flow

SYSTEM POINT SCHEDULE

POINT SCHEDULE NO. 1	HARDWARE																					SOFTWARE											
SYSTEM --	OUTPUT FROM BACS						INPUT TO BACS															ALARMS							APPLICATION PROGRAMS				
SPACES SERVED -- -- --	BINARY	ANALOG					BINARY			ANALOG												BINARY		ANALOG									
POINT DESCRIPTION	CONTROL RELAY	POSITION ADJUST	COOLING	HEATING	DEHUMIDIFICATION	REHEAT	CURRENT SENSOR	FIRE/SMOKE	FILTER	OUTSIDE HUMIDITY	OUTSIDE TEMP	SPACE HUMIDITY	SPACE TEMPERATURE	SUPPLY TEMP (AIR)	DUCT STATIC PRESSURE	VFD ①	OA AIRFLOW	SA AIRFLOW	SUPPLY DEWPOINT (AIR)	COIL LAT		FIRE/SMOKE	FILTER	HIGH TEMPERATURE	LOW TEMPERATURE	RUN TIME	HIGH HUMIDITY	SMOKE CONTROL	SCHEDULED START/STOP	OPTIMUM START/STOP	S/W CHANGEOVER	DAY/NIGHT SETBACK	MORNING WARM-UP
Outside										●	●																						
SPAC-1 - SPAC-7 ④	●	⑤	●	●	●		●	②	●			●	●	●		●	●		●	●		●	●	●	●	●	●	●		●	●	●	●
SPAC-8, SPAC-9 ④	●	③	●	●	●		●	②	●			●		●	●	●	●	●	●	●		●	●	●	●	●	●	●		●	●	●	●
IDHP-2	●		●	●		●	●		●			●	●	●						●			●	●	●	●	●		●		●	●	●

Failure Modes
○ -- ON
● -- OFF
L -- Last

① INFORMATION AVAILABLE FROM THE VFD
② WHERE DUCT DETECTOR INDICATED
③ DAMPERS AND AIRFLOW
④ BACNet INTERFACE. SEE CONTROL SEQUENCE FOR POINTS REQUIRED.
⑤ DAMPERS

END OF SECTION 23 0993

SECTION 23 0993.1 - SEQUENCE OF OPERATION (CENTRAL AIR HANDLING EQUIPMENT)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0993 - Sequence of Operations for HVAC Controls and Points List

PART 2 - SEQUENCE OF OPERATION

2.1 VARIABLE AIR VOLUME AIR HANDLERS (SPAC-8 AND SPAC-9):

A. Supply Fan Operation:

1. The supply fans shall be controlled by a variable frequency drive and a direct digital controller.
2. Upon a start signal, the fans shall soft start. The direct digital controller shall provide a signal to the variable frequency drives to control supply fan speeds. The supply fan speed shall modulate based upon the duct static pressure sensor.

B. Temperature Control:

1. The cooling control and heating control shall maintain the scheduled supply air temperature; PID algorithms shall be applied. When multiple cooling coils are installed, control shall maintain individual coil leaving air temperatures.
2. The automation system shall stage compressors on as temperature increases above the deadband.
3. When in cooling mode, the supply air temperature shall be controlled in accordance with a supply air reset schedule as follows (all values adjustable).

a. 95 degrees F ambient, design supply air temperature
b. 90 degrees F ambient, design SA temp. plus 2 degrees F

c. 85 degrees F ambient, design SA temp. plus 4 degrees F
d. 80 degrees F ambient or lower, design SA temp. plus 6 degrees F (max. 58 degrees F)

4. The automation system shall proportionally open the gas valve when the temperature drops below the deadband.
5. When in heating mode, the supply air temperature shall be controlled in accordance with a supply air reset schedule as follows (all values adjustable).

a. When X number of zones are in non-cooling mode for more than Y minutes, supply air shall be reset to 60 degrees F.
b. When supply air is at 60 degrees F and X number of zones are in non-cooling mode for more than Y minutes, supply air shall be reset to 64 degrees F.
c. When supply air is at 64 degrees F and X number of zones are in non-cooling mode for more than Y minutes, supply air shall be reset to 68 degrees F.

6. The control valves shall close, no flow to the coil, when the fans are off.

C. Morning Warm-Up:

1. During morning warm-up, the outside air damper shall remain closed and the air handler shall energize.
2. The unit shall provide 70 degree F (adj.) supply air.

D. Outside Air:

1. Upon beginning of occupancy (plus time delay of x minutes), minimum outside air damper shall open and maintain required airflow.
2. The outside air damper for AHU-X shall modulate to provide design airflow as measured by the airflow measuring stations.

E. Smoke Mode:

1. When the system is in smoke control mode, the unit outside air damper shall be 100% open. The unit return damper shall close.
2. If the supply duct smoke detector senses smoke in the supply duct, the unit shall shut down.

F. Emergency Power Mode:

1. When operating on emergency power, the compressors shall be locked out.

G. Override:

1. The system shall operate in occupied mode.

H. Unoccupied Mode:

1. During unoccupied mode, the system shall start if space temperature drops below unoccupied heating setpoint or above unoccupied cooling setpoint.
2. Outside air dampers shall be closed.
3. The system shall operate in cooling or heating mode as required.

I. Failure Mode:

1. High condensate level

2. Smoke detection

3. Others indicated with equipment or required by the manufacturer

END OF SECTION 23 0993.1

SECTION 23 0993.2 - SEQUENCE OF OPERATION (AIR HANDLING EQUIPMENT)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0993 - Sequence of Operation for HVAC Controls and Points List

PART 2 - SEQUENCE OF OPERATION

2.1 TERMINAL BOXES:

A. Terminal Box Controls:

1. The terminal boxes shall be controlled by a unit mounted direct digital controller.

B. Airflow:

1. A pressure independent controller shall modulate air valve to maintain airflow set point.
2. Two position boxes shall maintain a minimum CFM when switch is in "Unoccupied" position.
3. Fan shall run as follows:

a. Series type terminal boxes - continuously
b. Parallel type terminal boxes - in heating mode only

4. Fans shall be off where air handler is shut down on smoke alarm.
5. Heating Airflow:

a. When air handler is in cooling mode and space heating is required, the terminal unit shall provide minimum scheduled heating airflow.

b. When the air handler is in heating mode and no terminal unit is in cooling mode, the terminal unit shall provide the maximum scheduled heating airflow. If a maximum heating airflow is not indicated on the schedule, airflow shall be 80% (adj.) of cooling airflow or minimum heating airflow, whichever is greater.

C. Temperature Control:

1. General:

a. Space temperature control shall be by a space sensor with adjustable set point. Provide a night setback override.
b. When the terminal unit is in heating mode and the space temperature has been satisfied, (the electric heat shall proportionally energize) (the hot water control valve shall proportionally open) to maintain the supply air at a temperature equal to the space setpoint (i.e., supply air at a neutral temperature).
c. Occupied space setpoint shall be 72 degrees F (adj.).
d. Unoccupied space setpoint shall be 80 degrees F (adj.) in cooling mode and 55 degrees F (adj.) in heating mode.

2. Shutoff Terminal Units:

a. Airflow shall modulate to minimum or full shut off position when space temperature decreases below set point.
b. (Hot water valve shall modulate) (Electric heating coil shall proportionally energize) upon a further drop in space temperature.

3. Fan Powered Terminal Units:

a. Upon a rise in space temperature above cooling setpoint, the primary air shall increase to satisfy the space cooling load.
b. Upon a drop in space temperature the primary air shall decrease.
c. As the space temperature continues to fall, the unit shall modulate its cooling flow to its minimum heating CFM and the (hot water valve shall modulate open) (electric heating coil shall proportionally energize) to satisfy the space heating load.

D. Override:

1. When terminal unit is in override setback mode, the primary air system and terminal units shall operate in occupied mode.

E. Morning Warm-up:

1. When system operates in morning warm-up mode, the primary air system shall energize.
2. The non-fan powered terminal units shall operate at maximum heating airflow if space requires heating and minimum airflow if heating is not required for the space.

3. Fan powered terminal units shall operate with primary air closed and in heating mode.
4. When space temperature is satisfied, and the building is in occupied mode, the terminal unit shall revert back to normal operating sequence.

END OF SECTION 23 0993.2

SECTION 23 0993.6 - SEQUENCE OF OPERATION (SINGLE ZONE PACKAGED EQUIPMENT)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0993 - Sequence of Operations for HVAC Controls and Points List

PART 2 - SEQUENCE OF OPERATION

2.1 PACKAGED HVAC UNITS (SPAC-1 TO SPAC-7):

A. Unit Operation:

1. The indoor fan, compressors, heating coil, reheat coil, and outside air damper shall be controlled independently of each other by the direct digital controller.
2. Cooling and heating shall not operate simultaneously except where specifically specified otherwise.
3. The unit shall be controlled by a space thermostat, space humidistat, and a direct digital controller.
4. When system is in occupied or override modes, the system shall operate in occupied mode.

