

SECTION 00 2115
RFI FORM

CONTRACTOR'S REQUEST FOR INFORMATION NO. _____ F&D RFI NO: _____ (F&D USE)

NAME OF PROJECT: Boiler Replacement, HVAC Upgrades & Asbestos Abatement

NAME OF OWNER: Yonkers Public Schools

FACILITY: Westchester Hills School 29

DATE: _____

A/E PROJECT NO: 19359.02

ARCHITECT: Fuller and D'Angelo, P.C.

45 Knollwood Road, Elmsford, NY 10523

Tel: 914-592-4444; Fax: 914-592-1717

William Means, RA

WilliamM@fullerdangelo.com

FROM (CO. NAME): _____

CONTACT NAME: _____ **Tel:** _____

SUBJECT: _____

DISCIPLINE/TRADE: _____

DWG./SPEC. REFERENCE: _____

QUESTION: _____

___ **FIELD CONDITION** _____

___ **DRAWING/SPEC** _____

___ **DISCREPANCY** _____

___ **OWNER CHANGE** _____

___ **CLARIFICATION** _____

___ **CONTRACTOR'S SUGGESTION (IF APPLICABLE):** _____

ANSWER

ARCHITECT'S SIGNATURE: _____ **DATE:** _____

Note: review and any responses to this request for information by the architect/engineer is strictly for design intent only and does not constitute acknowledgement or acceptance of any cost or schedule implications unless specifically presented by the contractor. By submission of this request for information, the contractor assumes all responsibility in the absence of an approved change order or work directive.

END OF SECTION

Fuller and D'Angelo, P.C.
Architects and Planners

SECTION 01 1000
SUMMARY OF CONTRACT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 PROJECT

- A. Project Description: Boiler Replacement, HVAC Upgrades & Asbestos Abatement
- B. Facility: Westchester Hills School 29
- C. Address: 47 Croydon Road, Yonkers, New York
- D. Owner: Yonkers Public Schools
- E. Architect's Name Fuller and D'Angelo, P.C., Architects and Planners

1.3 PROJECT

- A. The work includes but not limited to:
 - 1. Asbestos Abatement,
 - 2. Removals.
 - 3. Masonry.
 - 4. Plasatic Laminate Casework
 - 5. Removal and replacement of existing flooring finishes.
 - 6. Removal and replacement of existing ceilings.
 - 7. Removal and replacement of existing lights.
 - 8. Plumbing.
 - 9. HVAC modifications & controls.
 - 10. Boiler replacement.
 - 11. Select ventilation system equipment and control upgrades.
 - 12. Electrical Renovations.

1.4 CONTRACT DESCRIPTION

- A. Contract Type: Multiple contracts are separate contracts, representing significant construction activities, between Owner and separate contractors. Each contract is performed concurrently and coordinated closely with construction activities performed on Project under other contracts. Contracts for this Project include the following
 - 1. General Construction Contract including asbestos abatement.
 - 2. Plumbing Contract
 - 3. Heating, Ventilating, Air-Conditioning (HVAC) Contract
 - 4. Electrical Contract
- B. The work of each Contractor is identified in this Project Manual and on the Drawings.
- C. Local custom and trade-union jurisdictional settlements do not control the scope of Work included in each prime contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, the affected contractor(s) shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruption and delays.

- D. If it becomes necessary to refer to the contract documents to determine which prime Contract includes a specific element of required work, begin by referring to the prime Contracts, themselves; then, if a determination cannot be made from the prime Contracts, refer, in the following order, to the Supplementary Conditions, if any, this section of the Specifications, followed by the other Division-I sections and finally with the Drawings and other Sections of the Specifications.
- E. If, after referring to the contract documents, it cannot be clearly determined which prime Contractor will perform a specific item of required work, then, that item of work will be brought to the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. attention in writing for determination.
- F. Summary by References: Work of the Contract can be summarized by reference to the School Facilities Management Contract Manual And Specifications, Specification Sections, Drawings, or Addenda to Contract Documents issued subsequent to the initial printing of this Project Manual, and including but not necessarily limited to printed material referenced by any of these. It is recognized that the work of the Contract is unavoidably affected or influenced by governing regulations, natural phenomenon, including weather conditions, and other forces outside the contract documents.

1.5 RELATED REQUIREMENTS

- A. YPS Front End Documents or School Facilities Management Contract Manual And Specifications.
- B. Attachment B: Division 01 General Requirements and Technical Specification.

1.6 JURISDICTIONAL DISPUTES

- A. If the Contractor has engaged the services of workers and/or subcontractor who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the YPS Office of Facilities Management, any conflict between its agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.
- B. The Contractor shall ensure that its work continues uninterrupted during the labor dispute and will be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes

1.7 SUBCONTRACTORS/SUPPLIERS

- A. All subcontractors shall be submitted to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for approval.

1.8 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of removal and alterations work is shown on drawings.
- B. Refer to paragraph 1.3 for general scope of project
- C. Maintain all building systems in operation during construction until acceptance of the project.
- D. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- E. HVAC: Alter existing system and add new construction, keeping existing in operation.
- F. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- G. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- H. Telephone: Alter existing system and add new construction, keeping existing in operation.
- I. Security System: Alter existing system and add new construction, keeping existing in operation.

1.9 OWNER OCCUPANCY

- A. Refer to School Facilities Management Contract Manual and Specifications for occupancy and hours building is available during constructions.

- B. Cooperate with YPS Office of Facilities Management to minimize conflict and to facilitate Yonkers Public Schools's operations.

1.10 CONTRACTOR USE OF SITE AND PREMISES

- A. Refer to School Facilities Management Contract Manual and Specifications for additional requirements.
- B. Provide access to and from site as required by law and by YPS Office of Facilities Management:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Existing building spaces may not be used for storage unless approved by the YPS Office of Facilities Management.
- D. Contractors shall comply with Local Noise Ordinance. Work disrupting the community must be performed with the following hours:
 - 1. Monday thru Friday: 8 AM to 8 PM.
 - 2. Weekends/ Holidays: 9 AM to 6 PM.
- E. Construction deliveries shall not occur during the hours of 7:30 AM and 9:00 AM and 2:00 PM and 3:00 PM, when school buses are arriving or leaving the school grounds and school is in session.
- F. During the entire construction period the Contractor(s) shall have the use of the premises for construction operations, including use of the site as indicated in School Facilities Management Contract Manual and Specifications and work time included in this section.
 - 1. General: Limitations on site usage as well as specific requirements that impact utilization are indicated on the drawings and/or by other contract documents. In addition to these limitations and requirements, the Construction Contractor shall administer allocation of available space equitably among the separate prime(s) and other entities needing access and space, so as to produce the best overall efficiency in performance of the total work of the project. Each Prime Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.
 - 2. Each Prime Contractors shall limit their use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public during the period when the Owner occupies the building.
 - 3. Each Prime Contractors shall to maintain clear and unobstructed paths of exit discharge from all existing exits.
 - 4. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the YPS Office of Facilities Management at all time. Do not use these areas for parking or storage of materials.
 - 5. Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.
- G. Only materials and equipment, which are to be used directly in the work, shall be brought to and stored on the project site by the Contractor. After equipment is no longer required for the work, it shall be promptly removed from the project site. Protection of construction materials and equipment stored at the project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractors.
- H. Site work shall be scheduled and coordinated with General Engineering Agreement and the YPS Office of Facilities Management whose decisions shall be final and binding on all contractors.
 - 1. Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction

- I. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas designated by YPS Office of Facilities Management. If additional storage is necessary obtain and pay for such storage off-site.
- J. The Contractor(s) and any entity for which the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the YPS Office of Facilities Management which may be withheld in the sole discretion of the Owner.
- K. Contractor(s) shall ensure that the work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, each contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of:
 - 1. Any areas and buildings adjacent to the site of the work or;
 - 2. The Building in the event of partial occupancy as more..
- L. Without prior approval of the YPS Office of Facilities Management, each Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitations, lavatories, toilets, entrances and parking areas other than those designated by the YPS Office of Facilities Management. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with the rules and regulations promulgated by the YPS Office of Facilities Management in connection with the use and occupancy of the Project Site, and the Building, as amended from time to time. The Contractor shall immediately notify the YPS Office of Facilities Management in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The YPS Office of Facilities Management may, in the YPS Office of Facilities Management's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations. The Contractor shall also comply with all insurance requirements, applicable to use, and occupancy of the Project Site and the Building.
- M. Maintain the existing building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. When work is scheduled after hours clean and remove all temporary barriers and protection so that the building can be occupied the following day when normal building occupancy will occur.
- N. Keep public areas such as hallways, stairs, elevator lobbies, and toilet rooms free from accumulation of waste material, rubbish or construction debris.
- O. Smoking, drinking of alcoholic beverages or open fires will not be permitted on the project site.
- P. Utility Outages and Shutdown:
 - 1. Limit disruptions, shut downs, switch overs, etc. of utility services to hours the building is unoccupied, Saturdays, Sunday and/or holidays.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire alarm system, electrical, data, and heating system, without 7 days notice to YPS Office of Facilities Management and authorities having jurisdiction.
 - 3. Prevent accidental disruption of utility services to other facilities.

1.11 AVAILABILITY OF EXISTING BUILDING

- A. Refer to School Facilities Management Contract Manual and Specifications for additional requirements.
- B. Upon request by the Contractor, the building may be made available, at the discretion of the YPS Office of Facilities Management and at the Cost to the Contractor, during such times as are allowed by local

noise ordinance, in addition to the above listed hours. A request for use during these off-regular hours must be made at least two (2) days before the use. Such off-hours may include Saturdays, and Holidays.

1. If the Contractor requests the use of the facility for off-hours to maintain the scheduled completion date, the Contractor shall pay all additional costs in connection with opening, providing security and project management expenses incurred with no costs to the Owner. All expenses shall be deducted from the Contractor's contract price. Comply with other portions of this Section.
 2. Weekend, Holiday and Night Work:
 - a. The contractor shall make no claim for delay for the inability of the YPS Office of Facilities Management to make the site available for off-hours work. Should the YPS Office of Facilities Management make the site available during these hours at the contractor's request, the cost will be borne by the Contractor.
- C. ALL CONTRACTORS SHALL BE REQUIRED TO PERFORM SCHEDULED WORK WITHIN THE EXISTING BUILDING ONLY DURING THE TIME PERIODS INDICATED AND SHALL INCLUDE IN THE BID ALL COSTS FOR LABOR, MATERIAL, ETC. INCLUDING PREMIUM TIME TO PERFORM THE WORK, PER PHASE PER TIME PERIOD.

1.12 COMPLETION OF WORK AFTER SCHEDULED COMPLETION DATE

- A. Refer to School Facilities Management Contract Manual and Specifications for additional requirements.
- B. Contractor(s) shall perform work only within these limitations and all manpower, equipment, etc., shall be provided as required to complete the work as per schedule. In the event the contractor does not complete the work as scheduled all work to be performed shall be performed after 4:30 PM when the building is unoccupied and approved by the YPS Office of Facilities Management. All costs shall be borne by the Contractor.
- C. The Contractor shall provide necessary manpower, equipment, etc., as required to maintain schedule developed within the time limitations as described above.

1.13 WORK SEQUENCE

- A. Refer to Section 01 1010 - Milestone Schedule.

1.14 COVID-19

- A. Refer to Notice to Bidders for additional Information.
- B. Due to the ongoing COVID-19 pandemic and the resulting uncertainty with regard to (a) when the Owner's schools will be in session during 2020, (b) what restrictions, if any, will be applicable to construction activities on the Owner's property due to State, Federal or Local orders, laws, regulations or rules related to the COVID-19 pandemic (including but not limited to social distancing, cleaning and disinfection requirements) and (c) the duration of any restrictions imposed on construction activities, the Owner may modify the construction schedule set forth in the Contract Documents and the Contractor acknowledges and agrees that there shall be no additional compensation paid by the Owner for schedule modifications caused directly or indirectly by the COVID-19 pandemic. The Contractor further acknowledges and agrees that the sole remedy for any schedule modifications caused directly or indirectly by the COVID-19 pandemic shall be an extension of time, if warranted.
- C. In the event that due to the ongoing COVID-19 and school continuing to be **not** in session, the facilities will be made available to the Contractor earlier than the proposed schedule; subject to any restrictions imposed by Federal, State or Local laws, regulations and rules. The completion dates will remain unchanged.

1.15 SPECIFICATION SECTIONS

- A. Unless otherwise noted, all provisions of Division 01 General Requirements apply to all contracts.
 1. 00 2115 RFI FORM
 2. 01 1000 SUMMARY OF CONTRACTS
 3. 01 2000 PRICE AND PAYMENT PROCEDURES

4. 01 2500 SUBSTITUTION PROCEDURES
5. 01 3000 ADMINISTRATIVE REQUIREMENTS
6. 01 3216 CONSTRUCTION PROGRESS SCHEDULE
7. 01 3307 SED SPECIAL REQUIREMENTS
8. 01 3553 SITE SAFETY AND SECURITY PROCEDURES
9. 01 4000 QUALITY REQUIREMENTS
10. 01 4100 REGULATORY REQUIREMENTS
11. 01 4533 SPECIAL INSPECTIONS AND STRUCTURAL TESTING
12. 01 5000 TEMPORARY FACILITIES AND CONTROLS Based on multi-prime contract.
13. 01 5213 FIELD OFFICES AND SHEDS
14. 01 5510 TRAFFIC AND PEDESTRIAN ACCESS & CONTROL
15. 01 5713 TEMPORARY EROSION AND SEDIMENT CONTROL
16. 01 5721 INDOOR AIR QUALITY CONTROLS
17. 01 5813 TEMPORARY PROJECT SIGNAGE
18. 01 6000 PRODUCT REQUIREMENTS
19. 01 6116 VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS
20. 01 7000 EXECUTION
21. 01 7310 CUTTING AND PATCHING
22. 01 7419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
23. 01 7600 PROCEDURES AND SPECIAL CONDITIONS FOR SEPARATE PRIME CONTRACTS Send copy to BGA Done
24. 01 7800 CLOSEOUT SUBMITTALS
25. 01 7900 DEMONSTRATION AND TRAINING

1.16 GENERAL CONSTRUCTION CONTRACT

- A. Division 01 - General Requirements:
- B. Provide all Work as specified, but not limited to, the following sections:
 1. 01 7000: FINAL CLEANING
 2. 02 2080 ASBESTOS REMOVAL AND DISPOSAL
 3. 03 3000 CAST-IN-PLACE CONCRETE
 4. 04 0100 MAINTENANCE OF MASONRY
 5. 05 5000 METAL FABRICATIONS
 6. 06 1000 ROUGH CARPENTRY
 7. 07 8400 FIRESTOPPING
 8. 07 9200 JOINT SEALANTS
 9. 08 9100 LOUVERS
 10. 09 5100 ACOUSTICAL CEILINGS
 11. 09 6500 RESILIENT FLOORING
 12. 09 9113 EXTERIOR PAINTING
 13. 09 9123 INTERIOR PAINTING
 14. 12 3200 PLASTIC LAMINATE CASEWORK
 15. 12 3600 SOLID SURFACING COUNTERTOPS

1.17 PLUMBING CONTRACT

- A. Provide all Work as specified, but not limited to, the following sections:
 1. 07 8400 FIRESTOPPING
 2. 07 9200 JOINT SEALANTS
 3. 22 0100 GENERAL CONDITIONS

4. 22 0125 SCOPE OF WORK
5. 22 0130 WATER SUPPLY SYSTEM
6. 22 0160 SANITARY AND STORM DRAINAGE SYSTEMS
7. 22 0190 NEW GAS CONNECTIONS AND ASSOCIATED WORK
8. 22 0300 PLUMBING FIXTURES AND EQUIPMENT
9. 22 0320 DOMESTIC HOT WATER GAS-FIRED HEATING EQUIPMENT
10. 22 0420 SUPPORTS, SLEEVES AND PLATES
11. 22 0430 INSULATION
12. 22 0470 TESTS AND ADJUSTMENTS
13. 22 0480 TAGS, CHARTS AND IDENTIFICATION
14. 22 0490 GUARANTEE

1.18 HEATING, VENTILATING, AND AIR CONDITIONING CONTRACT

- A. Provide all Work as specified, but not limited to, the following sections:
1. 07 8400 FIRESTOPPING
 2. 07 9200 JOINT SEALANTS
 3. 23 0100 GENERAL CONDITIONS
 4. 23 0110 SCOPE OF WORK
 5. 23 0120 GAS FIRED CONDENSING BOILERS
 6. 23 0130 BOILER START-UP AND TESTING
 7. 23 0140 DOUBLE WALL BOILER BREECHING
 8. 23 0190 PUMPS
 9. 23 0200 HYDRONIC SPECIALTIES
 10. 23 0290 DUCT MOUNTED COILS
 11. 23 0300 FANS
 12. 23 0310 HOT WATER CABINET HEATERS
 13. 23 0320 HOT WATER UNIT HEATERS
 14. 23 0330 CONVECTORS
 15. 23 0340 FIN-TUBE RADIATION
 16. 23 0400 SHEETMETAL WORK AND RELATED ACCESSORIES
 17. 23 0410 PIPING, FITTINGS, VALVES AND NOTES (HOT WATER)
 18. 23 0420 SUPPORTS, SLEEVES AND PLATES
 19. 23 0430 INSULATION AND COVERINGS
 20. 23 0450 LOUVERS
 21. 23 0460 AUTOMATIC TEMPERATURE CONTROLS
 22. 23 0470 TESTING, START-UP AND ADJUSTMENTS
 23. 23 0480 GENERAL LABELING, VALVE CHARTS AND PIPING IDENTIFICATION
 24. 23 0490 GUARANTEE

1.19 ELECTRICAL CONTRACT

- A. Provide all Work as specified, but not limited to, the following sections:
1. 26 0100 GENERAL CONDITIONS
 2. 26 0125 SCOPE OF WORK
 3. 26 0150 APPROVED MANUFACTURERS
 4. 26 0200 CONDUIT
 5. 26 0250 DUCT BANK
 6. 26 0300 WIRE AND CABLE
 7. 26 0320 OVERCURRENT PROTECTIVE DEVICES

Yonkers Public Schools
Boiler Replacement, HVAC Upgrades & Asbestos Abatement
P.S. 29 Phase 2 of 3 - YPS # 10878
SUMMARY OF CONTRACT

8.	26 0350	BOXES
9.	26 0400	WIRING DEVICES
10.	26 0425	DIGITAL LIGHTING CONTROL SYSTEM
11.	26 0450	CABINETS AND ENCLOSURES
12.	26 0500	SUPPORTING DEVICES
13.	26 0550	GENERAL LABELING AND IDENTIFICATION
14.	26 0575	INTERIOR LUMINAIRES
15.	26 0600	DISCONNECT SWITCHES
16.	26 0650	GROUNDING
17.	26 0700	PANELBOARDS
18.	26 0725	SWITCHBOARDS
19.	26 0750	ELECTRIC SERVICE
20.	26 0775	PACKAGED ENGINE GENERATOR SYSTEMS
21.	26 0785	AUTOMATIC TRANSFER SWITCH
22.	26 0800	ADDRESSABLE FIRE PROTECTIVE SIGNALING SYSTEM
23.	26 0825	PUBLIC ADDRESS AND CLOCK SYSTEM
24.	26 0900	GUARANTEE

25.

END OF SECTION

SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Change procedures.
- C. Procedures for preparation and submittal of application for payments.

1.3 RELATED REQUIREMENTS

- A. Article 28 Partial Payments and Article 79 Payments of the General Engineering Agreement for additional requirements.
- B. Article 47 General Engineering Agreement for allowances requirements, if any.
- C. Section 01 5000 - Temporary Facilities and Controls.
- D. Section 01 7800 - Closeout Submittals for additional requirements for Final Payment.
- E. Section 01 2100 - Allowances: Payment procedures relating to allowances.
- F. Section 01 2300 - Alternates for bid alternates.
- G. Section 01 7800 - Closeout Submittals: Additional requirements for project record documents.

1.4 SCHEDULE OF VALUES

- A. Form to be used: AIA G702/703.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Fuller and D'Angelo, P.C. for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in PDF Format within 10 days after date Letter of Intent to Award.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify Bonds and Sub-contractors.
- F. Include in each line item, the amount of each Allowances specified. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.
- H. Sub-schedules: Where the Work is separated into phases provide separate payment applications, or provide sub-schedules showing values correlated with each phase.
 - 1. For public school projects identify each application with the SED Project number for each phases and YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s project number.
- I. Provide a separate line item for the following: (where applicable)
 - 1. Bonds. (Bond premium may be paid when invoice of premium is provide).
 - 2. Labor and materials, when payment is anticipated for material not installed.
 - 3. Submittals. (1% Minimum of contract amount).
 - 4. Each allowance.
 - 5. Meeting attendance.

6. As-built Drawings.
7. Testing, HVAC balancing reports. Minimum 0.5% of contract amount.
8. Punch list.
9. Final Cleaning.
10. Closeout Documents (1% Minimum of contract amount).
11. Authorized change orders.

1.5 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement but not more than one per month.
- B. Form to be used: Approved Schedule of Values form.
- C. Forms filled out by hand will not be accepted.
- D. For each item, provide a column for listing each of the following:
 1. Item Number.
 2. Description of work.
 3. Scheduled Value.
 4. Previous Applications.
 5. Work in Place and Stored Materials under this Application.
 6. Authorized Change Orders.
 7. Total Completed and Stored to Date of Application.
 8. Percentage of Completion.
 9. Balance to Finish.
 10. Retainage.
- E. Execute certification by signature of authorized officer.
- F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- H. Submit one (1) electronic "pencil copy", in PDF format, of each Application for Payment to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for approval.
- I. After Architect's approval of the "pencil copy" submit three hard copies of approved Application for Payment to YPS Office of Facilities Management.
- J. Include the following with each application:
 1. Transmittal letter as specified for submittals in Section 01 3000.
 2. Construction progress schedule, revised and current as specified in Section 01 3216.
 3. Partial Waivers of Mechanic's Lien: With each Application for Payment, submit partial waivers of mechanic's liens from Contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - a. Waiver Forms: Submit waivers of lien on forms, ~~provided by the Architect in Section 01 2005.~~
 4. When an application shows completion of an item, submit final or full waivers.
 5. Submit Final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 6. Certified Payrolls: All Applications for Payment must be accompanied with certified payrolls for all Contract Work performed. **Each contractor and sub-contractor shall submit to the Owner within thirty days after issuance of its first payroll, and every thirty days thereafter, a transcript of the original payroll record subscribed and affirmed as true under penalties of perjury.**

The Owners shall be required to receive and maintain such payroll records. The original payrolls or transcripts shall be preserved for three years from the completion of the work on the awarded project.

- a. Submit certification that all personnel listed on certified payrolls have successfully completed an OSHA construction safety and health course of at least 10 hours prior to performing any work on the project.
- K. Liens: No Payment will be made when a lien is filed against Owner by contractor or any subcontractor, or supplier or other entities until such lien is removed, bonded or similar action acceptable to the Owner
- L. Project record documents as specified in Section 01 7800 - Closeout Submittals, shall be available for review by YPS Office of Facilities Management and Fuller and D'Angelo, P.C. as a prerequisite for approval of payment.
- M. Payment for stored materials, whether on-site but not installed, or stored in secured warehouse) will require a bill of lading showing the exact value. In no case will more than 90% be approved if the item is not installed. Insurance certificates will be provided specific to materials stored for on-site or offsite items.
- N. When YPS Office of Facilities Management or Fuller and D'Angelo, P.C. requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.
- O. The Owner shall retain Five (5) percent of the amount of each payment.

1.6 INITIAL APPLICATION FOR PAYMENT:

- A. Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. Executed contract.
 2. Approved bonds.
 3. Approved insurance certificates.
 4. Names of full time project manager, on site superintendent, and foreman.
 5. Approved Schedule of Values.
 6. Contractor's Construction Schedule (preliminary if not final).
 7. Contractor's Submittal Schedule.
 8. Emergency Phone Numbers and Contacts.
 9. Health and Safety Manual.

1.7 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION

- A. Comply with Requirements of Section 01 7800 - Closeout Submittals.

1.8 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in its employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, YPS Office of Facilities Management will issue instructions directly to the Contractor.
- C. For other required changes YPS Office of Facilities Management will issue a document signed by YPS Office of Facilities Management instructing the Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 2. Promptly execute the change.
- D. YPS Office of Facilities Management may issue a document which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time

for executing the change . The Contractor shall prepare and submit a fixed price quotation within ten (10) days.

- E. Contractor may propose a change by submitting a request for change to YPS Office of Facilities Management, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 25000.
- F. Computation of Change in Contract Amount:
 - 1. Refer to Article 21 and 22 of General Engineering Agreement.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
 - a. If the contractor is directed to perform work on a "Time and Material" basis he will notify the YPS Office of Facilities Management prior to starting and will present an itemized T&M sheet daily for YPS Office of Facilities Management signature at the end of the shift. No payments will be made for any T&M work without daily signed worksheets.
- H. Execution of Change Orders: YPS Office of Facilities Management will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.9 APPLICATIONS FOR PAYMENT WHEN BEHIND SCHEDULE

- A. When the project falls behind schedule the contractor shall demonstrate the actions to be taken to put the project back on schedule.
 - 1. Payments will not be approved until satisfactory evidence is presented to put the project on schedule.

1.10 APPLICATION FOR PAYMENT AFTER SCHEDULED COMPLETION DATE

- A. In the event the work is not completed by the schedule date, listed in Agreement and in addition to the other remedies described, the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. will not review progress payment requisitions submitted after the construction completion date, and the District will not issue any progress payments after that date, until all work is completed.

1. Only one requisition for work performed, after the construction completion date, may be submitted, and it may be submitted only when all work is complete and a Punch List inspection is conducted; said requisition may be submitted when the work at 100% complete, less 5% retainage.

1.11 APPLICATION FOR FINAL PAYMENT

- A. Refer to General Engineering Agreement and the following:
- B. Comply with Section 01 7800 - Closeout Submittals.
- C. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 01 7800 - Closeout Submittals are submitted and approved.
 2. All Substantial Completion Inspection Lists (Punch List) items have been completed.

END OF SECTION

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.3 RELATED REQUIREMENTS

- A. Section 00 2113 - Instructions to Bidders: Restrictions on timing of substitution requests.
- B. Section 01 2300 - Alternates, for product alternatives affecting this section.
- C. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- D. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling and restrictions on timing of substitution requests.

1.4 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Yonkers Public Schools.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Architect and Construction Manager for review or redesign services associated with re-approval by authorities.
 - 7. Statement indicating why specified material or product cannot be provided.
 - 8. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

9. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 10. Samples, where applicable or requested.
 11. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 12. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 13. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 14. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 15. Cost information, including a proposal of change, if any, in the Contract Sum.
 16. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 17. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - a) Official project name and number, and any additional required identifiers established in Contract Documents.
 - b. Substitution Request Information:
 - a) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - b) Indication of whether the substitution is for cause or convenience.
 - c) Issue date.
 - d) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - e) Description of Substitution.
 - f) Reason why the specified item cannot be provided.
 - g) Differences between proposed substitution and specified item.
 - h) Description of how proposed substitution affects other parts of work.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - a) Physical characteristics.
 - b) In-service performance.
 - c) Expected durability.
 - d) Visual effect.
 - e) Sustainable design features.
 - f) Warranties.
 - g) Other salient features and requirements.
 - h) Include, as appropriate or requested, the following types of documentation:

- (a) Product Data:
 - (b) Samples: Provide full size actual sample of item proposed for substitution. Sample shall be provided, without exception, even if the originally specified item did not require a sample.
 - (c) Certificates, test, reports or similar qualification data.
 - (d) Drawings, when required to show impact on adjacent construction elements.
 - d. Impact of Substitution:
 - a) Savings to Yonkers Public Schools for accepting substitution.
 - b) Change to Contract Time due to accepting substitution.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.
 - 2. Deliver sample to Architect.

3.2 SUBSTITUTION PROCEDURES AFTER AWARD OF CONTRACT

- A. Submittal Form:
 - 1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Fuller and D'Angelo, P.C. will consider requests for substitutions only within 30 days after date Letter of Award.
- C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by YPS Office of Facilities Management, in order to stay on approved project schedule.
- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Fuller and D'Angelo, P.C. and Consultant, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Yonkers Public Schools through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected prime contractors and subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Yonkers Public Schools's compensation to the Fuller and D'Angelo, P.C. and Consultant for any required redesign, time spent processing and evaluating the request.
 - b. Other construction by Yonkers Public Schools.
 - c. Other unanticipated project considerations.
- E. Substitutions will not be considered under one or more of the following circumstances:
 - 1. During the bidding phase.
 - 2. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 3. Without a separate written request.
 - 4. When acceptance will require revisions to Contract Documents.

3.3 RESOLUTION

- A. YPS Office of Facilities Management, Fuller and D'Angelo, P.C., and Consultant may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

- B. YPS Office of Facilities Management will notify Contractor in writing of decision to accept or reject request.
 - 1. YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s decision following review of proposed substitution will be noted on the submitted form.

3.4 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.5 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

3.6 ATTACHMENTS

- A. A facsimile of the Substitution Request Form (During Construction) required to be used on the Project is included following this section.

SUBSTITUTION REQUEST FORM

SUBSTITUTION REQUEST No. _____

(After the Bidding Phase)

Project: Boiler Replacement, HVAC Upgrades & Asbestos Abatement

Facility: Westchester Hills School 29.

Substitution Request Number: _____

From: _____

Date: _____

A/E Project Number: 19359.02

Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution:

Manufacturer: _____ Address: _____ Phone: _____

Trade Name _____ Model no.: _____

Installer: _____ Address: _____ Phone: _____

History: _____ New product _____ 2-5 years old _____ 5-10 yrs old _____ More than 10 years old

Differences between proposed substitution and specified product:

Point-by-point comparative data attached - REQUIRED

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

Date Installed: _____

Proposed substitution affects other parts of Work: _____ No _____ Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____)

Proposed substitution changes Contract Time: _____ No _____ Yes Add _____ Deduct _____ days.

Supporting Data Attached: _____ Drawings _____ Product Data _____ Samples _____ Tests Reports

The Undersigned certifies:

Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.

Same warranty will be furnished for proposed substitution as for specified product.

Same maintenance service and source of replacement parts, as applicable, is available.

Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.

Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.

Proposed substitution does not affect dimensions and functional clearances.

Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Fuller and D'Angelo, P.C.
Architects and Planners

Yonkers Public Schools
Boiler Replacement, HVAC Upgrades & Asbestos Abatement
P.S. 29 Phase 2 of 3 - YPS # 10878
SUBSTITUTION PROCEDURES

Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments:

A/E's REVIEW AND ACTION

____ Substitution approved - Make submittals in accordance with Specification Section 01330

____ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.

____ Substitution rejected - Use specified materials.

____ Substitution Request received too late - Use specified materials.

____ Date: _____

Additional Comments: __ Contractor __ Subcontractor __ Supplier __ Manufacturer __ A/E

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meetings.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Contractor's daily reports.
- F. Coordination drawings.
- G. Submittals for review and information.
- H. Number of copies of submittals.
- I. Requests for Interpretation (RFI) procedures.
- J. Submittal procedures.

1.3 RELATED REQUIREMENTS

- A. General Engineering Agreement.
- B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
- C. Section 01 6000 - Product Requirements: General product requirements.
- D. Section 01 3553 - Site Safety and Security Procedures.
- E. Section 01 7000 - Execution: Additional coordination requirements.
- F. Section 01 7800 - Closeout Submittals:
- G. Section 01 9113 - General Commissioning Requirements:

1.4 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 7000 - Execution for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to YPS Office of Facilities Management and Fuller and D'Angelo, P.C.:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.

10. Substantial Completion Inspection Correction Report and Final Correction Report.
11. Closeout submittals.

1.5 PROJECT COORDINATOR

- A. Project Coordinator: YPS Office of Facilities Management.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation
- C. Coordinate installation of different components with other contractors and/or subcontractor to ensure maximum accessibility for required maintenance, service, and repair
- D. Cooperate with the Project Coordinator in allocation of mobilization areas of site, access, traffic, parking facilities, and field offices.
- E. During construction, coordinate use of site and facilities through the Project Coordinator.
- F. Comply with YPS Office of Facilities Management and Fuller and D'Angelo, P.C. procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- G. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 5000 - Temporary Facilities and Controls.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

- A. YPS Office of Facilities Management will schedule a meeting after Notice of Award.
- B. Attendance Required:
 1. YPS Office of Facilities Management.
 2. Fuller and D'Angelo, P.C.
 3. Consultants.
 4. Contractor(s) and field superintendent(s).
- C. Agenda:
 1. Status of Yonkers Public Schools - Contractor(s) Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 5. Submission of initial Submittal schedule.
 6. Designation of personnel representing the parties to Contract: YPS Office of Facilities Management, Fuller and D'Angelo, P.C., and Contractor(s), .
 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 8. Scheduling.
 9. Use of premises by Contractor(s).
 10. Yonkers Public Schools's requirements and occupancy prior to completion.
 11. Construction facilities and controls provided by YPS Office of Facilities Management.
 12. Temporary utilities provided by YPS Office of Facilities Management.
 13. Survey existing facilities prior to starting construction.
 14. Survey and site layout.

15. Security and housekeeping procedures.
 16. Procedures for testing.
 17. Procedures for maintaining record documents.
 18. Requirements for start-up of equipment.
- D. Fuller and D'Angelo, P.C. will record minutes and distribute copies within five days after meeting to all participants. Contactor shall distribute to all entities of the Contractor affected by decisions made.

3.2 PROGRESS MEETINGS

- A. YPS Office of Facilities Management and Fuller and D'Angelo, P.C. will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
1. Meetings will be scheduled throughout progress of the Work at minimum of two week intervals.
- B. Attendance Required:
1. Contractor(s).
 2. YPS Office of Facilities Management
 3. Fuller and D'Angelo, P.C.
 4. Consultants.
 5. Contractor's Superintendent.
 6. Major Subcontractor and suppliers as appropriate to agenda topics for each meeting.
- C. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Review of delivery schedules.
 8. Review construction safety programs.
 9. Review exiting and separation of construction
 10. Maintenance of progress schedule.
 11. Corrective measures to regain projected schedules.
 12. Planned progress during succeeding work period.
 13. Coordination of projected progress.
 14. Maintenance of quality and work standards.
 15. Effect of proposed changes on progress schedule and coordination.
 16. Other business relating to work.
- D. Fuller and D'Angelo, P.C. will record minutes and distribute copies within five after meeting to all participants. Contactor(s) shall distribute to all entities of the Contractor affected by decisions made.

3.3 WEEKLY COORDINATION MEETINGS

- A. The Contractor for General Construction shall schedule and hold weekly general project coordination meetings at regularly scheduled times that are convenient for the attendance of other prime contractors and other parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special pre-installation meetings. Required attendance includes General Construction Contractor, HVAC, Plumbing, and Electrical Contractor and every other entity identified by any prime contractor as being currently involved the coordination or planning for the work of the entire project. Conduct meetings in a manner that resolve coordination problems. The Contractor for General Construction shall preside at each meeting, and shall record meeting results. The Contractor for General Construction shall distribute copies of the meeting result to everyone in attendance, the YPS

Office of Facilities Management and Fuller and D'Angelo, P.C. and to others affected by the decisions and actions resulting from each meeting.

- B. The Prime Contractors shall schedule and hold weekly general project coordination meetings with the YPS Office of Facilities Management, to review the work schedule for the week in order to insure the planned work does not conflict with facility operations.

3.4 CONSTRUCTION PROGRESS SCHEDULE - See Section 01 3216

3.5 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Transmit electronically a copy to YPS Office of Facilities Management and Fuller and D'Angelo, P.C.
- C. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 - 1. Date.
 - 2. High and low temperatures, and general weather conditions.
 - 3. List of subcontractors at Project site.
 - 4. List of separate contractors at Project site.
 - 5. Approximate count of personnel at Project site.
 - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
 - 6. Major equipment at Project site.
 - 7. Material deliveries.
 - 8. Safety, environmental, or industrial relations incidents.
 - 9. Meetings and significant decisions.
 - 10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (listed in most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 - 11. Testing and/or inspections performed.
 - 12. Signature of Contractor's authorized representative.

3.6 PROOF OF ORDERS AND DELIVERY DATES

- A. Within two (2) weeks after the approval of shop drawings, samples, product data and the like, the Contractor(s) shall provide copies of purchase orders for all equipment and materials which are not readily available in local stock. The Contractor(s) shall submit written statements from suppliers confirming the orders and stating promised delivery dates. Dates shall be indicated and coordinated with the Construction Schedule.