B. Heating Control (Air Conditioning Unit):

1. Upon a demand for heating, the unit heating sequence shall be energized.
2. Gas valve shall stage or proportionally energize as indicated on equipment schedule or specification to maintain sensor setpoint.

C. Cooling Control:

1. Upon a demand for cooling, the unit cooling sequence shall energize.

2. The compressors shall load to maintain sensor setpoint.

D. Indoor Fan Operation:

1. The fan shall run continuously when the unit is energized except where noted otherwise.

E. Smoke Control:

1. When the system is in smoke control mode, the unit outside air damper shall be 100% open. The unit return damper shall close.

2. If the supply duct smoke detector senses smoke in the supply duct, the unit shall shut down.

F. Morning Warm-Up:

1. Unit shall operate in heating to bring space to design temperature.

G. Outside Air Damper:

1. The outside air damper shall be closed during unoccupied mode.
2. The outside air damper shall be closed during morning warm-up mode.
3. The outside air damper shall be open during occupied mode.

H. Unoccupied Mode:

1. When space temperatures drop below the night low limit setpoint, the unit shall energize in heating.
2. When space temperatures rise above the night high limit setpoint, the unit shall energize in cooling.
3. When the space humidity rises above setpoint, the system shall operate in dehumidification mode.

I. Failure Mode:

1. High condensate level
2. Smoke detection
3. Others indicated with equipment or required by manufacturer.

2.2 SPLIT SYSTEM COOLING UNITS (IDAC/ODAC-1):

A. Unit Operation:

1. The unit shall be controlled by a space thermostat.

2.3 SPLIT SYSTEM COOLING AND HEATING UNITS (WITH ELECTRIC REHEAT) (IDHP/ODHP-2):

A. Unit Operation:

1. The units shall be controlled by a (space) thermostat, space humidistat and direct digital controller.

B. Dehumidification Mode:

1. The unit shall operate in cooling mode when humidity level exceeds setpoint.
2. The electric reheat coil shall stage to maintain the space temperature setpoint.

END OF SECTION 23 0993.6

SECTION 23 0993.9 - SEQUENCE OF OPERATION (VARIOUS SYSTEMS)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0993 - Sequence of Operations for HVAC Controls and Points List

PART 2 - SEQUENCE OF OPERATION

2.1 SMOKE CONTROL:

A. Upon a signal from the fire alarm system, the smoke exhaust fan in that zone shall energize and the HVAC units serving that zone shall operate in economizer mode without any return air to the unit.

B. If smoke is detected by the duct detector in a unit's supply duct, that unit shall shut down.

C. Upon activation of smoke fan SEF-1, fan F-1 shall shut off and the motorized damper at F-1 shall close. The motorized damper in the duct to SEF-1 shall open.

D. Upon activation of smoke fan SEF-2, fan F-2 shall shut off and the motorized damper at F-2 shall close. The motorized damper in the duct to SEF-2 shall open.

E. Upon activation of smoke fan SEF-3, exhaust fan F-1 shall continue to operate.

F. Upon activation of smoke fan SEF-4, exhaust fan F-2 shall continue to operate.

G. Upon activation of smoke fan SEF-5, exhaust fan F-4 shall continue to operate.

H. Upon activation of SEF-6, exhaust fan F-5 shall continue to operate.

I. Upon activation of smoke fan SEF-7, exhaust fan F-6 shall continue to operate.

J. Upon activation of smoke fan SEF-8, the motorized dampers in the return ducts to AC-8 and AC-9 shall close and the motorized dampers in the 48" x 24" ducts to SEF-8 shall open. The general exhaust fans, F-7 to F-16 and F-20, shall not be turned off.

K. When any smoke exhaust fan is energized, the motorized damper at the rooftop intake hood serving that same area shall open.

L. The existing Firemen's Smoke Control Panel has an ON-OFF-AUTO switch for each fire zone.

2.2 EMERGENCY POWER:

A. If the building loses normal electrical power and the generator is energized, the compressors on units AC-1 to AC-9 shall be locked out.

2.3 FLOAT SWITCHES:

A. When float switch rises to preset water depth, the system shall be de-energized except when in smoke mode. When in smoke mode, the float switch shall be ignored.

B. When float switch drops to below preset water depth, the system shall automatically restart.

END OF SECTION 23 0993.9

SECTION 23 2113 - HVAC PIPING (GENERAL)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of pipe, pipe fittings, accessories and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0517 - Sleeves, Seals, and Escutcheons
2. Section 23 0519 - Meters and Gauges for HVAC Piping
3. Section 23 0523.01 - General Duty Valves for HVAC Piping
4. Section 23 0523.02 - General Duty Valves for HVAC Piping (Steam and Steam Condensate)
5. Section 23 0523.03 - Gas Valves for HVAC Systems
6. Section 23 0529 - Hangers and Supports for HVAC Piping
7. Section 23 0548 – Sound, Vibration, and Seismic Control for HVAC
8. Section 23 2113.1 - Preinsulated Underground Piping
9. Section 23 2113.2 - Field Insulated Underground Piping
10. Section 23 2113.3 - Underground Pipe Coating

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All pipe and pipe fittings shall comply with American National Standards Institute Code, all local codes and ordinances, and meet or exceed the standards and procedures (latest editions) of the following:

a. Ferrous Pipe and Fittings:

1) Malleable Iron Screwed Fittings. ANSI B16.3
2) Steel Flanges. ANSI B16.5
3) Steel Fittings. ANSI B16.9

4) Steel Pipe, Welded or Seamless, Black or Galvanized. ASTM A53, A106, and A120
5) Steel Pipe, Welded or Seamless (for coiling) Black or Galvanized. ASTM A53
6) Wrought Iron Pipe. ASTM A72

b. Non-Ferrous Metallic Pipe and Fittings:

1) Copper Tube, Water, Seamless, Types K, L, and M. ASTM B88
2) Pipe Fittings, Brass or Bronze, 125 and 250 lbs., Cast or Wrought. ANSI B16.15
3) Solder Joint Fittings, Pressure, Copper Alloy. ANSI B16.22
4) Refrigerant Piping. ANSI B31.5, ANSI B36.40, ASTM A333
5) Copper tube (drain, vent) DWV. ASTM B306
6) Copper tube (refrigeration), ACR. ASTM B280

c. Pipe Joining Materials, Gaskets, Methods, and Accessories:

1) Soldering and brazing ANSI B9.1

B. Material shall be new domestic materials (made in the USA) of standard manufacture suitable for specified use.

C. Manufacturer shall certify materials conform to reference specifications, or specification number shall be cast into or marked on each piece.

D. Manufacturers:

1. The following solder manufacturers are acceptable:

a. United Wire
b. Engelhard
c. Elkhart

PART 2 - PRODUCTS

2.1 GENERAL:

A. No materials shall be co-mingled within the same system except those which are specifically approved in these specifications.

2.2 PIPE SCHEDULE:

A. Cooling Coil Condensate Drain Piping:

1. Indoor piping shall be seamless hard drawn, Type L, copper pipe.
2. Outdoor piping shall be schedule 40 PVC.

B. Gas Piping and Gas Relief Piping:

1. Steel pipe shall be Schedule 40 black steel complying with ANSI B36.10 and ASTM A53 as follows:

a. Pressures 3 psig and less:

1) Piping 3" and smaller shall be threaded.

C. Refrigerant Piping:

1. Piping shall be seamless hard drawn, Type L, ACR, copper pipe.
2. Piping shall be dehydrated, charged with nitrogen, and capped.

2.3 FITTINGS AND CONNECTIONS:

A. Fittings shall be the same material and weight as the pipes joined by the fitting unless noted otherwise. Fittings shall comply with all applicable standards.

B. Prohibited Fittings:

1. The following are prohibited fittings:

a. Bullhead tees
b. Street ells
c. Bushings
d. Close nipples
e. "T" drill fittings
f. No mitered fittings in welded systems

C. Copper Pipe Fittings - Refrigerant Service:

1. Fittings shall be wrought copper.
2. All joints shall be brazed.
3. Brazing material may be an alloy of silver, copper and/or phosphorus with a minimum melting point above 1100 degrees F.

D. Gas Relief Piping:

1. Relief vents shall terminate with a manufacturer’s fitting with bug screen.

2.4 DRAIN LINE NEUTRALIZATION:

A. All drain lines from gas furnaces shall have a neutralization kit installed in line with the unit drain line.

B. If a specific neutralization kit is not specified for the equipment or a specific neutralization kit is not required by the manufacturer for their equipment, the neutralization kit listed in this specification shall be provided.

C. The neutralization kit shall be a litre (0.26 gal) capsule constructed of corrosion resistant material filled with neutralization material.

D. Basis of design neutralization kit shall be:

1. Axiom Industries

PART 3 - EXECUTION

3.1 GENERAL:

A. Pipe shall be installed in strict accordance with manufacturer's recommendations.

B. Cut pipe accurately to measurements established at building or site, and work into place without springing or forcing piping in place, properly clearing all window, doors, and other openings or obstructions.

C. Excessive cutting or other weakening of building to facilitate piping installation will not be permitted.

D. Piping shall line up fittings freely and shall have adequate unions so that all equipment can be disassembled for repairs.

E. Each length of pipe, as erected, shall be upended and rapped. Dirt and all foreign matter shall be cleaned from pipe and fittings before installation.

F. All turns and connections shall be made with long radius fittings as specified hereinafter.

G. Piping shall be installed straight and level except where required to be sloped.

3.2 REFRIGERANT PIPE:

A. Cut refrigerant pipe with wheel cutter only. Do not saw or ream.

3.3 CONCEALED PIPE:

A. Test all pipe prior to concealing or insulating.

3.4 PIPE INSPECTION:

A. The Owner and the Engineer reserve the right to inspect, sample, and test any pipe after delivery and to reject all pipe represented by any sample which fails to comply with the specified requirements. Inspection of pipe shall be for pits, blisters, rough spots, breakage, or other imperfections. Any pipe which has been rejected because of the above shall be conspicuously identified and immediately removed from the construction site.

3.5 DRAINAGE PIPING:

A. Provide cleanouts at all changes of direction totaling 90 degrees or more.

END OF SECTION 23 2113

SECTION 23 3112 - MECHANICAL DUCT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the installation of mechanical duct, accessories, and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. All sections of Division 23 Specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0520 - Meters and Gauges for HVAC Duct System
2. Section 23 0548 – Sound, Vibration, and Seismic Control for HVAC
3. Section 23 3113.01 - Metal Duct
4. Section 23 3113.06 – Outdoor Duct System (Preinsulated)
5. Section 23 3300 - Duct Accessories
6. Section 23 3313 - Dampers
7. Section 23 3346 - Flexible Duct

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Mechanical duct systems shall be fabricated and installed in accordance with the manufacturer's recommendations and meet or exceed the standards and procedures (latest editions) of the following:

a. SMACNA, Balancing and Adjustment of Air Distribution
b. SMACNA, High Velocity Duct Construction Standards
c. SMACNA, Low Pressure Duct Construction Standards
d. SMACNA, Fire Damper and Heat Stop Guide
e. SMACNA, Ducted Electric Heat Guide
f. SMACNA, Duct Cleanliness for New Construction Guidelines
g. SMACNA, HVAC Duct Construction Standards
h. NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems

i. ASHRAE Handbook of Fundamentals and ASHRAE Systems and Equipment Handbook
j. International Building Codes

2. Duct shall be Class 0 in accordance with UL Standard 181. Where permitted by Code, Class 1 duct shall be allowed.
3. All duct system components including insulations, adhesives, mastics, cements, tapes, coverings, connectors and appurtenances shall have a maximum UL flame spread of 25 and a smoke development rating of 50 as tested by ASTM E-84.
4. Duct sealants shall meet UL 181A and UL 181B.

B. Manufacturers:

1. The following duct sealant manufacturers are acceptable:

a. AirSeal McGill
b. Ductmate
c. Hardcast

PART 2 - PRODUCTS

2.1 GENERAL:

A. Dimensions shown on the plan are finished inside dimensions. The sizes of internally lined ducts shall be increased accordingly. The size of dampers, security bars and accessories shall also be increased in size.

B. Ducts shall be smooth on inside.

C. The general location of ducts shall be as shown on the contract drawings. Exact location of ductwork shall be determined by the Contractor.

2.2 SEALING DUCTS:

A. General:

1. Sealants shall be water based. Solvent based sealants are not acceptable.
2. Sealants shall be UV, water and mildew resistant.
3. Sealants shall be suitable for low, medium and high pressure applications up to 15" WG.
4. Sealants shall have a mild odor, no flashpoint, and not require a respirator for application.

B. All ducts shall be sealed in accordance with Seal Class A. Seal all joints (longitudinal and traverse) and all penetrations. The following shall not require sealant:

1. Spiral lockseams
2. Gasketed connections

C. Basis of design sealant (not exposed to weather) shall be:

1. McGill AirSeal United Duct Sealer (Water Based).

D. Basis of design sealant (exposed to weather) shall be:

1. McGill AirSeal Uni-Weather.

2.3 DUCT SHIPMENT:

A. Intermediate Level (SMACNA):

1. Ducts leaving the place of fabrication shall be kept clean and dry.

B. Advanced Level (SMACNA):

1. Ducts leaving the place of fabrication shall be wiped clean (interior) and have all ends capped.

PART 3 - EXECUTION

3.1 GENERAL:

A. Contractor shall provide additional bends and offsets as may be required to bring ductwork into proper relation with other equipment and features of the building.

B. Where changes are made in shape of ducts, full area shall be maintained and changes shall be gradual to minimize pressure drop.

C. Ducts terminating at grilles and registers shall be provided with suitable means of attachment.

D. All ductwork shall operate without chatter and vibration and shall be free from pulsation.

E. The following work shall be performed under direction of the System Test and Balance Contractor.

1. Install all automatic dampers.
2. Provide necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
3. Assemble multiple section dampers with required number of shafts through duct for external mounting of damper motors.
4. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation and affix and seal permanently in place after stratification problem has been eliminated.
5. Provide access doors to adjust, maintain, or service equipment sensors, controllers and all other devices.

3.2 DUCT STORAGE:

A. Duct shall be protected by storing on elevated supports.

B. All ducts shall have ends capped during storage.

C. The area used for storage shall be kept dry and clean.

3.3 PROTECTION AND CLEANING DURING INSTALLATION:

A. During construction, all open ends of duct installed shall be capped.

B. Prior to capping, all interior duct surfaces shall be wiped clean.

3.4 HANGING:

A. Hanging and support systems shall be in accordance with SMACNA Duct Construction Standards and drawing details.

B. Vertical ducts shall be supported by extending bracing angles to rest firmly on floors or shall be bolted to walls, columns or other construction.

C. Where duct is supported by threaded rods, see Mechanical Sound, Vibration, and Seismic Control specifications for threaded rod requirements and attachment requirements.

D. Where duct is supported by sheetmetal straps, the strap shall attach to the duct with two #10 sheetmetal screws located within 2 inches of the top of the duct.

3.5 ACCESSORIES:

A. Doors, coils, dampers, registers, grilles, diffusers, air turning vanes, air volume extractors, and other accessory items shall be installed as detailed in the SMACNA Duct Construction Standard with adequate reinforcement and support to accommodate additional weight without damage to the duct.

3.6 COMPLETION AND DEMONSTRATION:

A. Upon completion of the duct system installation, and before the Engineer has inspected the system operation, open all system dampers and turn on fans to blow all scraps and other loose material out of the duct system. Allow for a means of removal of such material.

B. Check the duct system to ensure there are no excessive air leaks through joints, at reinforcement locations, seams, points of connection with fire dampers, coils, or other duct accessories. Where there are unacceptable leaks, the leakage shall be repaired and shall be done so in a manner of a new installed system. Excessive air leaks shall be leaks that exceed industry standards, cause higher than acceptable noise, or where leakage exceeds reasonable expectations.

END OF SECTION 23 3112

SECTION 23 3113.1 - METAL DUCT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of all metal duct where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 3112 - Mechanical Duct

1.3 QUALITY ASSURANCE:

A. Codes and Standards: All work shall meet or exceed the standards and procedures (latest editions) of the following:

1. ASTM A527 Galvanized Steel Spiral Lock Seam Duct
2. Underwriter Laboratories, UL 103
3. ANSI Z223.1
4. NFPA 96

B. Material shall be free from blisters or other mechanical defects. Material shall be galvanized prime sheet steel unless noted otherwise.

C. Sheet metal thickness, cross joints, seams, slip-connections, cross-breaking, bracings, duct supports and reinforcing shall be in accordance with the more stringent requirements of ASHRAE Guide and SMACNA Duct Construction Manual for system pressure classifications. Minimum gauge thickness is 26 unless thicker gauges are indicated.