3.7 COORDINATION DRAWINGS

- A. Provide information required for preparation of coordination drawings.
- B. Review drawings prior to submission to Fuller and D'Angelo, P.C.
- C. Indicate all HVAC equipment, ductwork, and major piping, including elevations and dimensions to all fixed building elements, such as beams; columns; slabs; ceilings, including ceiling suspension; framing; floors; walls; doors, including door swings; and windows affected by the equipment, ductwork, and piping.
- D. Indicate all existing and proposed lighting fixtures and smoke detectors.
- E. Show location of all valves, dampers (fire, smoke, volume, and automatic), coils, humidifiers, smoke detectors, etc. requiring access for service and maintenance.
- F. Show all registers, grilles, diffusers, radiators and convectors, and other terminal elements.

- G. Locate all access doors.
- H. Include large-scale details and sections as required to fully delineate the conditions in congested areas, leaving space for the work of the other trades.
- I. Show plan layout of all equipment and anchorage and fasteners

3.8 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - c. Prepare RFI using form in Section 00 2115 - RFI Form.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions refer to Section - 01 2500 - Substitution Procedures
 - 2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 - 3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Yonkers Public Schools reserves the right to assess for the costs (on time-and-materials basis) incurred by the Fuller and D'Angelo, P.C., and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
- H. Review Time: Fuller and D'Angelo, P.C. will respond and return RFIs within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to

Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to YPS Office of Facilities Management.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
3. Notify Fuller and D'Angelo, P.C. within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.9 SUBMITTAL SCHEDULE

- A. Submit to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for review a schedule for submittals in tabular format.
 1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
 2. Coordinate with construction schedule and schedule of values.
 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
 4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.10 SUBMITTALS FOR REVIEW

- A. All submittals are the product and the property of the Contractor. The YPS Office of Facilities Management, Fuller and D'Angelo, P.C., and Consultant shall not be responsible for the contractor's construction means, methods or techniques; safety precautions or programs; Acts or admissions; or failure to carry out the work in accordance to the contract documents
- B. Refer to "Article 76 General Engineering Agreement Shop Drawings, Product Data and Samples" for additional requirements.
- C. Shop Drawing Submittal Log no later than ten (10) days after award of contract.
- D. Shop Drawing Submittals shall be submitted no later than twenty (20) days after Letter of Award of Contract. No further payments will be made to the contractor after twenty (20) until all major submittals are made.
- E. When the following are specified in individual sections, including but not limited to the following, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Templates.
- F. Submit to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
 1. Submittals for HVAC, plumbing, electrical, structural, or others requiring consultant review submit directly to consultant with copy to YPS Office of Facilities Management and Fuller and D'Angelo, P.C.
- G. Samples will be reviewed only for aesthetic, color, or finish selection and for record documents purposes described in Section 001 7800 - Closeout Submittals.
- H. After review, provide copies and distribute in accordance with Submittal Procedures article below .

- I. The Architect shall review and approve or take other appropriate action on the Contractor submittals, such as shop drawings, product data, samples and other data, which the Contractor is required to submit, but only for the limited purpose of checking for conformance with the design concept and the information shown in the Construction Documents. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Architect's review shall be conducted with reasonable promptness while allowing sufficient time in the Architect's judgment to permit adequate review. Review of a specific item shall not indicate that the Architect has reviewed the entire assembly of which the item is a component. **The YPS Office of Facilities Management and Fuller and D'Angelo, P.C. shall not be responsible for any deviations from the Construction Documents not brought to the attention of the Architect, in writing, by the Contractor.** YPS Office of Facilities Management and Fuller and D'Angelo, P.C. shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
- J. Marking or comments on shop drawings shall not be construed as relieving the Contractor from compliance with the contract project plans and specifications, nor departure therefrom. The contractor remains responsible for details and accuracy for conforming and correlating all quantities, verifying all dimensions, for selecting fabrication processes, for techniques of assembly and for performing their work satisfactorily and in a safe manner.
- K. **Architect will review the original submittal and one (1) re submittal. Additional reviews will be additional services provided to the Owner and charged accordingly. The Owner will back charge the contractor accordingly.**
- L. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- M. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

3.11 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Inspection reports.
 - 4. Manufacturer's instructions.
 - 5. Manufacturer's field reports.
 - 6. Other types indicated.
- B. Submit for YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s knowledge as contract administrators. for. No action will be taken.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Refer to Section 01 7800 - Closeout Submittals and General Engineering Agreement.

3.13 NUMBER OF COPIES OF SUBMITTALS

- A. Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. All submittals shall be in electronic format and conforming to the following:
 - 1. Each item shall be in a separate file.
 - 2. Each file name shall start with the specification section number and contain an abbreviated explanation of what it contains; for example:
 - a. 03 3000 Concrete; 07 5323 EPDM.pdf; 07 5323 Bond Adh.pdf; 07 7100 Drain.pdf; 07 7100 Hatch.pdf; 09900 Painting;

3. Add Revision number (Rev2 Rev3, etc) to the file name when resubmitting items, for example:
 - a. 07 5323 EPDM Rev1.pdf 07 5323 Bond AdhRev1.pdf
 4. Do not zip the files, and do not put the files in Folders.
 5. Do not send MSDS with the technical submittals; collate all of the MSDS needed for the entire project in three ring binders, organized by specification section, and submit the binders to the YPS Office of Facilities Management, with copy of Transmittal to the Architect, and maintain one copy at the project site.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by YPS Office of Facilities Management.
1. After review, produce duplicates.
 2. Approved sample will be retained at the project site.
 3. Retained samples will not be returned to Contractor unless specifically so stated.
 4. Submit with each sample, in electronic PDF, data, cuts, photos, color, charts, etc.

3.14 SUBMITTAL PROCEDURES

- A. General Requirements:
1. Use a separate transmittal for each item attached to this section.
 2. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, without Contractor's stamp will not be acknowledged, reviewed, or returned.
 3. All submitted shop drawings shall be stamped and signed by the Contractor with the following note:
 - a. "We the undersigned certify that we have reviewed and coordinated this shop drawing and they are in conformance to the plans, specifications, applicable codes and other provisions of the Contract Documents."
 4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Deliver submittals to YPS Office of Facilities Management, Fuller and D'Angelo, P.C., and Consultant at e-mail address.
 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Fuller and D'Angelo, P.C.'s consultants, Yonkers Public Schools, or another affected party, allow an additional 7 days.
 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 7. Provide space for Contractor and YPS Office of Facilities Management, Fuller and D'Angelo, P.C., and Consultant review stamps.
 8. When revised for resubmission, identify all changes made since previous submission.
 9. Submittals not requested will not be recognized or processed.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
- E. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

3.15 SUBMITTAL REVIEW

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Submittals for Review: Fuller and D'Angelo, P.C. will review each submittal, and approve, or take other appropriate action.
- C. Submittals for Information: Fuller and D'Angelo, P.C. will acknowledge receipt and review. See below for actions to be taken.
- D. Fuller and D'Angelo, P.C.'s actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

3.16 ARCHITECT'S ACTION

- A. Fuller and D'Angelo, P.C.'s and Consultants' actions on items submitted for review:
 1. Final Unrestricted Release: The work covered by the submittal may proceed provided it complies with the requirements of the contract documents; acceptance of the work will depend upon that compliance.
 - a. "No Exception Taken".
 2. Final-But-Restricted Release: When the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with both the Architect's/Engineer's notations or corrections on the submittal and with the requirements of the contract documents; acceptance of the work will depend on that compliance.
 - a. "Make Corrections Noted" Resubmission not required.
 3. Returned for Re-submittal: When the submittal is marked as follows, do not proceed with the work covered by the submittal, including purchasing fabrication, delivery or other activity. Revise the submittal or prepare a new submittal in accordance with the Architect's/Engineer's notations stating the reasons for returning the submittal; resubmit the submittal without delay. Repeat if necessary to obtain a different action marking. Do not permit submittals with the following marking to be used at the project site, or elsewhere where work is in progress.
 - a. "Revise and Resubmit".
 - b. "Rejected".
 - a) Submit item complying with requirements of Contract Documents.
 - c. "Submit Specified Item".
- B. Fuller and D'Angelo, P.C.'s actions on items submitted for information:
 1. Items for which no action was taken:
 - a. "Examined and Reviewed" - to notify the Contractor that the submittal has been received for record only.

SUBMITTAL COVERSHEET

Yonkers Public Schools

Boiler Replacement, HVAC Upgrades & Asbestos Abatement

Westchester Hills School 29

ARCHITECT:

Fuller and D'Angelo, P.C.

45 Knollwood Rd.

Elmsford, NY10523

OWNER:

Yonkers Public Schools

One Larkin Center

Yonkers, NY 10701

CONTRACTOR: _____ **CONTRACT:** _____

ADDRESS: _____

TELEPHONE: _____ **FAX:** _____ **EMAIL:** _____

Facility Name: Westchester Hills School 29

Type of Submittal: Re-submittal: ☐ No ☐ Yes

☐ Shop Drawings ☐ Product Data ☐ Schedule ☐ Sample
☐ Test Report ☐ Certificate ☐ Color Sample ☐ Warranty

SUBMITTAL DESCRIPTION: _____

PRODUCT NAME: _____

MANUFACTURER: _____

SUBCONTRACTOR/ _____

SUPPLIER: _____

SPEC. SECTION NO.: _____ **DRAWING NO(S):** _____

PARAGRAPH: _____ **RM. OR DETAIL NO(S):** _____

CONTRACTOR'S REVIEW STAMP

Contractor Review Statement: These documents
have been checked for accuracy and coordinated
with job conditions and Contract requirements by
this office and have been found to comply with the
provisions of the Contract documents.

Remarks:

NAME: _____ **DATE:** _____

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.3 RELATED SECTIONS

- A. Section 01 1000 - Summary of Contract: Work sequence.
- B. Section 01 1010 - Milestone Schedule.
- C. Section 01 3000 - Administrative Requirements.

1.4 REFERENCE STANDARDS

- A. Article 5 General Engineering Agreement for additional requirements.
- B. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.5 RESPONSIBILITY

- A. Each Contractor shall develop a full schedule, in sufficient detail and clarity of form and technique so that the contractor can plan and control his work properly and the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. can readily monitor and follow the progress for all portions of the work. Each Contractor shall complete the detailed schedule within 10 days after contract award.
 - 1. Identify all long lead items and dates required on site.
 - 2. In the event of conflict YPS Office of Facilities Management and Fuller and D'Angelo, P.C. shall resolve a provide direction which is in the best interest on the Owner.
- B. Each Contractor shall coordinate their work with work of all prime contractors.
- C. The General Construction Contractor shall be responsible for incorporating all schedules, of all prime contractors, and prepare a full master schedule, and updates, as required or directed by the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. Each Contractor shall coordinate their work with work of the other prime contracts.
 - 1. In the event of conflicts the YPS Office of Facilities Management shall resolve and provide direction which is in the best interest on the District.
 - 2. Identify all long lead items and dates required on site.
- D. The activities identified in the schedule shall be analyzed in detail to determine activity time durations in units of whole working days. All duration's shall be the result of definitive manpower and resource planning by the Contractor.
- E. The activity data shall include activity codes to facilitate selection, sorting and preparation of summary reports and graphics. Activity codes shall be developed for:
 - 1. Area: Subdivision of the building(s) and site(s) into logical modules or blocks and levels. Pods A, B, C and D.
 - 2. Responsibility: Contractor or subcontractor responsible for the work.
 - 3. Specifications: 16 Division CSI format.

4. System: Division of the work into building systems for summary purposes.
5. Milestone: Work associated with completion of interim completion dates or milestones
6. Pay Item: Work identified with a pay item on the Schedule of Values.

1.6 SUBMITTALS

- A. After the Letter of Award, as scheduled in the Milestone Schedule each Contractor shall submit to the General Construction Contractor a preliminary schedule with copies to YPS Office of Facilities Management and Fuller and D'Angelo, P.C..
- B. Within ten (10) days after date Notice of Award, submit preliminary schedule .
- C. If preliminary schedule requires revision after review, submit revised schedule within 5 days.
- D. Within 5 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 1. Include written certification that all Prime Contractors have reviewed and accepted proposed schedule.
- E. Within 10 days after joint review, the General Construction Contractor submit completed master schedule.
- F. The General Construction Contractor shall submit updated master schedule with each Application for Payment based upon update information provide by Each Contractor.
- G. Submit in PDF format.
- H. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements.
- I. The Contractor(s) are hereby notified that payment requisitions will not be processed by the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. nor paid by the Owner until all schedules are reviewed and approved by YPS Office of Facilities Management and Fuller and D'Angelo, P.C. .

1.7 QUALITY ASSURANCE

- A. Scheduler: Contractor 's personnel or specialist Consultant specializing in construction scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.
- B. Contractor's Administrative Personnel: 3 years minimum experience in using and monitoring Bar Chart schedules on comparable projects.

1.8 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each phase and each activity. Identify each activity with the applicable specification section number.
- B. Submit schedule in electronic PDF format.
- C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.
- B. Based on the preliminary development of the progress schedule and on feedback from YPS Office of Facilities Management and Fuller and D'Angelo, P.C. or whatever updating may have occurred during the project start-up, the Contractor shall, for the entire work of the contract, prepare the Master Schedule, secure critical time commitments for performing major elements of all the work.

3.2 GENERAL CONTENT.

- A. Each prime contractor shall prepare a schedule for their work.

- B. Milestones: Include milestones in schedule, including, but not limited to, Notice of Award, Submittals, Verification of existing conditions, Removals, Installation, Substantial Completion Inspection, (Punch List), Final Substantial Completion Inspection, and Closeout
- C. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- D. Identify each item by specification section number.
- E. Identify work of separate floors and other logically grouped activities.
- F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- G. Provide legend for symbols and abbreviations used.

3.3 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.4 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with YPS Office of Facilities Management and Fuller and D'Angelo, P.C. at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 5 days.
 - 1. When project work is behind schedule indicate revisions required to put the project on schedule.
 - 2. Payments will not approved until satisfactory evidence is presented to put the project on schedule.

3.5 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Update diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.6 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to YPS Office of Facilities Management , Fuller and D'Angelo, P.C., Contractor's site files, subcontractors, and major suppliersand other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 01 3307
SED SPECIAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SUMMARY

- A. This Section specifies special requirements of State Education Department, including Commissioner's Regulation Part 155.5, 155.7
 - 1. Copies of Commissioner's Regulation Part 155.5, 155.7 are available on the State Education Department's web site. www.p12nysed.gov
 - 2. Copy of Commissioner's Regulation Part 155.5 is included as Appendix to the specification.

1.3 CERTIFICATE OF OCCUPANCY

- A. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a Certificate of Occupancy.

1.4 GENERAL SAFETY AND SECURITY DURING CONSTRUCTION

- A. All construction materials shall be stored in a safe and secure manner.
- B. Fences around construction supplies or debris shall be maintained.
- C. Gates shall always be locked unless a worker is in attendance, to prevent unauthorized entry.
- D. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
- E. Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites.

1.5 SEPARATION OF CONSTRUCTION

- A. Separation of construction areas from occupied spaces. Construction areas that are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Metal stud and gypsum board (Type X) must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.
 - 1. A specific stairwell and/or elevator may be assigned for construction worker use during work hours, when approved by the Owner. Workers may not use corridors, stairs or elevators designated for students or school staff.
 - 2. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.
 - 3. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each work day. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.
 - 4. A plan detailing how exiting required by the applicable building code will be maintained.
 - 5. A plan detailing how adequate ventilation will be maintained during construction.

1.6 FIRE PREVENTION

- A. There is no smoking on school property for fire prevention and conformance to New York State Law.
- B. Any holes in floors or walls shall be sealed with a fire resistant material.
- C. Owner shall maintain existing fire extinguishers.
- D. Fire alarm and smoke detection systems shall remain in operation at all times.

1.7 CONSTRUCTION DIRECTIVES

- A. Construction Noise. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken.
- B. Construction Fume Control: Each Contractor shall be responsible for the control of chemical fumes, gases, and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure they do not enter occupied portions of the building or air intakes.
- C. Off-Gassing Control. Each Contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc., are scheduled, cured or ventilated in accordance with manufacturer's recommendations before a space can be occupied.

1.8 ASBESTOS

- A. Asbestos/Lead Test Asbestos Letter. Indication that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and asbestos.
- B. Asbestos Code Rule 56. Large and small asbestos abatement projects as defined by 8 NYCRR 155.5(k) shall not be performed while the building is occupied. Note: It is SED's interpretation that the term "building" as referenced in this section, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non combustible construction. The isolated portions (the occupied portion and the portion under construction) of the building must contain separate code compliant exits. The ventilation systems must be physically separated and sealed at the isolation barrier(s).
 - 1. Asbestos TEM. The asbestos abatement area shall be completely sealed off from the rest of the building and completely cleaned and tested by TEM prior to re-entry by the public.
 - 2. Lead Abatement Projects. A project that contains materials identified to be disturbed which tests positive for lead shall include that information in the Construction Documents. The Construction Documents must address the availability of lead testing data for the building and include a statement that the OSHA regulations be followed and that cleanup and testing be done by HUD protocol.

1.9 VENTILATION

- A. The work, as scheduled in the existing building, is to be performed when the facility is unoccupied. In the event that work is required to be performed during times when the building is occupied, all existing ventilation system between areas of work and areas of occupancy shall be disconnected, separated and code complying ventilation requirements be provided the occupied area. Prior to such work commencing the contractor shall submit a plan, for review indicating procedure to be taken. Also see paragraph 1.5 above for additional requirements."

1.10 ELECTRICAL CERTIFICATION:

- A. The electrical Contractor shall obtain UL Certification or Inspection from a Certified Electrical Organization for electrical installation.

1.11 EXITING

- A. Exiting: Work will be performed when school is not in session or after school hours. All exiting will be clear and usable at all times.

- B. All exits shall be clear and usable at all times.
- C. All modifications or changes to the exiting plan shall be approved by the Architect.

1.12 CONSTRUCTION WORKERS IN OCCUPIED AREAS

- A. No worker shall be permitted in areas occupied by students. If access is required by the contractor's personnel they will be supervised by District personnel. Contractor shall provided 24 hour notice to the Owner when such access will be required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3553
SITE SAFETY AND SECURITY PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. The safety requirements, which must be followed by each Contractor during the execution of this contract.
- B. Each Contractor agrees that the work will be completed with the greatest degree of safety and:
 - 1. To conform to the requirements of the Occupational Safety and Health Act (OSHA) and the Construction Safety Act including all standards and regulations that have been or shall be promulgated by the governmental authorities which administer such acts, and shall hold the Owner, Owner's Representative, the Architect, and all their employees, consultants and representatives harmless from and against and shall indemnify each and everyone of them for any and all claims, actions, liabilities, costs and expenses, including attorneys fees, which any of them may incur as a result of non-compliance.
- C. Security measures including entry control, personnel identification, and miscellaneous restrictions.

1.3 REFERENCES:

- A. Code of Federal Regulations OSHA Safety and Health.

1.4 RELATED REQUIREMENTS

- A. Articles 68 and 73 of General Engineering Agreement for additional requirements.
- B. Section 01 5510 - Traffic and Pedestrian Access & Control
- C. Section : 01 5713 - Temporary Erosion and Sediment Control.

1.5 DEFINITIONS

- A. Public shall mean anyone not involved with or employed by the contractor to perform the duties of this contract.
- B. Site shall mean the limits of the work area.
- C. Contractor shall mean each Contractor, his/her subcontractors and any other person related to the contract execution.

1.6 SECURITY PROGRAM

- A. Security and Protection Facilities and Services shall be the responsibility of each contractor and all costs shall be included in their bid.
- B. Protect Work including existing premises and Yonkers Public Schools's operations from theft, vandalism, and unauthorized entry.
- C. Coordinate with Yonkers Public Schools's security program.
- D. Initiate program in coordination with YPS Office of Facilities Management 's existing security system at project mobilization.
- E. Maintain program throughout construction period until directed by YPS Office of Facilities Management .

1.7 ENTRY CONTROL

- A. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the YPS Office of Facilities Management is notified and arrangements made to deactivate the system
- B. Restrict entrance of persons and vehicles into Project site .
- C. Allow entrance only to authorized persons with proper identification.
- D. Maintain log of workers and visitors, make available to Yonkers Public Schools on request.
- E. YPS Office of Facilities Management will control entrance of persons and vehicles related to Yonkers Public Schools's operations.
- F. Coordinate access of Yonkers Public Schools's personnel to site in coordination with YPS Office of Facilities Management and Yonkers Public Schools and security forces.
- G. Traffic Control
 - 1. Each Contractor shall maintain access for emergency vehicles, fireman and pedestrians and protect from damage all persons and property within the limits of and for the duration of the contract;
 - 2. Conduct construction operations so that the traveling public and pedestrian safety is subjected to a minimum of hazard and delay.
 - 3. Each Contractor shall perform the following minimum requirements as directed by YPS Office of Facilities Management.
 - a. Keep the surface of the traveled way free from mounds, depressions, and obstructions of any type which could present hazards or annoyance to traffic.
 - b. Keep the surface of all pavements used by the public free and clean of all debris, masonry, stucco, and concrete or other obstructions to provide safe traveled ways.
 - c. Control dust and keep the traveled way free from materials spilled from hauling and construction equipment.
 - d. Provide all cones, barricades, signs and warning devices as may be required and/or as ordered by YPS Office of Facilities Management to safely carry out the foregoing. All such signs and devices shall be fabricated and placed in accordance with the latest "Federal Manual on Uniform Control Devices". Use of Open Flares Is Prohibited.
 - e. **Each Contractor shall cover with steel plates all open trenches at the close of each work day. Such plates to abut each other and be wedged at each end of trench to prevent plates from sliding open**
 - 4. Ingress and Egress
 - a. Contractor shall provide and maintain at all times safe and adequate ingress and egress to and from site at existing or at new access points consistent with work, unless otherwise authorized by the YPS Office of Facilities Management.
 - 5. If, upon notification by YPS Office of Facilities Management, and the contractor fails to correct any unsatisfactory condition within 24 hours of being so directed, YPS Office of Facilities Management will immediately proceed with adequate forces to properly maintain the project and the entire cost of such maintenance shall be deducted (back charged) from any moneys due the contractor
 - 6. All traffic control costs shall include the base bid of furnishing all labor, material and equipment including the cost of any and all incidental required by job conditions as ordered by YPS Office of Facilities Management.

1.8 FIRE PREVENTION AND CONTROL

- A. Each Contractor shall provide Fire Extinguishers as follows: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical fires or grease-oil-flammable liquid fires. In other locations provide either type "ABC" dry chemical

extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

1. All required exits, fire alarm, security, automatic temperature control, PA, sprinkler and similar systems shall be maintained and operable throughout the entire construction contract.
 - a. Contractor(s) will be back-charged for all fines imposed for false alarms or service calls.
- B. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations. Portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site. Contractor(s) shall notify their employees of the location of the nearest fire alarm box at all locations where work is in progress.
- C. Each Contractor shall take all possible precautions for the prevention of fires. Where flame cutting torches, blow torches, or welding tools are required to be used within the building, their use shall be as approved by the Construction Manager at the site. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.
- D. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.
- E. Storage of gas shall be in locations as approved by the Owner and subject to Fire Department regulations and requirements.
- F. No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Owner and/or Architect and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Owner, who shall determine the extent of volatile liquid allowed within the building at any given time.
- G. Each Contractor shall comply with the following requirements relating to compressed gas:
 1. Where compressed gas of any type is used for any purpose at the site, it shall be contained in cylinders complying with ICC regulations. Gases of different types shall not be stored together except when in use and when such proximity is required.
 2. All gas cylinders shall be stored in sheds constructed of noncombustible materials. Sheds shall be well ventilated and without electric lights or fixtures and shall be located as far from other buildings as is practicable. All gas cylinders not in actual use, or in proposed immediate use, shall be removed from the building under construction or reconstruction. Empty gas cylinders shall be removed prior to bringing in a replacement cylinder. Cylinders shall at all times be supported and braced in an upright position. When not in use, the protective cap shall be screwed over the valve.
 3. All persons required to handle gas cylinders or to act as temporary firemen (Fire Watchers) shall be able to read, write and understand the English language; they shall also be required by the Contractor to read Part 3 of Pamphlet P-1 "Safe Handling of Compressed Gases" published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
 4. Where local ordinances are in effect regarding gas cylinders, (their use, appurtenances and handling), such ordinances shall supplement the requirements of this paragraph. All personnel engaged in fire watch shall be certified by the Local Fire Department having jurisdiction.
 5. LP-Gas Heating will not be permitted in enclosed areas below grade.
 6. Any cylinder not having the proper ICC markings or reinspection marking, or any cylinder with a leak shall be isolated immediately away from any building and the supplier shall be immediately notified; such other precautions as may be required to prevent damage or injury shall also be taken by the Contractor.

1.9 PERSONNEL IDENTIFICATION

- A. Provide identification badge or other approved identification to each contractor, their subcontractor's project superintendent, employees, directly or indirectly employed by the contractors or persons authorized to enter premises.

1. Badge To Include: Personal photograph, name and employer.
- B. Maintain a list of accredited persons, submit copy to YPS Office of Facilities Management on request.

1.10 RESTRICTIONS

- A. Do not allow cameras on site or photographs taken except by written approval of YPS Office of Facilities Management.

PART 2 PRODUCTS -

2.1 MATERIALS

- A. Refer to Section 01 5000 - Temporary Facilities and Controls for additional barrier requirements.
- B. Signs shall be made of sturdy plywood of 1/2" minimum thickness and shall be made to legible at a distance of 50 feet.

PART 3 EXECUTION

3.1 GENERAL

- A. In the performance of its contract, each Contractor shall exercise every precaution to prevent injury to workers and the public or damage to property.
 1. Each Contractor shall, at their own expense, provide temporary structures, place watchmen, design and erect barricades, fences and railings, give warnings, display such lights, signals and signs, exercise such precautions against fire, adopt and enforce such rules and regulations, and take such other precautions as may be necessary, desirable or proper or as may be directed.
 2. Each Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work to be done under this contract. Each Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss including but not limited to:
 - a. All employees working in connection with this contract, and other persons who may be affected thereby.
 - b. All the work materials and equipment to be incorporated therein whether in storage on or off site; and including trees, shrubs, lawns, walks, pavements, facilities not designated for removal, relocation or replacement in the course of construction.
- B. Each Contractor's duties and responsibilities for the safety and protection of the work: shall continue until such time as all the work is completed and contractor has removed all workers, material and equipment from the site, or the issuance of the certificate of final completion, whichever shall occur last.
- C. Each Contractor shall use only machinery and equipment adapted to operate with the least possible noise, and shall so conduct his operations that annoyance to occupants of the site and nearby homes and facilities shall be reduced to a minimum
- D. It shall be the responsibility of the Contractor to insure that all employees of the contractor and all subcontractors, and any other persons associated with the performance of their contract shall comply with the provisions of this specification.
- E. The Contractor shall clean up the site daily and keep the site free of debris, refuse, rubbish, and scrap materials. The site shall be kept in a neat and orderly fashion. Before the termination of the contract. Each Contractor shall remove all surplus materials, falsework, temporary fences, temporary structures, including foundations thereof.
- F. The Contractor shall follow all rules and regulations put forth in the Code of Federal Regulations (OSHA Safety and Health Standards).

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- J. Manufacturers' field services.
- K. Defect Assessment.

1.3 RELATED REQUIREMENTS

- A. "Artical 12 General Engineering Agreement" for additional requirements.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 4216 - Definitions.
- D. Section 01 6000 - Product Requirements: Requirements for material, product quality and substitution procedures.

1.4 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.
- B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2022.
- C. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2019.
- D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.
- E. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
- F. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

1.5 DEFINITIONS:

- A. Refer to "Article 7 and Article 47 of the General Engineering Agreement".

1.6 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary hoist(s) and rigging.

1.7 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - 1. Concrete Mix Design: As described in Section 03 3000 - Cast-in-Place Concrete. No specific designer qualifications are required.
 - 2. Structural Design of Metal Fabrications: As described in Section 05 5000 - Metal Fabrications.
 - 3. Structural Design of Railings: As described in Section 05 5213 - Pipe and Tube Railings.
 - 4. Structural Design of Foundation: As described in Section 10 7500 - Flagpoles.

1.8 SUBMITTALS

- A. Design Data: Submit for YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to YPS Office of Facilities Management and Fuller and D'Angelo, P.C.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. Provide YPS Office of Facilities Management and Fuller and D'Angelo, P.C., interpretation of results.
 - 2. Test report submittals are for YPS Office of Facilities Management's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and installation/application subcontractor to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to YPS Office of Facilities Management and Fuller and D'Angelo, P.C..
- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, for the YPS Office of Facilities Management's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- E. Manufacturer's Field Reports: Submit reports for YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s benefit as contract administrator or for Yonkers Public Schools.
 1. Submit report in duplicate within 30 days of observation to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for information.

1.9 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 2. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State of New York.
- C. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.10 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Fuller and D'Angelo, P.C. before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of YPS Office of Facilities Management and Fuller and D'Angelo, P.C. shall be altered from Contract Documents by mention or inference otherwise in any reference document.
- G. Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries or the internet.

1.11 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Yonkers Public Schools will employ and pay for services of an independent testing agency to perform specified testing which is the responsibility of the YPS Office of Facilities Management.
- B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of 2, 1, 1, and 1.
 - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 - 3. Laboratory: Authorized to operate in the State in which the Project is located.
 - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Fuller and D'Angelo, P.C. before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

- A. Accepted mock-ups establish the standard of quality the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for the work and they will be the sole judge the Work.
- B. Integrated Exterior Mock-ups: construct integrated exterior mock-up as directed. Coordinate installation of exterior envelope materials and products as required in individuals Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- C. Room Mock-ups: Construct room mock-ups as indicated on drawings or individual sections. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Fuller and D'Angelo, P.C. to evaluate quality of the mock-up.
- D. Notify YPS Office of Facilities Management and Fuller and D'Angelo, P.C. seven (7) working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- H. Obtain YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s approval of mock-ups before starting work, fabrication, or construction.
- I. Accepted mock-ups shall be a comparison standard for the remaining Work.

- J. Where mock-up has been accepted by YPS Office of Facilities Management and Fuller and D'Angelo, P.C. and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by YPS Office of Facilities Management.

3.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Fuller and D'Angelo, P.C. before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

- A. Testing Agency Duties:
1. Test samples of mixes submitted by Contractor.
 2. Provide qualified personnel at site. Cooperate with YPS Office of Facilities Management and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify YPS Office of Facilities Management and Fuller and D'Angelo, P.C. of observed irregularities or non-conformance of Work or products.
 6. Perform additional tests and inspections required by YPS Office of Facilities Management
 7. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of the Contractor.
 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify YPS Office of Facilities Management and Fuller and D'Angelo, P.C. and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 6. Arrange with YPS Office of Facilities Management's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Fuller and D'Angelo, P.C..
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

- F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by YPS Office of Facilities Management. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.5 OWNER'S TESTING AND INSPECTIONS

- A. YPS Office of Facilities Management will engage a qualified testing agency or special inspector to conduct tests and inspections as the responsibility of and paid for by Owner as follows:
1. Asbestos inspection and air monitoring
 2. Commissioning.
- B. Contractor shall perform the work in an efficient manner consistent with industry standards. Excessive testing resulting from the contractor's inability to perform efficiently will result in back charges to the contractor.
- C. All re-inspections required for work not properly installed shall be paid for by the contractor.
- D. The Owner will not be liable for any costs or delay claims due to the testing agency or special inspector failure to provide inspection without proper and sufficient notification.
- E. All requests by the contractor for inspection that are cancelled and result in charges to the Owner will be back charged to the contractor.

3.6 CONTRACTOR'S TESTING AND INSPECTION

- A. Testing and Inspections shall be conducted by a qualified testing agency or special inspector, approved by the YPS Office of Facilities Management and as indicated in individual Specification Sections.
- B. Contractor's responsibility including:
1. Notifying YPS Office of Facilities Management, Fuller and D'Angelo, P.C, and Contractor promptly of irregularities and deficiencies observed in the work during performance of its services.
 2. Submitting a certified written report of each test, inspection, and similar quality-control service to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. with copy to Contractor and to authorities having jurisdiction.
 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Retesting and re-inspecting corrected work.
 6. All design mixes.
 7. Testing and balancing of all plumbing and mechanical .
 8. Testing Fire Alarm, smoke detection systems, and emergency light.
 9. Testing public address system.
 10. Electrical systems.
 11. Electrical Certification: The contractor shall obtain UL Certification or Inspection from a Certified Electrical Organization for electrical installations.

3.7 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start up of equipment, balancing of equipment, adjusting, and traffic coatings as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.8 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of YPS Office of Facilities Management, it is not practical to remove and replace the work, YPS Office of Facilities Management will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SUMMARY OF REFERENCE STANDARDS

- A. The YPS Office of Facilities Management shall file and obtain the Building Permit.
- B. Each Contractor shall furnish and pay for all other permits, fees and other installation costs required for the various installations by governing authorities and utility companies; prepare and file drawings and diagrams required; arrange for inspections of any and all parts of the work required by the authorities and furnish all certificates necessary to the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. as evidence that the work installed under this Section of the Specifications conforms with all applicable requirements of the State Codes and Municipal Code.
- C. Regulatory requirements applicable to this project are the following:
 - 1. 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services; Final Rule; Department of Justice; current edition.
 - 2. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
 - 3. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
 - 4. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
 - 5. NFPA 1 - Fire Code; 2021, with Amendment (2020).
 - 6. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 7. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 8. New York State Uniform Fire and Building Codes known as the "Building Codes of the State of New York" and consist of the following:
 - a. Building Code of New York State
 - b. State Education Department Planning Standards, including Commissioner's Regulation Part 155.5, 155.7
 - c. Energy Conservation Construction Code of New York State
 - d. Fire Code of New York State
 - e. Fuel Gas Code of New York State
 - f. Mechanical Code of New York State
 - g. Plumbing Code of New York State
 - h. Utility Company Regulations and Requirements.
 - i. Classification of Construction: Type I.
 - j. Occupancy Classification: Education E
 - k. State Education Department: Planning Standards is applicable to the work. Any conflicts between the Building Codes of New York and the State Education Department Planning Standards, the most restrictive shall apply. Copies of the Planning standards are available at the SED web site. www.p12.nysed.gov › facplan › documents › mps

- D. Electrical Certification: The Electrical Contractor shall obtain UL Certification or Inspection from a Certified Electrical Organization for certification of electrical installations.
- E. Any items of work specified herein and shown on the drawings which conflict with aforementioned rules, regulations and requirements, shall be referred to the Fuller and D'Angelo, P.C. for decision, which decision shall be final and binding.
- F. The work shall not be deemed to have reached a state of Substantial Completion until the certificates have been delivered
- G. EPA - Environmental Protection Agency.
- H. OSHA Part 1926 Safety and Health Regulations for Construction.
- I. Federal Regulation for Asbestos Abatement
 - 1. Title 30 CFR Part 61, Subpart G; The Transport and Disposal of Asbestos Waste
 - 2. The Transport and Disposal of Asbestos Waste]
 - 3. Title 40 CFR, Part 763 Asbestos Containing Materials in Schools; Final Rule and Notice
 - 4. Title 49 CFR Parts 106, 107, and 171-179. The Transportation Safety Act of 1974 and the Hazardous Material Transportation Act..
 - 5. Public Law 101-637 ASHARA
- J. New York State Official Compilation of Codes, Rules and Regulations
 - 1. Title 12 Part 56
 - 2. Title 10 Part 73
 - 3. Title 6 Parts 360-364
 - 4. Labor Law - Article 30 and Sections 900-912
 - 5. All applicable Additions, Addenda, Variances and Regulatory Interpretation Memoranda

1.3 MANDATORY OSHA CONSTRUCTION SAFETY AND HEALTH TRAINING

- A. Pursuant to NYS Labor Law §220-h - All laborers, workers and mechanics working on the site are required to be certified as having successfully completed an OSHA construction safety and health course of at least 10 hours prior to performing any work on the project.

1.4 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements.
- B. Section 01 4219 - Reference Standards

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.

1.3 DEFINITIONS

- A. Owner: The term "Owner shall mean Yonkers Public Schools and their duly authorized representative.
 - 1. The word "Owner" and the words "School Board", "City School District", "Board of Education", "Union Free School District", "Central School District", etc., shall have the same meaning.
- B. Architect: The term "Architect" or "Engineer" or the words "Architect/Engineer" shall mean the Professional Architect responsible for the contract documents Fuller and D'Angelo, P.C., Architects and Planners.
- C. Owner's Representative: The term Owner's Representative shall mean YPS Office of Facilities Management
- D. MEP Consultant shall mean Barile Gallagher Associates, 35 Marble Avenue, Pleasantville, New York 10570
- E. Site Consultant shall mean Hudson Engineering & Consulting, 45 Knollwood Road. Suite 201 - Elmsford. NY 10523
- F. Environmental Consultant shall mean Warrenpanzer, 228 East 45th Street New York, NY 10017
- G. Contractor for Construction: The term "Contractor for Construction", "General Contractor" "Contractor for General Work" "Construction Contractor" shall have the same meaning.
- H. Contractor for Plumbing: The term "Plumbing Contract", "Plumbing Contractor" "Contractor for Plumbing" shall have the same meaning.
- I. Contractor for HVAC: The term "HVAC Contract", "HVAC Contractor" "Contractor for HVAC", "Mechanical Contractor" "Ventilation Contractor" shall have the same meaning.
- J. Contractor for Electrical: The term "Electrical Contract", Electrical Contractor" "Contractor for Electric" shall have the same meaning.
- K. Contractor(s): Shall include all separate contractor(s) have contracts with the Owner for the same project and may include but not limited to: General Construction, Plumbing, HV, HVAC, Electrical, Site and others
- L. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract and Section 01 3000 - Administrative Requirements.
- M. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
- N. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

- O. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- P. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- Q. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- R. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.
- S. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.
- T. The term "Building Code" shall mean the Building Code of the State of New York including all amendments and reference standards to date.
- U. "Work" - Labor, materials, equipment, apparatus, controls, accessories, and all other items customarily furnished and/or required for proper and complete disconnection and reconnection, installation of new work.
- V. "Wiring" - Conduit, fittings, wire, junction and outlet boxes, switches, cutouts, and receptacles and all items necessary or required in connection with or relating to such wiring.
- W. "Concealed" - Embedded in masonry or other construction, installed behind wall furring, within double partitions, or hung ceilings, in trenches, or in crawl spaces.
- X. "Exposed" - Not installed underground or "Concealed" as defined above.
- Y. Furnish: The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations..
- Z. Install: The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- AA. 'Noted' - as indicated on the drawings and/or specifications.
- AB. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- AC. Provide: To furnish and install complete and ready for the intended use.
- AD. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4534
CODE REQUIRED SPECIAL INSPECTIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 GENERAL REQUIREMENTS

- A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the New York State Uniform Code (NYSUC).

1.3 DEFINITIONS

- A. Registered Design Professional: Licensed Professional Engineer or Registered Architect whose seal appears in the Construction Drawings. Unless noted otherwise, references to the Registered Design Professional in this section refer to the Structural Engineer for building design.
- B. RDP for Geotechnical Engineering: Licensed Professional Engineer whose seal appears on the Geotechnical Investigation. The RDP for Geotechnical Engineering shall perform or oversee Agent 2 services as indicated in the Schedule of Special Inspections. If a Geotechnical Investigation was not performed or if the RDP for Geotechnical Engineering is not retained to perform Agent 2 services, a licensed Geotechnical Engineer shall be retained to perform these duties.
- C. Code Enforcement Official: Officer or other designated authority charged with administration and enforcement of the NYSUC. For projects under jurisdiction of New York State agencies such as the Department of Education (SED), State University Construction Fund (SUCF), Office of General Services (OGS), and Dormitory Authority (DASNY), the Code Enforcement Official is an official from agency having jurisdiction.
- D. Special Inspector (SI): Professional Engineer licensed in the State of New York, acting on behalf of the Owner, that implements the Special Inspection Program for the project.
- E. Testing/Inspecting Agency: Agent retained by Special Inspector or Owner and coordinated by Special Inspector to perform some inspection services on behalf of Special Inspector.
- F. Testing/Inspecting Agency (Agent 1): Professional Engineer licensed in the State of New York that is qualified to perform structural inspections. The Special Inspector shall have a minimum of three years of experience performing inspections for similar projects.
- G. Testing/Inspecting Agency (Agent 2): Professional Geotechnical Engineer licensed in the state of New York that is qualified to perform inspections for preparation of building subgrades and foundations.
- H. Testing/Inspecting Agency (Agents 3 or 4): Agency or firm qualified to inspect certain structural elements and perform field and laboratory tests to determine the characteristics and quality of building materials and workmanship.
- I. Statement of Special Inspections: Documents prepared by the Registered Design Professional and filed with and approved by the Code Enforcement Official as a condition of obtaining a building permit. These documents include this specification and the Schedule of Special Inspections.
- J. Schedule of Special Inspections: An itemized list of inspections, verifications, and tests (including frequency) required for the project and individuals, agencies, or firms who will be retained to perform these services. The Schedule of Special Inspections is located in Drawing S003.

- K. Inspect and Inspection: Visual observation of materials, equipment, or construction work as defined in the Statement of Special Inspections, to determine that the work is in substantial conformance with the requirements of the Contract Documents.
- L. Continuous Special Inspection: Full-time observation of work by the Special Inspector or Testing Agency while the work is being performed.
- M. Periodic Special Inspections: Part-time or intermittent observation of work by the Special Inspector or Testing Agency for work that has been or is being performed and at completion of work.

1.4 QUALIFICATIONS

- A. Special Inspector and Testing/Inspecting Agency shall be accepted by the Registered Design Professional (RDP) and the Code Enforcement Official.
- B. Special Inspections shall be performed by agents who have relevant experience for each category of inspections indicated in the drawings.
- C. Minimum qualifications of inspection agents are indicated in the drawings.

1.5 SUBMITTALS

- A. Special Inspector and Testing/Inspecting Agency shall submit to the Registered Design Professional and Code Enforcement Official for review, a copy of their qualifications including names and qualifications of each inspector and technician who will be performing inspections or tests.
- B. Special Inspector and Testing/Inspecting Agency shall disclose past or current business relationship or potential conflict of interest with Contractor or Subcontractors whose work will be inspected or tested.

1.6 PAYMENT

- A. YPS Office of Facilities Management will engage and pay for services of Special Inspector and Testing/Inspecting Agency.
- B. If materials requiring Special Inspections are fabricated in a plant not within 200 miles of project site, Contractor shall be responsible for travel expenses of Special Inspector or Testing/Inspecting Agency.
- C. Contractor shall be responsible for cost of retesting or reinspection of work failing to comply with requirements of Contract Documents.

1.7 OWNER RESPONSIBILITIES

- A. YPS Office of Facilities Management will provide Special Inspector with complete set of Contract Documents sealed by the Registered Design Professional and approved by the Code Enforcement Official.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Contractor shall cooperate with Special Inspector and his agents so Special Inspections and testing may be performed without hindrance.
- B. As indicated in the Schedule of Special Inspections, Contractor shall notify YPS Office of Facilities Management, Testing Agency, and Special Inspector at least 48 hours in advance of a required inspection or test.
- C. Contractor shall provide incidental labor and facilities to provide access to work to be inspected or tested, to obtain and handle samples at site or at source of products to be tested, to facilitate tests and inspections, and for storing and curing of test samples.
- D. If Special Inspections or testing require the use of Contractor's scaffolding to access work areas, Contractor shall provide competent person to perform daily evaluation of scaffolding to verify it is safe to use. Contractor shall notify Special Inspector and Testing Agent of this review before each use. Contractor is responsible for safe assembly and stability of scaffolding.
- E. Contractor shall keep latest set of Construction Drawings, field sketches, accepted shop drawings, and specifications at project site for field use by Inspectors and Testing Technicians.

- F. Contractor shall perform remedial work if required and sign nonconformance reports stating remedial work has been completed. Contractor shall submit signed reports to Special Inspector as work proceeds.
- G. The Special Inspection program shall not relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents or from implementing an effective Quality Control program.
- H. Contractor shall be solely responsible for construction site safety.

1.9 SPECIAL INSPECTOR RESPONSIBILITIES

- A. Special Inspector shall hold a Special Inspections preconstruction meeting at least 7 days prior to initial planned date for start of construction. Attendees shall include Contractors, Owner's Representative, Testing Agency, Special Inspector, and YPS Office of Facilities Management, Contractor, Testing Agency, and Registered Design Professionals for Structural Engineering and for Architecture. Discussions shall include the following:
 - 1. Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.
 - 2. Responsibilities of YPS Office of Facilities Management, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and for Architecture.
 - 3. Notification and reporting procedures.
- B. Special Inspector shall record and distribute minutes from the Special Inspection Preconstruction meeting.
- C. Special Inspector shall review inspection and material testing reports and coordinate the services of the Testing/Inspecting Agencies as follows:
 - 1. Verify inspections have been performed in accordance with the Schedule of Special Inspections.
 - 2. Verify reports are being distributed to the YPS Office of Facilities Management, Architect, Contractor, and Registered Design Professionals for Structural Engineering and for Architecture.
 - 3. Verify discrepancies have been recorded and are being tracked.
- D. Special Inspector shall make site visits to inspect work as designated in the Statement of Special Inspections. Discrepancies will be brought to the attention of the Contractor and RDP.
- E. Special Inspector shall keep records of inspections and tests.
- F. Special Inspector shall review Certificates of Compliance for conformance with the standards specified in the Contract Documents. Discrepancies will be brought to the attention of the Contractor and RDP.
- G. Special Inspector shall submit a final report of Special Inspections in accordance with Section 1.3 of this specification.

1.10 LIMITS ON AUTHORITY

- A. Special Inspector or Testing/Inspecting Agency shall not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Special Inspector or Testing/Inspecting Agency shall not have control over Contractor's means and methods of construction.
- C. Special Inspector or Testing/Inspecting Agency shall not be responsible for construction site safety.
- D. Special Inspector or Testing/Inspecting Agency shall not have authority to stop work.

PART 2 INSPECTIONS AND TESTING

2.1 CAST-IN-PLACE CONCRETE

- A. Special Inspector shall perform the following:
 - 1. Inspect reinforcing steel and placement.
 - a. Inspect embedded bolts and anchor rods prior to concrete placement.
- B. Testing Agency shall perform the following:
 - 1. Verify use of required design mix.

2. Sample and test concrete during placement as follows. Test shall be taken at point of discharge into structure:
 - a. Record specific locations where concrete was placed. Refer to column lines where possible.
 - b. For each truck, record time concrete is batched as shown in truck ticket, time placement begins/sample time, and time truck is emptied.
 - c. For each truck, sample fresh concrete in accordance with ASTM C 172, except modified for slump to comply with ASTM C 94.
 - d. For each truck, perform slump test in accordance with ASTM C 143. Perform two slump tests for pumped concrete; one at truck and one at point of discharge.
 - e. For normal-weight concrete, measure air content in accordance with ASTM C 231, pressure method. For lightweight concrete, measure air content in accordance with ASTM C 173, volumetric method. Perform one test for each truck for air-entrained and non-air-entrained concrete.
 - f. Record temperature of concrete for each truck. Test in-place concrete temperature hourly when ambient temperature is 40 degrees F and below and when 80 degrees F and above.
 - g. Record air temperature and general weather conditions (cloudy, windy, sunny, etc.).
 - h. Record unit weight of fresh normal-weight concrete in accordance with ASTM C 138. Record unit weight of lightweight concrete in accordance with ASTM C 567. Perform one test for each 50-cubic yard of concrete.
 - i. Perform concrete compressive tests as follows:
 - a) Prepare compressive test specimens in accordance with ASTM C 31. Take a set of six 6 x 12 cylinders or nine 4 x 8 cylinders for each 50 cubic yards of concrete or each 5,000 square feet of slab area for each type of concrete. Store undisturbed in insulated box during cold weather. Deliver to laboratory between 16 and 32 hours after making. Perform compressive tests in accordance with ASTM C 39: two 6 x 12 specimens (three 4 x 8 specimens) tested at 7 days, two 6 x 12 specimens (three 4 x 8 specimens) tested at 28 days, and two 6 x 12 specimens (three 4 x 8 specimens) retained for later testing if required.
 - b) In cold weather or whenever steel erection is scheduled to commence less than 14 days after placement of supporting foundation concrete, cast additional set of four 6 x 12 specimens (six 4 x 8 specimens) for each 50 cubic yards or fraction thereof of supporting foundation concrete. Field-cure cylinders, and test two 6 x 12 specimens (three 4 x 8 specimens) at 7 days, retaining two 6 x 12 specimens (three 4 x 8 specimens) for later testing if required. Steel erection may not begin until supporting concrete obtains 75 percent of its design strength.
 - c) If concrete will be placed in separate buildings on a given project, make individual compressive strength test cylinders for each building.
 - j. Perform additional testing as follows if required:
 - a) Take additional set of cylinders for compressive strength testing for each truck in which total time period between batching and completing placement has exceeded ACI-recommended, 90-minute-maximum time limit. Take additional cylinders within 10 minutes of placement completion.
 - b) Make additional tests of in-place concrete when test results indicate specified concrete strengths or other characteristics have not been attained in structure.
 - c) Perform tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods acceptable to Architect.
 - d) Contractor shall reimburse Owner for cost of additional tests.
 - k. Inspect concrete placement for proper application techniques.
 - l. Inspect for maintenance of specified curing temperature and techniques.

- m. Perform floor flatness (FF) and levelness (FL) testing of slabs receiving a trowel finish no later than 48 hours after slab placement in accordance with ASTM E 1155.
 - a) Each floor/level shall be divided into test section areas. FF and FL numbers for each test section area are local values.
 - b) Test section areas shall be minimum of 320 square feet with minimum boundary length of 8 feet for any side. Testing is not to be performed for smaller slab areas.
 - c) Test section areas shall be maximum of 2,000 square feet.
 - d) Test section areas shall not cross slab construction joints.
 - e) Locate test lines orthogonally or at 45 degrees to slab edges in accordance with ASTM E 1155 and no closer than 2 feet to any edge or opening.
 - f) Overall FF and FL numbers are for entire floor/level and shall be determined by considering measurements from all of test section areas on that floor/level.
 - g) (FL) testing is not required for slabs on metal deck.
- n. Perform moisture vapor emission and alkalinity testing in accordance with ASTM F 1869 and ASTM F 710, respectively, as follows:
 - a) Perform testing after building is enclosed, prior to installation of adhered floor finishes, and once HVAC systems are operational.
 - b) Test results must be reviewed and accepted by floor finish installer.
- o. Inspect welding of reinforcing bars.

2.2 UNIT MASONRY

- A. Special Inspector shall perform the following:
 - 1. As masonry construction begins, the following shall be verified to ensure compliance:
 - a. Construction of mortar joints.
 - b. Location of joint reinforcement and connectors.
 - c. Verify:
 - a) Size and location of structural elements.
 - b) Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
 - c) Specified size, grade, and type of reinforcement.
 - d) Protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F).
 - d. Prior to grouting, verify:
 - a) Grout space is clean.
 - b) Placement of reinforcement and connectors.
 - c) Construction of mortar joints.
 - e. Verify grout placement to ensure compliance with code and Construction Document provisions.
 - a) Grouting of CMU cells.
- B. Testing Agency shall perform the following:
 - 1. Verify for compliance with approved submittals:
 - a. Proportions of site-prepared mortar.
 - b. Proportions of site-prepared grout.
 - c. Inspect:
 - a) Welding of reinforcing bars.
 - d. Field Quality Control Testing: Perform tests and evaluations listed below during construction for each 5,000 square feet of wall area or portion thereof.

- a) Sample and evaluate mortar composition and properties in accordance with ASTM C 780.
- b) Sample and test grout compressive strength in accordance with ASTM C 1019.
- c) For each type of wall construction indicated, test masonry prisms in accordance with ASTM C 1314 and as follows:
- d) Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

2.3 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

- A. Verify penetration firestops in accordance with 1.
- B. Verify fire resistant joints in accordance with 1.

PART 3 DOCUMENTATION

3.1 RECORDS AND REPORTS

- A. Prepare detailed reports of each test or inspection. Include the following general information:
 - 1. Project name and number.
 - 2. Date of test or inspection.
 - 3. Name of Testing Agency or Inspecting Agency.
 - 4. Name of technician or inspector.
 - 5. Weather conditions.
 - 6. Locations and elevations of specific areas tested or inspected referenced to grid lines.
 - 7. Description of test or inspection.
 - 8. Reference to applicable ASTM standard.
 - 9. Summary of observations, results, and recommendations.
 - 10. Description of areas or materials requiring retesting or reinspection.
- B. Concrete compressive strength test reports shall contain the following information:
 - 1. Name of Contractor and concrete supplier.
 - 2. Name of concrete testing service.
 - 3. Name of technician making and testing specimens.
 - 4. Truck number and delivery ticket number.
 - 5. Date and location within structure of concrete placement.
 - 6. Concrete type, class, mix proportions of materials, and design compressive strength at 28 days.
 - 7. Slump, air content, unit weight, and concrete temperature.
 - 8. Total time period between batching and completing placement for each truck.
 - 9. Compressive strength and type of break for tests.
- C. Field reports for concrete inspection shall contain general information noted above plus ambient temperature and cylinder numbers.
- D. Test reports for masonry materials shall include proportions, composition, and compressive strength.

3.2 COMMUNICATION

- A. Testing/Inspecting Agency shall immediately notify Contractor, Special Inspector, and Registered Design Professional by telephone, fax, or e-mail of test results failing to comply with requirements of Contract Documents.
- B. Special Inspector shall immediately notify Contractor of work found to be in nonconformance with Contract Documents during inspections. If nonconforming work is not corrected while Special Inspector is on-site, Special Inspector shall notify Registered Design Professional within 24 hours (one business day) and issue an inspection report noting the non-conformance.
- C. Special Inspector and each Testing/Inspecting Agent shall use a log to record and track non-conforming work during construction. Non-Conformance log shall include the following information:

1. Description of non-conformance.
 2. Date of non-conformance.
 3. Description of RDP response if received.
 4. Status of nonconformance: 'Open' or 'Closed.'
- D. Updated log shall be attached to each inspection report. Special Inspector or Testing/Inspecting Agent may use Non-Conformance Log form provided at end of this section or other similar form.
- E. If non-conforming work is not corrected at time of substantial completion of structure or other appropriate time, Special Inspector shall notify Code Enforcement Official.

3.3 DISTRIBUTION OF REPORTS

- A. Testing/Inspecting Agency shall submit reports to Special Inspector and Registered Design Professional within 7 days of inspection or test. Legible handwritten reports may be submitted if final typed copies are not available.
- B. Special Inspector shall distribute reports to the Contractor, Owner, Architect, Code Enforcement Official, and RDP for Structural Engineering within 7 days of inspections. Legible handwritten reports may be submitted if final typed copies are not available.
- C. If requested by the Code Enforcement Official, Special Inspector shall submit interim reports that include inspections and tests performed since beginning of construction or since previous interim report. Interim reports shall be addressed to the Code Enforcement Official with copies sent to the Registered Design Professionals (Structural Engineer and Architect) and Contractor. Interim reports shall be signed by Agent performing inspections.

3.4 FINAL REPORT OF SPECIAL INSPECTIONS

- A. At completion of work, each Testing/Inspecting Agency shall submit Agent's Final Report of Special Inspections to Special Inspector stating work was completed in substantial conformance with Contract Documents and appropriate inspections and tests were performed. Testing/Inspecting Agency may use Agent's Final Report of Special Inspections form provided at end of this section or other similar form.
- B. At completion of work, Special Inspector shall compile a Final Report of Special Inspections including each Agent's Final Report of Special Inspections. The Final Report of Special Inspections shall state required inspections have been performed and itemize nonconforming work not corrected or resolved as required by the NYSUC. Interim reports from all Agents will not be included unless specifically requested by the Owner or Code Enforcement Official. The Final Report shall be stamped by a New York State Professional Engineer.
- C. Special Inspector may use Final Report of Special Inspections form provided at end of this section or other similar form based on CASE Form 102-2001.
- D. Special Inspector shall submit Final Report of Special Inspections to Registered Design Professional and Code Enforcement Official prior to issuance of a Certificate of Use and Occupancy.

Testing/Inspection Agent's Final Report of Special Inspections

Project Name: _____ Inspection Agent: _____
Location: _____ Inspection Agent Project No.: _____
Owner: _____ Special Inspector: _____
Owner Address: _____ Structural RDP: _____

To the best of my information, knowledge, and belief, the Special Inspections and testing required for this project and designated for this Agent in the Statement of Special Inspections (which includes Specification Section 014533 and the Schedule of Special Inspections) have been performed and discovered discrepancies have been reported and resolved except for the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Respectfully submitted,

Agent of the Special Inspector

TITLE _____

(Type or print name)

Signature

Date

Address

City, State, Zip

Design Professional Seal or Certification

Testing/Inspection Agent's Final Report of Special Inspections

Project Name: _____ Inspection Agent: _____
Location: _____ Inspection Agent Project No.: _____
Owner: _____ Special Inspector: _____
Owner Address: _____ Structural RDP: _____

Ryan Biggs | Clark Davis Project No.: 11737.

To the best of my information, knowledge, and belief, the Special Inspections and testing required for this project and designated for this Agent in the Statement of Special Inspections (which includes Specification Section 014533 and the Schedule of Special Inspections) have been performed and discovered discrepancies have been reported and resolved except for the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Respectfully submitted,

Agent of the Special Inspector

TITLE _____

(Type or print name)

Signature

Date

Address

City, State, Zip

Design Professional Seal or Certification

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Temporary water.
- B. Temporary electric power and light.
- C. Temporary telephone service.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Material Hoists
- G. Waste removal facilities and services.
- H. Construction aids and miscellaneous services and facilities.
- I. Sidewalk bridge
- J. Enclosure fence for the construction site.

1.3 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements for submittals.
- B. Section 01 3553 - Site Safety and Security Procedures.
- C. Section 01 5213 - Field Offices and Sheds.
- D. Section 01 5500 - Vehicular Access and Parking.
- E. Section 01 5510 - Traffic and Pedestrian Access & Control.
- F. Section 01 5713 - Temporary Erosion and Sediment Control.
- G. Section 01 5510 - Traffic and Pedestrian Access & Control.
- H. Section 01 7000 - Execution progress cleaning.
- I. Section 01 5813 - Temporary Project Signage.
- J. Divisions 2 through 40 ventilation and humidity requirements for products in those Sections.

1.4 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

1.5 DEWATERING

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.
- B. Maintain temporary facilities as directed by YPS Office of Facilities Management.

1.6 REFERENCES

- A. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

1.7 SITE PLAN:

- A. Show existing fencing, temporary facilities, staging areas, and parking areas for construction personnel.

1.8 REPORTS AND PERMITS:

- A. During the progress of the Work, each prime contractor shall submit copies of reports and permits required by governing authorities, or necessary for the installation and efficient operation of temporary services and facilities
- B. Submit copies of reports of tests, inspections, and similar procedures performed on temporary utilities before, during and after performance of work. Submit copies of permits, easements and similar documentation necessary for installation, use and operation of temporary utility services.

1.9 QUALITY ASSURANCE

- A. Regulations: Each contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Police, fire department and rescue squad rules.
 - 4. Environmental protection regulations
- B. Standards: Each prime contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1.10 PROJECT CONDITIONS

- A. General: Each contractor shall provide each temporary service and facility ready for use at each location, when first needed to avoid delays in performance of work. Maintain, expand as required, and modify as needed throughout the progress of the work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.
- B. Temporary Use of Permanent Facilities: Regardless of previously assigned responsibilities for temporary services and facilities, the Installer of each permanent service or facility shall assume responsibility for its operation, maintenance and protection during use as a construction service or facility prior to the YPS Office of Facilities Management's acceptance and operation of the facility.
- C. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload, and do not permit temporary services and facilities to interfere with the progress of work, or occupancy of existing facility by owner. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
- D. Temporary Construction and Support Facilities: Maintain temporary facilities in a manner to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary facilities in a sanitary manner so as to avoid health problems.
- E. Security and Protection: Maintain site security and protection facilities in a safe, lawful, publicly acceptable manner. Take measures necessary to prevent site erosion.

1.11 TEMPORARY UTILITIES

- A. YPS Office of Facilities Management will provide the following:
 - 1. Electrical power, consisting of Contractor's connection to existing facilities.
 - 2. Water supply, consisting of Contractor's connection to existing facilities.
- B. Use trigger-operated nozzles, with back flow devices, for water hoses, to avoid waste of water.

1.12 DIVISION OF RESPONSIBILITIES

- A. Each Contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, as well as the costs and use charges associated with each facility.
 2. Plug-in electric power cords and extension cords.
 3. Supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 4. Special power requirements for installation of its own work such as welding.
 5. Its own field office complete with necessary furniture, utilities, and telephone service.
 6. Its own storage and fabrication sheds.
 7. Temporary telephone service.
 8. All hoisting and scaffolding for its own work.
 9. Collection and disposal of all major equipment removed such as boilers, unit ventilators, heaters, fans, toilet fixtures, light fixtures, and casework.
 10. Secure lockup of its own tools, materials and equipment.
 11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
 12. Containerized bottled-water drinking-water units.
 13. First Aid Station and Supplies.
 14. Disposal of wastes containers.
 15. Barricades, warning signs, and lights.
 16. Security enclosure and lockup.
 17. Temporary Fire Protection
 18. Temporary Protection for existing flooring, from altered areas to exits.
 19. Construction aids and miscellaneous services and facilities.
- B. The HVAC Contractor is responsible and pays all costs for the following:
1. Maintaining the existing heating system in service during the period between September 15 and June 15. Contractor shall provide all piping, valves, controls, etc., and labor and materials required to maintain operation of the existing heating system where affected by the work.
- C. Temporary Lighting: Electrical Contractor shall provide and pay all costs to provide temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy, retain light suitable for work-in-progress, access traffic, security check and project lock-up. Provide temporary lighting at all areas where existing lighting is indicated on the contract documents to be removed.
1. Provide not less than one 200-watt lamp per 400 sq. ft. of floor area, uniformly distributed, for general construction lighting, or illumination of a similar nature.
- D. Temporary light and power shall be provided 15 minutes before the normal scheduled daily start of any trade and 15 minutes after the normal schedule daily completion of the last trade. Regardless of specific trade work hours.
- E. The Contractor shall maintain power and lighting during the normal work week during the hours established by YPS Office of Facilities Management whether or not they fall within established working hours.

1.13 ELECTRIC WELDERS

- A. Separate Power Sources Required: Power for electric welders and for other loads larger than the available capacities of existing power sources shall be taken from portable power sources provided, paid for and operated by the Contractor or Sub-Contractor requiring the use of such equipment. Remove such power sources when no longer needed.

1.14 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or the Architect, Engineer or the Owner's Representative. The YPS Office of Facilities Management will not accept a contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.
 - 1. Water Service Use Charges: Water from the Owner's existing water system may be used without metering, and without payment for use charges.
 - 2. Electric Power Service Use Charges: Electric power from the Owner's existing system may be used without payment of use charges. Contractor and Sub-Contractors shall exercise measures to conserve energy usage.
 - a. Use of owner electric for items not specific to project (e.g. heating construction shanties, etc.) will not be permitted.
 - 3. Temporary Utility Services: Where Owner's existing services is inadequate or would disrupt owners use of the existing facility, contractor shall provide utility services for the temporary use at the project site from the utility company, and pay all costs, including use charges.

1.15 TELECOMMUNICATIONS SERVICES

- A. Each Contractor shall provide and pay for its own telephone service.
 - 1. Provide mobile phone service for all field superintendents and foreman.
- B. General Construction Contractor at central location, post a list of important telephone numbers, including the following:
 - 1. Local police and fire department.
 - 2. Ambulance service.
 - 3. Contractor's temporary and home office.
 - 4. YPS Office of Facilities Management temporary and home office
 - 5. Architect's home office.
 - 6. Principal subcontractors temporary and home office

1.16 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.
- D. Sanitary Facilities: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project's needs.
 - 1. Responsibilities: The General Construction Contractor is responsible for temporary sanitary facilities and their maintenance, including supplies for all contractors .
 - 2. Install self-contained toilets to the extent permitted by governing regulations.
 - 3. Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility for full contract duration. Provide covered waste containers for used material.
 - 4. Provide separate toilet facilities for male and female construction personnel where required by law.

1.17 BARRIERS

- A. Each contractor shall provide temporary barriers to prevent unauthorized entry to construction areas created by their work to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and removals .

- B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.18 FENCING

- A. Enclosure Fence: Each contractor shall be responsible to provide a general enclosure fence with suitable lockable entrance gates around any materials stored on site.
- B. Construction: Commercial grade chain link fence.
- C. Locate where indicated, or if not indicated, as agreed with YPS Office of Facilities Management. Provide enclosed portions of the site determined to be sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except through entrance gates.
1. Material:
 - a. Steel fencing: Galvanized Chain Link and galvanized gates (non-climbable size).
 - b. Fabric: No. 9 GA galvanized, steel wire mesh, furnish one-piece fabric widths for fencing up to 12' in height indicated in the Contract Documents.
 - c. Framing and Accessories: End, Corner and Pull posts: 2.375" OD steel pipe.
 - d. Line Posts: Space 10'-0" O.C. maximum. 1.90" steel pipe or 1.875" x 1.625 C-sections.
 - e. Fence Rails: Locate at top and bottom of fabric. Post brace assembly - manufacturer's standard.
 - f. Wire ties: For tying fabric to line posts use wire ties spaced 12" O.C.
 - g. Height: 6'
 2. Excavate hole depths approximately 3" lower than post bottom; with bottom of posts set not less than 36" below finish grade surface. The line post holes will be 16" in diameter and 3'-9" in depth filled with set in a compacted mixture of gravel and earth.
 - a. Self-supporting fence with movable bases may be used when approved by the YPS Office of Facilities Management

1.19 EXTERIOR ENCLOSURES

- A. Each contractor shall be responsible to provide temporary solid, insulated weather tight closure of exterior openings, created by their construction activities, to accommodate acceptable working conditions and protection for products, to allow for maintenance of required ambient temperatures. and to prevent entry of unauthorized persons. Provide minimum 1/2" plywood, adequately supported. Provide access doors with self-closing hardware and locks, if required.

1.20 INTERIOR ENCLOSURES

- A. Each contractor shall provide temporary dustproof partitions at areas disturbed by their construction activities, as required to separate work areas from Yonkers Public Schools-occupied areas, to prevent penetration of dust and moisture into Yonkers Public Schools-occupied areas, and to prevent damage to existing materials and equipment.
- B. Contractor shall remove and reinstall any devices impacted by temporary partition installation. At conclusion of project electrician will again remove and reinstall these devices onto the permanent locations

1.21 SITE SAFETY AND SECURITY PROCEDURES- See Section 01 3553

1.22 VEHICULAR ACCESS AND PARKING 01 5310 Traffic and Pedestrian Access and Control

1.23 WASTE REMOVAL

- A. General Construction Contractor shall provide containers, at grade, sufficient for the depositing of non-hazardous/non-toxic waste materials, and shall remove such waste materials from project site as required or directed by the Owner's representative.
1. Provide specific containers for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

2. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 3. Contractors shall not utilize the Owner's bins or dumpsters.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. Each prime contractor shall be responsible for daily cleaning up of spillage and debris resulting from its operations and from those of its subcontractors; and shall be responsible for complete removal and disposition of hazardous and toxic waste materials.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- E. Burying or burning of waste materials on the site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- F. Site: Each Contractor shall maintain Project site free of waste materials and debris, created by its construction operation.
- G. Installed Work: Keep installed work clean. Each Contractor shall clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- H. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- I. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

1.24 FIELD OFFICES - See Section 01 5213

1.25 TEMPORARY BOILER

- A. In the event the contractor does not complete the project as scheduled, the HVAC Contractor shall provide a temporary boiler until new boilers are on line as follows:
- B. The HVAC Contractor shall install and operate a portable outdoor heating plant (4,800 HP boiler minimum) with all required fuel piping, connections, permits, trenching, controls, electrical connection including cables, disconnect switches, etc from an available panel in the building, cutting and patching, and removal from the site after the completion of work, including start up and testing of new boilers, site restoration etc. The boiler shall be delivered on site and shall be operational to provide heat for the entire facility. The YPS Office of Facilities Management Owner will pay for fuel required for the operation of the temporary boiler. The Contractor shall notify the YPS Office of Facilities Management 48 hours prior to the need for fuel.
- C. Boiler shall be available starting September 1st and shall remain and operating until system is on line and functioning automatically.

1.26 TEMPORARY HEAT

- A. Temporary Heat: Each contractor shall provide temporary heat as required for proper performance of their work, curing or drying of recently installed work, or protection of work in place, from adverse effects of low temperatures or high humidity.

1.27 HOISTS

- A. Each Contractor shall provide facilities for hoisting materials and employees. Do not permit employees to ride hoists which comply only with requirements for hoisting materials. Selection of type, size and number of facilities is the Contractor's option. Truck cranes and similar devices used for hoisting are considered tools and equipment and not temporary facilities

1.28 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION -

3.1 TEMPORARY UTILITY INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Each Prime Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 CONTRACTOR FIELD OFFICES Refer to Section 5213

3.3 STORAGE FACILITIES

- A. Each Contractor and each subcontractor shall provide temporary storage facilities as required for his own use. Temporary structures shall be located at the fenced staging area, and shall be removed upon completion of the work or when directed.
 - 1. All temporary storage facilities and location shall be subject to the approval of YPS Office of Facilities Management.
- B. Materials delivered to the site shall be safely stored and adequately protected against loss or damage. Particular care shall be taken to protect and cover materials that are liable to be damaged by the elements.
- C. Due to limited on site storage space, each Contractor shall coordinate delivery of his materials with the YPS Office of Facilities Management who will determine when large deliveries shall be made and shall be designate storage locations on site for delivered materials. All stored materials must be stored in locked, watertight trailers, paid for by applicable contractor.

3.4 SCAFFOLDING AND STAGING

- A. All scaffold, staging and appurtenances thereto shall comply in total to the requirements of Safety and Health Regulations for Construction Chapter XVII of OSHA, Part 1926 and all related amendments.
- B. Install and maintain pipe scaffolding where masonry, roofing, and window restoration or replacement work is specified until all work and punch list work is complete and approved by the Architect.
 - 1. Scaffolding may be installed and removed in phases as the work progresses, at the Contractor's option and approved by the Architect
 - 2. No work shall occur on any roof area until the scaffold is erected on that entire wing.

3.5 ROOF PROTECTION

- A. Each Contractor(s) shall provide temporary protection on any existing roof surface when it is necessary for work to take place on completed sections.
- B. Upon such notification as required in subparagraph A, the Contractor shall assume responsibility for damages, if any, to the roofing system caused by the work of other trades, except that financial liability for any and all damages rests with the offending trade.

3.6 FIRE PREVENTION AND CONTROL Refer to Section 01 3553 - Site Safety and Security Procedures.

3.7 DISCONTINUE, CHANGES AND REMOVAL

- A. Each Contractor(s) shall:
 - 1. Discontinue all temporary services required by the Contract when so directed by the YPS Office of Facilities Management .
 - 2. The discontinuance of any such temporary service prior to the completion of the work shall not render the Owner liable for any additional cost entailed thereby and the Contractor shall thereafter furnish, at no additional cost to the Owner, any and all temporary service required by such Contractors work.
 - 3. Remove and relocate such temporary facilities as directed by the YPS Office of Facilities Management without additional cost to the Owner, and shall restore the site and the work to a condition satisfactory to the Owner.

3.8 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION

- A. Each Prime Contractor shall be responsible for own temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
- B. Ventilate enclosed area to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.
- C. Provide equipment as necessary for air and fresh exchange for the work area per OSHA standards.
- D. Remove temporary ventilation equipment prior to the completion of construction.
- E. Each Contractor will provide negative air machines of sufficient size/qty for square footage of work areas to exhaust any dust / fumes through flexible duct hose to exterior to eliminate any odors/smoke etc. During second shift work, there can be no odors in school the following day.
- F. The Contractor(s) who allows water infiltration into the building is responsible for cleanup and commercial dehumidifiers of sufficient size and quantity to prevent mold growth. Failure to immediately address will result in owner hiring others and back charging in order to insure safe school environment

3.9 ENVIRONMENTAL PROTECTION:

- A. Each Prime Contractor shall provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near Project site.

3.10 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

END OF SECTION

SECTION 01 5213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Temporary field offices for use of YPS Office of Facilities Management
- B. Temporary field offices for use of each Contractor.
- C. Maintenance and removal.

1.3 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary of Contract: Use of premises.
- B. Section 01 5000 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.
- C. Section 01 5500: Parking and access to field offices.
- D. Section 01 5510 - Traffic and Pedestrian Access & Control.

1.4 USE OF EXISTING FACILITIES

- A. Existing facilities shall not be used for field offices.
- B. Due to limited space availability, location, size and number of field office may be limited and subject to the approval of YPS Office of Facilities Management.