D. Grease duct doors shall be UL 1978 listed.

E. Manufacturers:

1. The following round and flat oval duct manufacturers are acceptable:

a. United McGill

b. Semco
c. Turnkey Duct Systems
d. Eastern Sheet Metal
e. Lindab
f. Hamlin
g. BHV Sheet Metal Fabricators
h. Spiral Pipe of Texas
i. Patton Industries

PART 2 - PRODUCTS

2.1 GENERAL:

A. Materials:

1. Duct shall be galvanized or as indicated elsewhere on the plans or in these specifications.
2. Plenums, collars, flashing, etc. located on roofs, exterior of the building, or other locations where exposed to the weather shall be stainless steel.

B. Closure:

1. Transverse joints and seams in sheet metal duct shall be of the types and sizes recommended by SMACNA and the ASHRAE Handbook for the specific duct pressure classification.

2.2 RECTANGULAR DUCT (DUAL WALL):

A. Duct:

1. Dual wall shall be:
   a. Outdoor supply: 3"
   b. Outdoor return: 3"

B. Materials:
1. Outer wall stainless steel (outdoor)
2. Inner wall galvanized

C. Fittings:

1. Fittings shall be constructed similar to fittings specified for single wall duct except that they shall be dual wall.

D. Liner:

1. Fittings shall have solid liner.
2. Dual wall duct shall have solid liner.

E. Insulation:

1. Insulation shall be .27K @ 75 degrees F.
2. Insulation shall be thickness of the dual wall.
3. A 1 mil (min.) polyester film shall be provided between the fiberglass insulation and airstream to prevent fibers from contacting the airstream where perforated liners are provided.
4. The insulation and film shall have a flame and smoke spread of less than 25/50.

F. Location:

1. Dual wall duct shall be provided in the following locations:

a. As indicated on plans.

b. All outdoor ductwork.

PART 3 - EXECUTION

3.1 DUAL WALL DUCT:

A. Submittals shall include:

1. Duct gauges and general construction
2. Fitting gauges and general construction
3. Liner gauges and general construction
4. Friction loss
5. Thermal conductivity factors defining the insulation characteristics

3.2 DUCT DRAWINGS:

A. Provide 1/4" scale CADD drawings indicating layout of all dual wall duct.

B. Where new duct ties into existing duct, existing duct must also be shown based upon field verified dimensions.

3.3 SUBMITTALS:

A. Provide a list of all duct materials and systems in which they are to be installed for the entire project.

3.4 CUTTING DUCTS:

A. Ducts shall be cut with a handheld plasma cutter whenever practical. This shall include, but not be limited to, cutting openings for access doors, duct taps, cutting into existing ducts, and similar applications.

END OF SECTION 23 3113.1

SECTION 23 3300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor and materials and perform all installation of duct accessories and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 3112 - Mechanical Duct

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Duct accessories shall be fabricated and installed in accordance with the manufacturer's recommendations and meet or exceed the standards and procedures (latest editions) of the following:

a. UL Standard 214 for Fire Retardancy
b. NFPA 90A and 90B
c. SMACNA
d. ASTM E84
e. AMCA Standard 500

2. Duct accessories shall have AMCA Certified Rating Seal when specified.

B. Manufacturers:

1. The following access door (low pressure) manufacturers are acceptable:

a. Ruskin
b. Air Balance
c. KEES
d. National Controlled Air

2. The following flexible duct connector manufacturers are acceptable:

    a. Ventfabrics
    b. Ductmate
    c. Approved Equal

3. The following test cap manufacturers are acceptable:

    a. Ventlok
    b. Approved equal

PART 2 - PRODUCTS

2.1 FLEXIBLE CONNECTORS:

A. General:

1. Flexible connectors shall consist of two strips of 24 gauge metal and a coated fabric.
2. Fabric used in indoor applications shall meet NFPA 90A and 90B.
3. Fabrics shall meet NFPA 701.
4. Connectors shall be unaffected by mildew, resistant to weather and have a fire retardant coating on a noncombustible fabric.
5. Connector shall be suitable for -40 degree F to 180 degree F.
6. Where duct has roll formed mating flange, metal strips shall be roll formed.

B. Indoor Applications:

1. Characteristics:

    a. Fabric: glass cloth
    b. Weight: 30 ± 2 oz/sq. yd.
    c. Tongue Tear: 40/30 lbs.
    d. Tensile Strength: 395/255 lbs.

2. Metal strips shall be galvanized or aluminum.
3. Metal strips shall be 3" minimum and fabric shall be 5" minimum.
4. Basis of design manufacturer shall be:

    a. DuctMate Proflex Neoprene

C. Locations:

1. Inlet and outlet of each duct at all equipment with a fan except grease exhaust fans.
2. Other locations where indicated.

PART 3 - EXECUTION

3.1 FLEXIBLE DUCT CONNECTORS:

A. Installed length of material shall be 50% flat length.

3.2 AIR FLOW TEST CAP:

A. Coordinate with Test and Balance Agency the required location for each test port.

B. If duct surface is not flat or test port is not available in the duct radius, weld a test port extension to the duct.

END OF SECTION 23 3300

SECTION 23 4100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of air distribution equipment and appurtenances where shown on the drawing and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following as referenced (latest editions):

a. AMCA 300 - Certified Ratings for Sound and Airflow
b. AMCA 210 - Test Code for Air Moving Devices
c. Insulation - NFPA 90A and UL 181
d. ASHRAE 52 Test Standard for filter efficiencies
e. UL Standard 900 for filter flame and smoke rating
f. Institute of Environmental Services Standard IES-RP-CC-DDI-86 for HEPA filters

B. Manufacturers:

1. The following filter manufacturers are acceptable:

a. Camfil Farr
b. American Air Filter
c. Airguard
d. Flanders Precisionaire
e. Glasfloss
f. Airflow, Inc.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Equipment with filters 4" or less in depth requires the following filters:

1. First set shall be installed before initial start-up.
2. Second set shall be installed for testing and balancing.
3. Third set shall be turned over to the Owner at final inspection.

B. Equipment with permanent filters requires the following filters:

1. One set of throwaway filters shall be installed during construction.
2. One set of permanent filters shall be installed at time of testing and balancing.

2.2 TWO INCH (2") PLEATED PANEL FILTERS:

A. MERV 13A Filters:

1. Panel filters shall be flat throwaway type constructed of high strength moisture resistant board forming a double wall around the filter media.
2. A metal support grid is bonded to the leaving air side of the pleated media.
3. The filters shall be UL Class 2 approved and listed.
4. Filter shall have a maximum initial pressure drop of 0.41 inches WG at 500 FPM and 15 pleats per linear foot for 2 inch filters.
5. Filter shall not have an electrostatically enhanced media.
6. Filter media and frame shall be from 100% recyclable material.

2.3 TEMPORARY FILTERS:

A. During start-up, preliminary testing of system, operation of system prior to system being ready for testing and balancing, or operation of a system prior to final building cleaning, the contractor shall protect all equipment, coils, and the entire duct system with filters.

B. Filters shall be MERV 8 minimum and contain an antimicrobial biocide to control the growth of mold, mildew, algae, and fungi on the filters (i.e., fibers shall not support microbial growth). Biocide shall not offgas, migrate, or leach into the airstream.

C. Basis of design filter shall be:

1. Fiberbond Dustlok

2.4 EQUIPMENT REQUIREMENTS:

A. Filters shall be provided on all equipment to protect heat transfer components from outside air, building exhaust air or other airstreams that would foul heat transfer surfaces.

B. Where no other filtration is indicated or scheduled, air handling equipment shall have a 2" pleated panel filter. The 2" filter shall be MERV 13A.

PART 3 - EXECUTION

3.1 TEMPORARY FILTERS:

A. The contractor shall install temporary filter media on all negative pressure openings if the system is to be operated prior to the final cleaning of all spaces served by a system. These openings include open return ducts, exhaust ducts, and grilles. All filters shall be replaced as often as necessary.

B. All temporary filters shall be held securely in place and with minimum bypass. Filters shall be changed as needed.

C. Systems shall not be operated without filters equaled to specified filters in place to protect coils and other heat exchanger devices.

3.2 SPARE FILTERS:

A. The spare set of filters shall be (delivered to the Owner's warehouse facility within 25 miles of the project site) (stored at the project site at the location designated by the Owner).