PART 2 PRODUCTS

2.1 MATERIALS, EQUIPMENT, FURNISHINGS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.2 CONSTRUCTION

- A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
- B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove at completion of Work or when directed by the YPS Office of Facilities Management.
- C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.
- D. Exterior Materials: Weather resistant, finished in one color.
- E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
- F. Lighting for Offices: 50 fc (538 lx) at desk top height, exterior lighting at entrance doors.
- G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.3 ENVIRONMENTAL CONTROL

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.4 CONTRACTOR(S) OFFICE AND FACILITIES

- A. Contractor's Option.
- B. Each Contractor is responsible for their field offices if they deem them necessary for their use.
- C. Each respective contractor shall pay all costs for delivery, setup, temporary utility connections and removal costs for their own facilities.

2.5 OWNER AND CM/ARCHITECT/ENGINEER OFFICE

- A. The GC Contractor Contract #1 shall be responsible and pay all costs for YPS Office of Facilities Management and Construction Manager's field office.
 - 1. The EC Electrical Contractor shall provide and pay all costs for temporary power to trailer.
- B. Trailer Manufacture:
 - 1. Cassone Inc, Ronkonkoma, NY. Model #: CA 832, or equal
- C. Heating, Cooling, and Ventilating: Automatic equipment to maintain 68 degrees F heating and 76 degrees F (23 degrees C) cooling.
- D. Separate spaces for sole use of Construction Manager with separate entrance door with new lock and two keys.
- E. Area: At least 224 sq ft (20.8 sq m), with minimum dimension of 8 ft (2.4 m).
- F. Windows: At least five, with minimum total area equivalent to 10 percent of floor area, with an operable sash and insect screen. Locate to provide views of construction area.
- G. Electrical Distribution Panel: 100 amp breaker panel, Two circuits minimum, 110 volt, 60 hz service.
- H. Minimum six 110 volt duplex convenience outlets, one on each wall.
- I. Furnishings:
 - 1. One desk 54 by 30 inch (1372 by 762 mm), with three drawers.
 - 2. One drafting table 36 by 72 inch (914 by 1829 mm), with one equipment drawer and a 48 inch wide parallel straight edge.
 - 3. One metal, double-door storage cabinet under table.
 - 4. One standard four-drawer legal size metal filing cabinet with locks and two keys per lock.
 - 5. Two swivel arm chairs.
 - 6. One tackboard 36 by 30 inch (914 by 762 mm).
 - 7. One waste basket per desk and table.
 - 8. Conference Table: 8' folding with ten (10) folding chairs.
 - 9. Two exterior stairs and platforms.
 - 10. All support, foundations and miscellaneous support and installation items.

PART 3 EXECUTION

3.1 PREPARATION

- A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.2 INSTALLATION

- A. Install YPS Office of Facilities Management office spaces ready for occupancy 15 days after date fixed in Notice of Award.

3.3 MAINTENANCE AND CLEANING

- A. Weekly janitorial services, including supplies for YPS Office of Facilities Management's offices; periodic cleaning and maintenance for offices.
- B. Maintain approach walks free of mud, water, and snow.

3.4 REMOVAL

- A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 5500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Parking.
- B. Existing pavements and parking areas.
- C. Construction parking controls.
- D. Maintenance.
- E. Removal, repair.

1.2 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary of Contract: For access to site, work sequence, and occupancy.

PART 3 EXECUTION

2.1 PARKING

- A. Use of existing parking facilities by construction personnel while school is in operation is not permitted.
- B. During times when school is not in operation designated areas of contractor parking shall be designated by Owner's Representative. Contractors shall limit their vehicles to designated spaces.
- C. Each contractor shall be responsible for vehicle parking of their personnel and company vehicles off-site during school operation.

2.2 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Yonkers Public Schools's operations.
- B. Prevent parking on or adjacent to access roads or in non-designated areas.

2.3 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Repair any damage to existing paving caused by construction operations.

2.4 REMOVAL, REPAIR

- A. Repair existing facilities damaged by use, to original condition.

END OF SECTION

SECTION 01 5510
TRAFFIC AND PEDESTRIAN ACCESS & CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Each Contractor shall maintain clear traffic flow to all site areas for the duration of the contract and protect the traveling public and pedestrians from all damage to persons and property within the limits of thier construction operationsfor the duration of the contract.
- B. It is specifically noted that while school is in session, there are children playing at recess, walking to outdoor gym classes, etc. Contractor's trucks must be walked from the point of entry onto the site to the designated parking area and vice versa, with a separate monitoring individual to insure children's safety. See 01 1000 - Summary of Contract for delivery black out times.

1.3 METHOD OF MAINTAINING AND PROTECTING TRAFFIC

- A. Contractor shall maintain and protect traffic by so conducting his construction operations that the traveling public and pedestrian safety is subjected to a minimum of hazard and delay. In order to adequately maintain and protect traffic, contractor shall perform the following additional minimum requirements as directed by YPS Office of Facilities Management:
 - 1. Keep the surface of the traveled way free from mounds, depressions, and obstructions of any type which could present hazards or annoyance to traffic.
 - 2. Keep the surface of all pavements used by the public free and clean of all dirt, debris, stone, timber or other obstructions to provide safe traveled ways.
 - 3. Control dust and keep the traveled way free from materials spilled from hauling and construction equipment.
 - 4. Provide all cones, barricades, signs and warning devices as may be required and/or as ordered by the YPS Office of Facilities Management to safely carry out the foregoing. All such signs and devices shall be fabricated and placed in accordance with the latest "Federal Manual on Uniform Control Devices". Use of Open Flares Is Prohibited.
 - 5. Prepare and submit for approval sketch/drawing showing proposed location and type of signs, barricades and devices as required in above.
 - 6. Contractor to post temporary construction signs, including construction traffic signs, safety signs, security signs, and no trespassing signs as required.

1.4 INGRESS AND EGRESS

- A. All Contractors shall provide and maintain, at all times, safe and adequate ingress and egress to and from site at existing or at new access points consistent with work, unless otherwise authorized by the YPS Office of Facilities Management.

1.5 CONTRACTOR'S ATTENTION IS DIRECTED TO

- A. If, upon notification by YPS Office of Facilities Management, contractor fails to correct any unsatisfactory condition within 24 hours of being so directed, Owner's Representative will immediately proceed with adequate forces to properly maintain the project and the entire cost of such maintenance shall be deducted (back charged) from any moneys due the contractor.

1.6 PAYMENT

A. Withholding of Payment

1. If Contractor fails to maintain and protect traffic adequately and safely for a period of 24 hours, the YPS Office of Facilities Management shall correct the adverse conditions by any means he deems appropriate, and shall deduct the cost of the corrective work from any Monies due the Contractor. The cost of this work shall be in addition to the liquidated damages and nonpayment for Maintenance and Protection of Traffic listed above.
2. However, where major nonconformance with the requirements of this specification is noted by the Owner's Representative and prompt contractor compliance is deemed not to be obtainable, all contract work may be stopped by direct order of the Owner's Representative regardless of whether corrections are made by the Owner's Representative as stated in the paragraph above.

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Maintenance materials, extra materials.

1.3 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary of Contract.
- B. Section 01 2500 - Substitution Procedures: Substitutions made after the Bidding/Negotiation Phase.
- C. Section 01 3000 - Administrative Requirements.
- D. Section 01 4000 - Quality Requirements: Product quality monitoring.
- E. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- F. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.4 REFERENCE STANDARDS

- A. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services; 2017.
- B. NEMA MG 1 - Motors and Generators; 2018.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 DEFINITIONS

- A. Refer to "Article 7 General Engineering Agreement" for additional requirements
- B. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- C. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
- D. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

- E. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- F. Substitutions: Changes in products, materials, equipment, and methods of construction from those required or specified by the Contract Documents and proposed by Contractor.
- G. Basis-of-Design Or Equal Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," or "or equal", including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers **shall be submitted as substitutions**.
- H. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

1.6 SUBMITTALS

- A. Refer to Section 01 3000 - Administrative Requirements for additional requirements
- B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 10 days after date of Notice of Award.
 - 2. For products specified only by reference standards, list applicable reference standards.
- C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.7 ASBESTOS

- A. Asbestos: All products, materials, etc., used in conjunction with this Project shall be Asbestos-Free.
 - 1. Contractor shall provide a certified letter to the YPS Office of Facilities Management stating that no asbestos containing material has been used in this project. Refer to Section 01 7800 - Closeout Submittals.
- B. Contractor(s) and sub contractors must provide test results upon completion from a New York State accredited testing lab certifying that all material including joint and pipe insulation on this project is non-asbestos.
 - 1. This certification shall be based on a sampling of 10% of all linear feet of pipe insulation, (unless manufacturer's certificate is submitted).

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Yonkers Public Schools, or otherwise indicated as to remain the property of the Yonkers Public Schools, become the property of the Contractor(s); remove from site.

2.2 NEW PRODUCTS

- A. Provide new products for all unless otherwise specifically required or permitted by the Contract Documents.
- B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Made of wood from newly cut old growth timber.
 - 4. Containing lead, cadmium, or asbestos.

2.3 PRODUCT OPTIONS

- A. Refer to Section 00 2113 - Instructions to Bidders for Product/Assembly/System Substitutions.
- B. Refer to Section 01 2500 - Substitution Procedures.
- C. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3000 - Administrative Requirements. All products, **other than "Basis of Design"**, shall be submitted as a substitution. Show compliance with requirements. Submit on form attached.

2.4 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
 - 1. Deliver to YPS Office of Facilities Management; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.
- B. Substitutions will not be considered during the bidding phase.

3.2 SUBSTITUTION SUBMITTAL PROCEDURE AFTER BIDDING PHASE

- A. Refer to Section 01 2500 - Substitution Procedures.

3.3 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide off-site storage and protection when site does not permit on-site storage or protection.
 - 1. Execute a formal supplemental agreement between Yonkers Public Schools and Contractor allowing off-site storage, for each occurrence.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Do not store products directly on the ground.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- L. Prevent contact with material that may cause corrosion, discoloration, or staining.
- M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. VOC restrictions for product categories listed below under "DEFINITIONS."
- D. All products of each category that are installed in the project must comply; Yonkers Public Schools's project goals do not allow for partial compliance.

1.3 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements and product options, delivery, storage, and handling.
- D. Section 07 9200 - Joint Sealants: Emissions-compliant sealants.
- E. Section 09 5100 - Acoustical Ceilings.
- F. Section 09 9123 - Interior Painting.
- G. Section 09 9113 - Exterior Painting.
- H. Section 09 6500 - Resilient Flooring.

1.4 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Products making up wall and ceiling assemblies.
 - 5. Thermal and acoustical insulation.
 - 6. Free-standing furniture.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Exterior and interior paints and coatings applied on site.
 - 2. Exterior and interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
- C. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
 - 1. Interior of Building: Anywhere inside the exterior weather barrier.

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2. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
3. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- D. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 1. Concrete.
 2. Clay brick.
 3. Metals that are plated, anodized, or powder-coated.
 4. Glass.
 5. Ceramics.
 6. Solid wood flooring that is unfinished and untreated.

1.5 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).
- C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association; 2019.
- D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- E. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- F. GreenSeal GS-36 - Standard for Adhesives for Commercial Use; 2013.
- G. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2017).
- I. SCS (CPD) - SCS Certified Products; Current Edition.
- J. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.7 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 1. Wet-Applied Products: State amount applied in mass per surface area.
 2. Paints and Coatings: Test tinted products, not just tinting bases.
 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current listing in CHPS (HPPD) as a low-emitting product.
 - c. Current CRI (GLP) certification.
 - d. Test report showing compliance and stating exposure scenario used.
 4. Product data submittal showing VOC content is NOT acceptable evidence.
 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

Fuller and D'Angelo, P.C.
Architects and Planners

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- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Aerosol Adhesives: GreenSeal GS-36.
 - 3. Joint Sealants: SCAQMD 1168 Rule.
 - 4. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - 5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.
- C. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GREENGUARD Children & Schools certification; www.greenguard.org.
 - b. Current SCS Indoor Advantage Gold certification; www.scs-certified.com.
 - c. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
 - d. Current certification by any other agencies acceptable to CHPS.
 - e. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.
 - 2. Product data submittals showing VOC content are NOT acceptable forms of evidence.
- D. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- E. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GreenSeal Certification.
- F. Paints and Coatings: Provide products having VOC content as specified in Section 09 9113 - Exterior Painting and 09 9123 - Interior Painting.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Yonkers Public Schools reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Yonkers Public Schools.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 7000
EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Inspections prior to start of work.
- B. Examination, preparation, and general installation procedures.
- C. Requirements for alterations work, including selective removals .
- D. Pre-installation meetings.
- E. Surveying for laying out the work.
- F. Site scoping.
- G. Construction layout.
- H. General installation of products.
- I. Progress cleaning.
- J. Protection of installed construction.
- K. Correction of the Work.
- L. Dust control
- M. Cleaning and protection.
- N. Starting of systems and equipment.

1.3 RELATED REQUIREMENTS

- A. YPS General Engineering Agreement for additional requirements.
- B. Section 01 1000 - Summary of Contract: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials
- C. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- D. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- E. Section 01 5000 - Temporary Facilities and Controls.
- F. Section 01 3553 - Site Safety and Security Procedures .
- G. Section 01 5713 - Temporary Erosion and Sediment Control.
- H. Section 01 7310 - Cutting and Patching.
- I. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- J. Section 01 7800 - Closeout Submittals: Project substantial completion, record documents, operation and maintenance data, warranties .
- K. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

- L. Section 07 8400 - Firestopping.
- M. Section 07 9200 - Joint Sealants.
- N. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.

1.4 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. Submit documentation verifying accuracy of existing survey.
 - 2. Submit surveys and survey logs for the project record.
- C. Certified Surveys: Submit two copies signed by land surveyor or professional engineer for each the following surveys:
 - 1. Final Survey: Before substantial completion, the Surveyor shall prepare a final property survey showing significant features (real property) that have resulted from construction of the project, including underground utilities, tanks and similar work install under all contracts.
 - a. Each prime contractor shall provide related information to the surveyor for the work installed under their contract. Include on the survey a certification, signed by the Surveyor, to the effect that the principal lines and levels of the project are accurately positioned as shown on the drawings.
 - b. Show, where applicable, boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - c. Final Survey: Submit one (1) CAD drawing showing the Work performed and record survey data.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Cutting and Patching: Refer to Section 01 7310 - Cutting and Patching for requirements.

1.6 QUALIFICATIONS

- A. Refer to individual sections for additional requirements.
- B. Each Contractor shall do all cutting, patching, repairing as necessary for their work. In all cases, the cutting, patching, repairing and finishing shall be performed by mechanics skilled in the particular trade required at no additional cost to the Owner.
- C. For survey work, the Construction Contractor shall employ a land surveyor registered in New York and acceptable to YPS Office of Facilities Management. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- D. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in State of New York.

1.7 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

- D. Perform dewatering activities, as required, for the duration of the project.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Dust Control: Each Contractor shall execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. The General Construction Contractor shall provide dust-proof barriers between construction areas and non construction areas inside or outside the construction areas.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Refer to Section 01 5713 - Temporary Erosion and Sediment Control for additional requirements.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations when the building is occupied..
 - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day when building is occupied; excessively noisy includes jackhammers and pneumatic hammers.
 - 2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
 - 3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

1.8 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Contract Manual and Specification to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate sections.
- F. After Yonkers Public Schools occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Yonkers Public Schools's activities.
- G. General: The General Construction Contractor includes general coordination of the entire work of the project, including preparation of general coordination drawings, diagrams and schedules and control of site utilization from the beginning of construction activity through project closeout and warranty periods.
- H. Alterations: Where applicable, requirements of the contract documents apply to alteration work in the same manner as to new construction. Refer to drawings for specific requirements of alteration work. Primarily, alterations can be described as normal architectural, mechanical and electrical alterations. Contractors shall review phasing and scheduling of the work to understand that certain areas of work must be completed and occupied prior to start of other work. This is essential to the Owner in their ability to maintain the educational programs during construction.

1.9 CODES, PERMITS, FEES

- A. Refer to Section 01 4100 - Regulatory Requirements.

1.10 MANDATORY OSHA CONSTRUCTION SAFETY AND HEALTH TRAINING

- A. Pursuant to NYS Labor Law §220-h - On all public work projects all laborers, workers and mechanics working on the site are required to be certified as having successfully completed an OSHA construction safety and health course of at least 10 hours prior to performing any work on the project.

PART 2 PRODUCTS

2.1 MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.
- D. Barriers shall be constructed of sturdy lumber having a minimum size of 2 x 4.
 - 1. Signs shall be made of sturdy plywood of 1/2" minimum thickness and shall be made to legible at a distance of 50 feet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Prior to start of construction take photographs, video's or similar documentation as evidence of existing project conditions as follows:
 - 1. Interior views: Each room and areas of outside work area which could be construed as damaged caused by the contractor.
 - 2. Exterior views: Each area of work and areas of outside work area which could be construed as damage caused by the contractor.
- B. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- C. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- D. Examine and verify specific conditions described in individual specification sections.
- E. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site **prior to commencing work of the section.**
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify YPS Office of Facilities Management and Fuller and D'Angelo, P.C. four days in advance of meeting date.

- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to YPS Office of Facilities Management and Fuller and D'Angelo, P.C., participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify YPS Office of Facilities Management of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to YPS Office of Facilities Management the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to YPS Office of Facilities Management
- F. Utilize recognized engineering survey practices.
- G. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

3.5 REMOVAL AND DUST CONTROL

- A. The following procedures shall be followed when removals will create dust:
 - 1. Exterior
 - a. Work must be in compliance with OSHA Construction Standard (29 CFR 1926.62).
 - b. Windows directly below, above and adjacent to the work area shall be closed.
 - c. Provide tarps on the outside of the building to catch all dust, debris and paint chips when items are being removed and/or installed.
 - d. Roof top exhaust fans and HVAC equipment to shut down and intakes covered.
 - 2. Interior:
 - a. Floor surfaces shall be provided with a minimum of one layer of six mil plastic from work area to exits.
 - b. All air vents in the room shall be closed, shut off and sealed.
 - c. Access to all rooms undergoing removals shall be restricted to prevent unauthorized entry.
 - d. All moveable objects will be moved away from the vicinity of the removals by the Contractor. The Contractor shall cover with a drop cloth.
 - e. All corridors used by Contractors shall be mopped and left clean daily prior to occupancy.
 - 3. General Construction Contractor shall provide labor for daily cleanup on the interior and the exterior of the building as required or directed by the YPS Office of Facilities Management. Any visible debris shall be removed prior to occupancy the following day.

4. All debris shall be disposed of properly in accordance with Federal, State and Local Regulations. Refer to Section 01 5000 - Temporary Facilities and Controls and asbestos and lead abatement sections for containers required.
5. Do not leave any openings unprotected at end of work day or during periods of excessive cold weather or precipitation.
6. At completion of each work area HEPA vacuumed and wet wipe.

3.6 CHEMICAL FUMES AND OTHER CONTAMINATES

- A. Each Contractor shall be responsible for the control of chemical fumes, gases and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc., to ensure they do not enter occupied portions of the building or air intakes.
- B. Each Contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc., are scheduled, cured or ventilated in accordance with manufacturer's recommendations before a space can be occupied.

3.7 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Saw cut all concrete slabs and asphalt paving.
- E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- F. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- G. Make neat transitions between different surfaces, maintaining texture and appearance.

3.8 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 1. Verify that construction and utility arrangements are as indicated.
 2. Report discrepancies to YPS Office of Facilities Management before disturbing existing installation.
 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are occupied or unoccupied.
 1. Provide, erect, and maintain temporary dustproof partitions of construction as indicated in Section 01 7000 .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 1. Remove items indicated on drawings.

2. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
3. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Identify new equipment installed, but not in service, with appropriate signage or other forms of identification. indicating "Not in Service".
 - b. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - c. Provide temporary connections as required to maintain existing systems in service.
 - d. Perform all switchovers, shutdowns, etc after hours, weekends, holidays or times when the building is not occupied. All switchover scheduling shall be approved by the Owner.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove conduits; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
 1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch as specified for patching new work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 1. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 2. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Fuller and D'Angelo, P.C. review and request instructions.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
- J. Remove debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before removals are complete.
- L. Comply with all other applicable requirements of this section.

3.9 CUTTING AND PATCHING Refer to Section 01 7310 - Cutting and Patching

3.10 SPECIAL REQUIREMENTS

- A. All existing systems are required and shall remain operational during the performance of the work.
- B. Notwithstanding anything contained in the Contract Documents to the contrary, the contractor shall not be permitted to disrupt operation of any building system or any of the services without YPS Office of

Facilities Management's prior written consent, which shall not be unreasonably withheld. Any request to perform such work shall be in writing, received by YPS Office of Facilities Management and Fuller and D'Angelo, P.C. no less than 5 working days prior to the commencement of the request for disruption, and shall detail:

1. The exact nature and duration of such interruption;
2. The area of the Building affected, and;
3. Any impact upon the Construction Schedule caused by such proposed temporary disruption. All Work shall be performed during the hours and on the days set forth in the Specifications.

3.11 FIRE PREVENTION AND CONTROL Refer to Section 01 3553

3.12 UNDERGROUND UTILITIES

- A. Call 1-800-962-7962 (Call Before You Dig) and register before beginning any excavation at least two (2) working days prior to the start of construction.
- B. Locate and identify existing underground and overhead services and utilities within the Contract Limits. Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations.
 1. Arrange for disconnection, disconnect and seal or cap all utilities and services designated to be removed before start of site work operations. Perform all work in accordance with the requirements of the applicable utility company or agency involved.
 2. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the YPS Office of Facilities Management immediately to obtain procedural directions. Cooperate with the applicable utility companies in maintaining active services in operation.
- C. Broken utilities from work are the responsibility of the Contractor. Use extreme caution when uncovering utilities. If a utility is broken while uncovering because the utility was not in the exact location identified, the cost of repair is the responsibility of the Contractor.

3.13 WATCHMAN

- A. The YPS Office of Facilities Management will not provide watchman. The Contractor will be held responsible for loss or injury to persons or property or work where his work is involved and shall provide such watchman and take such precautionary measures as he may deem necessary to protect his own interests.

3.14 SECURITY SYSTEM Refer to 01 3553 - Security Procedures

- A. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the owner is notified and arrangements made to deactivate the system.

3.15 VERIFICATION OF CONDITIONS

- A. All openings, measurements, door frames, existing conditions and other similar items or conditions shall be field measured prior to submission of any shop drawings or manufacturers literature for approval.
 1. Each Contractor shall investigate each space into and through which equipment must be moved. Equipment shall be shipped from manufacturer in sections, of size suitable for moving through restricted spaces. Where sectional fabrication and or delivery cannot be achieved, openings, enlargements etc shall be provided by each contractor whose equipment requires access, at no additional cost to the Owner.

3.16 PROGRESS CLEANING

- A. Each Prime Contractor is responsible for their own daily debris removal into containers provided by the General Construction Contractor. Working areas are to be broom swept on a daily basis by the General Construction Contractor.
- B. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

- C. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space pipe chases, plenums, attics, crawl spaces, and and other closed or remote spaces,.
- D. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- E. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.17 PROTECTION OF INSTALLED WORK

- A. Each Contractor shall be responsible for the protection of all his work and shall make good all damage to the Owners property, adjoining property, and/or to any work or material in place in the premises, or included in his contract, which is caused by his work or workmen. which may occur to his work prior to the date of the final acceptance.
 - 1. From the commencement to the completion of the Project, each Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause.
- B. Each Contractor shall be held responsible for and be required to make good at his own expense any and all damage done to the Owners property, adjoining property, and/or to any work or material in place in the premises, or included in his contract, which is caused by his work or workmen.
 - 1. From the commencement to the completion of the Project, Each Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause of
- C. Mechanical and electrical equipment delivered and stored at the site, properly packed and crated. Each piece of equipment shall remain packed and crated at location until final installation. Uninstalled and installed equipment and materials shall be protected against damage by weather, water, paint, plaster, moisture, fumes, dust or physical damage.
- D. Protect installed work from damage by construction operations.
- E. Provide special protection where specified in individual specification sections.
- F. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- G. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- H. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- I. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.18 SYSTEM STARTUP

- A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of Contractor's personnel and manufacturer's representative in accordance with manufacturers' instructions.

- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.19 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.

3.20 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Refer to Individual Sections for Testing, adjusting, and balancing of systems: .

3.21 FINAL CLEANING

- A. Final cleaning shall be the responsibility of the General Construction Contractor and all costs for final cleaning shall be included in the Base Bid. Final cleaning responsibility shall be limited to all areas where renovations occur.
- B. Execute final cleaning prior to final project assessment.
- C. Use cleaning materials that are nonhazardous.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean debris from area drains.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
- H. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- I. Remove snow and ice to provide safe access to building.
- J. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- K. Touch up and otherwise repair and restore marred, exposed finishes and surfaces evidence of repair or restoration. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show
- L. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
- M. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- N. Leave Project clean and ready for occupancy.
- O. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.22 CLOSEOUT PROCEDURES Refer to Section 01 7800

3.23 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.

END OF SECTION

**SECTION 01 7310
CUTTING AND PATCHING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SUMMARY

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. This Section includes procedural requirements for cutting and patching.
 - 1. Refer to other Sections for specific requirements and limitations applicable to cutting and patching.
 - 2. Requirements of this Section apply to all contracts. Refer to various sections and divisions of these specifications for other requirements and limitations applicable to cutting and patching.
 - 3. Contractor acknowledges that the work involves renovation and alteration of existing improvements and, therefore, cutting and patching of the work is essential for the Project to be successfully completed. Contractor shall perform any cutting, altering, patching and fitting of the work necessary for the work and the existing improvements to be fully integrated and to present the visual appearance of an entire, completed, and unified project. In performing any work which requires cutting, fixing, or patching, Contractor shall use its best efforts to protect and preserve the visual appearance and aesthetics of the project to the reasonable satisfaction of both the Owner and the Architect.
 - 4. Each Contractor shall do all cutting, patching, repairing as necessary for their work. In all cases, the cutting, patching, repairing and finishing shall be performed mechanics skilled in the particular trade required at no additional cost to the Owner.

1.3 RELATED SECTIONS

- A. Division 1 Section 01 7132 - Selective Removals Single Prime for removals of selected portions of the building for alterations.
- B. Section 01 7330 - Selective Removals Multiple Contracts.
- C. Section 07 8400 - Firestopping for patching fire-rated construction.
- D. Requirements in this Section apply to all contractor(s) installations. Refer to Divisions 22, 23, and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.4 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.5 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Structural integrity of any element of Project.
 - 2. Visual qualities of sight exposed elements.
 - 3. Work of Yonkers Public Schools or separate Contractor.

4. Effect on work of Yonkers Public Schools or separate Contractor.
5. Written permission of affected separate Contractor.
6. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
7. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
8. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
9. Obtain approval of cutting and patching proposal before cutting and patching from YPS Office of Facilities Management. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.6 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 1. Primary operational systems and equipment.
 - a. Fire-protection systems.
 - b. Control systems.
 - c. Communication systems.
 - d. Conveying systems.
 - e. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 1. Water, moisture, or vapor barriers.
 - a. Membranes and flashings.
 - b. Exterior curtain-wall construction.
 - c. Equipment supports.
 - d. Piping, ductwork, vessels, and equipment.
 - e. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in YPS Office of Facilities Management's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

- B. Prior to cutting and patching verify with YPS Office of Facilities Management all existing warranties in effect.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
- B. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
- B. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition. A sufficient time in advance of the construction of new walls, floors, or roofing etc. Each Contractor shall be responsible for properly locating and providing in place all sleeves, inserts and forms required for work.
- C. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Section 31 2316 - Excavation where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- D. All cutting of holes in existing walls, existing floors, existing roofs, existing ceilings, etc. for the removal of any existing work (including, but not limited to ducts, fans, fixtures, motors, equipment, drains, wiring, conduit, etc.) or for the installation of any new work shall be done in a neat manner by each Contractor. Debris caused by such cutting or removals will be removed by each Contractor.
- E. Where sleeves, inserts or openings are required in existing walls, floors, roofs, vaults and pavements of existing buildings or structures, all necessary cutting, furnishing and installing of sleeves, inserts, lintels, etc., shall be done by each Contractor.
- F. Adequate blocking, fastening, etc., required to support equipment, casework, etc., from existing walls shall be included as required to complete work.
- G. All surfaces where existing items are removed from existing walls, floors, ceilings, roofs, vaults, etc. shall be patched to match existing surfaces.
 1. All patching shall be provided with prime and finish paint or other material to match existing. In areas indicated to be completely painted/finished by the Contractor for Construction, other prime contractors shall be required only to patch existing surfaces to match as required to accept new finishes.
 2. Proceed with patching after construction operations requiring cutting are complete.
- H. Removals of selected portions of the building for alterations is included in Section "Selective Removals".
- I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.4 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 WASTE MANAGEMENT REQUIREMENTS

- A. Yonkers Public Schools requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
 - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 7. Glass.
 - 8. Gypsum drywall and plaster.
 - 9. Plastic buckets.
 - 10. Paint.
 - 11. Windows, doors, and door hardware.
 - 12. Plumbing fixtures.
 - 13. Mechanical and electrical equipment.
 - 14. Fluorescent lamps (light bulbs).
 - 15. Acoustical ceiling tile and panels.
- E. Each Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- F. Each Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.

- H. Regulatory Requirements: Each Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.3 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 2316 - Excavation: Handling and disposal of soil material.

1.4 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Waste Management Plan: Include the following information:

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1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to YPS Office of Facilities Management.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.

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7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to installation, protection, and cleaning, cutting and patching, installation, protection, and cleaning.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, YPS Office of Facilities Management and Fuller and D'Angelo, P.C..
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 1. Prebid meeting.
 2. Preconstruction meeting.
 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 1. Provide containers as required. Refer to Section 01 5000 - Temporary Facilities and Controls.
 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7600
PROCEDURES AND SPECIAL CONDITIONS FOR SEPARATE PRIME CONTRACTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 DESCRIPTION OF WORK

- A. The types of minimum requirements for procedures and performance or control work of a general nature, to be fulfilled collectively by prime contractors, and must be participated in by each prime contractor (where applicable) even though certain lots of work may be assigned to a specific prime contractor.

1.3 USE OF PREMISES

- A. Refer to Section 01 1000 Summary of Contract(s).

1.4 MISCELLANEOUS PROVISIONS:

- A. Except as otherwise indicated comply with applicable requirements of Division-22, 23, and 26 sections for mechanical provisions within units of general (Divisions 2-14) work. Except as otherwise indicated, comply with applicable requirements of Division-26 section for electrical provisions within units of general (Divisions 2-14) work.
- B. Service Connections: Refer to Division-22, Division-23 and Division-26 sections for the characteristics of the mechanical and electrical services to be connected to units of general work. Provide units manufactured or fabricated for proper connection to and utilization of available services, as indicated. Except as otherwise indicated, final connection of mechanical services to general work is defined as being mechanical work, and final connection of electrical services to general work is defined as electrical work.

1.5 DISSIMILAR METAL

- A. Wherever dissimilar metals would otherwise come in contact with each other, they must be isolated by use of an approved, permanent non-staining material. Where one of the metals is aluminum, a coat of zinc-chromate primer followed by a coat of alkali-resistant bituminous paint shall be applied.

1.6 MODIFICATION OF WORK

- A. Where necessary, because of job or space conditions, the Contractor shall modify his work to suit these conditions, within accepted standards and limitations. No allowance will be made for this modification. Comply with Section 01 2100.
 - 1. If work is executed without regard for other trades as cited above, the Architect may direct its removal and modification. No allowance will be made for this work.

1.7 ACCESSIBILITY, SIZE AND LOCATION OF EQUIPMENT AND WORK

- A. Each Contractor shall investigate each space into and through which equipment must be moved. Equipment shall be shipped from manufacturer in sections, of size(s) suitable for moving through restricted spaces.
- B. Each Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and sizes of duct enclosures, for the proper installation of his work. They shall cooperate with the all other contractors whose work is in the same spaces and shall advise the Construction Contractor of their requirements. Such spaces and clearances shall, however, be kept to the minimum size required.
- C. Each Contractor shall locate all equipment, which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: valves, traps, cleanouts, motors,

controllers, switch-gear, and drain point etc. Minor deviations from drawings may be made to allow for better accessibility, but changes of magnitude or which involves extra cost shall not be made without approval.

1.8 ACCESS DOORS

- A. Provide all access doors for all dampers, valves, cleanest, junction boxes, pull boxes or similar items located above finished ceilings or ceiling breaks or extensions, behind finished walls or below finished floors. The access doors shall be steel, hinged types as required for type of construction.
 - 1. Where feasible locate all dampers, valves, cleanest, junction boxes, pull boxes or similar items above acoustical tile ceiling.

1.9 MACHINERY GUARDS

- A. Moving parts of machinery exposed to contact by personnel shall be guarded by a barrier of a type approved by the Architect.
 - 1. Exposed moving parts such as belts and couplings shall have 3/4" No 16 gauge galvanized expanded metal mesh guards, with all edges rounded. Guards shall be 1-1/2" x 1-1/2" x 1/8" angle iron framed properly supported.
 - 2. All machinery guards covering the ends of motor or equipment shafts shall have openings for the insertion of a tachometer.

1.10 DRIP PANS

- A. The respective mechanical contractor shall provide 20 oz. copper all soldered reinforced pans with 2" high lips under all heating, domestic water piping, soil and waste piping which runs over electric switchboards, mounting boards, motors or electric motor starters. Each drip pan shall have a copper drain piped to discharge where shown on the drawings, or if not shown, to discharge to the nearest available open drain or floor where directed by the YPS Office of Facilities Management. All piping shall be copper 1-1/2" minimum in diameter.

1.11 CONCEALMENT OF UNSIGHTLY INSTALLATIONS

- A. Piping and conduit work is to be run concealed in all occupied areas, in partitions, construction and pipe spaces. Obtain exact dimensions locations of partitions, use special care to see that no joints, fittings, piping or conduit will be exposed except as shown or specified. In the event of any unsightly exposed piping or conduit work or unsightly partitions resulting, the Contractor shall rebuild, and re-run lines at his own expense. When approved by the YPS Office of Facilities Management all exposed conduit shall be installed in wiremold.

1.12 SUPPORTS FROM OVERHEAD CONSTRUCTION

- A. Where overhead equipment does not permit fastening of supports for equipment, furnish at no additional cost to the Owner, additional framing, supplementary steel, etc., as required, subject to approval by the YPS Office of Facilities Management. Specific types of hangers and supports which are required in certain areas are to be installed as indicated on the drawings.

1.13 ESCUTCHEONS

- A. Where exposed un-insulated mechanical piping or conduits pass through floors, ceilings or walls of finished rooms, apply, approved hinged escutcheon of sufficient outside diameter to cover the pipe sleeve.
 - 1. Where exposed insulated pipes pass through walls, floors, or ceilings of finished rooms, provide escutcheons fastened to the sleeves.
 - 2. Finish shall be stainless steel in toilets, janitor's closet and similar "wet areas". Submit samples.

1.14 FLASHINGS

- A. Cap Flashing:
 - 1. Unless noted otherwise on drawings all cap flashings for HVAC, Plumbing and Electrical work shall be provided by the respective HVAC, Plumbing and Electrical contractor, except where specifically indicated or specified to be provided by the General Construction Contractor.

PROCEDURES AND SPECIAL CONDITIONS FOR SEPARATE PRIME CONTRACTS

- a. Unless noted otherwise on drawings cap flashings for all contracts shall conform to Section 07600 Flashing and Sheetmetal and shall be a minimum 16 oz.. lead coated copper. Provide a minimum 4" lap extending over the base flashing.
- B. Base Flashing:
 - 1. All base flashings and pitch pockets for all contracts to be installed in new roofing system shall be provided by the Construction Contractor.
 - a. All base flashing and pitch pockets for equipment installed on existing roof systems shall be furnished and installed by the Construction Contractor. Work shall be compatible to existing roofing system and performed by installers acceptable to the roofing manufacturer so as not to void any existing roofing warranties. Prior to starting work on existing roof systems notify YPS Office of Facilities Management and roofing manufacturer.
 - b. Unless noted otherwise on drawings all base flashing shall be a minimum 12" above roof membrane.

1.15 WATERPROOFING

- A. Where any work pierced waterproofing, including waterproof concrete, the method of installation shall be approved by YPS Office of Facilities Management before work is done. Each Contractor shall furnish all necessary sleeves, caulking and flashing required making openings absolutely watertight. (See Cutting and Patching, Section 00 1731.)

1.16 SALVAGEABLE MATERIALS:

- A. The Owner will prepare a list of salvageable items it wishes to retain. All salvageable items shall be delivered by the Contractor to a storage area designated by the Owner on site. All demolished equipment etc., except those items specifically requested by the Owner shall become the Contractor's property and shall be removed from the premises.

1.17 CONSERVATION:

- A. General: It is a requirement for each prime contractor's supervision and administration of the work, that construction operations be carried out with the maximum possible consideration given to conservation of energy, water and materials.

1.18 MATERIALS AND WORKMANSHIP

- A. All material, apparatus and accessories shall be new and of the best quality of their respective kind.
 - 1. All labor shall be performed in a first-class workmanlike manner, and adequate supervision must be provided to insure against neglect or faulty installations of any part of the systems during the progress of the work.
 - 2. Any inferior material and/or workmanship shall be removed at once, when directed by the YPS Office of Facilities Management and replaced with material and workmanship in accordance with the true intent and meaning of the drawings and specifications, at no additional cost to the Owner.
 - 3. If material or equipment is installed before it is approved, as to manufacture and shop drawings, the Contractor shall be liable for the removal and replacement at no extra charge, if in the opinion of the YPS Office of Facilities Management the material or equipment does not meet the intent of the drawings and specifications.
 - 4. If after installation (with or without prior approval) operation of any equipment proves to be unsatisfactory by reasons of defects, workmanship, error or omissions, the YPS Office of Facilities Management reserves the right to operate equipment until it can be removed from service for correction or replacement by the Contractor. The Contractor shall pay for the repair of all damage to work of other prime contractors caused by this defective equipment and its correction or replacement.
 - 5. No advertising matter exclusive of nameplates containing required data shall appear on any equipment without the written consent of the YPS Office of Facilities Management. The equipment furnished under this specification shall be essentially the standard product of a manufacturer

regularly engaged in the manufacture of such equipment. Where two or more units of the same class of equipment are required, the units shall be products of a single manufacturer; however, the component parts of the equipment need not be products of the same manufacturer.

1.19 SELECTIVE REMOVAL OF EXISTING PLUMBING, HEATING, ELECTRICAL AND RELATED WORK

- A. All selective removal work shall be in accordance with the time schedule as specified herein.
 - 1. All mechanical and electrical removals shall be performed as required to complete the work as intended.
 - 2. Remove all plumbing, heating and electrical apparatus, equipment, specialties, drains, controls, hangers, bases supports, piping, pneumatic tubing, conduit, panels, switches, wiring, plumbing accessories and electrical fixtures, etc., that are not incorporated in the new layout or required.
 - 3. Where removal is indicated, or implied, or not incorporated in the new layout, the item itself is to be removed completely together with all connecting conduits, specialties, supports, controls, etc. Connecting conduits are to be removed back to the mains and panels where they are to be capped or disconnected. All abandoned open ends shall be sealed and capped or disconnected. This includes all heating, electric, water, gas, etc. Patching and finishing of all surfaces to match existing shall be performed by the Contractor doing the removal. (See Cutting and Patching, Section 00 1731.)
 - 4. Where existing conduit, etc., enter inaccessible trenches, tunnels, shafts, walls, and ceilings, inside of the existing building, they shall be cut back at least 2" into such inaccessible spaces and shall be suitably capped and sealed by the Contractor.
 - 5. Each Contractor shall exercise all normal caution to prevent unnecessary cutting and damage to the existing building. Any excessive damage, as determined by the YPS Office of Facilities Management shall be repaired and paid for by the Contractor causing the damage.

1.20 ELIMINATION OF NOISE AND VIBRATION

- A. All equipment and accessories shall operate without objectionable noise or vibration.
 - 1. Should operation of any one or more of the systems produce noise or vibration which is, in the opinion of the YPS Office of Facilities Management and Fuller and D'Angelo, P.C., objectionable, the Contractor shall, at his own expense, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.
 - 2. All work shall operate under all conditions of load without any sound or vibration which, in the opinion of the YPS Office of Facilities Management, is objectionable. In the case of moving machinery, sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the YPS Office of Facilities Management shall be corrected in an approved manner by the Contractor at his expense.
 - a. Provide vibration isolators on all moving machinery.

1.21 GENERAL LABELING

- A. All mechanical and electrical equipment such as unit ventilators, heating and ventilating units, exhaust fans, etc., shall have appropriate descriptive labels, identification tags and nameplates, furnished and installed under the respective control under which the corresponding item is provided, and shall be properly placed and permanently secured to (or adjacent to) the item being installed.
 - 1. Submit complete schedules, listings, and descriptive data, together with samples for checking and approval before purchasing.
 - 2. Refer to respective M/E specifications for additional requirements.

1.22 IDENTIFICATION OF PIPING

- A. The respective Mechanical Contractor shall provide on all new exposed, insulated and uninsulated piping, semi-rigid, wrap-around plastic identification markers.

PROCEDURES AND SPECIAL CONDITIONS FOR SEPARATE PRIME CONTRACTS

1. Each marker background is to be appropriately color-coded with a clearly printed legend to identify the contents of the pipe conformance with the Scheme for the Identification of Piping Systems (ASA A13.1-1956). Direction of flow arrows is to be included on each marker.
2. Exposed locations for the pipe markers to be as follows:
 - a. Adjacent to each valve.
 - a) At each branch and riser take-off.
 - b) At each pipe passage through wall, floor and ceiling construction.
 - c) On all horizontal pipe runs - marked every 15 feet.
 - d) At each inlet and outlet of coils, pumps, etc.
3. Refer to respective M/E specifications for additional requirements.

1.23 PAINTING

- A. All apparatus, cabinets, etc., furnished under the Mechanical and Electrical Sections of the specifications, shall be provided with a priming coat, and enamel finish. All patched surfaces and surfaces where removals have occurred (by each Contractor) shall receive a prime coat and a finish coat to match adjacent surfaces acceptable to the YPS Office of Facilities Management unless noted otherwise.
 1. All finish painting of new insulated and uninsulated piping, new duct work, apparatus, and appurtenances, will be performed by each contractor, unless noted otherwise.
 2. All concealed supports and ironwork not otherwise protected against corrosion shall be given two (2) coats of bituminous base paint.

1.24 TEMPLATES:

- A. Each contractor shall prepare templates showing all dimensions and shall furnish all anchor bolts and sleeves required for all equipment,, boilers, and transformers, etc., and submit to Contractor who requires this information.

1.25 EQUIPMENT BASES

- A. Each contractor shall submit for approval of the Fuller and D'Angelo, P.C., detail drawings of all equipment foundations and shall furnish all templates for his foundation.
 1. Unless otherwise indicated Construction Contractor will furnish and install their equipment bases. It is the responsibility of each Contractor to place any templates and anchor bolts and to supervise the construction of the equipment bases regardless of who installs the bases.
 - a. Concrete equipment bases for shall be minimum 3,000 psi test strength at 28 days . Provide minimum 6/6 x 10/10 welded wire mesh.

1.26 MOTORS

- A. Each contractor shall furnish and install the electric motors required for the motor-driven equipment supplied under his contract. The motors shall be of sufficient size for the duty to be performed, and shall not exceed their full rated load when the driven equipment is operating at required capacity under the most severe conditions likely to be encountered. The speed and horsepower for each motor are given in the schedule on the drawings, or are specified.
 1. All motors shall be suitable for operating on alternating current, sixty (60) cycle frequency. Motors 1/2 horsepower and smaller shall be wound for single-phase, 60 cycle, 120 volt current. Motors exceeding 1/2 horsepower shall be designed for operation on three phase, 60 cycle, 208 volt current.
 - a. Fractional horsepower motors shall be of the sealed prelubricated ball bearing type.
 - a) All motors shall be approved by the Underwriters Laboratories, Inc., for the service and location intended.
 - b) All motors shall be equipped with ball bearings unless specified otherwise in other sections of these specifications.
 - c) Motors for single-phase operation shall be of the capacitor type.

1.27 WIRING

- A. The wiring of prewired equipment or apparatus is specified under the corresponding sections of the Specifications. The Electrical volt systems design as indicated on the Electrical Drawings and Specifications.
- B. The Electrical Contractor will perform all Power wiring; however, each Contractor shall furnish all magnetic starters and automatic controls, suitable for the equipment furnished by the Contractor. Motor starters shall be installed by the Electrical Contractor.
- C. Each Contractor shall prepare wiring diagrams and submit same for approval Submit in electronic PDF format. Approved copies with any additional instructions are to be given to the Electrical Contractor.
 - 1. All prewired and job wired control panels for motors shall be provided with approved high interrupting capacity circuit breakers.
 - 2. All electrical wiring for equipment where exposed to the weather (factory or field installed) shall be installed in weathertight conduits and shall be U.L. approved.

1.28 CONTROL WIRING

- A. Control wiring is required wiring, conduit, relays, contractors, electro-mechanical, hydraulic activators and solid state regulating devices either low or line voltage, to the controlled device that is regulated by the controller and necessary for the operation, controlling, sequencing etc. of the equipment or system. Control wiring shall be furnished and installed by each contractor furnishing and installing such equipment or systems.
 - 1. Power wiring to equipment, including wiring and installation of magnetic starters and disconnect switches, where required, shall be the responsibility of the Electrical Contractor. The Electrical Contractor shall furnish and install all disconnect switches, where required, and install all magnetic starters. All magnetic starters shall be furnished by each contractor furnishing the equipment or systems.
 - 2. Each Contractor shall supervise the wiring of all equipment included under his Contract.

1.29 MOTOR STARTERS

- A. Except where specified to be motor or pedestal mounted as part of a prewired control panel furnished with the equipment they serve, all magnetic starters shall be provided by each Contractor. Magnetic starters, with thermal and under voltage protection, suitable for the voltages indicated, shall have a heater in each phase and reset button on the cover.
 - 1. Motors 1/2 HP and larger shall have Allen Bradley, Emerson Phase Guard or approved substitute phase failure relays suitable for the voltages indicated, included in the starter enclosure. Refer to specific section of specifications for special starters.
- B. Motors over 1 HP shall be provided with variable frequency drive. (VFD), unless shown otherwise
- C. Where the installation of phase failure non-reversing relays are required, these shall, wherever possible, be wired and installed at the equipment manufacturer's factory panel mounted equipment in connection with refrigeration equipment and temperature controls. Starters shall be Allen Bradley, Square D or approved equal.

1.30 UNDERWRITERS' LABORATORIES CERTIFICATION

- A. All mechanical and electrical equipment shall bear the UL label of approval where such inspection service is furnished for the particular type of equipment.

1.31 LOCATIONS AND MEASUREMENTS

- A. The locations of fixtures, appliances, conduits, etc., are specified and shown on the plans as accurately as possible, but in all cases, they are to be adjusted to the surrounding conditions. Contractor must take all measurements at the building, and should the space allotted for any appliance be inadequate, it shall be the Contractor's responsibility to immediately notify in writing, and shall he fail to do so, he must bear the expense necessary to correct the conditions. All work shall be coordinated with the work of other trades.

1.32 GROUNDING

- A. Standards set forth by the latest edition of the National Electric Code, relative to the grounding of system and equipment, shall be followed together with the rules and regulations of the Utility Company. All non-current carrying metal parts shall be solidly grounded. All motor frames that are not clamped to supply conduits shall be grounded by suitable wire and ground clamp.
 - 1. The identified neutral wire or white wire of the interior wiring system shall be permanently grounded to the water services. The grounded wire shall be connected to the supply side of the main service switch and mechanically connected to an approved ground clamp and securely bonded to the water service at the point of entry. The ground connection shall be made on the supply side of the first main control valve. The conductors shall be protected from mechanical injury by rigid steel conduit to which the conductors shall be securely bonded in each length of connection. Conduit system shall be securely grounded to the above described ground of wiring system.
 - 2. Ground connections to water mains shall be made to non-current carrying metal parts of distribution panels, instrument cases, and instrument transformer cases.

1.33 FIRESTOPPING:

- A. All openings thru walls, floors, shafts, etc. shall be fire stopped with approved material to maintain rating. See Section 07 8400 - Firestopping.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Substantial Completion.
- B. Final Completion.
- C. Project Record Documents.
- D. Operation and Maintenance Data.
- E. Warranties and bonds.

1.3 RELATED REQUIREMENTS

- A. Refer to Article 81 YPS General Engineering Agreement for additional requirements.
- B. YPS General Engineering Agreement Article 81 for additional requirements.
- C. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.4 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion:
 - 1. Prepare a list of items to be completed and corrected, the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise YPS Office of Facilities Management and Fuller and D'Angelo, P.C. of pending insurance changeover requirements.
 - 3. Obtain and submit releases permitting YPS Office of Facilities Management and Fuller and D'Angelo, P.C. unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- B. Prior to issuance of the Certificate of Substantial Completion, submit, in writing, a request to the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. to perform site inspection for the purpose of preparing a "punch list".
- C. On receipt of request the YPS Office of Facilities Management and Fuller and D'Angelo, P.C. will schedule and prepare a punch list.
- D. Certificate of Substantial Completion will be issued **only after completion of all punch list items** or YPS Office of Facilities Management and Fuller and D'Angelo, P.C. will notify Contractor of items, either punch list or additional items identified by Architect, **that must be completed or corrected before a certificate will be issued.** After completion of **all punch list items** submit the following:
 - 1. Application for Payment showing 100 percent completion for portion of the Work claimed as substantially completed.
 - 2. Manufacturer's Warranties/guarantees.
 - 3. Contractor's Warrantee Two (2) years minimum and extended warranties.

4. Maintenance agreements, if any.
 5. Manifest for disposal of Hazardous Material.
 6. Manifest for disposal of material.
 7. Test/adjust/balance reports and records.
 8. Maintenance Manuals and Instructions Manuals
 9. Signed Receipt by YPS Office of Facilities Management of spare parts and attic stock.
 10. Start-up performance reports.
 11. Changeover information related to Owner's occupancy, use, and maintenance.
 12. Advice on shifting insurance coverage.
 13. List of incomplete Work, recognized as exceptions to Architect's "punch list".
 14. Removal of temporary facilities and services.
 15. Removal of surplus materials, rubbish and similar elements.
 16. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 17. As Built Drawings.
 18. Project Record Documents.
 19. DOL Final Completion Form. (PW 200).
- E. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
1. If necessary re-inspection will be repeated and the contractor shall pay for all additional inspections.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.5 FINAL PAYMENT

- A. Refer to School Facilities Management Contract Manual and Specifications for additional requirements.
- B. Following issuance of the Substantial Completion of work submit the following:
1. Architect's punch list certifying all punch list items have been completed with each item signed off by the YPS Office of Facilities Management and Contractor.
 2. Update final statement, accounting for final changes to the Contract Sum.
 3. Release of liens from contractor and all entitles of the contractor.
 4. Consent of Surety to Final Payment, AIA Document G707.
 5. Final Liquidated Damages settlement statement.
 6. Contractor's Affidavit of Release of Liens (AIA G706A).
 7. Contractors Affidavit of Payment of Debts and Claims (AIA G706).
 8. Contractor's Certification of Payment of Prevailing Wage Rates.
 9. Contractor's Certification of Compliance that products comply with VOC requirements stated in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
 10. Contractor's Certified Statement that no asbestos containing material was incorporated into the project.
 11. Asbestos manifest.
 12. Underwriters Certificate or authorized third party Certificate.

1.6 SUBMITTALS

- A. Contractor shall submit all documentation identified in this section within thirty (30) working days from the time the Contractor submits the list of items to be corrected, in addition to other rights of the Owner set forth elsewhere in the Contract Documents, to include but not limited to withholding of final payment. If the documentation has not been submitted within Thirty (30) day period, the Owner will obtain such through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by

the Owner, provided the Owner has advised the Contractor of this action seven7 days prior to the culmination date by written notice

- B. Project Record Documents: Submit documents to Fuller and D'Angelo, P.C. with claim for final Application for Payment.
- C. Warranties and Bonds:
 - 1. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by YPS Office of Facilities Management.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.

3.2 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and approved Shop Drawings at the project site.
- B. Each Prime Contractor is responsible for marking up Sections that contain its own Work and for submitting the complete set of record Specifications as specified.
- C. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
- D. Content: Types of items requiring marking include, but are not limited to, the following:
 - 1. Dimensional changes to Drawings.
 - 2. Revisions to details shown on Drawings.
 - 3. Locations and depths of underground utilities.
 - 4. Revisions to routing of piping and conduits.
 - 5. Revisions to electrical circuitry.
 - 6. Actual equipment locations.
 - 7. Duct size and routing.
 - 8. Changes made by Change Order or Construction Change Directive.

9. Changes made following YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s written orders.
10. Details not on the original Contract Drawings.
- E. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
- F. Mark important additional information that was either shown schematically or omitted from original Drawings.
- G. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- H. **Provide three copies of final record contract drawings, specifications and approved shop drawings on CD in PDF format.**

3.3 RECORD CAD DRAWINGS

- A. Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with YPS Office of Facilities Management and Fuller and D'Angelo, P.C.. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
 1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on Record Prints. Delete, re draw, and add details and notations where applicable.
 3. Refer instances of uncertainty to YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for resolution.
- B. Fuller and D'Angelo, P.C. and Consultant will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
 1. Fuller and D'Angelo, P.C. and Consultant makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
 2. CAD Software Program: The Contract Drawings are available in Auto CAD 2007.

3.4 FORMAT

- A. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Contractor shall certify and sign.
- B. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Identify Record Drawing as follows:
 1. Project name.
 - a. Date.
 - b. Designation "PROJECT RECORD DRAWINGS."
 - c. Name of Owner, YPS Office of Facilities Management, Fuller and D'Angelo, P.C., and Contractor(s)
 - d. Contractor(s) shall certify and sign each drawing.

3.5 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.6 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.7 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Carbon Dioxide Monitoring Protocol.
 - 3. Include Carbon Monoxide Monitoring Protocol.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide contractors's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.8 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Yonkers Public Schools's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of YPS Office of Facilities Management, Fuller and D'Angelo, P.C., Consultant, Contractor(s), and Sub-contractor(s) , with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Operation and maintenance data.
 - c. Field quality control data.
 - d. Photocopies of warranties and bonds.
- K. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
 - 1. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3.9 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with YPS Office of Facilities Management's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

Yonkers Public Schools
Boiler Replacement, HVAC Upgrades & Asbestos Abatement
P.S 29 Phase 2 of 3 - YPS # 10878
CLOSEOUT SUBMITTALS

- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor(s) and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

**CHECKLIST FOR PROJECT CLOSEOUT
AND PROCESSING OF FINAL PAYMENT**

A. **PROJECT:** Boiler Replacement, HVAC Upgrades & Asbestos Abatement.

BOARD OF EDUCATION BID NUMBER: PS 29 - YPS # 10878

CLOSE-OUT SUBMITTALS: (As Applicable)

- ☐ **PREVAILING WAGE CERTIFICATION.**
- ☐ **UL CERTIFICATION**
- ☐ **THREE (3) 3-RING BINDER BROCHURES OF OPERATION AND MAINTENANCE MANUALS FOR ALL EQUIPMENT INSTALLED ON THE PROJECT INCLUDING THE FOLLOWING:**
 - ☐ **TYPED OR PRINTED INSTRUCTIONS COVERING THE CARE AND OPERATIONS OF EQUIPMENT AND SYSTEMS FURNISHED AND INSTALLED.**
 - ☐ **MANUFACTURERS INSTRUCTION BOOKS, DIAGRAMS, SPARE PARTS LISTS COVERING ALL EQUIPMENT.**
 - ☐ **INSTRUCTION OF OWNER'S REPRESENTATIVE IN CARE AND MAINTENANCE OF NEW EQUIPMENT.**
 - ☐ **ALL APPROVED SHOP DRAWINGS.**
 - ☐ **CERTIFICATES OF COMPLIANCE AND INSPECTION. (WHERE APPLICABLE MANUFACTURER'S REPORTS, ELECTRIC, ELEVATOR, ETC.)**
 - ☐ **SPARE PARTS AND MAINTENANCE MATERIALS. (RECEIPT SIGNED BY FIELD SUPERINTENDENT)**
 - ☐ **EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES (CERTIFICATES OF INSPECTION ELECTRICAL).**
 - ☐ **CERTIFICATES OF INSURANCE FOR PRODUCTS AND COMPLETED OPERATIONS.**
 - ☐ **NOTARIZED STATEMENT THAT ONLY NON-ASBESTOS MATERIALS WERE INSTALLED ON THIS PROJECT.**
 - ☐ **FULLY EXECUTED CERTIFICATE OF SUBSTANTIAL COMPLETION: AIA G704.**
 - ☐ **CONTRACTOR'S WRITTEN FIVE-YEAR WARRANTY, MANUFACTURER'S WARRANTY, AND EXTENDED WARRANTIES (IF ANY REQUIRED).**
 - ☐ **PROJECT RECORD DOCUMENTS: SECTION 7800.**
 - ☐ **AS-BUILT DRAWINGS.**

EVIDENCE OF PAYMENT AND RELEASE OF LIEN

- ☐ **CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS: AIA G706.**
- ☐ **CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS - AIA G706A PRIME CONTRACTORS AND SUBCONTRACTORS.**
- ☐ **CONSENT OF SURETY TO FINAL PAYMENT AIA G707.**

REFER TO SCHOOL FACILITIES MANAGEMENT CONTRACT MANUAL AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. FINAL PAYMENT WILL NOT BE PROCESSED UNTIL ALL ITEMS INDICATED ARE RECEIVED.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of YPS Office of Facilities Management personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Electrical systems and equipment.
- C. Training of YPS Office of Facilities Management personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Finishes, including flooring, wall finishes, ceiling finishes.
 - 2. Fixtures and fittings.
 - 3. Items specified in individual product Sections.

1.3 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
- B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by Commissioning Plan.
 - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: YPS Office of Facilities Management will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.

- e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by YPS Office of Facilities Management.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
- 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
- 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
 - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
 - 4. Include Commissioning Authority's formal acceptance of training session.

1.5 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
- 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by YPS Office of Facilities Management.
- B. Demonstrations conducted during Functional Testing need not be repeated unless YPS Office of Facilities Management personnel training is specified.
- C. Demonstration may be combined with YPS Office of Facilities Management personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
- 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
- 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. YPS Office of Facilities Management will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum of two (2) - two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of YPS Office of Facilities Management's personnel to be trained; re-schedule training sessions as required by YPS Office of Facilities Management; once schedule has been approved by YPS Office of Facilities Management failure to conduct sessions according to schedule will be cause for YPS Office of Facilities Management to charge Contractor for personnel "show-up" time.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Removals.
- B. Concrete formwork.
- C. Floors and slabs on grade.
- D. Concrete reinforcement.
- E. Concrete curing.
- F. Finishes.
- G. Mix design
- H. Concrete materials.
- I. Placement procedure.

1.3 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- B. Section 31 2316 - Excavation.

1.4 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; 1998 (Reapproved 2004).
- C. ACI 301 - Specifications for Concrete Construction; 2020.
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- E. ACI 305R - Guide to Hot Weather Concreting; 2020.
- F. ACI 306R - Guide to Cold Weather Concreting; 2016.
- G. ACI 308R - Guide to External Curing of Concrete; 2016.
- H. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).
- I. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
- K. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2019.
- L. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2019, with Editorial Revision (2020).
- M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

- N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
- O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021b.
- P. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
- Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
- S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.
- U. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2016.
- V. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- W. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- X. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2021.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions for each product indicated.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
 - 1. Indicate all penetrations and sleeve location and reinforcing.
 - 2. Identify areas of exposed surfaces and finish.
- D. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- E. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
 - 3. Indicate amounts of mixing water to be withheld for later addition at Project site.
- F. Test Reports: Submit report for each test or series of tests specified.
- G. Qualification Data: For installer, testing agency, and concrete supplier.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Material Certificates: For each of the following, signed by manufacturers:
 - a. Cementitious materials.
 - b. Admixtures.
 - c. Steel reinforcement and accessories.

d. Joint-filler strips.

- I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.6 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. Manufacturer/Supplier Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- E. Installer Qualifications: The work of this section shall be performed by a qualified installer, with a minimum of five (5) years experience, approved by the YPS Office of Facilities Management. The term "installer" used herein, shall mean a firm of established reputation which is regularly engaged in and which maintains a regular force of workmen skilled in the installation of the type of work specified in this section.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements.
1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
- a. Contractor's superintendent.
- b. Concrete subcontractor.
- c. YPS Office of Facilities Management.
- G. Delivery Records: Each delivery to the site of concrete shall be accompanied by weigh master's certification. Retain all copies for inspection by the Testing Agency.
1. Indicate water added to mix a job site on each delivery ticket. Show quantity of water added. Site water tempered mixes exceeding specified slump range will be rejected as not complying with specification requirements

1.7 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Store materials so as to preserve their quality and fitness for work.
- B. Store reinforcement and formwork in manner to prevent bending, damage (including damage to coatings), and accumulation of dirt.
- C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- D. All packed materials shall be delivered to the site in original unopened containers, clearly indicating manufacturer's name, brand name, and other identifying information.

1.9 PROJECT CONDITIONS

- A. Coordinate with the work of all other sections and/or separate contracts.

PART 2 PRODUCTS

2.1 FORMWORK

- A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.

2. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings, maximum VOC of 450 g/l that will not bond with, stain, or adversely affect concrete surfaces or impair subsequent treatments of concrete surfaces requiring bond or adhesion or impede wetting of surfaces to be cured with water or curing compound.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
1. Type: Deformed billet-steel bars.
 2. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Class A epoxy coated, deformed type, 1.
1. Mesh Size: 6 x 6.
 2. Wire Gage: W 6 x W6.
- C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Do not use bricks to support epoxy-coated or galvanized reinforcing
 - b. Supports for epoxy-coated reinforcing shall be either wire bar-type coated with epoxy, plastic, or vinyl compatible with concrete for a minimum distance of 2 inches from the point of contact with reinforcing or all plastic-type.
 - c. Supports for galvanized reinforcing shall be either galvanized wire bar-type or all-plastic type.
 3. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
 4. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

2.3 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.

2.4 ACCESSORY MATERIALS

- A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
1. Grout: Comply with ASTM C1107/C1107M.
- B. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.
1. Composition: High solids content material exhibiting positive expansion when tested in accordance with ASTM C827/C827M.
 - a. Maximum Height Change: Plus 4 percent.
 - b. Minimum Height Change: Plus 1 percent.

2.5 BONDING AND JOINTING PRODUCTS

- A. Epoxy Bonding System:
1. Complying with ASTM C881/C881M and of Type required for specific application.
 2. Manufacturers:
 - a. Euclid Chemical Company: www.euclidchemical.com.

- b. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- c. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- d. Substitutions: See Section 01 2500 Substitution Procedures

2.6 CURING MATERIALS

- A. Moisture-Retaining Sheet: ASTM C171.
 - 1. Polyethylene film, clear, minimum nominal thickness of 4 mil, 0.004 inch (0.102 mm).
- B. Membrane Curing Compound: ASTM C 309 Type 1 - Clear or translucent, Class A.
- C. Water: Potable, not detrimental to concrete.

2.7 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to YPS Office of Facilities Management for preparing and reporting proposed mix designs.
- C. Identify sources of all products used in design mixes.
- D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- E. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with 1 at 28 days: 4000 psi.
 - 2. Water-Cement Ratio: Maximum 40 percent by weight.
 - 3. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
 - 4. Maximum Slump: 4 inches (100 mm).
 - 5. Maximum Aggregate Size: 3/4 inch (19 mm).

2.8 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.
- B. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347 and ACI 117.
- C. Verify that forms are clean and free of rust before applying release agent.
- D. Clean and coat forms before erection. Do not coat forms in place.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for concrete placement. Securely brace temporary openings, and set

tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

- F. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- G. Chamfer exposed corners and edges as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Fit corners and joints with gaskets or tape to prevent leakage.
- I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- J. Sleeves: Provide sleeves in concrete formwork for plumbing, electrical, and mechanical penetrations. Coordinate size and location of sleeves with Contractors and mechanical, electrical, and plumbing drawings.
 - 1. Accurately place and secure in forms.
 - 2. Coordinate sleeve locations with reinforcing bars.
- K. Penetrations shall not occur through footings, piers, columns, beams, joists, grade beams, or supported slabs unless shown in structural drawings
- L. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
- M. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.3 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement
- B. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.
- C. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- D. Place slab reinforcing one-third of slab thickness below top surface of slab. Support reinforcement by metal chairs, runners, bolsters, or concrete brick as required.
 - 1. Dedicate workers to placement of reinforcement to continuously monitor and adjust reinforcement location during concrete placement.
- E. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Galvanized Reinforcement: Repair cut and damaged zinc coatings with zinc repair coating according to ASTM A 780. Use galvanized steel wire ties to fasten galvanized steel reinforcement.
- H. Comply with manufacturer-recommended procedures for installing and anchoring of doweled reinforcement using chemical adhesives, including drilling and cleaning of holes and mixing and applying of adhesives.
- I. Coordinate placement of reinforcement with openings, including sleeves and other embedded items. Where one or more bars are interrupted, provide additional reinforcement at openings. Additional reinforcement is noted in drawings.

- J. Use of nails in forms and use of clay brick to support reinforcement is prohibited.

3.4 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Notify YPS Office of Facilities Management not less than 24 hours prior to commencement of placement operations.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
 - 1. Slabs on Grade: Use strip pour methods and mechanical vibratory screed whenever possible.
 - 2. Deposit and consolidate concrete in continuous operation within limits of construction joints until placing of panel or section is complete.
 - 3. Bring slab surfaces to correct level with a straightedge and strike off. Uniformly slope to drains. Use darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water or portland cement on plastic surface. Do not disturb slab surfaces before beginning finishing operations.
- E. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in manner to avoid inclined construction joints.
- F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- G. Do not use vibrators to transport concrete inside formwork.
- H. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Vibrators shall penetrate placed layer of concrete at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.
- I. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- J. Do not allow vibrator to come in contact with form.

3.5 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Equipment Bases and Foundations: Provide machine, locker and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.6 CONCRETE FINISHING

- A. Repair surface defects, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Broom Finish: Apply a broom finish to exterior sidewalks, concrete platforms, steps, and ramps, and elsewhere as indicated.
 - a. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

- D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings

3.7 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Surfaces Not in Contact with Forms:
 - 1. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches (75 mm) and seal with waterproof tape or adhesive; secure at edges.
 - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.8 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.9 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to YPS Office of Facilities Management and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the YPS Office of Facilities Management. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Fuller and D'Angelo, P.C. for each individual area.

3.10 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 04 0100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Refer to Drawing A430 for General Restoration Notes.
- B. Dust control.
- C. Removal and rebuilding of exterior brick units where indicated on drawings.
- D. Salvaging and re-using existing brick units.
- E. Mortar.
- F. Repointing mortar joints where indicated and/or required.
- G. Repair of damaged masonry and cast stone units.
- H. Replacement of selected existing lintels.
- I. Refurbishing of existing lintels.
- J. Parging.
- K. Dampproofing.
- L. Concealed flashings.
- M. Re-anchoring ties.
- N. Anchors.

1.3 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls.
- B. Section 05 5000 - Metal Fabrications.
- C. Section 07 9200 - Joint Sealants.
- D. Section 09 9113 - Exterior Painting.

1.4 REFERENCE STANDARDS

- A. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- B. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- C. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.
- D. IMIABC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.
- E. IMIABC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.
- F. New York State Parks, Recreation & Historic Preservation Brief #2 Guidelines.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1. Require attendance of parties directly affecting work of this section.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on all material, including recommended installation procedures.
- C. Samples: Submit four samples of face brick units to illustrate matching color, texture and extremes of color range.
 1. For each type of mortar provide 6 inch long by 1/2 inch wide sample strips set in metal or plastic channels.
 2. Each type of anchor
- D. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.
- E. Test reports and certifications substantiating compliance with specification requirements.
- F. Material Safety Data Sheets.

1.7 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Qualification: The sub-contractor with a minimum of five years experience, experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.
 1. The Installer shall directly employ the personnel performing the work of this section
 2. The Installer shall have a full time supervisor/foreman on the roof when roofing work is in progress. The Supervisor shall have a minimum of 5 years experience in roofing work similar in nature and scope to this project, and speak fluent English
 3. Submit a reference list which shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect and Owner's Representative's name - contact person and phone number.
- C. The Installer shall provide a reference list of at least three (3) projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
 1. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
 2. The Installer shall provide the reference list prior to contract award if requested.
- D. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
- E. Pre-Work Conference: Attend the pre-roofing meeting and discuss the following:
 1. How masonry work will be performed and coordinated with other work.
 2. How the building will be kept watertight as masonry work progresses.
 3. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
 4. A schedule for Manufacturer and Architect inspections.

1.8 MOCK-UP

- A. Restore and repoint an existing masonry wall area sized 4 feet (120 m) long by 2 feet (60 m) high; include in mock-up area instances of mortar, accessories, and flashings.

- B. Locate where directed.
- C. Acceptable panel and procedures employed will become the standard for work of this section.
- D. Mock-up may remain as part of the Work.
- E. Allow samples to cure at least three days (or longer, if possible) before obtaining YPS Office of Facilities Management and Fuller and D'Angelo, P.C.'s approval for color match. Mortar colors will continue to lighten as they cure and are exposed to the weather, so samples should be installed as far in advance as possible. Samples should be viewed from a minimum distance of 12 feet.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Carefully pack, handle, and ship masonry units and accessories strapped together in suitable packs or pallets or in heavy cartons.
- B. Deliver material to the site in the Manufacturer's original and unopened containers and packaging, bearing labels which identify the type and names of the products and Manufacturers. Unload and handle to prevent chipping and breakage.
- C. Protect masonry materials and aggregates during storage and construction from excess wetting by rain, snow or ground water, and from staining or inter mixture with earth or other types of materials.
- D. Protect grout, mortar and cement products from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Protect liquid components from freezing.
- E. Do not overload the structure when storing materials on the roof.

1.10 FIELD CONDITIONS

- A. Repoint mortar joints and repair masonry only when air temperature is between and 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of work.
- B. Erect temporary covers over pedestrian walkways and at building entrances and exits which will remain active as the work progresses.
- C. Prevent mortar from staining the face of surrounding masonry and other building surfaces, immediately remove any which falls or spills. Protect sills, ledges and projections from mortar droppings.
- D. Coordinate masonry removal and restoration with the installation of new metal and membrane flashings

1.11 GUARANTEE

- A. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a two year period beginning upon Final Completion:
 - 1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.
 - 2. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense:
 - 3. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.
- B. The Contractor's Guarantee shall be issued no more than 30 days before the satisfactory completion of punch list work.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

- A. Cleaning Agent: ProSoCo; Sure Klean Light-Duty Restoration Cleaner Cathedral Stone.Syra G. by Cathedral Stone® Products, Inc
 - 1. Application: General Cleaning of existing masonry units.
- B. Cleaning Agent: ProSoCo; Sure Klean 600 Detergent

1. Application: General Cleaning of new masonry units.

2.2 MORTAR MATERIALS

- A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.
- B. Mortar Color: Match existing.
- C. Mortar Mix Designs: 1, Property Specification.
 1. Type N for setting mortar.
 2. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

2.3 MASONRY MATERIALS

- A. Brick shall be clay or shale, ASTM C216, Type FBS, solid. Brick shall be tested for efflorescence in accordance with ASTM Test Methods C67 and the rating shall be "Not Effloresce".
 1. Use 100% solid brick over exterior relieving angles/lintels or other brick projections on exterior face of building. (Use of solid brick with cores is acceptable if cores are filled solid with mortar and the cores are not visible to view.
- B. Include special bricks for corners, and other special shapes, to match the color, surface texture, shape and size of existing adjacent brick.
- C. Provide units with colors, surface texture, and physical properties to match existing units in size and shape.
 1. Provide special shapes as indicated and required to match existing.

2.4 MASONRY ANCHORS

- A. All reinforcement and anchors located in exterior walls shall be stainless steel.
- B. Strap Anchors: Bent steel shapes configured as required for specific situations, 1/-1/2 in (___ mm) width, 0.105 in (2.7 mm) thick, lengths as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face, corrugated for embedment in masonry joint, stainless steel.
 1. Length: Verify in field.
 2. Hohmann & Barnard weld on ties #345.
 3. #340-A by Heckman Building Products
- C. Repair and Restoration Anchors: mechanical anchoring system used re-connect existing veneers to backup, with 360 Brass expanders with a Type 304 St/Steel shaft and 300 St/Steel hardware
 1. "Spira-Lok" by Hohmann & Barnard, minimum 2" embed. Length to be verified in field.
- D. Restoration Anchors: Friction Pinning Anchor for anchoring existing brick to backup masonry, stainless steel, 5/16" x 7-3/4".
 1. #DA508 by Duro-Wall Masonry Accessories.
- E. Single Wythe Joint Reinforcement: Truss type; stainless steel conforming to ASTM A580/A580M Type 304; 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; for all exterior wall and ASTM A82/A82M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B for interior walls, width as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage on each exposure. Flush weld all keys
 1. Hohmann & Barnard - #120.