END OF SECTION 23 4100

SECTION 23 9005 - HEAT TRANSFER (ELECTRIC COOLING)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of heat transfer equipment and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:

1. Section 23 0502 - Common HVAC Materials

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following as referenced (latest editions):

a. ARI Standards 210/240, 340, and 360
b. ANSI Z21.47/UL - Unitary Air Conditioning Standard for Safety Requirements
c. Underwriter's Laboratory
d. NFPA 90A
e. AMCA 210 Test Code For Air Moving Devices
f. National Electrical Code
g. ASHRAE 15 - Safety Code for Mechanical Refrigeration

B. All motors and equipment shall be U.L. labeled.

C. All insulation and materials shall have a flame spread rating of less than 25 and smoke developed of less than 50.

D. All heating and cooling equipment shall bear the ARI seal.

E. All coils shall be ARI certified.

F. All electric heaters shall have impedance protection per UL519.

G. Burner assembly, including the gas train, shall be FM and IRM approved.

H. All outdoor cabinets shall meet or exceed the 500 hour salt spray test unless more stringent tests are specified.

I. Manufacturers:

1. The following constant volume packaged heating and cooling unit manufacturers (with hot gas reheat) are acceptable:

a. Trane
b. Daikin
c. JCI
d. AAON
e. Carrier

PART 2 - PRODUCTS

2.1 GENERAL:

A. General:

1. Equipment shall meet or exceed the scheduled efficiencies or ASHRAE 90.1, whichever is greater.
2. Furnish and install heating and cooling units in accordance with the drawings and as specified hereinafter.
3. Units shall be air conditioning or heat pump as shown on equipment schedules.
4. Unit shall be factory assembled and tested.
5. Standard operating range for cooling shall be 55°F to 120°F outdoor ambient except where low ambient controls are required. See equipment schedule.
6. Provide all controls and accessories for a complete operating system including but not limited to:

a. Crank case heater
b. Start capacitor kit (single phase condensers)

7. Refrigerant shall be R410A.
8. Motors shall be premium efficiency.

B. Outdoor Cabinets:

1. Unit shall be designed for outdoor installation.
2. Cabinet shall be insulated and constructed of heavy duty galvanized steel. Frame and panels shall be 18 gauge minimum. They shall be zinc coated or epoxy coated with a baked-on finish.
3. Prewired control panel.

4. Hinged access doors with quick release handles shall be provided as follows:

   a. On all access sections on units 3 tons and larger.
   b. On filter sections for all units smaller than 3 tons.

5. Single wall cabinets shall be thermally and acoustically insulated with a minimum of R4 fiber insulation. Provide a foil, sprayed neoprene, or mat faced finish.
6. Dual wall cabinets shall be finished with a baked acrylic finish.

C. Refrigerant Circuits:

1. All units shall have factory installed liquid line filter dryer, liquid line sight glass, pressure tap ports, check valves, and suction and liquid service valves.
2. Heat pump units shall also have reversing valve, suction line accumulator, and discharge muffler.
3. Where low ambient control is required, electronic head pressure control shall be provided.

D. Compressors (up to 7 tons):

1. Compressor shall have centrifugal oil pump.
2. Motor shall have internal temperature and current sensing motor.
3. Compressor shall have totally dipped hermetic motor windings.
4. Compressor shall be resiliently mounted and seismically isolated.

E. Outdoor Coil:

1. The outdoor coil shall be constructed of aluminum spine fin mechanical bonded to seamless aluminum or copper tubing with all joints brazed.
2. Surface shall be engineered to facilitate defrost water runoff.
3. Louvered panels.

F. Indoor Coil:

1. The indoor coil shall be constructed of aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.
2. Coil shall include factory installed refrigerant metering device and refrigerant line fittings.

G. Outdoor Fans:

1. Fan motors shall be permanently lubricated, weatherproof motors suitable for outdoor use.
2. Motor shall have built-in current and thermal overload protection.
3. Fans shall be resiliently mounted and seismically isolated.
4. Fans shall be statically and dynamically balanced.
5. Provide PVC coated fan guard.

H. Indoor Fan:

1. Indoor fan shall be direct drive plenum fan with ECM motor and speed adjustment feature or inverter duty motor with a variable frequency drive.
2. Fan shall be seismically isolated.
3. The fan shall be mounted on spring isolators with a minimum 1" deflection.

I. Safeties:

1. Heat pumps shall have a solid state defrost control. Defrost shall occur only when coil saturated suction temperature indicates freezing temperatures. Defrosting shall be limited to a maximum of 10 minutes over a 90 minute period.
2. Provide a time-guard device to prevent compressor recycling by requiring a 5-minute delay before restarting.
3. Three phase protection.
4. Drain pan float switch.

J. Electrical (Outdoor Unit):

1. Provide control voltage transformer.
2. Provide an unswitched GFI service receptacle on all three phase outdoor units. Receptacles shall have metal covers.
3. Provide transformer for motor or heaters as required.
4. Transformers shall be factory mounted and wired.
5. Power to the packaged unit shall be through the interior of the unit curb.

K. Electric Heaters:

1. Heaters shall have a total output as scheduled on drawings.
2. Each heater assembly shall include power supply fusing if over 48 amps, automatic resetting limit switches and heat limiters for thermal protection.
3. Heaters shall be provided with polarized plug for quick connection to unit low voltage wiring.
4. Electric heaters factory furnished and installed capacity not to exceed scheduled capacity at rated voltage.
5. If larger heaters are supplied, they shall not be large enough to require larger supply wiring or disconnects.
6. Heaters shall have SCR control except where staged heaters are scheduled.

L. Refrigerant Circuit (Units with Hot Gas Reheat):

1. Reheat control shall maintain space setpoint to ± 2 degrees F.
2. Discharge air temperature shall be adjustable from the building automation control system.

M. Drain Pan:

1. Provide dual slope insulated noncorrosive drain pan.

N. Filters:

1. Provide flat filter rack for 2 inch pre filter.
2. Where additional filters are specified, additional filter racks shall be provided for the additional filters.

O. Indirect Fired Gas Furnaces (Units with Gas Heat):

1. General:

a. Furnace shall be an integral component of packaged equipment.
b. The furnace shall be natural gas.

2. Furnace:

a. The gas furnaces shall contain a heat exchanger of 439 stainless steel, die-formed burners of 439 stainless steel and a stainless steel drip pan.
b. Furnaces shall be gravity vented unless power venting is indicated.
c. Minimum thermal efficiency shall be 80 percent unless a higher efficiency is indicated.
d. Vent shall be raintight.

3. Burner:

a. The burner assembly shall be complete with pressure regulator, main manual shut-off valve, gas connections and controls.
b. Provide a gas regulator to reduce line pressure to burner pressure.
c. Burner shall be designed to operate:

1) Natural gas: 5" w.g. to 11" w.g.

d. The ignition system shall be:

1) Natural gas: intermittent spark ignition system.

e. Provide a burner air sheet for propane systems.
f. Burner shall be modulating with a 10:1 turndown (min.) unless noted otherwise.

P. Outside Air Intake:

1. Provide outside air intake hoods with birdscreen when outside is specified directly from outdoors.
2. Settable low leak, motorized, outside air dampers.

Q. Provide BacNet communication card on all equipment.

R. Controls:

1. The unit shall be provided with digital controls to provide the specified sequence of operation. See the Sequence of Operations specification.

2. Space temperature and humidity sensors shall be capable of controlling the unit in cooling, heating, and dehumidification modes.
3. The space sensor shall have an override button.
4. The unit controller shall provide as a minimum:
    a. Space cooling setpoint
    b. Space heating setpoint
    c. Space humidity setpoint
    d. Supply air reheat setpoint

2.2 PACKAGED UNITS (CONSTANT VOLUME):

A. Unit:
1. Unit shall be single wall construction.
2. Unit shall have an outside air louver or hood.

B. Reheat Coil:
1. Hot gas reheat with full modulation.

C. Indoor Fan:
1. Fans shall be direct drive.
2. Fan motor shall be ECM type.

D. Gas Heat:
1. 2-stage gas heat

E. Accessories:
1. Factory mounted circuit breaker
2. Modulating OA damper, 2-position return air damper.

2.3 PACKAGED UNITS (VARIABLE AIR VOLUME):

A. Unit:
1. Unit shall be single wall construction.
2. Unit shall have an outside air louver or hood.
3. 2" deflection seismic vibration isolation springs on fans.

B. Variable Frequency Drives:
1. Airflow modulation shall be provided by a variable frequency drive (VFD) with bypass. This VFD shall be factory mounted, completely wired, and functionally tested.

C. Reheat Coil:

1. Hot gas reheat with full modulation.

D. Gas Heat:

1. Modulating gas heat with 10:1 turndown.

E. Accessories:

1. Factory mounted circuit breaker
2. Modulating OA damper, 2-position return air damper.

2.4 SPLIT SYSTEM UNITS (DUCTED):

A. Controls:

1. Provide a control wiring terminal board in the outdoor unit to match the indoor unit terminal board and thermostat terminals.
2. Airflow switch interlocked with condenser operation.

B. Air Handler:

1. Unit enclosures shall be single wall insulated, constructed of heavy-gauge steel, and finished with a baked-on acrylic finish.
2. Units shall be acoustically and thermally insulated with a minimum of 1/2 inch 1-1/2 lb. density mat-faced glass fiber material.
3. Insulation shall have a foil, sprayed neoprene or mat faced finish.