2.5 ACCESSORIES

- A. Paint: Refer to Section 09 9113 - Exterior Painting.
- B. Joint Filler: Closed cell neoprene; 3/8" inch (___ mm) wide x 3" wide x by maximum lengths available. Provide tear strip to permit sealant joint.

1. Manufacturers:
 - a. Hohmann & Barnard, Inc; Product MS: www.h-b.com.

2.6 EMBEDDED FLASHING MATERIALS

- A. Membrane Non-Asphaltic Flashing Materials:
 1. Use only where flashing is fully concealed in masonry.
 2. Composite Polymer Flashings - Self-Adhering: Composite polyethylene; 40 mil (1mm) thick with reinforced membrane Elvaloy KEE, solid-phase plasticizer and flexibilizer added to membrane flashing. Provide pressure-sensitive adhesive and release paper, preformed shapes for outside, inside and end dams. as recommended by the manufacturer.
 3. Verify sealants specified in Section 07 9200 - Joint Sealants are compatible with flashing.
 4. Termination Bars: 1/8" x 1", stainless steel with foam seal. Use at top of all flashing.
 5. Manufacturers:
 - a. Substitutions: See Section 01 2500 - Substitution Procedures.
- B. Flexible Flashing Membrane - For Steel Lintel Flashing
 1. Self adhered Flashing Membrane with Drip Edge: Standard type, elastomeric and thermal plastic polymers combined with Dupont Elvaloy, reinforced with synthetic fibers and calendared into 40 mil thick sheets with rubberized adhesive, 1-1/2 inch sealant compatible drip edge and disposable silicone release sheet adhered to the bottom adhesive side.
 2. Drip Edge: 3/8".
 3. Provide primers, adhesives, pre-formed inside and outside corners and dams as recommended by the manufacturer.
 4. Verify sealants specified in Section 07 9200 - Joint Sealants are compatible with flashing.
 5. Termination Bars: 1/8" stainless steel with foam seal. Use at top of all flashing.
 6. Manufacturers:
 - a. Hyload Inc.; 5020 Enterprise Pkwy., Seville, OH 44273. ASD. Toll Free: 800-457-4056. Phone: 330-769-3546. Fax: 330-769-4153. Web: www.hyload.com. Email: info@hyload.com.
 - b. Substitutions: See Section 01 2500 - Substitution Procedures.

2.7 MORTAR MIXES

- A. Comply with ASTM C 270, Proportion Specification
 1. Brick Replacement Mortar: Type S .
 2. Pointing mortar Type N.
 - a. Verify strength of existing mortar. New mortar shall not exceed strength of existing mortar.
- B. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match existing.
- C. Do not use admixtures of any kind in mortar, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces to be cleaned are ready for work of this section.

3.2 PREPARATION

- A. Protect surrounding elements from damage due to restoration procedures.
- B. Separate areas to be protected from restoration areas using means adequate to prevent damage.
- C. Cover existing landscaping with tarpaulins or similar covers.

- D. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures, including:
 - 1. Windows.
 - 2. Soft joints and sealants.
 - 3. Door frames.
 - 4. Vents, louvers and grills
- E. Close off adjacent occupied areas with dust proof partitions.
- F. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.
- G. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.3 BRICK REMOVAL AND REPLACEMENT

- A. Carefully remove bricks on a piece by piece basis. Cut out full units from joint to joint and to permit replacement with full size units. Clean the edges of remaining bricks, to remove all mortar, dust, and loose debris in preparation for rebuilding
- B. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.
- C. Simultaneously remove limited sections of existing masonry; support and protect masonry remaining next to and above the removal areas
- D. Support structure as necessary in advance of cutting out units.
- E. The Contractor is responsible for performing Work in a safe manner. Provide temporary shoring or other supports as required to prevent displacement of existing masonry that is to remain. Perform the removal Work with such care as may be required to prevent failure of the masonry or damage to adjoining masonry that is to remain
- F. Cut away loose or unsound adjoining masonry and mortar to provide firm and solid bearing for new work. Do not use impact type tools, use only rotary type grinders.
- G. Use power tools only after test cuts determine no damage to masonry units will result. Provide vacuum attachment for all grinding/cutting equipment for dust control purposes.
- H. Do not damage masonry units.
- I. Build in new units following procedures for new work. .
- J. Mortar Mix: Colored and proportioned to match existing work.
- K. Ensure that anchors, ties, reinforcing, and flashings are correctly located and built in.
- L. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings. Use a motor driven diamond blade saw to cut bricks with clean, sharp, unchipped edges.
- M. Wet brick which have initial rates of absorption (suction) of more than 30 grams per 30 square inches per minute, (in accordance with ASTM C 67), to ensure the bricks are nearly saturated with water, but surface dry when laid
- N. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min.. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.
- O. Install metal wall tie mesh in each joint.

- P. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area
- Q. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brick work

3.4 REPOINTING

- A. Perform repointing prior to cleaning masonry surfaces.
- B. Repointing of existing joint where joint reinforcing is exposed, shall be as indicated and detailed on drawings.
- C. Cut out loose or disintegrated mortar in joints to minimum 3/4" inch (19 mm) depth or until sound unweathered mortar is reached. Use power chisels die grinder, circular grinder or other power equipment approved by the YPS Office of Facilities Management.
 - 1. Test mock-up shall be performed in area directed by the YPS Office of Facilities Management. Contractor shall not proceed until mock-up and methods are approved.
 - 2. Use power tools only after test cuts determine no damage to masonry units will result.
 - 3. Provide vacuum attachment for all grinding/cutting equipment for dust control purposes.
- D. Do not damage masonry units. Do not spall the edges of adjoining masonry or widen the joints. Replace any masonry which is damaged.
- E. When cutting is complete, remove dust and loose material brushing and with water jet.
- F. Form a smooth, compact concave joint to match existing.
- G. Slightly recess pointing mortar from the faces of the masonry units where the units have rounded edges. Do not spread mortar on the edges or faces of the masonry. Do not featheredge the mortar.
- H. Tool repointed joints to match the appearance of adjoining joints when the mortar is thumbprint hard. Remove excess mortar from the edges of the joints with a soft bristle brush
- I. Moist cure for 72 hours.
- J. Clean repointed area minimum 24" each side of repointed joints.
 - 1. Immediately after the mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water, spray applied at low pressure.
 - 2. Do not use metal scrapers or brushes. Do not use acid or alkali cleaning agents
- K. Remove efflorescence by dry brushing followed by wet brushing.

3.5 UNUSED ANCHOR REMOVAL

- A. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. Where directed, if an item cannot be removed without damaging surrounding masonry, do the following:
 - a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antitrust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - 3. Patch the hole where each item was removed unless directed to remove and replace the masonry unit

3.6 LINTEL REPLACEMENT

- A. Replace lintels as follows:

1. Abate asbestos flashing and lead paint, where indicated.
2. Remove existing masonry as required to expose lintel and supporting structure.
3. Remove existing lintel, plates, clips, etc.
4. Clean and refurbish existing steel support beam.
5. Weld new lintel and clips to existing steel structure.
6. Provide rust control coating over all concealed steel in accordance with manufacturer's instructions..
7. Install conceal flashing over lintel and steel structure in accordance with manufacturer's instructions.
8. Provide two finish coats paint over exposed to view steel. Refer to 09 9113 - Exterior Painting.

3.7 LINTEL RESTORATION

- A. Abate lead paint where indicated.
- B. Wire or power brush all exposed surfaces.
- C. Provide two finish coats paint over exposed to view steel. Refer to 09 9113 - Exterior Painting.

3.8 TERRA COTTA UNIT PATCHING

- A. Patch units indicated where indicated on drawings..
- B. Preparation: Remove all loose mortar and masonry prior to installation of the repair mortar. "Sound" masonry with a hammer to verify its integrity. If necessary, cut away an additional 1/2" of the substrate to ensure the surface to be repaired is solid and stable. Remove any sealant residue.
 1. Where cramp anchors, threaded rod anchors, or dowels have been cut and pieces remain embedded in the substrate: Anchors that are free of rust, solidly embedded, and do not project beyond the surface of the masonry unit may remain. All others shall be removed.
 2. Cut the edges of the repair area to provide a minimum depth of 1/4". The edges of the repair should be square cut. Do not allow any feathered edges in the repair area.
 3. Clean all dust from surface and pores of the substrate, using clean water and a scrub brush.
 4. For very dry or porous surfaces, pre-wet the substrate ahead of time to prevent the substrate from drawing moisture out of the repair too quickly. Re-wet the surface immediately before applying the repair material.
- C. Mixing Mortar for Repair: Do not mix more material than can be used within 30 minutes.
 1. Discard any mixed material that has been unused for 30 minutes or more.
 2. Mixing ratios for brick, terra cotta and precast concrete are as follows:
 - a. Approximately 4 to 4 1/2 parts dry material to 1 part water:
 3. Add water to dry ingredients and mix well. Adjust amount of water according to the weather and the porosity of the substrate.
 4. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
- D. Patching Terra Cotta:
 1. Apply the mortar mix using a trowel in a series 1" lifts allowing mortar to dry approximately 10-20 minutes between lifts. If applied in layers, scrape off any cement skin that has formed and continue application. Dampen the surface before applying the next layer. Work mortar firmly into the surface of the masonry, including the corners, and under and around all mechanical anchors.
 2. Build up repair material so that it is slightly above the adjacent masonry surface. Allow mortar 15 to 30 minutes to set slightly (wait time will vary with temperature and humidity-longer in cool weather), and then scrape off excess material using a straight edge (a plasterer's miter rod is good for this). Do not press down or "float" the repair. Where repairs occur at panel edges or corners, form mortar to match the profile of the surrounding masonry. In all cases, finish and texture repair so that it is as indistinguishable as possible from the adjacent masonry.

3. Mask or remove surrounding mortar joints if patch will extend to edge of adjacent units.
 4. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding units. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
 5. Keep each layer damp for 72 hours or until patching compound has set.
 6. Clean any mortar residues from area surrounding the repair by sponging as many times as necessary with clean water before repair material sets.
- E. After the repair has been cured and allowed to dry for at least one week, if the appearance of a repair does not meet the specifications of the job, the surface color of the repair may be enhanced by applying a vapor permeable, mineral based pigmented stain.
- F. Lightly mist the repair with water to wet the entire surface of the finished repair approximately 30 minutes to 1 hour after completion on hot sunny days, and approximately 2 hours or longer, on cool or cloudy days. Time will vary with temperature and humidity.
1. Mist several times a day on the three days following the repair installation. Do not cover with plastic.

3.9 GENERAL CLEANING AND PROTECTION PROCEDURES

- A. Protect persons and surrounding surfaces of building being restored from harm resulting from masonry restoration work.
1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
 2. Comply with cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 3. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 4. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures, including:
 - a. Windows.
 - b. Soft joints and sealants.
 - c. Door frames.
 - d. Vents, louvers and grills
 5. Keep wall wet below area being cleaned to prevent streaking from runoff.
 6. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 7. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 8. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- B. Prevent mortar from staining face of surrounding masonry and other surfaces.
1. Cover sills, ledges, and projections to protect from mortar droppings.
 2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 3. Immediately remove mortar in contact with exposed masonry and other surfaces.
 4. Clean mortar splatters from scaffolding at end of each day
- C. Apply all material in strict accordance with the manufacturer's instructions.

- D. Protect people, vehicles, property, plants, non masonry surfaces from product splash, residue, wind drift and fumes.
- E. Do not apply when surface and air temperature falls below 50 degrees.

3.10 CLEANING NEW BRICK MASONRY

- A. Test surface for cleaning effectiveness.
- B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.
- C. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.
- D. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.
 - 1. Apply 400-1000 psi pressure, water flow rate of 6-8 gallons per minute, to masonry surfaces, maintaining uniform depth and surface texture throughout. Use 15-45 degree fan spray. If required heat water to 150-180 degree.
 - 2. Let dwell 3 to 5 minutes. Do not let cleaner dry on the surface. Fresh water rinse the surfaces below areas being cleaned to prevent streaking.
 - 3. Repeat steps as required

3.11 FIELD QUALITY CONTROL

- A. Inspectors: YPS Office of Facilities Management may engage qualified inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Notify YPS Office of Facilities Management in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.12 CLEANING

- A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
- B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
- C. Clean surrounding surfaces.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Shop fabricated steel items.
- B. Loose lintel where required for work under this section.

1.3 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- B. Section 09 9113 - Exterior Painting: Paint finish.
- C. Section 09 9123 - Interior Painting: Paint finish.

1.4 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).

1.5 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: For the following:
 - 1. Lintels
 - 2. Paint products.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, licensed in the State of New York responsible for their preparation
- D. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 2. Provide for trimming and fitting at site.

1.9 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.2 FABRICATION

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work
- D. Fit and shop assemble items in largest practical sections, for delivery to site.
- E. Fabricate items with joints tightly fitted and secured.

- F. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Do not use ferrous material and equipment on stainless steel components.
 - 3. Obtain fusion without undercut or overlap.
 - 4. Remove welding flux immediately.
 - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate
- H. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- I. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- C. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594

2.4 FABRICATED ITEMS

- A. Lintels: As detailed; galvanized.
 - 1. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated
 - 2. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
 - 3. Galvanize loose steel lintels located in exterior walls.
 - 4. Refer to Lintel Schedule on drawings.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.7 FINISHES - STEEL

- A. Galvanized: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft (530 g/sq m) galvanized coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

- A. Install fabricated items as per manufacturer's instructions
- B. Install items plumb and level, accurately fitted, free from distortion or defects.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components as indicated on shop drawings.
- E. Perform field welding in accordance with AWS D1.1/D1.1M.
- F. Obtain approval prior to site cutting or making adjustments not scheduled.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Concealed wood blocking, nailers casework and hardware.
- B. Miscellaneous wood nailers, furring, and grounds.

1.3 RELATED REQUIREMENTS

- A. Section 12 3200 - Plastic Laminated Casework.

1.4 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2021.
- C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. PS 2 - Performance Standard for Wood Structural Panels; 2018.
- E. PS 20 - American Softwood Lumber Standard; 2021.
- F. WPA G-5 - Western Lumber Grading Rules; 2021.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on lumber, plywood, fasteners, and application instructions .
- C. Shop drawings, or 2 foot long on-site samples which show the size, shape, configuration and method of fastening for all wood blocking assemblies, and which show how the blocking assemblies will relate to other adjoining work.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- E. Material Safety Data Sheets

1.6 QUALITY ASSURANCE

- A. A firm (Installer) with not less than 5 continuous years experience performing carpentry work comparable to that required for this project, employing personnel skilled in the work specified.
- B. The Installer shall directly employ the personnel performing the work of this section.
- C. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
 - 1. Acceptable Lumber Inspection Agencies: Any agency with rules approved by American Lumber Standards Committee.
 - 2. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Deliver and store materials dry at all times.

1.8 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a two (2) year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Wood, including shims, nailers, blocking, furring and similar members, in the sizes indicated, worked into the shapes shown.
 - 2. Acceptable Lumber Inspection Agencies: Any agency with rules approved by American Lumber Standards Committee.
 - 3. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.
 - 4. Pre-Work Conference: Attend the pre-roofing meeting to discuss how carpentry work will be performed and coordinated with other work.
 - 5. Species: Douglas Fir, unless otherwise indicated, construction grade solid lumber free of splits, large knots and other imperfections.

2.2 DIMENSION LUMBER

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: Kiln-dry or MC15.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.

2.3 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. General: Provide fasteners of size and type that comply with requirements specified in this article by the authority having jurisdiction, International Building Code, International Residential Code, Wood Frame Construction manual, and National Design Specification
 - 2. Metal and Finish: Hot-dipped galvanized steel as per ASTM A153/A153M for exterior, wet areas, and high humidity areas and for other wood locations.
 - 3. Use screws wherever possible, minimum size diameter #12. If nails are used they shall be annular ring shank type. Do not use dry wall screws to secure wood blocking assemblies.
 - 4. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.5 FACTORY WOOD TREATMENT

PART 3 EXECUTION

3.1 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- C. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Towel and bath accessories.
 - 3. Visual display boards
 - 4. Windows.

3.4 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated or required as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.6 CLEANING AND PROTECTION

- A. General: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 07 9200
JOINT SEALANTS**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Acoustical sealant.
- D. Joint backings and accessories.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07 8400 - Firestopping: Firestopping sealants.
- C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.4 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.
- G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Sample product warranty.
 - 7. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Fuller and D'Angelo, P.C. and submit at least two physical samples for verification of color of each required sealant.
- F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
 - 1. Identification of testing agency.
 - 2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Test date.
 - b. Copy of test method documents.
 - c. Age of sealant upon date of testing.
 - d. Test results, modeled after the sample form in the test method document.
 - e. Indicate use of photographic record of test.
- E. Field Quality Control Plan:
 - 1. Visual inspection of entire length of sealant joints.
 - 2. Field testing agency's qualifications.
 - 3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- F. Field Adhesion Test Procedures:
 - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 - 2. Have a copy of the test method document available during tests.
 - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 - 4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
 - 5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Yonkers Public Schools.

6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Fuller and D'Angelo, P.C..
- G. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
 1. Sample: At least 18 inches (457 mm) long.
 2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25.4 mm) by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
 3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.7 MOCK-UP

- A. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution:
 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.8 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 1. Bostik Inc: www.bostik-us.com.
 2. Dow Corning Corporation: www.dowcorning.com/construction.
 3. Sika Corporation: www.usa-sika.com.
 4. W.R. Meadows, Inc: www.wrmeadows.com/sle.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 1. Sika Corporation: www.usa-sika.com.
 2. W.R. Meadows, Inc: www.wrmeadows.com.

2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Vertical Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
- C. Interior Vertical Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 1. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
- D. Exterior and Interior Horizontal Joints: Single component, self-leveling, premium-grade polyurethane sealant

2.3 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 6116.

2.4 NONSAG JOINT SEALANTS

- A. Silicone Sealant: 1, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.
 4. Cure Type: Single-component, neutral moisture curing
 5. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
 6. Manufacturers:
 - a. Sika Corporation; Sikasil 728NS: www.usa-sika.com.
 - b. Substitutions: 01 2500 - Substitution Procedures
- B. Mildew-Resistant Silicone Sealant: 1, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: White.
 2. Applications: Use for:
 - a. Use for all perimeter joints of toilet fixtures, cabinets, casework, countertops and similar locations..
 3. Manufacturers:
 - a. 786 Mildew Resistant; Dow Corning.
 - b. Pecora Corporation; 898 Silicone Sanitary Sealant: www.pecora.com.
 - c. Sika Corporation; Sikasil GP: www.usa-sika.com.
 - d. Sanitary 1700; GE Silicones..
 4. Substitutions: 01 2500 - Substitution Procedures
- C. Type Acoustical Sealant: - Acrylic Emulsion Latex: Water-based; 1, single component, non-staining, non-bleeding, non-hardening, non-sagging; not intended for exterior use.
 1. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.

2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
3. Manufacturers:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.
4. Applications: Use for:
 - a. Use for all interior joints of where acoustical sealant indicated.
5. Substitutions: 01 2500 - Substitution Procedures

2.5 SELF-LEVELING SEALANTS

- A. Self-Leveling Silicone Sealant: 1, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
 5. Manufacturers:
 - a. Sika Corporation; Sikaflex 1c SL: www.usa-sika.com.
 - b. Use for all horizontal exterior joints and Interior joints in wet areas..

2.6 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: 1; Type O - Open Cell Polyurethane.
 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: 1; Type C - Closed Cell Polyethylene.
 3. Open Cell: 40 to 50 percent larger in diameter than joint width. (Not to be used in flat or horizontal joints)
 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width. (Use for flat and horizontal joints)
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 2. Notify Fuller and D'Angelo, P.C. of date and time that tests will be performed, at least seven days in advance.
 3. Record each test on Preinstallation Adhesion Test Log as indicated.
 4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Fuller and D'Angelo, P.C..

5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Self-leveling joints: Recess joint depth as recommended by the sealant manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 08 9100
LOUVERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Louvers, frames, and accessories.
- B. Foam sealant for filling perimeter of louver space..
- C. Remove and reinstall existing ductwork.

1.3 RELATED REQUIREMENTS

- A. Section 04 0100 - Maintenance of Masonry
- B. Section 05 5000 - Metal Fabrications
- C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 23 0400 - Sheet metal Work and Related Accessories: Ductwork attachment to louvers, and blank-off panels.

1.4 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2020.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021, with Errata (2022).
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
- E. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

- D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.
- E. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum five (5) years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- D. Welding: Qualify procedures and personnel according AWS D1.2, "Structural Welding Code--Aluminum."
- E. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

1.7 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
 - 1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.1 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
 - 1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf (1.2 kPa) without damage or permanent deformation.
 - 2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
 - 3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
 - 4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Stationary Louvers, : _____ extruded aluminum construction.
 - 1. Free Area: 8.67 sf., minimum.
 - 2. Static Pressure Loss: 0.12, H2O maximum per square foot (square meter) of free area at velocity of 973 fpm, when tested in accordance with 1.
 - 3. Frame: 2 inches (50 mm) deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
 - 4. Aluminum Thickness: Frame 0.063" minimum; blades 0.063" minimum.
 - 5. Product: Use the following : Airolite K6772 with flange at wall louvers.
 - a. Substitutions: See Section 01 2500 Substitution Procedures.
- C. Stationary Louvers, Type 4": Horizontal blade, extruded aluminum construction.
 - 1. Free Area: 8.67 sf., minimum.
 - 2. Static Pressure Loss: 0.14 maximum per square foot (square meter) of free area at velocity of 961 fpm, when tested in accordance with 1.
 - 3. Blades: Drainable.

4. Frame: 4 inches (100 mm) deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
5. Aluminum Thickness: Frame 0.081" minimum; blades 0.081" minimum.
6. Product: Use the following : Airolite K6774 with flange at wall louvers.
 - a. Substitutions: See Section 01 2500 Substitution Procedures.

2.2 MATERIALS

- A. Extruded Aluminum: 2 (1), 6063 alloy, T-5 temper.

2.3 FINISHES

- A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).
 1. Manufacturers:
 - a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com.
 - b. Sherwin-Williams Company; SHER-NAR 5000: www.sherwin-williams.com.
 - c. Substitutions: See Section 01 2500 Substitution Procedures
- B. Color: As selected from manufacturer's standard colors.

2.4 ACCESSORIES

- A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1-1/2 inch (38 mm) thick, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct. Coordinated with HVAC Contractor.
- B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
- C. Bird Screen: Interwoven wire mesh of steel, 14 gage, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.
- D. Insect Screen: 18 x 16 size aluminum mesh.
- E. Window and Door Joint Seal: Polyurethane-based joint filler:
 1. UL Classified.
 2. Product: "Great Stuff" as manufactured by Dow Chemical.
 - a. "Gaps and Cracks: for joints less than 1".
 - b. "Big Gap Filler" for joint over 1".
 3. Use for all filling all spaces and joints around louvers located on exterior walls.
- F. Sealant: Type, as specified in Section 07 9200 - Joint Sealants.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
- B. Verify that field measurements are as indicated.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Coordinate with installation of flashings by others.
- C. Install louvers level and plumb.
- D. Set sill members and sill flashing in continuous bead of sealant.

- E. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- F. Secure louver frames in openings with concealed fasteners.
- G. Fill all exterior spaces and joint between windows and doors solid with foam in accordance with manufacture's instructions.
 - 1. Cut back to permit application of joint sealant.
- H. Install perimeter sealant and backing rod in accordance with 07 9200 - Joint Sealants.
- I. Coordinate with installation of mechanical ductwork.

3.3 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Metal channel soffit/ceiling framing.
- B. Metal Trim
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 8400 - Firestopping: Top-of-wall assemblies and penetrations at fire rated walls.
- C. Section 07 9200 - Joint Sealants.

1.4 REFERENCE STANDARDS

- A. AISI S-100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- C. ASTM C473-19 - Standard Test Methods For Physical Testing Of Gypsum Panel Products.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
- I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.
- J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.
- N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

- O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- P. UL (FRD) - Fire Resistance Directory; Current Edition.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- F. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.6 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum Ten (10) years of experience.

1.7 REGULATORY REQUIREMENTS

- A. Refer to Section 01 4100 - Regulatory Requirements.
 - 1. Conform to New York State Building and Fire Code for fire rated assemblies as indicated on drawings.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.2 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. Marino: www.marinoware.com.
- B. Non-structural Framing Accessories:
 - 1. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
- C. Suspended Ceiling and Soffit Framing:
 - 1. Components, General: Comply with ASTM C 754 for conditions indicated.
 - 2. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch-wide flange, with ASTM A 653, G40 (Z120), hot-dip galvanized zinc coating.
 - a. Depth: 1-1/2" unless otherwise indicated.
 - 3. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

2.3 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. Georgia-Pacific Gypsum: www.gpgypsum.com.

2. National Gypsum Company: www.nationalgypsum.com.
 3. USG Corporation: www.usg.com.
 4. Substitutions: See Section 01 2500 Substitution Procedures
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and soffits, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. **Mold resistant board is required at all locations.**
 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 4. Thickness:
 - a. Vertical Surfaces: As indicated on drawings.
 - b. Soffits and Ceilings: 5/8 inch (16 mm).

2.4 GYPSUM WALLBOARD ACCESSORIES

- A. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with 1; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with 2.
1. Smoke Developed Index: 0 (zero), when tested in accordance with 1.
 2. Thickness: Full width of framing member (___ mm).
- B. Beads, Joint Accessories, and Other Trim: 1, galvanized steel, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.
 2. L-Trim with Tear-Away Strip: Sized to fit the thickness gypsum wallboard.
 - a. Products:
 - a) Phillips Manufacturing Co; gripSTIK L-Tear: www.phillipsmfg.com.
 - b) Substitutions: See Section 01 2500 Substitution Procedures
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Mold resistant and asbestos free.
 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - a. Products:
 - a) CertainTeed Corporation; Extreme All-Purpose Joint Compound: www.certainteed.com.
 - b) Substitutions: See Section 01 2500 Substitution Procedures
- D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- E. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- F. Utility angle: 2"x 2" 20 ga. for attachments of intersection framing and right angle corner enclosures.
- G. Flat straps: 6", 16 ga. use for stud bridging.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Provide metal Bracing: at midpoint up to 8' 0"; at third point over 8'-0".

- C. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 - 1. Level ceiling system to a tolerance of 1/1200.
- D. **Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs minimum 16 gauge.**
- E. Blocking: Install blocking for support of toilet partitions, casework, toilet accessories, and hardware. Comply with Section 06 1000 for wood blocking.

3.3 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board.
- F. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.4 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.5 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling, and sanding are not required at base layer of double-layer applications.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.6 FIRE RATED WALL MARKING AND IDENTIFICATION

- A. For all walls or partitions indicated to be fire rated, or smoke rated, where there is an accessible concealed floor, ceiling or attic space adjacent to said wall. Contractor shall permanently mark with signs or stenciling within the concealed space, in accordance with IBC 703.7 in concealed spaces.
 - 1. Identifications shall be located within 15 feet of the end of each wall or partition and at intervals not exceeding 30 feet measured horizontally along the wall or partition.

2. Identifications shall include lettering not less than 3 inches in height with a minimum 3/8 inch stroke width in a contrasting color incorporating the wording " FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS".

3.7 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.8 FINISH LEVEL SCHEDULE

- A. Level 1: Above finished ceilings concealed from view.
- B. Level 2: Utility areas and areas behind cabinetry.
- C. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.
- D. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. New and Replacement of acoustical panels and suspended grid indicated on drawings.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 9200 - Joint Sealants.
- C. Divisions 23 and 26 for air outlets and inlets, light fixtures, and fire alarm.

1.4 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.
- G. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- H. Ceilings and Interior Systems Construction Association (CISCA): Code of Practices.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 12 x 12 inch (300 by 300 mm) in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 12 inches (300 mm) long, of suspension system main runner.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.7 QUALITY ASSURANCE

- A. Fire Performance: ASTM E84 surface burning characteristics. Flame Spread index 25 or less. Smoke development index 50 or less. (UL Labeled) Class A in accordance to ASTM E1264
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years documented experience.
- D. Installers Qualifications: Company specializing in the installation of acoustical ceilings specified in this section with minimum 5 years documented experience.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by YPS Office of Facilities Management and Fuller and D'Angelo, P.C..
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by YPS Office of Facilities Management and Fuller and D'Angelo, P.C..
 - 3. Refinish mock-up area as required to produce acceptable work.
- F. Pre-installation Conference: Conduct conference at Project site minimum one week before removal and installation. Agenda shall include project conditions, coordination with work of other trades, and layout of items which penetrate ceilings.

1.8 EXTRA MATERIALS

- A. See Section 01 6000 - Product Requirements.
- B. Deliver extra acoustical units for YPS Office of Facilities Management's use in maintenance. Label and store where directed by the YPS Office of Facilities Management including codes used on the Drawings. Do not deliver to the Project site until the YPS Office of Facilities Management is prepared to receive and store maintenance materials.
 - 1. Panels: Furnish 5 percent of total acoustic unit area of extra panels to YPS Office of Facilities Management.
 - 2. Suspension System Components: Furnish 5 percent of each exposed component of the quantity installed.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet conditions such as concrete, plaster, paint, and adhesives have been completed and cured.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Protect system components from excessive moisture in shipment, storage, and handling

1.10 WARRANTY

- A. Warranty: Provide manufacturer's standard warranty against manufacturing defects in material or workmanship when installed in accordance with the current CISC Handbook and ASTM C367.
 - 1. Warranty Period: 30 years.

1.11 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

- A. Acoustical Panels, Type ACT-1 & ACT-2: Painted wet formed mineral fiber, with the following characteristics:
 - 1. Classification: 1 Form 2, Pattern C E; Fire Class A.
 - a. Type III, Form 1, Pattern E I, Fire Class A.
 - 2. Size: 24 by 24 inches (610 by 610 mm) and 24 by 48 inch (610 by 1219 mm) as indicated on drawings
 - 3. Thickness: 7/8 inches (2.1875 mm).
 - 4. Light Reflectance: 0.85 percent, determined in accordance with 1.
 - 5. NRC Range: 0.75, determined in accordance with 1.
 - 6. Articulation Class (AC): 170 , determined in accordance with 1.
 - 7. Ceiling Attenuation Class (CAC): 35, determined in accordance with 1.
 - 8. Panel Edge: Square.
 - 9. Color: White.
 - 10. Suspension System Type Prelude XL: Exposed grid.
 - 11. Products:
 - a. Armstrong World Industries, Inc: www.armstrongceilings.com.
 - a) Cirrus High NRC 563 for 24 x 24.
 - b) Cirrus High NRC 565 for 24 x 48
 - b. Substitutions: See Section 01 2500 - Substitution Procedures..

2.2 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc; Product Prelude XL 15/16": www.armstrong.com.
 - 2. Structural Classification: Intermediate duty, ASTM C 635.
- B. Metal Suspension Systems - General: Complying with 1; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required.

2.3 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch (2 mm) galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
 - 1. Minimum 7/8" horizontal flange
- D. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 9200 - Joint Sealants.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.
- C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.3 INSTALLATION - SUSPENSION SYSTEM

- A. Repair and Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit existing grid, tile and provide new units as required at new windows.
 - 2. Make field cut edges of same profile as factory edges.
- F. Install seismic clips or stabilizer bars as per code requirements.

3.5 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 ADJUSTING AND CLEANING

- A. Replace damaged or broken material, Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with mfg., touch up procedures using Armstrong Item #5760 8 oz, touch up paint as required for small nicks and minor scratches in the surface, Remove and replace any work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
 - 1. Provide touch up kit for YPS Office of Facilities Management's use.

3.7 SCHEDULE

- A. As indicated on drawings.

END OF SECTION

**SECTION 09 6500
RESILIENT FLOORING**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Removals.
- B. Crack repair.
- C. Resilient tile flooring.
- D. Resilient base.
- E. Installation accessories.

1.3 RELATED REQUIREMENTS

- A. Section 02 2080 - Asbestos Removal and Disposal.
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.4 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- B. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006 (Reapproved 2018).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
- E. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring.
- F. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- I. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs.
- J. ASTM F2420 - Standard Test Method for Determining Relative Humidity on the Surface of Concrete
- K. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- L. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.
- M. Recycled Content: No
- N. ISO 9001 – Quality Management System: Meets and exceeds passing requirements
- O. ISO 14001 – Environmental Management System: Meets and exceeds passing requirements
- P. FloorScore® Certified: Yes
- Q. Environmental Product Declaration, EPD® (SCS Global Services): Verified

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12" x 12" in size illustrating color and pattern for each resilient flooring product specified.
- D. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. MSDS (Material Safety Data Sheets) should be submitted for all adhesives used:
 - 1. Membrane, primer, patch, leveler, heat weld rod, cold weld, liquid wax and cleaning agents
- H. Maintenance Materials: Furnish the following for Yonkers Public Schools's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Materials: Furnish one box of tile for each fifty boxes or fraction thereof, for each type, color, pattern and size of the tile installed, from same manufactured lot as materials installed.
 - a. Deliver extra tile to Owner after completion of work.
 - b. Furnish tiles in protective packaging with identifying labels.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum 10 years documented experience, with resilient flooring of types equivalent to those specified.
 - 1. Manufacturers proposed for use, which are not named in this section, shall submit evidence of ability to meet performance requirements specified not less than 10 days prior to bid date.
 - a. Color Matching: Provide resilient flooring products, including wall base and accessories, from one manufacturer to ensure color matching.
 - b. Manufacturer capable of providing technical training and field service representation.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions

1.8 MOCK UP

- A. Field Samples per Section 001 4000 - Quality Requirements. Provide field samples, dry laid, to demonstrate aesthetic effects of materials in place.

1.9 FIELD CONDITIONS

- A. Store materials for not less than 48 hours before, during, and 72 hours after installation, in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.10 PRE-INSTALLATION TESTING

- A. Conduct pre-installation testing as follows:
 - 1. ASTM F-2170 Test Method for Determining Relative Humidity in Concrete: Maximum RH: 55%.

1.11 WARRANTY

- A. Provide manufacturer's non-prorated ten (10) year limited warranty to be free from defects in material and workmanship, under normal use and service, to repair or replace all defective tiles including reasonable labor.

PART 2 PRODUCTS

2.1 TILE FLOORING

- A. Enhanced Resilient Tile :
 - 1. Manufacturers:
 - a. R9 – Canyon Collection, Raskin Industries, 710 South Powerline Road, Suite G Deerfield Beach, FL 33442, 561-997-6658.
 - b. Substitutions: 01 2500 - Substitution Procedures.
 - 2. Composition: Virgin Vinyl – Dry Back
 - 3. Size (inches / mm): 12” x 24” (304.8 x 609.6mm)
 - 4. Gauge: .100” (2.5mm)
 - 5. Wear Layer: 28mil (.7mm) Phthalate-Free
 - 6. Finish: G88 Advanced Coating System – Antibacterial and Anti-Fungal treatment with ceramic coating
 - 7. Edge: Square
 - 8. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648.
 - 9. ASTM F925 – Resistance to Chemicals: Meets and exceeds passing requirements
 - 10. D2047-Coefficient of Friction (James Machine): Meets and exceeds passing requirements (>.6)
 - 11. ASTM F1515-Resistance to Light: Meets and exceeds passing requirements
 - 12. ASTM F1514-Resistance to Heat: Meets and exceeds passing requirements
 - 13. ASTM F970 - Static Load Limit: Meets and exceeds passing requirements (1,000 PSI-Modified)
 - 14. Squareness: ASTM F2421 - Passes - ±0.10” max
 - 15. Size and Tolerance: ASTM F2055 - Passes - ±0.016 in. per linear foot
 - 16. Thickness: ASTM F386 - Passes - as specified ±0.005”
 - 17. VOC Content Limits: As specified in Section 01 6116.
 - 18. Color: As noted on drawings.
- B. Installation Method: Full Spread.
- C. Adhesive: As recommended by the manufacturer.

2.2 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and Style A straight for carpet installation as follows:
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
 - 3. Height: 4 inch (100 mm) and 2-1/2 inch (62 mm).
 - 4. Thickness: 0.125 inch (3.2 mm).
 - 5. Length: 4 foot (1.2 m) sections.