C. Accessories:

1. Provide factory return air plenum permitting side or front return air inlet.

2. Filter housing

2.5 SPLIT SYSTEM UNITS (DUCTLESS):

A. Controls:

1. Provide a control wiring terminal board in the outdoor unit to match the indoor unit terminal board and thermostat terminals.
2. Airflow switch interlocked with condenser operation.
3. Hard wired thermostat (with 24 hour time clock control.)

B. Indoor Wall Mounted Unit:

1. Unit shall be compact, lightweight design suitable for wall mounting.
2. Unit vanes adjusts to downflow in heating mode and horizontal airflow in cooling mode.

C. Filters:

1. Washable filter

D. Accessories:

1. Condensate pump
2. Heavy duty PVC enclosure over exposed utilities (refrigerant lines, drain lines, etc.)

2.6 DEHUMIDIFICATION CONTROL MODULE:

A. Provide a dehumidification control module for the following systems:

1. IDHP-2

B. The relay board includes relays and wiring terminal strips for a plug and play connection between a conventional auto-changeover thermostat/humidistat and the heat pump.

C. Upon a rise in space humidity, the unit shall energize cooling. If the space temperature drops below its setpoint, the unit's electric heat shall energize.

D. The basis of design manufacturer shall be:

1. Simple Engineered Solutions Model HPDM (contact John Suggs 910-231-9929).

PART 3 - EXECUTION

3.1 CONDENSATE DRAIN LINES:

A. Provide a weather seal grommet where drain penetrates casing and wall sleeve.

3.2 WARRANTY:

A. Compressors shall have five (5) year parts and labor warranty:

B. Compressor Failure:

1. When a compressor fails within the warranty period, the compressor shall be replaced.
2. If the system has multiple compressors on a single refrigerant circuit, and one compressor fails, all compressors shall be replaced during the warranty period.

3.3 DEHUMIDIFICATION CONTROL MODULE:

A. Coordinate thermostat/humidistat requirements with contractor.

B. Review the approved equipment shop drawings prior to submitting shop drawings.

C. Secure control module in the air handler or in an enclosure.

END OF SECTION 23 9005

SECTION 26 0500 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL CONDITIONS

1.1 WORK INCLUDED:

A. The work covered under these sections of the specifications consists of furnishing all labor, equipment, supplies and materials, and of performing all operations, including cutting, channeling, chasing, excavating and backfilling necessary for the installation of complete wiring systems, raceways, wiring, and electrical equipment in accordance with this section of the specifications and the accompanying drawings.

B. The Electrical Work shall include, but not be limited to, the following:

1. Electrical distribution system
2. Raceway system
3. Conductors and cables

1.2 RELATED WORK:

A. Related work to Division 26:

1. Division 1
2. The provisions, conditions, and requirements preceding and including general and supplemental conditions apply to and are a part of Division 26.

1.3 DEFINITIONS:

A. Provide: Furnish and install complete ready for use, including all accessories required for operation.

B. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance, support and accessories required for operation.

C. Install: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

1.4 DESCRIPTION OF SYSTEMS:

A. Furnish and install all materials for systems, resulting upon completion, in functioning systems in compliance with performance requirements specified. The omission of express reference to any parts necessary for or reasonably incidental to a complete installation shall not be construed as a release from furnishing such parts.

B. The wiring specified and shown on the drawings is for complete and workable systems. Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no cost to either the contract or to the Owner. Changes in electrical

service to equipment due to substitutions of equipment by any Divisions of this specification shall be at no additional cost to the Owner.

1.5 QUALITY ASSURANCE:

A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service.

1.6 REQUIREMENTS OF REGULATORY AGENCIES/CODE COMPLIANCE:

A. Contractors shall submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits, and pay all required fees.

B. All work shall conform to the following Building Codes:

1. National Electrical Code (NEC-2020)
2. South Carolina Building Code (SCBC 2021)

C. All work shall conform to all federal, state and local ordinances.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS:

A. All requests for substitutions should be submitted so as to be received by the Engineer at least 10 days before bid date and must be approved before award of Contract.

PART 3 - EXECUTION

END OF SECTION 26 0500

SECTION 26 0501 - ELECTRICAL COORDINATION

PART 1 - GENERAL CONDITIONS

1.1 INTERPRETATION OF CONTRACT DOCUMENTS:

A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 26.

B. Attention is directed to Instructions to Bidders and to Division 1, General Conditions, which are binding in their entirety on this portion of the work in particular to paragraphs concerning materials, workmanship and substitutions.

1.2 EXISTING CONDITIONS:

A. Visit the premises and become familiar with all details of the work, working conditions, verify dimensions in the field, advise the Engineer of any discrepancy, and submit shop drawings of any changes he proposes to make, in quadruplicate for approval, before starting the work. Contractor shall install equipment in a manner to avoid building interference.

1.3 SHOP DRAWINGS:

A. The Contractor shall not purchase any materials or equipment prior to receipt of reviewed shop drawings.

B. Submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements.

C. Shop drawing sets shall be suitably bound and indexed. Loose sheets are not acceptable.

D. Catalog cuts submitted for approval shall be legible and shall clearly identify equipment being submitted. Items of the submittal that have been faxed or scanned are not acceptable.

E. Before preparing drawings, Contractor shall consult all contract drawings and specifications in detail, obtain manufacturer's recommended installation instructions, and have shop drawings prepared based on specific equipment and material intended for installation. A principal of the contracting firm shall sign all shop drawings (indicating conformance with plans and specifications) before submission

F. Approval on shop drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing (and in letter form) called attention to such deviations at the time of submission and secured written approval; nor shall it relieve him from responsibility for errors in shop drawings or schedules.

G. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1.4 AS-BUILT DRAWINGS:

A. The Contractor shall keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment on these job drawings.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION:

A. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to any Work, the Contractor shall carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where his installation may properly commence.
2. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.
2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.2 INSTALLATION:

A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings. Secure equipment using fasteners suitable for the use, materials, and loads encountered. If requested, submit evidence proving suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.

B. Working spaces shall be not less than specified in the National Electrical Code for all voltages specified.

3.3 COORDINATION WITH OTHER TRADES:

A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to the attention of Engineer, in writing, prior to signing of contract; or Contractor shall, at his own expense, provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interferences.

3.4 WORK PERFORMANCE:

A. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior condition.

B. Where conduits, wireways, busduct, and other electrical raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight, and completely fill clearances between raceways and openings.

3.5 CONNECTION OF EQUIPMENT FURNISHED AND INSTALLED UNDER OTHER DIVISIONS OF THE WORK:

A. This Contractor shall rough-in and make final electrical connection to all pieces of equipment requiring electrical connections. Such equipment being furnished and installed under other Divisions of the Work.

B. This Contractor shall provide whatever incidental devices are necessary for final connection, such as, but not necessarily limited to outlet boxes, receptacles, connectors, clamps and switches.

END OF SECTION 26 0501

SECTION 26 0502 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SCOPE:

A. This section describes the electrical demolition work to be done to existing facilities.

B. The term demolition, as used in this specification, shall mean any and all removal of electrical equipment as shown on the demolition plans or as described herein.

1.2 RELATED WORK/SECTIONS:

A. In addition to this section, refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:

1. Division 1
2. All other Division 26 sections

1.3 WORK INCLUDED:

A. The work under this section consists of furnishing equipment, performing labor and services necessary for the demolition and removal of the electrical system shown on the drawings and hereinafter noted.

1.4 SALVAGED MATERIALS:

A. The Owner shall have priority for the selection of salvaged material and equipment. Any equipment and material selected to remain the property of the Owner shall be removed and delivered to a location on the site as designated by the Owner. Material and equipment not retained by the Owner shall become the property of the Contractor and shall be removed from the site by him.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify field measurements and circuiting arrangements prior to commencement of work.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing existing installation.

3.2 PREPARATION:

A. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

B. Reconnect existing circuits and services interrupted by demolition.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK:

A. Remove abandoned wiring to source of supply.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

D. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

3.4 SERVICE CONTINUITY:

A. At all times during the construction of the project, electric service shall be maintained to all portions of the site except with prior written approval of interruptions. Any required interruptions of electric service due to work being performed under this contract shall be scheduled in advance after consultation with the Engineer and the Owner and shall generally occur between the hours of five o'clock p.m. and five o'clock a.m. The Contractor shall be responsible for any material and labor costs, including overtime pay, to meet these requirements as part of the Division 26 scope of work.

B. At least 14 days prior to the requirement of any interruption of electrical service, the Contractor shall furnish to the Engineer for approval a written plan for the work associated with the outage including a description of the installation and removal of temporary wiring and facilities necessary to be installed.