6. Color: Solid color as indicated on drawings.

2.3 ACCESSORIES

- A. Subfloor Crack and Joint Repair: Two-part polyurethane repair compound .
 1. 100% solids for no shrinkage
 2. Service temperature range of -35° to 110°F (-37° to 43°C),
 3. Product:"Ardex ArdiFix", Ardex Engineered Cements, 400 Ardex Park Drive, Aliquippa, PA 15001 USA, Tel: 724-203-5000
- B. Adhesive for Vinyl Tile Flooring:
 1. Adhesive shall be as recommended by the manufacturer, compatible with tile and substrate.
 - a. Note that recommendations shall be made which reflect and are compatible with the results of moisture level tests in the concrete substrate.
- C. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Test as Follows:
 - a. Internal Relative Humidity: ASTM F2170.
 - b. Moisture Vapor Emission: ASTM F1869.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Moisture Testing: Moisture testing shall be performed using ASTM test method ASTM F 2170 in situ Relative Humidity Test. The acceptable test result when using test method F 2170 should not exceed seventy five per cent (75%) AND pH readings should not exceed 9.0.
- E. Verify that existing concrete sub floor do not containing curing compound by placing 1/4 cup of water on surface. If water beads up scarify surface.
- F. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Existing flooring shall be removed by Asbestos sub-contractor. Refer to Section 02 2080.
 1. Do not proceed until removal is completed and clearances authorized.
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Concrete substrate that fully conforms to the requirements of ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring is required, or as detailed in the manufacturer's Installation Guide.
- D. Crack and Joint Repair: Concrete must be structurally sound, solid, dry, and free of laitance, dirt, debris, coatings, sealers, solvent base adhesives and any contaminant that may act as a bond breaker.
 1. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface up to 1/2".
 2. Dry diamond blade may be used to prepare cracks and create a clean surface for bonding.
 3. Do not use sweeping compounds, solvents or acid etching to prepare the surface.

4. Cracks or joints should be free of dust, dirt, oils and any other debris.
 5. New concrete should be fully cured and free of movement.
 6. Prohibit traffic until filler is fully cured.
- E. Underlayment: All concrete substrates must be solid, thoroughly clean and free of oil, wax, grease, asphalt, latex and gypsum compounds, curing compounds, sealers and any contaminant that might act as a bond breaker.
1. **Mechanically profile with grinder 100% of all existing substrates receiving resilient flooring. Provide dust control as required.**
 - a. After profiling test substrate by place drop of water, or other means to insure all coatings, sealers etc have been removed. Repeat profiling if necessary.

3.3 INSTALLATION GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Crack and Joint Repair: During set-up of cartridge (purging air and balancing) and initial dispensing of material, keep cartridge and nozzle assembly pointed straight up to prevent material in the nozzle from flowing back into the cartridge.
 1. Apply continuously once opened to prevent the tip from becoming clogged.
 2. Immediately broadcast clean sand size #30 or #35 into the freshly applied material.
 3. Fill the crack, joint or repair area so the material is slightly higher than the face of the concrete slab.
 4. Allow to set for approximately 10 to 15 minutes (at 75° F), and then use a sharp razor scraper to shave excess material from the top of the slab.

Adhesive-Applied Installation:

 1. Spread only enough adhesive to permit installation of materials before initial set as recommended by the manufacturer.
 2. Fit joints and butt seams tightly.
 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 1. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- G. Install flooring in recessed floor access covers, maintaining floor pattern.
- H. Install feature strips where indicated.
- I. Do not mix manufacturing batches of a color within the same area.
- J. Do not install resilient flooring over building expansion joints.
- K. Do not install defective or damaged resilient flooring.
- L. Layout resilient flooring to provide equal size at perimeter. Adjust layout as necessary to reduce the amount of resilient flooring which is cut to less than half full width.
- M. Install resilient flooring without voids at seams. Lay seams together without stress.
- N. Remove excess adhesive immediately

3.4 INSTALLATION TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
 - 1. Lay tiles square with room axis, unless otherwise indicated.

3.5 INSTALLATION RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. Cleaning of Vinyl Composition Tile
 - 1. Sweep or dust mop to remove dirt and grit. Do not use treated dust mops.
 - 2. Add heavy duty cleaner to cool water following the manufacturer's instructions.
 - 3. Remove the solution with a wet-dry vacuum or auto scrubber until floor is dry and free of residue.
 - 4. Rinse the floor with clean water. Repeat the rinse process as necessary to remove all haze and residue.
 - 5. Apply three to five coats of high gloss or matte floor finish following the manufacturer's instructions.

3.7 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation and 72 hours heavy rolling loads.

3.8 SCHEDULE

- A. Refer to Finish Schedule on drawings.

END OF SECTION

**SECTION 09 9113
EXTERIOR PAINTING**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Glass.
 - 6. Concealed pipes, ducts, and conduits.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 5000 - Metal Fabrications: Shop-primed items.
- C. Section 09 9123 - Interior Painting.

1.4 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning; 2018.
- G. SSPC-SP 3 - Power Tool Cleaning; 2018.
- H. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).
 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
 2. Where sheen is not specified, discuss sheen options with Fuller and D'Angelo, P.C. before preparing samples, to eliminate sheens definitely not required.
 3. Allow 15 days for approval process, after receipt of complete samples by Fuller and D'Angelo, P.C..
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Yonkers Public Schools's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five (5) years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three (3) years experience.

1.8 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide column & beam assembly illustrating paint color, texture, and finish.
- C. Locate where directed by Construction Manager.
- D. Mock-up may remain as part of the work.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer.
- B. Paints:
 - 1. Base Manufacturer: Sherwin-Williams Company; www.sherwin-williams.com.
- C. Substitutions: See Section 01 2500 - Substitution Procedures

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Colors: As indicated on drawings.

2.3 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including galvanized and primed metal.
- B. Ferrous Metals, Unprimed Alkyd: Provide the following finish systems over unprimed exterior ferrous metal:
 - 1. Rust inhibiting, modified phenolic alkyd resin primer: Two finish coats over primer
 - a. Primer: Sherwin WilliamsKem Kromik Universal Metal Primer spreading rate recommended by manufacturer to achieve a dry film thickness of 3.3 to 4.4 mils.
 - 2. Topcoat: Two Coats Alkyd applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6mils
 - a. Sherwin Williams: Pro Industrial Urethan Alkyd Enamel.
- C. Ferrous Metals, Unprimed, Latex, 3 Coat:
 - 1. Rust inhibiting, modified phenolic alkyd resin primer: 2 finish coats over primer
 - a. Primer: Sherwin WilliamsKem Kromik Universal Metal Primer spreading rate recommended by manufacturer to achieve a dry film thickness of 3.3 to 4.4 mils.
 - 2. Topcoat: Acrylic Latex applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.1 to 4.2 mils
 - a. Sherwin Williams: Pro Industrial Acrylic.
- D. Ferrous Metals, Primed, Alkyd, 2 Coat:
 - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

2. Topcoat: Two Coats Alkyd applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6mils
 - a. Sherwin Williams: Direct To Metal Alkyd.
- E. Ferrous Metals, Primed, Latex, 2 Coat:
 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 2. Topcoat: Acrylic Latex applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.5 to 4.0
 - a. Sherwin Williams: Pro Industrial Acrylic.
- F. Galvanized Metals, Alkyd, 3 Coat:
 1. One coat galvanize primer.
 2. Two coats of alkyd enamel :
 - a. Intermediate coat: Alkyd enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6.
 - a) Sherwin Williams Direct To
 - b. Finish coat: Alkyd enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6.
 - a) Sherwin Williams Direct To Metal Alkyd Enamel Semi-Gloss Pure White

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to 1.
- H. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 3. Remove rust, loose mill scale, and other foreign substances by power wire brushing, power sanding, power grinding, power tool chipping and power tool descaling, using methods recommended in writing by paint manufacturer and 1. Protect from corrosion until coated.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Sand metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 09 9123
INTERIOR PAINTING**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, indicated to be painted, new installation or surfaces disturbed by construction operations unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Brick, architectural concrete.
 - 10. Glass.
 - 11. Acoustical materials, unless specifically indicated.
 - 12. Concealed pipes, ducts, and conduits.

1.3 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.4 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2017).
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning; 2018.
- G. SSPC-SP 3 - Power Tool Cleaning; 2018.
- H. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Fuller and D'Angelo, P.C. before preparing samples, to eliminate sheens definitely not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for YPS Office of Facilities Management's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 10 years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience.

1.8 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide door and frame assembly illustrating paint color, texture, and finish.
- C. Locate Where directed by the [].

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. Substitutions: Refer to Section 01 2500 - Substitution Procedures..
- B. Paints:
 - 1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
 - 2. Primer Sealers: Same manufacturer as top coats.
- C. Substitutions: 01 2500 - Substitution Procedures..

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Fuller and D'Angelo, P.C. from the manufacturer's full line.
- E. Colors: As indicated in Finish Schedule.

2.3 PAINT SYSTEMS - INTERIOR

- A. Concrete/Masonry, Opaque, Latex, 2 coat: (Existing surfaces)
 - 1. Latex Primer Sealer: One Coat latex enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 mils dry..
 - a. Sherwin Williams Multi-Purpose Interior Exterior Latex Primer EW
 - 2. Topcoat: Semi-gloss: One coat of latex enamel.
 - a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- B. Ferrous metals, Not Primed, Acrylic Latex, 3 coat:
 - 1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6 mils.
 - a. Sherwin Williams Direct-to-Metal Semi-Gloss.
 - 2. Topcoat: Three coats Acrylic Latex

- a. Sherwin Williams ProMar 400 Zero VOC Semi-Gloss
- C. Gypsum Board/Plaster, Latex, 2 coat: (Existing Surfaces)
 - 1. Concrete/Masonry, Opaque, Latex, Three coats: (New surfaces)
 - a. Block Filler: One Coat Spreading rate recommended by manufacturer to achieve a dry film thickness of 16 mils wet; 7.7 mils dry
 - a) Sherwin Williams Super PrepRite Block FillerCraft No. 285.
 - b. Topcoat:Two Coats latex enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.7 mils dry.
 - a) Sherwin Williams ProMar 200 Zero VOC Eggshell
 - 2. Aluminum and Galvanized Metals, Not Primed, Acrylic Latex, 3 coat:
 - a. One Coat latex primer spreading rate recommended by manufacturer to achieve a film thickness of 5.0 to 10 mils wet; 1.8.to 3.6 mils dry..
 - a) Sherwin Williams Pro-Cryl Universal Primer
 - b. Two Coats Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.7 nils dry to 6.4 mils:
 - a) Sherwin Williams ProMar 200 Zero VOC Semi-Gloss
- D. Concrete Floor Surface, Acrylic Water Base, Two coat (Existing surfaces)
 - 1. First Coat: spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5-2.0 mils.
 - a. Sherwin Williams Armorseal Tread-Plex
 - 2. Finish Coat: spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 2.0 mils.
 - a. Sherwin Williams Armorseal Tred-Plex

2.4 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Fuller and D'Angelo, P.C. of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Stucco: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
 - 1. Prior to removing mildew, test any cleaner on a small, inconspicuous area prior to use.
 - 2. Bleach and bleaching type cleaners may damage or discolor existing paint films. Alternative cleaning solutions may be required
 - 3. Wear protective eye wear, waterproof gloves, and protective clothing.
- F. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
 - 3. Clean concrete according to ASTM D4258. Allow to dry.
 - 4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- G. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
 - 3. Clean boiler room wall surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and 1. Protect from corrosion until coated.
- J. Cleaning Existing Walls: Remove all loose paint, plaster and other coatings.
 - 1. Working from bottom to top, apply prepared cleaning solution to a dry surface.
 - 2. Leave solution on the surface for 5-20 minutes. If solution begins to dry, reapply.
 - 3. Gently scrub heavily soiled areas.
 - 4. Rinse thoroughly with clean water with by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip.
 - 5. Apply after wash. Let the Afterwash stay on the surface for three to five minutes.
 - 6. Pressure rinse from the bottom of the treated area to the top.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 12 3200
PLASTIC LAMINATED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Provide all plastic laminated casework and accessory items as specified herein. Refer to drawings for specific details, requirements, types and locations.
 - 1. All casework shall be plastic laminate, unless noted otherwise and shall include but not be limited to the following:
 - a. Base cabinets
 - b. Solid-surfacing-material countertops
 - c. Separate wood bases for laminated cabinets.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 06 1000 - Rough Carpentry for blocking.
- B. Section 09 6500 - Resilient Flooring. Base molding furnished and installed.
- C. Section 12 3600 - Solid Surfacing Countertops for solid surface countertops.

1.4 DEFINITIONS

- A. Identification of casework components and related products by surface visibility.
 - 1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
 - 2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
 - 3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
 - 4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
 - 5. Semi-Exposed Surfaces: Interior surfaces which are exposed to view when doors or drawers are opened, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
 - 6. Concealed Surfaces: Any surface not visible after installation

1.5 QUALITY ASSURANCE

- A. System Structural Performance: Casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
 - 1. Support Framing System: 600 lb/ft.
 - 2. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft
 - 3. Wall Cabinets (Upper Cabinets): 160 lb/ft.
 - 4. Shelves: 40 lb/ft .
 - 5. Delegated Design: Design casework, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.
 - 6. Seismic Performance: Casework and support framing system or including attachments to other work and shall withstand the effects of earthquake motions determined according to New York State Building Code.

- B. Installer Qualifications: A single installer shall perform the work of this section, and shall be a firm with not less than ten (10) continuous years of successful experience in the installation of this work, similar to that required for this project and approved by the manufacturer..
 - 1. The installer shall provide a list of at least five projects of comparable size and similar in design within a fifty mile radius of this project, which may be observed by the representative of the Architect, and or Owner.
 - 2. Provide laminate clad casework and countertops furnished and installed by the same supplier for single responsibility and integration with other building trades.
- C. Manufacturer: Minimum of ten (10) years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.
 - 1. Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.
 - 2. Single Source Manufacturer: Casework millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework between multiple manufacturers will not be permitted.
 - 3. Manufacturer shall be member of the Architectural Woodwork Institute and Approved Quality Certification Program.
- D. Test data performed and certified by an independent testing agency, covering the following areas of product performance:
 - 1. Base cabinet construction racking test. 990 lbs.
 - 2. Cabinet front joint loading test: 650 lbs.
 - 3. Cabinet adjustable shelf support device:
 - a. Static load test: 1150 lbs.
 - 4. Particleboard screws holding power: Face: 225 lbs. / Edge: 155 lbs.
- E. Casework must conform to design quality of materials, workmanship and function of casework specified and shown on drawings.
- F. Design: Door/Drawer overlay cabinet end panels, as reveal overlay design. Door/Drawer and all cabinet body edges to be 3mm PVC as specified herein. Overlay door designs and/or edging other than specified are not acceptable.
- G. Preinstallation Conference: YPS Office of Facilities Management shall schedule pre-installation meeting three (3) weeks prior to start of work at project site.

1.6 ADA AMERICANS WITH DISABILITIES ACT REQUIREMENTS:

- A. The following special requirements shall be met, where specifically indicated on architectural plans as "ADA" or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:
 - 1. Countertop height: with or without cabinet below not to exceed a height of 34 inches A.F.F. (Above Finished Floor), at a surface depth of 24 inches.
 - a. 12 inch deep shelving, adjustable or fixed: not to exceed a range from 9 inches A.F.F. to 54 inches A.F.F.
 - b. Sink cabinet clearances: in addition to above, upper knee space frontal depth to be no less than 8 inches, and lower toe frontal depth to be no less than 11 inches, at a point 9 inches A.F.F. and as further described in Volume 56, Section 4.19.
 - c. No cabinets shall be install closer than 18" to the pull side of any door. Co-ordinate with electrical drawings for electrical devices.

1.7 SUBMITTALS

- A. Comply with Section 01 3000 - Administrative Requirements, unless otherwise indicated
- B. Shop Drawings:

1. Submit CAD production shop drawings prepared by manufacturer for laminate clad casework and countertops showing layout, elevations, ends, cross-sections, service run spaces, specific modifications, component connections, anchorage details, location methods, hardware, and installation procedures .
 2. Verify all dimensions and conditions in field.
 3. Include layout of units with relation to and clearances of surrounding walls, doors, windows, and other building components.
 4. Indicate locations of blocking and reinforcements required for installing casework.
 5. Coordinate shop drawings with other work involved.
- C. Samples: When requested by YPS Office of Facilities Management and Fuller and D'Angelo, P.C.:
1. Submit 2-2" x 3" samples of casework manufacturer's standard decorative laminate colors, patterns and textures, for exposed and semi-exposed materials for architect's selection. Samples will be reviewed by YPS Office of Facilities Management and Fuller and D'Angelo, P.C. for color, texture, and pattern only. Compliance with other specified requirements is the exclusive responsibility of the contractor.
 2. Submit one full-size sample base cabinet unit with hardware, doors and drawers, without countertop.
 3. Acceptable sample units will be used for comparison inspections at the project. Unless otherwise directed, acceptable sample units may be incorporated in the work. Notify YPS Office of Facilities Management of their exact locations. If not incorporated in the work, retain acceptable sample units in the building until completion and acceptance of the work.
 4. Remove sample units from the premises when directed by the YPS Office of Facilities Management .
 5. Plastic-laminate products, 8 by 10 inches, for each type, color, pattern, and surface finish.
 6. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 7. Component samples: Two sets of samples for each of the following:
 - a. PVC edgings and Solid surface countertops.

1.8 PRODUCT HANDLING:

- A. Deliver laminate clad casework and countertops only after wet operations in building are completed.
- B. Store completed laminate clad casework and countertops in a ventilated place, protected from the weather, with relative humidity range of 25% to 55%.
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with a protective covering.

1.9 JOB CONDITIONS:

- A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
 1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
 2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.
- B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete

1.10 WARRANTY:

- A. All materials shall be guaranteed for a period of 5 years from manufacturer's defects and workmanship from date of acceptance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Basis of Design: For purpose of determining minimum performance and quality standards, this specification is based upon drawings, specifications and manufacturer's literature fixed modular, flexible rail mounted, and mobile casework and accessories as manufactured by TMI SYSTEMS CORPORATION, 50 South Third Avenue West, Dickinson, North Dakota, 58601, Phone: 800-456-6716.
1. Substitutions: Refer to Section 01 2500 - Substitution Procedures.
- B. Regardless of manufacturer or model numbers indicated, construction shall be in accordance with TMI Systems Corporation and AWI Architectural Woodwork Standards (AWS)s for modular cabinets except where modified by these specifications. Where standard manufacturers' units do not conform to layout and/or dimensions indicated, custom fabricate unit to conform to these specifications unless such non-conformance is specifically approved by the YPS Office of Facilities Management and Fuller and D'Angelo, P.C..

2.2 MATERIALS:

- A. Core Materials:
1. All core material shall be a blended bio fiber composition with ultra-low formaldehyde resin system. Board shall exceed performance requirements listed below. Testing for conformance to the listed specifications must be done in accordance with procedures described in the American National Standard for Particleboard (ANSI A208.1 2016 section 5.2 Sampling for Acceptance). Board shall comply with formaldehyde emission requirements for Particleboard in CPA-ECC-2011, ANSI A208.1 2016 and CCR 93120.2 (CARB Composite Wood ATCM Phase II) Casework manufacturer shall provide documentation and certification of use within the entire cabinet. No formaldehyde, no exceptions.
 2. Core material shall meet the following average performance requirements: Submit compliance data from the manufacturer prior to fabrication:
 - a. Density: Minimum 45 lbs.
 - b. Modulus of Rupture: 1,800 psi.
 - c. Modulus of Elasticity: 298,000 psi.
 - d. Average Internal Bond: 80 psi.
 - e. Screw holding Face: 2 225 lbs.
 - f. Screw holding Edge: 155 lbs.
 - g. Thickness Tolerance: 0.003+/- inches.
 - h. Linear expansion: 0.2%
 - i. Thickness swell: 5.5%
 - j. Thickness used are 1/4", 1/2", 3/4" and 1".
 - k. Plywood: Shall be 9-ply pressure treated hardwood plywood, "A" faced, hardwood veneer.
 - l. Provide moisture resistant core material at sink locations and wet areas:
 - a) Meeting ANSI MR10 minimum requirements, adding protection against occasional wetting and high humidity.
- B. Decorative Laminates:
1. High Pressure Decorative Laminates (HPDL) shall be as follows:
 - a. Exposed Casework Surfaces, Including Exposed Interior Surfaces:
 - a) 335VGS, matte finish, nominal thickness .028+0.001-0.004 as manufactured by Wilsonart Brand Decorative Laminate.

- b) 335VGP, matte finish, nominal thickness .028+0.001-0.004 HIGH WEAR as manufactured by Wilsonart Brand Decorative Laminate.
 - c) 12/HGP High Pressure Grade (Standard grade) .028" as manufactured by Formica Brand Laminate.
 - b. Thermally Fused Laminate (TFL) meeting, NEMA Test LD 3-2005. (TFM allowed on casework interiors only. Utilization of TFL on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)
 - c. All laminate shall be counter balanced with heavy gauge neutral colored backing sheet.
- 2. Fire Rating: ASTM E -84:
 - a. Flame spread 50.
 - b. Smoke: 45
 - c. Substitutions: Refer to Section 01 2500 - Substitution Procedures.
- C. Laminate Color Selection as indicated on drawings are as selected by the Fuller and D'Angelo, P.C.. Final acceptance of colors by other manufacturer(s) even if listed, as "acceptable manufactures" shall be at the sole discretion of the Fuller and D'Angelo, P.C..
- D. Edgebanding: 3mm PVC banding, machine applied with waterproof hot melt adhesive with external edges and outside corners of door and all exposed edges of plastic laminate machine profiled to 1/8" radius for safety.

2.3 CABINET HARDWARE:

- A. Hinges:
 - 1. Shall be five knuckle, epoxy powder coated, institutional grade, 2 3/4" overlay type with hospital tip, eased edges for safety, and a full, 270° door swing for easy access. Steel shall be minimum .095" thick and have minimum of nine (9) edge and leaf fastenings. Hinges shall pass ANSI-BHMA standard A156.9, Grade 1 requirement for both vertical and horizontal set and sag (pair of hinges will hold minimum of 310 pounds); copy of test result shall be provided upon request. Casework manufacturer shall use nine specifically engineered screws for attachment of hinges; wood screws shall not be permitted. Doors 48" and over in height shall have three (3) hinges per door.
 - 2. Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.
 - 3. Color: As selected by the Architect.
 - 4. Provide magnetic door catch with minimum seven (7) pound pull, attached with screws and slotted for adjustment. (Not ADA)
- B. Pulls:
 - 1. Door and drawer front pull shall be ABS plastic, semi recessed, designed of molded plastic and a large gripping space, impact resistance, and no sharp edges. Pull design shall be compatible with Americans with Disability Act (ADA), Federal Register Volume 56, No. 144, specifically paragraph 4.27.4. Other pulls may be acceptable pending architect approval.
 - a. Color: As selected by the Architect
- C. Adjustable Shelf Supports:
 - 1. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32 mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure
- D. Metal Grilles: Where metal grilles are indicated for countertops and/or base cabinets to permit thermal heat flow, they shall be as follows:

1. Countertop and Similar Deck Applications: Heavy gauge extruded aluminum construction, bar type, linear design with natural anodized finish. Frame to have a 5/8" perimeter boarder and frame is to have concealed fastenings and reinforcing bands. Exposed screws in top of frame will not be accepted. Core of frame must be removable allowing for cleaning and servicing of fin tubing below and core is to be held in place by spring clips. The core consists of pencil proof design with deflecting bars 1/8" wide and placed on 1/4" centers. Sizes to be as shown on drawings.
 - a. Model # AAG-100/B frame as manufactured by Advance Architectural Grills, New Hyde Park, NY; 516-488-0628 approved equal.
2. Base Grill Units: Twelve (12) gauge extruded aluminum construction, Design E, 1/4" wide openings, 1/8" satin finish aluminum, counter-sunk tamperproof screws.
 - a. Manufactured by A.J. Manufacturing, Kansas City, MO, or equal.
3. Lengths shall match the length off the baseboard.

2.4 SOLID SURFACING COUNTERTOP

- A. Refer to Section 12 3600 - Solid Surfacing Window Sills and Countertops.

2.5 REFLECTIVE INSULATION:

- A. Where base cabinets are located on exterior walls and in front of fin tube radiation, provide Class A fire rating exterior wall and/or back of cabinet.
 1. Thermo-ply composed of high-quality, longfibered specially treated water- and weather-resistant plies. Plies are pressure laminated.
 2. Structural Grade: Red
 3. Fire Rated : 1 hour in accordance with ASTM E-19
 4. Perm Rating: 0.53- 0.63.
 5. Thickness: 0.113
 6. R value: 4.2
 7. Manufacturer: Ludlow Coated Products. www.ludlowcp.com Product: Structural Grade Red.

2.6 FABRICATION

- A. Detailed Requirements for Cabinet Construction:
 1. Sub-Base: Cabinet Subbase: To be separate and continuous (no cabinet body sides-to-floor), 3/4" water-resistant exterior grade plywood, 4" high, with concealed fastening to cabinet bottom. Ladder-type construction, of front, back and intermediates, to form a secure and level platform to which cabinets attach. Casework with integral sides or sides running to the floor will be rejected.
 2. Sub-base at exposed cabinet end panels shall be recessed 1/4 inch (6.4 mm) from face of finished end, for flush installation of finished base material by other trades.
- B. Fabricate casework to dimensions, profiles, and details shown.
 1. Cabinet Body Construction:
 - a. Fabricate casework, countertops and related products to dimensions, profiles, and details shown on shop drawings.
 - b. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.
 - c. Solid sub-top shall be furnished for all base and tall cabinets.
 - d. At cabinets over 36 inches wide, bottoms and tops shall be joined by a fixed vertical divider.
 - e. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets.

(Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.)

- a) Tops, bottoms and sides of all cabinets are particleboard core
 - f. Unless specifically indicated, core shall be 3/4" thick particleboard. Edging and surface finishes as indicated herein.
 - g. Cabinet backs: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength
 - a) Exposed back on fixed or movable cabinets to be 3/4" particleboard, color matched to cabinet interior, exterior surface GP28 laminate as selected.
 - b) Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of 2 at base, 2 at wall, and 3 at tall cabinets.
 - h. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. (Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.)
 - a) Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
 - i. All end panels and vertical dividers, except sink base units, shall be prepared to receive adjustable shelf hardware at 32 mm (approximately 1-1/4") centers. Door hinges, drawer slides and pull-out shelves shall mount on line boring to maintain vertical alignment of components and provide for future relocation of doors, drawers, shelves and/or pull-out shelves.
 - j. All exposed and semi exposed edges of basic cabinet components shall be factory edged with 3 mm PVC banding, machine applied with waterproof hot melt adhesive. Color as selected by the Fuller and D'Angelo, P.C..
 - k. Adjustable Shelves in Cabinets
 - a) Core: Particleboard.
 - b) Core Thickness: 3/4 inch up to 30 inches wide, 1 inch over 30 inches wide.
 - c) Edge: 3mm PVC on Front Edge Only
 - l. Interior finish, units with open Interiors:
 - a) Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with Thermally Fused Laminate (TFL).
 - m. Interior finish, units with closed Interiors:
 - a) Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with Thermally Fused Laminate (TFL).
 - n. Exposed ends:
 - a) Faced with high-pressure decorative VGS laminate. Use of TFM on exposed ends will not be permitted.
 - o. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), will not be permitted. No exceptions.
- C. Door/Drawer Fronts:
- 1. Laminated door and drawer fronts shall be 13/16 inch (20.6 mm) finished thickness for all hinged and sliding doors. Drawer fronts and hinged doors shall overlay cabinet end panels, as reveal overlay design the cabinet body. Maintain a maximum 1/8 inch (3.2 mm) reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
 - 2. Double doors shall be used on all cabinets in excess of 24" wide.

3. Exterior faces shall be laminated with high pressure decorative laminate specified, color as selected. Interior face shall be high balanced with pressure cabinet liner CL20.
4. All edges shall be finished with 3mm PVC available in color as selected by the Fuller and D'Angelo, P.C.. External edges and outside corners shall be machine profiled to 1/8" radius.

2.7 ACCESS PANELS:

- A. Provide removal full width, back panels and closure panels with tamper proof screws cam lock for access to heating and/or plumbing valves, traps, etc. as required. Coordinate with mechanical/electrical drawings and prime contracts.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. The installer must examine the jobsite and the conditions under which the work under this section is to be performed, and notify the contractor in writing of unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 PREPARATION:

- A. Condition laminate clad casework to average prevailing humidity conditions in installation areas prior to installing.

3.3 COORDINATION:

- A. Verify site dimensions of cabinet locations in building prior to fabrication.
- B. Coordinate layout and installation of framing and reinforcements for support of casework, and equipment furnished by others and installed in casework..
- C. Coordinate installation of roughing with other prime contractors.
- D. Coordinate layout and installation of framing and reinforcements for support of casework.
- E. Coordinate installation of casework with installation of other casework equipments and accessories

3.4 INSTALLATION OF CABINETS

- A. Install all base cabinets on a separate wood base.
- B. Install insulation to rear of cabinets as detailed.
- C. Install level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
 6. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - a. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.
 7. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
 8. Adjust casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

- D. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- E. All fasteners shall be approved by the YPS Office of Facilities Management and provide with screw caps or approved washers. Gypsum board screws are not permitted.

3.5 INSTALLATION OF COUNTERTOPS

- A. Refer to Section 12 3600 - Solid Surfacing Countertops for additional requirements.
- B. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
 - 1. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.
 - a. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.
 - 2. Fastening:
 - a. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
 - b. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
 - a) Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
- C. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.6 PROTECTION

- A. Storage and Protection: Casework shall be protected in storage. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Store off the floor to prevent chipping of laminate. Do not store or install casework in building until concrete, masonry or other wet trades are dry.

3.7 ADJUSTING

- A. Repair or remove and replace defective work, as directed by (Architect/Owner) upon completion of installation.
- B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.8 CLEANING AND PROTECTION:

- A. Storage and protection: Casework shall be protected in storage. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Store off the floor to prevent chipping of laminate. Do not store or install casework in building until concrete, masonry or other wet trades are dry.
- B. Repair or remove and replace defective work as directed upon completion of installation.
 - 1. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts or units.
 - 2. Remove all cartons, debris, sawdust, scraps, etc. and leave space ready for final cleaning.
 - 3. Protect all casework and tops from damage by other trades until acceptance of the work by the Owner.

END OF SECTION

SECTION 12 3600
SOLID SURFACING WINDOW SILLS AND COUNTERTOPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including School Facilities Management Contract Manual and Specifications and Division 1 Specification Sections, apply to this Section.
- B. In the event of discrepancies between the specifications and School Facilities Management Contract Manual and Specifications the School Facilities Management Contract Manual and Specifications shall prevail.

1.2 SECTION INCLUDES

- A. Window Stools.
- B. Countertops for manufactured casework.

1.3 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry for plywood substrate.
- B. Section 12 3200 - Plastic Laminated Casework.

1.4 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation .
- D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section, with minimum ten years of documented experience.

1.7 MOCK-UP

- A. Provide mockup for window stools.
- B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from Project site.
- C. Approved mock-up will be used as standard for acceptance of subsequent work.
- D. See Section 01 4000 - Quality Requirements for additional requirements.
- E. Locate where directed.

- F. Mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies.
- C. Correct defective Work within a two year period after Date of Substantial Completion, at no additional cost to Yonkers Public Schools. Defects include, but are not limited to:
 - 1. Cracks.
 - 2. Discoloration or lack of finish integrity.
 - 3. Failure of adhesives.

PART 2 PRODUCTS

2.1 WINDOW STOOL AND COUNTERTOP ASSEMBLIES

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Window Countertops and Stools: Solid surfacing sheet or plastic resin casting over continuous substrate:
 - 1. Flat Sheet Thickness: 1/2 inch (12.5 mm), minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - a) Dupont: www.corian.com.
 - b) Substitutions: See Section 01 2500 Substitution Procedures.
 - b. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 25, maximum; when tested in accordance with ASTM E84.
 - c. Finish on Exposed Surfaces: Polished, gloss rating of 55 to 80.
 - d. Color and Pattern: As indicated on finish schedule.
 - e. Exposed Edge Treatment: Built up to minimum 1 inch (25 mm) thick; radiused edge.
 - f. Fabricate in accordance with manufacturer's standard requirements.

2.2 MATERIALS

- A. Plywood for Supporting Substrate: 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 1/2 inch (12.5 mm) thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, color as selected..

1. Mildew resistant conforming to FDA NSF 51, UL listed.
- D. Joint Sealant: Refer to Section 07 9200 - Joint Sealants.

2.3 FABRICATION

- A. Field measure and verify all dimensions before fabrication is complete.
- B. Solid Surfacing: Fabricate tops up to 72 inches (1800 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions. Form joints between components to be non conspicuous. Locate joins at window mullions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Fuller and D'Angelo, P.C. of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Verify dimensions of all existing countertops to be replaced.
- B. Clean surfaces thoroughly prior to installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Attach solid surfacing window stools using compatible silicone bonding material.
- B. Seal joint between window stools back and end splashes and adjacent surfaces.
- C. Provide products in largest pieces available.
- D. Cut and finish edges with clean sharpe returns.
- E. Provide radius at outside corners.
- F. Dress joints smooth, remove surface scratches and clean entire surfaces.
- G. Install to comply with all manufactures written instructions, including for adhesive, sealers, fabrication and finishing.

3.4 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

3.5 CLEANING

- A. Clean surfaces thoroughly. Remove adhesives, sealant and other stains.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 22 0100

GENERAL CONDITIONS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

1.1 GENERAL CONDITIONS

- A. Before submitting a proposal, Bidders shall examine all Drawings related to this work and shall become fully informed as to the extent and character of the work required and its relation to the other work in the building.
- B. Before commencing work, the Contractor will examine all conditions of the project upon which his work is in any way dependent for perfect workmanship according to the intent of this Specification. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed by this Contractor and acceded to by the Owner's representative in writing before the Contractor begins any part of the work.
- C. The Contractor will pay for all licenses, permits and inspection fees required by civil authorities having jurisdiction. Comply with all laws, ordinances, regulations, fire Underwriters requirements applicable to work herein specified without additional expense to the Owner. (Also, local building code requirements.).
- D. It is specifically intended that anything (whether material or labor) which is usually furnished as a part of such equipment as is hereinafter called for (and which is necessary for the completion and proper operation) shall be furnished as part of this Contract without additional cost the Owner, whether or not shown in detail on the Drawings or described in the Specifications.
- E. When Drawings and Specifications conflict or there is a question as to the proper intent of this Contract, the Contractor shall assume the more expensive method in his pricing. All questions shall be directed to the Architect/Engineer in writing only and only up to ten (10) days prior to bidding.
- F. The Drawings indicate the general runs of the piping, ductwork, etc. systems and the location of equipment and apparatus, but it shall be understood that the right is reserved by the Architect/Engineer to change the location of piping work, ductwork, equipment and apparatus to a reasonable extent as building conditions may dictate, prior to their installation without extra cost to the Owner.
- G. Small scale drilling through walls and floors which may contain asbestos shall be performed by a person with a "restricted asbestos handler allied trades certificate" and shall have a copy of it in his possession at all times while working on the project.
- H. Any changes from the Drawings and Specifications and any interpretation thereof shall have the prior approval of the Architect/Engineer. The Contractor shall submit in writing, at the time of signing the Contract, any items of necessary labor and materials, which, in his opinion, are lacking in requirements of the Drawings and Specifications to insure a complete job in all respects. No consideration will be granted to alleged misunderstanding of materials to be furnished, work to be done, or conditions to be complied with, it being understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein or indicated on the accompanying Drawings.

END OF SECTION

SECTION 22 0125

SCOPE OF WORK

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

1.1 SCOPE OF WORK

- A. The work under this section includes all labor, materials, equipment, tools, transportation, cutting and patching, excavation and backfill and the performance of all work necessary and required for the furnishing and installation complete of all Plumbing and Drainage work as shown on Contract Drawings, as specified herein and as otherwise required by job conditions or reasonably implied, including but not necessarily limited to the following:
1. Provide complete new and altered sanitary, storm, and vent piping from all new plumbing fixtures connecting to existing sanitary and vent system. See front end spec for bedding requirements.
 2. Provide complete new and altered hot and cold water piping to all new plumbing fixtures, equipment, etc. as indicated.
 3. Provide new and altered gas piping and removal of existing as indicated.
 4. Provide all new plumbing fixtures where indicated, complete including traps, stops, drains, strainers, tailpieces, faucets, escutcheons, etc.
 5. Provide complete new piping and final connections to equipment furnished under other Divisions.
 6. Provide all demolition, removal disconnecting, capping, sealing of all existing plumbing piping, apparatus, equipment, fixtures, specialties, accessories, etc. which are not included or incorporated in the new layout.
 7. Provide all required temporary connections to maintain all plumbing services without interruption.
 8. Pipe insulation.
 9. Tests and adjustments.
 10. This Contractor shall obtain all permits, bonds, approvals, etc. at no additional cost to the Owner.
 11. This Contractor shall provide shop drawings for all plumbing fixtures, piping, valves, insulation, equipment, etc.
 12. Furnish minimum 18" x 18" access doors for all valves, cleanouts, etc. in all inaccessible walls, ceilings, etc. Installation by General Contractor.
 13. Cutting and Patching: See Front End Specifications for Trade Responsibilities.
 14. Excavation and Backfill: See Front End Specifications for Trade Responsibilities.
 15. Fire stopping per FM/UL and NFPA. Refer to Division 1.