END OF SECTION 26 0502

SECTION 26 0503 - CUTTING, PATCHING AND REPAIR

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK:

A. Cutting: Furnish all labor, materials, tools and equipment and perform all operations in connection with the cutting of new and existing building structure, finishes and building assemblies as specified hereinafter.

B. Patching: Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of watertight sealant as required to seal voids or gaps around Division 26 equipment at penetrations through exterior floors, walls, and roof systems.

C. Repair: Furnish all labor, materials, tools and equipment required to repair all existing or new building components and finishes, outside components, landscaping, utilities, or other appurtenances that are damaged as a result of the performance of this contract.

1.2 QUALITY ASSURANCE:

A. All fill, void, and cavity firestopping materials shall be UL classified and FM approved as a through-penetration Firestop System.

B. Sealants shall equal or exceed all requirements of ASTM E-814.

C. No penetrations through any fire rated walls, floors, roofs, floor-ceilings, or ceiling-roof assemblies will be allowed unless they are sealed with firestop systems which are included in assemblies tested in accordance with ASTM E119 and ASTM E814 and are Factory Mutual approved for the assembly.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Materials shall be new, unused, (not more than one-year old) properly stored and matching existing in colors, texture, finish, appearance and function.

PART 3 - EXECUTION

3.1 GENERAL:

A. Patch and repair all building finishes, structural components, or other appurtenances that are damaged as a result of the performance of this contract. Patch and repair work shall

include finishes, components, substructure and materials required for the installation of such work in accordance with standard practices.

B. Patched and repaired work shall be finished to match existing or adjacent construction and conditions.

END OF SECTION 26 0503

SECTION 26 0519 - WIRE AND CABLE - BUILDING WIRE (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 SCOPE:

A. This section includes the furnishing, installation, and connection of the building wire for power and lighting circuits.

B. Unless otherwise specified in other sections of these specifications, control wiring shall be provided, installed, and connected to perform the functions specified in other sections of these specifications.

1.2 RELATED WORK/SECTIONS:

A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Building Wire (Power and Lighting):

1. Cable and wire shall be in accordance with UL, NEC, as shown on the drawings, and as hereinafter specified.
2. Conductors:

    a. Shall be annealed copper.
    b. Shall be stranded for sizes No. 8 and larger. Sizes No. 10, and smaller shall be solid.
    c. Size shall be not less than shown on the drawings. Minimum size shall be No. 12 AWG.

3. Insulation: Unless otherwise shown on the drawings, insulation shall be as follows:

    a. THWN - Dry, Wet Locations.

4. Color Code:

    a. Shall match existing color code used in building.
    b. All No. 12 and No. 10 branch circuit conductors shall have solid color compound or solid color coating.
    c. No. 8 AWG and larger phase conductors shall have either:

        1) Solid color compound or solid color coating.

2) Stripes, bands, or hash marks of colors specified above.

d. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

B. Splices and Joints:

1. Shall be in accordance with UL and NEC.
2. Branch circuits (No. 10 AWG and smaller):

a. Connectors shall be solderless, screw-on, pressure cable type, 600 volt, 105 degree C, with integral insulation. They shall be approved for copper conductors and shall be reusable.
b. The integral insulator shall have a skirt to completely cover the stripped wires.
c. The number, size, and combination of conductors as listed on the manufacturers packaging shall be strictly complied with.

3. Feeder Circuits:

a. Connectors shall be indent, hex screw, or bolt clamp-type. Material shall be high conductivity and corrosion-resistant.
b. Connectors for cable sizes 250 MCM and larger shall have not less than two compression indents.
c. Splices and joints shall be insulated with materials approved for the particular use, location, voltage, and temperature. Insulation shall be not less than that of the conductors being joined.
d. Plastic electrical insulating tape:

1) Tape shall be flame retardant, cold and weather resistant.

C. Control Wiring:

1. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring.
2. Wire size shall be large enough so that the voltage drop under inrush conditions will not adversely affect operation of the controls.

D. Wire Lubricating Compound shall be suitable for the wire insulation and conduit it is used with and shall not harden or become adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, as shown on the drawings, and as hereinafter specified.

B. All wiring shall be installed in raceway systems, except where direct burial is shown on the drawings.

C. Cables and wires shall be spliced only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.

D. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.

E. Cable and wire entering a building from underground shall be sealed between the wire and conduit, where the cable exits the conduit, with a nonhardening approved compound.

F. Wire Pulling:

1. Suitable installation equipment shall be provided to prevent cutting or abrasion of conduits during pulling of feeders.
2. Ropes used for pulling feeders shall be made of suitable nonmetallic material.
3. Pulling lines for feeders shall be attached by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All cables to be pulled in a single conduit shall be pulled in together.

G. Splices and terminations shall be mechanically and electrically secure.

3.2 FIELD TESTING:

A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.

B. Test shall be performed by megger and conductors shall test free from short-circuits, grounds, and opens.

C. Conductors shall be tested phase-to-phase and phase-to-ground.

END OF SECTION 26 0519

SECTION 26 0533 - METALLIC CONDUITS/RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE:

A. This section includes the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems.

B. Types of raceways in this section include the following:

1. Galvanized rigid metal conduit (GRC)
2. Intermediate metal conduit (IMC)
3. Electrical metallic tubing (EMT)
4. Flexible metal conduit
5. Liquidtight flexible metal conduit

C. The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK/SECTIONS:

A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:

1. Division 1
2. All other Division 26 sections

1.3 QUALITY ASSURANCE:

A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to raceways systems and provide products and components which have been UL listed and labeled.

C. NEC Compliance: Comply with requirements as applicable to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.1 RIGID STEEL CONDUIT:

A. Metal rigid steel conduit shall conform to ANSI C80.1 and Underwriter's Laboratories UL-6 specification, ANSI C80.1.

B. Conduit shall be hot-dipped galvanized to provide a corrosion resistant coating.

C. Fittings: Fittings shall be ANSI/NEMA FB 1 threaded type, hot dipped or electronic plated. Threaded conduit to be secured to boxes, cabinets, etc., by means of galvanized threaded bushings on the inside and bond-type locknuts on the inside and outside of such boxes and cabinets. Fittings shall be watertight and the same material as conduit installed with factory manufactured elbows.

2.2 RIGID INTERMEDIATE STEEL CONDUIT (IMC):

A. Intermediate Metallic Conduit shall conform to ANSI C80.1 and proposed Underwriter's Laboratories UL 1242 specification.

B. Conduit shall be hot-dipped galvanized to provide a corrosion resistant coating. Intermediate Metallic Conduit (IMC) shall have galvanized/metallized thread protection, and pipe interior shall be protected by corrosion inhibiting coating.

C. Fittings: Shall be similar to GRC.

D. Maximum allowable size shall be (4) inches.

2.3 ELECTRICAL METALLIC TUBING (EMT):

A. Electrical metallic tubing shall conform to ANSI C80.3 and Underwriter's Laboratories UL 797.

B. EMT shall be hot-dipped galvanized steel with internal coating of silicone epoxy lubricant to assist in wire pulling.

C. Fittings: Shall be compression type, steel or malleable iron. Set screw or indentation type of fittings are not acceptable.

2.4 FLEXIBLE METAL CONDUIT:

A. Flexible metal conduit shall conform to UL 1.

B. Flexible conduit to be of hot-dipped galvanized interlocked spirally wound steel strip.

C. Fittings shall be multiple point type, threading into the internal wall of the conduit convolutions, and shall have insulated throat. Connectors to be galvanized and be suitable for connection to associated boxes and conduits.

2.5 LIQUID TIGHT FLEXIBLE METAL CONDUIT:

A. Liquid-tight flexible metal conduit shall conform to UL 360.

B. Liquid-tight flexible metal conduit shall consist of flexible galvanized steel tubing over which is extruded a liquid-tight jacket of polyvinyl chloride (PVC). Conduit shall be provided with a continuous copper bonding conductor wound spirally between the convolutions.

C. Fittings used shall be reusable type of malleable iron/steel construction, electro zinc plated inside and outside, furnished with nylon insulated throat and taper threaded hub. Connectors to be galvanized and be suitable for connection to associated boxes and conduits.

2.6 RIGID NON-METALLIC CONDUIT (PVC) :

A. Conduit shall be UL rated 90°C and to UL-651. Fittings shall conform to UL-514.

B. Conduit shall be S40 wall thickness made from polyvinyl chloride (recognized by UL) compound which includes inert modifier to improve weatherability and heat distortion. Conduit and couplings shall be homogenous plastic material free from visible cracks, holes, or foreign inclusions. Conduit bore shall be smooth and free from blisters, nicks, or other imperfections which could mar conductors or cables.

C. Bends: 90° bends shall be made with galvanized rigid steel with bitumastic (externally applied) elbows. Bends other than 90° shall be made from S80 PVC conduit.

D. Where conduit rises from ground or through slab utilize galvanized rigid conduit with external PVC or bituminous coating or protective tape wrapping.

2.7 CONDUIT SUPPORTS:

A. All parts and hardware shall be zinc-coated or have equivalent corrosion protection.

B. Pipe straps: Fed. Spec. FF-S-760, type 1, style A or B.

C. Individual conduit hangers: Shall be designed for the purpose, and have pre-assembled closure bolt and nut, and provisions for receiving hanger rod.

D. Multiple conduit (trapeze) hangers shall be not less than 1-1/2 x 1-1/2 inch, 12 gage steel, cold formed, lipped channels. Hanger rods shall be not less than 3/8 inch diameter steel.

E. Solid masonry and concrete anchors: Fed. Spec. FF-S-325 shall apply. Anchors shall be GROUP III self-drilling expansion shields, or machine bolt expansion anchors GROUP II type 2 or 4, or GROUP VII.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE:

A. Branch circuits and feeders:

1. Exposed to weather - GRC or IMC
2. Concealed dry interior location - EMT.
3. Underground - S40 (PVC). Where conduit rises from ground utilize GRC or IMC conduit.

3.2 CONDUIT INSTALLATION - GENERAL:

A. Installation shall be in accordance with UL, NEC, as shown on the drawings, and as hereinafter specified.

B. Contractor shall lay out and install conduit runs to avoid proximity to hot pipes. In no case will a conduit be run within three inches of such pipes, except where crossings are unavoidable and then conduit shall be kept at least one inch from the covering on pipe crossed.

C. Conduits shall be supported as required to comply with applicable paragraphs of the NEC.

D. Conduit installation shall be as follows:

1. Installed as complete runs before pulling in cables or wires.
2. Flattened, dented, crushed or deformed conduit is not permitted and shall be removed and replaced at no cost to the Owner.
3. Installed so they will not obstruct head room, walkways, doorways or work by other trades.
4. Cut square with a hacksaw, reamed, burrs removed, and drawn up tight.
5. Mechanically and electrically continuous.
6. Supported within one foot of all changes of direction, and within one foot of each enclosure to which connected.
7. Ends of empty conduit to be closed with plugs or caps at rough-in stage to prevent entry of debris until wires are pulled in.
8. Conduits shall be secured to cabinets, junction boxes, pull boxes, and outlet boxes by bonding type locknuts.

E. Conduit Bends:

1. Shall be made with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
3. Conduits shall not be bent with a pipe tee or vice.

F. Conduit shall be securely fastened in place at intervals as specified by the code using suitable straps, hangers and other supporting assemblies. All strap hangers and supporting assemblies:

1. Shall be of rugged construction capable of supporting weight with a reasonable factor of safety.
2. Shall be adequately protected against corrosion.

G. In wet locations or in locations where corrosive conditions are present, vertical and horizontal runs of conduit shall be firmly supported so that there is at least 1/4" air space between the conduit and the wall or supporting surface. Spacers and supporting straps shall be of malleable iron construction, hot dipped galvanized.

H. EMT shall be securely fastened in place at intervals as specified by the code using straps, hangers and other supporting assemblies.

1. Spacers and supporting straps shall be of rugged malleable iron or steel construction hot dipped galvanized.

I. Flexible conduit when installed shall have sufficient slack to avoid sharp flexing and straining due to vibration and thermal expansion/construction. Conduit shall be installed in such a manner that liquids will tend to run off the surface instead of draining towards the fittings.

J. Concealed work installation:

1. Conduit shall be run parallel or perpendicular to the building lines.
2. Branch circuit conduits, and conduits feeding ceiling lighting shall not be supported by the suspended ceiling, lighting fixtures, or air conditioning ducts.
3. Recessed lighting fixtures shall be connected to conduit with not over six feet of flexible metal conduit.

K. Exposed work installation:

1. Conduit shall be run parallel or perpendicular to the building lines.
2. Horizontal runs shall be installed close to the ceiling or beams and secured with approved conduit straps.
3. Horizontal or vertical runs shall be supported at not over eight foot intervals.

3.3 MOTORS AND VIBRATING EQUIPMENT:

A. Flexible metal conduit shall be used for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Flexible metal conduit shall be liquid-tight when installed in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, and locations subject to seepage or dripping of oil, grease or water. Flexible metal conduit shall be installed with green ground wire.

3.4 CONDUIT SUPPORTS, INSTALLATION:

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Pipe straps or individual conduit hangers shall be used for supporting individual conduits.

C. Multiple conduit runs shall be supported by trapeze hangers. Trapeze hangers shall be designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds. Each conduit shall be attached by U-bolt or other approved fastener.

D. Conduit shall be supported independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, etc.

E. Solid Masonry and Concrete: Fasteners shall be as follows:

1. New construction: Generally, steel or malleable iron concrete inserts in concrete prior to pouring.
2. Existing construction:
   a. Steel expansion anchors not less than 1/4-inch bolt size and not less than 1-1/8 inch embedment.
   b. Power set fasteners shall be approved, and not less than 1/4-inch diameter with depth of penetration not less than three inches.
   c. Anchors or fasteners attached to concrete ceilings shall be vibration and shock resistant.

F. Metal structures. Fasteners shall be machine screw or devices specifically designed and approved for the application.

3.5 PULL WIRES:

A. Install a # 14 gauge fish wire in all empty conduits, except telephone and communications. Install a nylon pull string in telephone and communication conduits.

END OF SECTION 26 0533

SECTION 26 0535 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section includes the furnishing, installation and connection of all outlet boxes, junction boxes, and floor boxes as shown on the drawings or as required to house the intended wiring, devices or equipment.

B. Types of electrical boxes and fittings specified in this section include the following:

1. Outlet boxes
2. Junction boxes
3. Pull boxes

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. Outlet and Device Boxes (dry interior locations): Provide galvanized coated sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as required by particular application, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with conduit size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

B. Outlet and Device Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.

C. Outlet and Device Boxes (damp and wet locations): Provide corrosion resistant cast metal raintight outlet and wiring device boxes of types, shapes and sizes required for each application, including depth of boxes, with threaded conduit holes for fastening electrical conduit, and cast metal face plates. Where weatherproof devices are indicated, provide spring hinged watertight caps suitable configured for each application, including face plate gaskets and corrosion resistant plugs and fasteners.

D. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suite each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. Bushings, Knockout Closures, and Locknuts: Provide corrosion resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

3.2 GROUNDING:

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION 26 0535

SECTION 26 2816-SAFETY/DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section includes the furnishing, installation, connection, and wiring of safety switches.

1.2 QUALITY ASSURANCE:

A. Safety/Disconnect switches shall conform to Underwriter's Laboratories UL 98, "Enclosed and Dead-Front Switches."

1.3 SUBMITTALS:

A. Submit catalog cuts and descriptive literature for approval in accordance with Section 26 0500, Electrical General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL SAFETY/DISCONNECT SWITCH FEATURES:

A. Furnish and install safety/disconnect switches as indicated on the plans and specifications.

B. Switches shall be NEMA type HD (Heavy Duty) and UL listed.

C. All switches shall have switch blades which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60 degrees C and 75 degrees C, aluminum or copper wires.

D. Switches shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF".

E. Switches shall be horsepower rated for AC and/or DC as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600

volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL listed short circuit rating of the switch, when equipped with Class H fuses, shall be 10,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amperes.

F. Disconnect switches shall be equipped with ground lug.

2.2 NEMA 1 AND 3R HEAVY DUTY SAFETY/DISCONNECT SWITCHES:

A. Switches shall be furnished in NEMA 1 general purpose enclosures unless exposed to weather which shall be NEMA 3R. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel.

B. Switches shall comply with paragraph 2.01 of this section.

2.3 NEMA 4X HEAVY DUTY SAFETY/DISCONNECT SWITCHES:

A. Provide NEMA 4X disconnect switches where indicated on the drawings.

2.4 SPECIFIED MANUFACTURERS:

A. Specified manufacturers shall be as follows, or approved equal:

1. General Electric
2. Square D
3. Siemens
4. Eaton

PART 3 - EXECUTION

3.1 INSTALLATION LOCATION:

A. As a general rule, install switches on the equipment it serves, if shown that way on the drawings. Do not install switch on equipment removable panel.

B. All switches shall be accessible.

3.2 GROUNDING:

A. Connect ground wires to ground lug.

3.3 CONDUIT BUSHINGS:

A. Use plastic bushings where conduit enters switch.

END OF SECTION 26 2816