- B. Coordination Drawings: Attention is directed to Division 1 for coordination drawing requirements for this project. These drawings are critical to the proper execution of the work and failure to honor these requirements may become the basis for denial of any and all claims for either or both “time” and “money”.

1.2 ALTERATION WORK

- A. All equipment, piping, plumbing, fixtures, etc. to be removed, shall be disposed of or salvaged as directed by the Owner. They shall not be removed from the premises without Owners approval.
- B. All piping to be removed shall be properly plugged or capped so that upon completion of all new work, all abandoned piping shall be concealed in finished areas.
- C. No dead ends shall be left on any piping upon completion of job.
- D. The existing systems shall be left in perfect working order upon completion of all new work.
- E. Location and sizes of existing piping are approximate. Exact sizes and locations of all existing piping shall be verified on the job.
- F. All removals shall be removed from the site.

END OF SECTION

SECTION 22 0130

WATER SUPPLY SYSTEM

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. Furnish and install a complete cold-water distribution system to supply water to all new fixtures, water consuming equipment, and valved outlets for the use of other trades and connect to existing piping.
- B. The water supply system shall be complete with all pipe, fittings, valves, mains, risers, branches, shock absorbers, air chambers, hangers, anchors, expansion loops, connections to existing piping, covering, tests, etc. all as shown on the Drawings, as hereinafter specified.
- C. Furnish and install a complete hot water distribution system to supply water to all new fixtures and equipment requiring heated water.

PART 2 - PRODUCTS

2.1 PIPING, FITTINGS AND MATERIALS

- A. All components of water supply system shall confirm to all "No Lead" requirements including NSF/ANSI-372.
- B. The domestic water systems shall be of the following material and shall be in accordance with the latest ASTM and ASME Standards.
- C. Domestic water piping within the buildings shall be seamless drawn or extruded tubing type "L" copper. Both shall be of Chase, Anaconda, Revere, and approved equal, hard temper ASTM B88 with solder joint sweat end fittings. Fittings for use with copper tubing shall be cast brass of Muellers "Streamlin" pattern or approved equal.
- D. Joints for copper tubing shall be made with 95-5 (lead and antimony free) solder. Flanges where required shall be cast brass. Provide dielectric adapters between ferrous and non-ferrous pipe joints.

2.2 VALVES

- A. All shut-off valves 2" and smaller shall be ball valves equal to Apollo 70 Series or Milwaukee BA100 Series Valve. Bronze body with chrome plated trim
- B. This Contractor shall furnish all valves as indicated on the Drawings, or as may be required for the proper control of the pipe lines installed under this Specification, so that any fixture, line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the Facility.
- C. All domestic water valves shall have a minimum working pressure of 125 psig, steam rated unless otherwise noted on the Drawings or specified herein. All valves shall be of one manufacture as manufactured by Milwaukee Valve or Hammond.
- D. All gate valves within the buildings shall be wedge gauge valves with painted iron wheel handles, shall have gland followers in stuffing boxes, and shall be so constructed that they may be repacked while open and under pressure. All valves shall have the name of the manufacturer and working pressure cast or stamped thereon.

- E. All gate valves shall be all bronze with sweat or screwed joint ends as required by the piping system in which they are installed.
- F. Globe valves shall be of all bronze with composition disc, threaded or sweat joint ends as required by piping system in which they are installed.
- G. Check valves shall be all bronze swing check type with threaded or sweat joint ends. Check valves 4 inch and larger shall be iron body bronze mountings and shall be provided with screwed or flanged joint ends as required by piping system in which they are installed.
- H. Drain valves, at risers and at low points, shall be 3/4 inch heavy cast brass with composition washers with male thread for hose connections.

2.3 SHOCK ABSORBERS

- A. Shock absorbers shall be similar and equal to J.R. Smith 5000 series or Zurn Z1700 series with stainless steel pressurized shell sized in accordance with P.D.I. Bulletin WH-201.
- B. Provide shock absorbers on all fixtures and equipment having quick closing valves whether or not indicated on the Drawings.
- C. Provide access doors where shock absorbers are concealed.

2.4 VACUUM BREAKERS

- A. Provide vacuum breakers on water supply piping to each fixture and equipment with submerged inlets, and on faucets and outlets, within the facility to which hose can be, or is attached forming a submerged inlet.
- B. Set vacuum breakers in exposed readily accessible locations at least four inches above floor rim level of fixture, or high point of equipment.
- C. Vacuum breakers shall be chrome-plated brass. "Watts" or other approved.
- D. Vacuum breakers under constant pressure shall be of the continuous pressure type No. 9 "Watts" or Wilkins BFP-8CH or approved equal.

2.5 EXPANSION JOINTS, ANCHORS AND GUIDES

- A. The entire piping installation shall be installed with adequate provision for expansion. No rigid connections will be permitted. Refer to Drawings for locations of expansion joints and related guides and anchors. The joints, guides and anchors shall be as manufactured by Flexonics Products, Metraflex or Flex-weld.
- B. Branches shall be of sufficient length and have three elbow swings to allow for pipe expansion.
- C. Any breaks in the piping within the guarantee period due to improper provision for expansion must be replaced at the expense of this Contractor, and the conditions corrected to prevent future recurrence.
- D. Any damages to surrounding areas and equipment due to this failure shall also be repaired and paid for at the expense of this Contractor.
- E. Joints to have 150 psi rating, ANSI-B16.5 with liner and cover.

2.6 STERILIZATION

- A. The entire domestic water piping system shall be thoroughly sterilized with chlorine before acceptance for domestic operation.
- B. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million for 24 hours or 200 p.p.m. for one hour. The chlorinating material shall be either liquid chlorine or sodium hypochlorite solution and shall be introduced into the system and drawn to all points of the system. If possible to do so, the lines shall be thoroughly flushed before introduction of the chlorinating material. After a contact period of not less than 24 hours, the system shall be flushed with clean water until the residual content is not greater than 0.2 parts per million. All valves in the lines being sterilized shall be opened and closed several times during the contact period.
- C. Sterilization and tests for purity of water in the entire piping system shall be performed by the Contractor through an approved independent testing laboratory and a certificate shall be furnished to the Architect certifying the quality of purity.
- D. Per ANSI/AWWA Standard C651-15.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. It is the intent that each part of the plumbing system shall be complete in all details and water lines provided with all control valves as indicated on Drawings, or as may be required for the proper control of the pipe lines under this Specification so that any fixture, line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the facility.
- B. This Contractor shall carefully examine the Architectural Drawings in detail and familiarize himself with all conditions relative to the installation of piping, particularly where same is concealed behind furring or in hung ceilings.
- C. In no case shall this Contractor permit his pipes to be exposed beyond finished walls or ceilings unless specifically shown on Drawings. He shall consult with the Contractors of other trades in the building and install his piping in such a way as to least interfere with the installation of other trades.
- D. The water piping shall all be installed so as to drain to a valve provided by this Contractor and branches shall not be trapped but shall have continuous pitch. Where necessary to raise or lower mains, the same shall be provided with a drip and shall be properly valved.
- E. Piping shall be installed, whether indicated or not, so as to rise and/or drop to clear any and all conduits, lighting fixtures, ductwork and heating mains to maintain the desired clear heights. This Contractor shall consult with the Contractors of other trades and facilitate the erection of the equipment and piping.
- F. Run piping straight and as direct as possible, in general forming right angles with or parallel to walls or other piping. Risers shall be erected plumb and true.
- G. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.
- H. No piping or work shall be concealed or covered until all required tests have been satisfactorily completed and work has been approved by the Architect.
- I. All materials shall be new and installed in a first class manner.

- J. In erecting pipe, friction wrenches and vises shall be used exclusively, and any pipe cut, dented or otherwise damaged shall be replaced by this Contractor.
- K. All ferrous to non-ferrous pipe connections shall be made with approved dielectric pipe or flange unions isolating joints to prevent any electrolytic action between dissimilar materials.
- L. Any piece of pipe 6 inches in length or less shall be considered a nipple. All nipples with unthreaded portion 1-1/2 inch and less shall be of weight corresponding to fitting connected. Only shoulder nipples shall be used, close nipples will not be accepted.
- M. Revised water service shall be in accordance with the local water supply department requirements. All water lines are to be protected from freezing. Install new piping for water service below frost line and provide concrete separations when crossing other utilities. Provide concrete thrust mass at changes of pipe direction conforming to authorities having jurisdiction.

END OF SECTION

SECTION 22 0160

SANITARY AND STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. The work under this section includes all labor, materials, equipment and appliances necessary and required to completely install all drainage systems as required by the Drawings; code and as specified herein, including but not limited to the following:
- B. Complete sanitary drainage and venting systems including connections to the existing sanitary drainage and venting systems.
- C. Piping and final connections for equipment furnished under other Divisions.
- D. Alterations and removals to existing sanitary and vent systems.
- E. Tests.

1.2 QUALITY ASSURANCE

- A. All Cast Iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
- B. Hubless Couplings:
Standard, Stainless-Steel Shielded, Couplings: Standard Couplings shall conform to CISPI 310 and ASTM C 1277. Shield Assemblies shall consist of a stainless steel bi-directional corrugated shield; stainless-steel bands and tightening devices; and an ASTM C 564, rubber sleeve with integral center stop. Couplings shall bear the NSF Trademark, and be manufactured in the USA.

PART 2 - PRODUCTS

2.1 PIPING AND FITTING MATERIALS

- A. All indoor underground storm soil, waste and vent piping shall be service weight cast iron with fittings of bell and spigot type. All exterior underground storm soil and waste piping shall be extra heavy cast iron. Each length shall have the size, weight per foot and the manufacturer's name clearly cast or stamped thereon. Weight shall be as defined by the Plumbing Code. Fittings and traps shall be similarly marked and of corresponding weights.
- B. All above ground storm, soil, waste and vent piping and fittings 3" and larger shall be service weight and fittings of bell and spigot type as specified in paragraph above. Above ground waste and vent piping 2" and smaller shall be galvanized steel, fittings on waste piping shall be galvanized cast iron, recessed drainage pattern, fitting on vent piping shall be galvanized cast iron, beaded pattern, screwed joints shall be made up to be perfectly tight without the use of lead or filler of any kind, except oil or graphite. Nipples for galvanized pipe shall be shoulder type. No close nipples shall be permitted.

- C. Joints shall be made with gasket or hemp or picked oakum and lead, at least 12 oz. of fine soft pig lead shall be used for each inch of diameter pipe used. Lead shall be run in one (1) pouring. All lead shall be pure and soft and of the best quality and shall be sufficiently heated to run joint full at one pouring without hardening. Dross shall not be allowed to accumulate in the melting pot. See 2.1, E. for joint options where permitted.
- D. All galvanized pipe and fittings shall be galvanized with prime western spelter by hot drip process.
- E. The Contractor has the option of using the following types of joints with hubless cast iron pipe only if approved by the governing agencies. These joints shall be used throughout the project. No mixing of joints shall be permitted.
 - 1. Neoprene gasketed joints similar to Ty-Seal (for above and underground application).
 - 2. Hubless cast iron pipe with neoprene gaskets and stainless steel clamps (by Clamp-All or equal) above ground only. All in accordance with Cast Iron Soil and Pipe Institute Standard 301 latest edition. Hangers and supports shall be in accordance with manufacturer's recommendations.
 - 3. Copper DWV system with 50-50 tin antimony solder, DWV with solvent welded or screwed joints meeting CS-270-65.
- F. Pump Discharge Piping
 - 1. Piping: Galvanized steel pipe, Schedule 40 with marker's name rolled into each length.
 - 2. Fittings:
 - a. Threaded: Galvanized malleable iron with flat band steam pattern. Cast iron drainage pattern for waste piping.
 - b. Mechanical Joints: Victaulic couplings style 07 for grooved piping only, with gasket.
 - c. Bolted flange with gasket.
 - 3. Joints: Teflon tape for threaded, Victaulic couplings for gasket for mechanical joint.
 - 4. Application: Schedule 40 steel for sewage ejector and sump pump discharge.

2.2 CLEANOUTS

- A. Provide easily accessible cleanouts where indicated at base of vertical stacks at ends of horizontal drainage lines and at intervals not exceeding 50 ft.; at each change of direction; on handholes of running traps, and where necessary to make entire drainage system accessible for rodding. Provide at least 18" clearance to permit access to cleanout plugs.
- B. Cleanouts for cast iron pipe shall consist of tarpped extra heavy cast iron ferrule caulked into cast iron fittings and extra heavy brass tapered screw plug with solid hexagonal unit. Cleanouts for wrought iron pipe shall consist of extra heavy brass screw plug in drainage fitting.
- C. Cleanouts turning out through walls and up through floors shall be made by long sweep ells or "Y" and 1/8 bends with plugs and face or deck plates to conform to Architectural finish in the room. Where no definite finish is indicated on the Architectural and/or Mechanical Drawings, wall plates shall be chrome plated cast brass and floor plates shall be nickel bronze.
- D. Cleanouts shall be full size at the pipe up to 6" inclusive. On larger size piping 6" size plugs shall be used.

- E. Cleanout fittings in vertical stacks shall consist of tapped tees capable of receiving a rough brass raised head cleanout plug, J.R. Smith S-4730, Zurn Z1445-A-BP or approved equal.
- F. All cleanout plugs shall be brass lubricated with graphite before installation.
- G. Cleanouts occurring in cast iron soil pipe above floor at change of direction of pipe run and at ends of horizontal runs shall be J.R. Smith S-4425, Zurn Z1441-A-BP or approved equal with cast iron ferrule for caulk connection and fitted with a straight threaded tapered bronze plug with raised hex head.
- H. Cleanout deck plates for finished areas shall be similar and equal to J.R. Smith 4020 series, Zurn ZB1400-X or approved equal with cast iron ferrule, scoriated cutoff sections, brass cleanout plus collar with brass bolts for waterproofed slabs. In tile floor areas the cleanout deck plates shall be recessed to tile.

2.3 FLASHING

- A. Provide 6 lb. lead flashing extending at least 10" beyond edge of all floor drains and vents through roof and all floor sleeves in floors with waterproofing or vapor barriers. Flashing shall be held securely in by clamping devices.
- B. All floor drains shall be provided with flashing rings and 24" square 6 lb. sheet lead flashing, properly flashed into flashing ring of the drain.

2.4 SANITARY DRAINAGE

- A. A complete system of drainage shall be provided as shown on the Drawings. The system shall include all drains, leaders, branches, house drains with all pipe fittings, hangers, anchors, etc. to make a complete sanitary drainage system. The systems shall extend through house drains and terminate as indicated on the Drawings.
- B. Piping shall be sizes as indicated on the Drawings. The sanitary drains shall have a pitch of 1/8" per ft. minimum unless otherwise noted. Branch connections to stacks and house drains shall pitch a minimum of 1/8" per ft.

2.5 PIPING AND FITTINGS

- A. Provide piping of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

- A. The size of soil, waste and vent piping shall be as determined by the State codes, rules and regulations for plumbing and drainage, except where specifically noted to be larger by the Specifications or Drawings and all fixed rules of installation, as set forth in the codes, rules and regulations, shall be followed as part of the Specifications.
- B. This Contractor shall carefully examine the Architectural plans in detail and familiarize himself with all conditions relative to the installation of piping, particularly where same is concealed behind furring or in hung ceilings.
- C. In no case shall this Contractor permit his pipes to be exposed beyond finished plaster lines unless specifically shown on Drawings. He shall consult with the Contractors of other trades in the building and install his piping in such a way as to least interfere with the installation of other trades.

- D. Piping shall be installed, whether indicated or not, so to rise and/or drop to clear any and all conduits, lighting fixtures, ductwork and heating mains to maintain the desired clear heights. This Contractor shall consult with the Contractors of other trades and facilitate the erection of the equipment and piping.
- E. Run piping straight and as direct as possible in general forming right angles with or parallel to walls or other piping. Risers and stacks shall be erected plumb and true. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.
- F. No piping or work shall be concealed or covered until all required tests have been satisfactorily completed and work had been approved by the Architect and all other authorities having jurisdiction.
- G. Branch connections shall be made with "Wye" and long "Tee-Wye" fittings, short 1/4 bends, common offsets and double hubs will not be permitted. Short "Tee-Wye" fittings are to be used in vertical piping only. All fittings shall conform to code requirements.
- H. Cleanouts shall be provided at foot of all stacks, at changes of directions, at the ends of branch runs where shown and as required by code and shall be terminated as described under cleanouts.
- I. The house drains must be run at a minimum grade of 1/8" per ft. downward in the direction of flow. Wherever possible, a 1/4" per ft. pitch shall be maintained. Branch connections to stacks from fixtures shall pitch 1/4" per ft. where possible. Attention is again called to the necessity of maintaining the ceiling heights established.
- J. Furnish and install complete systems of vent pipes from the various plumbing fixtures and other equipment to which drainage connections are made. Vent pipes shall be connected to the discharge of each trap and shall be carried to a point above the ultimate overflow level of the fixture before connecting with any other vent pipe; in general, this will be approximately 3'-6" above the finished floor. Branches shall be arranged to pitch back to fixtures.
- K. The individual vent pipes shall be collected together in branch vent lines and connected to existing vent connections through roof.
- L. Any existing vents through roof, damaged, or if flashing on roof comes loose while connecting new vent to them shall be repaired and reflashed to the roof as required to maintain waterproofing the satisfaction of the Architect.

END OF SECTION

SECTION 22 0190

NEW GAS CONNECTIONS AND ASSOCIATED WORK

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. Furnish and install a gas piping system to boilers, hot water heater and other equipment as shown on Drawings.
- B. All new piping shall be schedule 40 steel, standard weight threaded malleable iron fittings for sizes 2-1/2" and smaller. For sizes 3" and larger joints shall be welded.
- C. All work in this section shall comply with NFPA-54.

PART 2 - PRODUCTS

2.1 REGULATOR REQUIREMENTS

- A. Provide all additionally required regulators as per manufacturer's recommendations. Coordinate with other contractors.

PART 3 - EXECUTION

3.1 TESTING

- A. Gas piping shall be tested with air using an air pump and mercury gauge. Tests shall be made by the Contractor with his equipment when directed by the Owner/Inspector/Construction Manager. Testing shall be done with 100 psig pressure (low pressure side) for a period of one hour and follow Utility Company procedures and all Plumbing Code requirements. Certify and submit written test results to Architect/Engineer. Indicate that system is functioning properly, and has been installed in accordance with NFPA, and all applicable codes.
- B. Contactor is responsible for maintaining gas pressure in existing gas piping to remain in accordance with utility company requirements, whether valving off pilot lights, using bottled gas, etc. Utility fees and re-testing existing piping as required is Contractors responsibility.

END OF SECTION

SECTION 22 0300

PLUMBING FIXTURES AND EQUIPMENT

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. The work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely do all plumbing fixture work, as required by the Drawings and as specified herein, including but not limited to the following: plumbing fixtures, traps, fittings, trimmings, brackets, plates, anchor, chair carriers and supports.
- B. Just before the Owner's taking over the work in the building, this Contractor shall thoroughly clean all fixtures furnished and set under this Contract, leaving every fixture in perfect condition and ready for use.
- C. Submit shop drawings and roughing sheets for all equipment for checking and approval.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES AND EQUIPMENT

- A. All fixtures shall be free from imperfections, true as to line angles, curves and color, smooth, watertight, complete in every respect and practically noiseless in operation, Fixtures specified are given as the typical standard required as manufactured by American Standard and they or other similar approved fixtures as made by Kohler or Eljer Companies shall be furnished, set and connected in good substantial, neat workmanlike manner.
- B. The letter designations hereinafter correspond with the schedule on the Drawings.
 - 1. Self-Contained Eye Wash:
Encon "Aquarion" model no. AQ100. Provide 11" x 17" sign.
 - 2. Floor Drains:
Josam series 30000A or Zurn Z415 type "B" coated cast iron, two piece body with double drainage flange, flashing collar, weepholes, bottom outlet and adjustable strainer.
 - 3. Floor Drain Trap Seal:
Zurn model Z1072 "Z-Shield" barrier trap seal device ASSE 1072.
 - 4. Domestic Hot Water Circulator Pump CP-1 and CP-2
Furnish and install domestic water circulator as indicated on Drawings; Grundfos model no. UP-43-75-BF, 22 gpm @ 15 ft. of head, 1/6 hp, stainless steel impeller, aluminum housing, bronze pump volute.
 - 5. Sump Pump Duplex:
Furnish and install as shown on Drawings, B&G model 2DWC, suspended wet pit sump pump unit. Pump shall have a non-clog impeller and stainless steel shaft. Motor shall have drip-proof enclosure with drip canopy. Pumps shall be controlled by an enclosed float switch actuated by copper float, brass rod and adjustable stops. Provide built-in overload protection. Provide custom support plate by Halliday Products with access door.

- a. SP-1 pump shall be 50 gpm at 3500 rpm, 25 ft. of head and 1/2 hp, 208 volts, 3 phase, 60 hz.
- b. Pumps shall be driven through a flexible coupling by a vertical mounted standard NEMA frame motor in an open, drip-proof housing.
- c. Furnish and install a model A2D float switches. Furnish an auxiliary float switch to turn on pump if the float switch is inoperative. Each switch shall have a copper float with adjustable stops and "T" shaped float bracket. Furnish a compression tube type high water alarm actuator and a 4 inch, 110 volt alarm bell.
- d. Furnish and install a magnetic starter for motor in a NEMA-1 general purpose enclosure with overload protection on each phase and a hand-off automatic selector switch in the cover.
- e. Provide 2" lift out rail with 304 stainless steel pump adapter and guide bracket.
- f. See detail on drawing for custom field fabricated basin, grate, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All fixtures shown on Drawings shall be set, connected and tested by the Contractor. He shall also make all water; soil, waste, vent and other service connections to fixtures as shown on Drawings or as directed and shall set, furnish, connect and test all necessary fittings.
- B. All pipes at fixtures passing into walls, floors or partitions shall be provided with heavy cast brass escutcheons and security (tamperproof) set screws finished to match the pipe. No "waiving" of this section will be permitted.
- C. All fittings escutcheons, faucets, traps, exposed piping etc. shall be brass, chrome plated over nickel plate with polished finish. Any visible hanger nuts shall be security (tamperproof) type and shall likewise be chrome plated over nickel plate.
- D. This Contractor shall be responsible for protecting all plumbing fixtures including in these Specifications against injury from the building materials, tools and equipment. Any fixtures damaged during the construction period shall be replaced new. After all fixtures are set, this Contractor shall carefully grout all around fixtures.

END OF SECTION

SECTION 22 0320

DOMESTIC HOT WATER GAS-FIRED HEATING EQUIPMENT

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. The work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely provide domestic hot water heater, as required by the Drawings and as specified herein, including but not limited to the following: equipment, fittings, trimmings, brackets, controls, carriers and supports.
- B. Submit shop drawings for approval, which shall include dimension Drawings, catalog cuts, performance ratings and construction schedules.

PART 2 - PRODUCTS

2.1 GAS-FIRED HEATER

- A. Water heaters shall be PVI-Conquest condensing type, or equal. Water heater(s) shall be gas-fired, equipped to burn natural gas and design certified by the American Gas Association (Canadian Gas Association) under Volume III tests for commercial heaters for delivery of 180 °F water, shall be approved by the National Sanitation Foundation and exceed requirements of ASHRAE 90.1. Heaters shall have an input rating of 199,000 and a recovery rating of 233 g.p.h. (based on 95% thermal efficiency obtained in an independent laboratory test) at a temperature rise of 100 °F with a storage capacity of 100 gallons. Maximum working pressure of 160 psi. Tank shall have ASME rating.
- B. Water heater shall be equipped with an integrated control system consisting of a 180 °F adjustable thermostat with upper and lower sensing bulbs, which average the water temperatures at the top and bottom of the tank for maximum water temperature control. Heater shall be provided with a manual reset gas shutoff device, a gas pressure regulator set for the type of gas supplied, coated steel burners, an approved draft diverter, anodes for cathodic protection, flue damper and IID system. ASME rated pressure and temperature relief valve shall be furnished and installed by the factory. The heater shall be insulated with foam insulation or equal.
- C. The outer jacket shall have a baked enamel finish over a bonderized undercoating. All internal surfaces of the heater exposed to water shall be glass-lined with an alkaline borosilicate, nickelous oxide composition that has been fused to steel by firing at a temperature range of 1400 degrees F to 1600 degrees F. Heater tank shall have a five (5) year limited warranty against corrosion as outlined in the written warranty. Heater shall include a fully illustrated instruction manual.
- D. Provide operating thermostat, adjustable, submersed bulb, ASME pressure and temperature relief valve, temperature limiting device and a drain valve shall be factory installed.
- E. Furnish and install domestic hot water circulators per Drawings and Specifications.
- F. Gas-flue material and installation per manufacturer's recommendations.
- G. Provide induced draft fan on flue as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment shown on Drawings shall be set, connected and tested by the Contractor. He shall also make all water and other service connections to fixtures as shown on Drawings or as directed and shall set, furnish, connect and test all necessary fittings.
- B. This Contractor shall be responsible for protecting all equipment included in these Specifications against injury from the building materials, tools and equipment. Any equipment damaged during the construction period shall be replaced new.

END OF SECTION

SECTION 22 0420

SUPPORTS, SLEEVES AND PLATES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. This Contractor shall furnish and install all plates, hangers and supports for his piping.
- B. All piping shall be hung or supported from structural members only.

PART 2 - PRODUCTS

2.1 PIPING

- A. All piping shall be supported from building structure in a neat and workmanlike manner wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze hangers. Vertical risers shall be supported at each floor line with steel pipe clamps. Use of wire perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted.
- B. Necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations shall be furnished and installed. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.
- C. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot.
- D. Pipe hangers shall be as manufactured by Grinnell, whose catalog numbers are given herein, or equivalent Carpenter and Paterson, or F&S Mfg. Co.
- E. Piping shall be supported as follows unless otherwise indicated on the Drawings:
 - 1. Piping: 1-1/2 inch and smaller Fig. #260 adjustable clevis hanger. 2 inch and larger Fig. #174 one-rod swivel roll hanger.
 - 2. Two-rod hangers shall be used for piping close to the ceiling slab or where conditions prohibit use of other hanger types.
 - 3. Anchors for hanger rods shall be Phillips "Red Head" self-drilling type. Anchors shall be placed only in vertical surfaces.
 - 4. Spacing of pipe supports shall not exceed 6 feet for pipes up to 1-1/2 inch and 10 feet on all other piping.
 - 5. Hangers shall pass around insulation and a 16 gauge steel protective band; 12 inch long shall be inserted between hangers and insulation.

6. All piping shall be supported to allow free movement where expanding or contracting. Pipe shall be anchored as required or directed.
 7. All lateral runs of piping shall be securely supported on hangers, rolls, brackets, etc. and in a manner to allow for proper expansion and elimination of vibration.
 8. 2 inch and smaller pipe, where run on walls, shall be supported on wrought iron "J" hook brackets with anchor bolts.
 9. All horizontal pipe, where run overhead or on walls, shall be supported as follows unless otherwise indicated: On adjustable steel clevis type hangers suspended on hanger rods, pipe sizes up to and including 4 inch.
- F. Space limitations in hung ceilings spaces and conditions in other locations may require use of other type of hangers than those specified above. Suitable and approved pipe hangers shall be provided for such job conditions.
- G. All supports shall be fastened to structural members or additional steel supports furnished by this Contractor.
- H. Hanger rods shall be steel, threaded with nuts and lock nuts, sizes in accordance with following schedule:
- | <u>Pipe Size</u> | <u>Rod Size</u> |
|-------------------------|-----------------|
| 3/4" to 2" inclusive | 3/8" |
| 2-1/2" and 3" inclusive | 1/2" |
| 4" and 5" inclusive | 5/8" |
| 6" | 3/4" |
| 8" to 12" inclusive | 7/8" |
- I. Cast iron piping shall be supported at intervals of not more than (5) feet (at each hub) on straight runs.

PART 3 - EXECUTION

3.1 PIPING

- A. Where pipes pass through masonry, concrete walls, foundations, or floors, this Contractor shall set sleeves as are necessary for passage of pipes. These sleeves shall be of sufficient size to permit insulation where required to be provided around pipe passing through. This Contractor shall be responsible for exact location of these sleeves.
- B. Sleeves shall not be used in any portion of building where use of same would impair strength or construction features of the building. Inserts for supporting lateral pipes and equipment shall be placed and secured to form work, and all sleeves inserts locations shall be thoroughly checked with Architect so as not to conflict with other trades.
- C. Where pipes pass through floor or walls, they shall be provided with chromium plated escutcheons.
- D. Anchor horizontal piping where indicated and wherever necessary to localize expansion or prevent undue strain on branches. Anchors shall be heavy forged construction entirely separate from supports.

- E. Anchor vertical piping wherever indicated and wherever necessary to prevent undue strains on offsets and branches. Anchors, unless otherwise noted shall be heavy steel clamps securely bolted and welded to pipes. Extension ends shall bear on building construction.
- F. Auxiliary steel supports that may be required for all mechanical equipment shall be furnished and installed by this Contractor.
- G. All operating equipment including pumps, piping, etc. shall be supported so as to produce minimum amount of noise transmission.

END OF SECTION

SECTION 22 0430

INSULATION

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. The work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely do all insulation work as required by the Drawings and as specified herein including but not limited to the following: Insulation, covering, bands, tie wire.

PART 2 - PRODUCTS

2.1 INSULATION

- A. The materials as specified have been selected from the catalogs of Owens-Corning Fiberglass Corp. and Johns-Manville Sales Corporation and are representative of the quality, design and finish desired. Insulation as manufactured by Gustin Bacon Co., or other approved manufacturer may be submitted for approval provided the product meets fully in all respects (such as density, moisture absorption, alkalinity, thermal-conductivity, jackets) to the materials as delineated below.
- B. All insulation shall be UL rated non-combustible type classified flame spread-25, smoke-developed-50.

2.2 PIPING, FITTINGS AND VALVES

- A. All insulation thickness shall be in accordance with the latest edition of the New York State Energy Conservation Construction Code.
- B. Minimum pipe insulation shall be:
 - 1. Hot water piping up to 1-1/4" - 1" insulation and piping 1-1/2" and larger - 1-1/2" insulation.
 - 2. Cold water piping up to 1-1/2" - 1/2" insulation and piping 1-1/2" and larger - 1" insulation.
- C. Domestic cold, hot water hot water return indirect waste, storm and piping aboveground. All piping shall be insulated with sectional glass fiber insulation, Owens-Corning 2 piece ASJ/SSL. Joints between sections shall be sealed with factory supplied 3 inch wide sealing strips. Sealing by means of Owens Corning self-sealing lap will also be acceptable. Install (anti-sweat) vapor barriers on all cold water piping.
- D. Domestic hot and cold water valves and fittings - Fittings, valves, etc. shall be insulated with flexible blanket insulation compressed to 1/2 its thickness, tied on with jute twine over which shall be applied a flood coat of Insul-Coustic IC-102 and 10-20 open weave glass cloth. Glass cloth to be finished within additional coat of IC-102. Insulation blanket shall be Owens-Corning wrap.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All insulation on pipes running through walls, floors, partitions and beams shall be continuous through sleeves and openings.
- B. Insulation shall be installed only after all tests of the piping system have been completed.
- C. All insulation shall fit snugly.
- D. All surfaces shall be clean and dry when insulation is applied.
- E. Longitudinal joints shall be on least conspicuous side off the pipe.
- F. Valves shall be insulated up to the packing unit.
- G. As specified hereinbefore, all horizontal runs of piping will be supported on adjustable clevis or group trapeze type hangers. Pipe hangers will be installed outside of the insulation. Where hangers occur, prefabricated insulation protective saddles shall be "Insul-Shield-Multi-Purpose-Saddle" as manufactured by Insul-Coustic Corp. or approved equal.
- H. Hot and cold water branch piping extending through slab or knockout panels to serve equipment shall be insulated to a point 4 inch above the top of sleeve provided for pipe.
- I. The use of staples shall not be permitted.
- J. It is the intent of this Specification that all vapor barriers be continuous throughout. Reinstate existing piping at point of new pipe connections.

END OF SECTION

SECTION 22 0470

TESTS AND ADJUSTMENTS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

1.1 TESTS AND ADJUSTMENTS

- A. The Contractor shall, at his own expense, during the progress of the work or upon its completion as ordered make such tests as are specified or as required by and in the presence of the Architects, Building Inspectors, etc. At least 48 hours' notice shall be given in advance of all tests.
- B. The Contractors shall provide all apparatus, temporary work or other requirements necessary for all tests. He shall take all due precautions to prevent damage to the building, its contents or the work of the other Contractors, that may be incurred by all tests. This Contractors shall also be responsible for the work of other Contractors that may be damaged or disturbed by the tests or the repair or replacement of his work, and he shall without extra charges, restore to its original condition, any work of other Contractors to do the work of restoration.
- C. Tests on the various systems may be conducted in sections as the work progresses or when the systems are completed.
- D. No caulking of pipe joints to remedy leaks will be permitted except where joints are made with lead and oakum.
- E. Each section of the sanitary, storm and vent piping tested shall have all openings tightly closed with screw plugs, or equal device. The drainage and vent systems shall be filled with water and proven tight under a 10'-0" head for a minimum of four (4) hours. Water level must remain constant through test without adding water.
- F. Upon final completion of the sanitary systems and when all fixtures and appurtenances have been set and the systems are in complete working order, all traps in the systems shall be filled with water and a thick penetrating smoke shall be introduced into the entire system.
- G. As smoke appears at the stack openings on the roof, such openings on the roof shall be tightly closed and a pressure equivalent to 1-1/2 inch of water shall be maintained during the test. Oils of peppermint shall be added at the smoke making machines so that any leakage is readily discernible.
- H. Before any covering is applied to the domestic water piping systems, the entire domestic water piping systems shall be hydrostatically tested for eight (8) hours to a hydraulic pressure of 125 psig.
- I. At the completion of the test, Contractor shall furnish the Owner with one (1) copy of test certificates as issued by the insurance company.
- J. Adjustments: Tests and adjustments shall be repeated as often as necessary until the systems are tight and are to the entire satisfaction of the Plumbing Inspector, Engineers and any other authorities having jurisdiction.
 - 1. Contractor is to thoroughly instruct the building custodian in the proper care and operation of the entire system. Contractor shall prepare for use by custodian, detailed brochures of instructions in non-technical terms, describing the maintenance and operation of all fixtures, apparatus, valves, controls etc. furnished by him.

2. Should any part of the work performed under this Contract fail to function because of cracked piping, obstructions, debris in piping, leaks in piping or any other cause, this Contractor shall disconnect, clean and reconstruct the work at his own expense and pay for any damages to adjoining work.
3. Water flow is to be balanced and adjusted to all flush valves, faucets, etc.
4. All parts of the plumbing system are to be thoroughly flushed until cleared of all grease and sediment and all dirt pockets cleaned. Repeat as often as necessary, open all cleanouts and reset in graphite.
5. All new motors shall be oiled as required.
6. All new valves are to have stuffing boxes packed and adjusted.

END OF SECTION

SECTION 22 0480

TAGS, CHARTS AND IDENTIFICATION

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 TAGS, CHARTS AND IDENTIFICATION

- A. Every valve installed under this Contract shall be tagged or labeled as follows: Tag shall be etched brass securely fastened to valve handwheels with heavy brass "S" hooks, soldered closed. At lock shield and similar type valves, tags for same shall be securely wired to valve body.
- B. Charts shall be provided for each piping system, as approved and shall consist of schematic diagrams of piping layouts showing and identifying each valve and piece of equipment etc., and its use. Upon completion one (1) copy of diagrams and valve charts suitably framed under glass, shall be furnished and mounted where directed. One (1) copy of diagrams and valve charts shall be delivered to Owner.
- C. This Contractor shall provide on all piping, semi-rigid, wrap around plastic identification markers equal to Seton Snap-Around and/or Seton Strap-On pipe markers.
- D. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe. Directions of flow arrows are to be included on each marker.
- E. Identification of all piping shall be adjacent to each valve, at each pipe passage through wall, floor and ceiling construction and at each branch and riser take-off.
- F. Identification shall be on all horizontal pipe runs, marked every 15 ft. as well as at each inlet outlet of equipment at changes in direction.

END OF SECTION

SECTION 22 0490

GUARANTEE

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

1.1 GUARANTEE

- A. The Contractor shall remove, replace and/or repair at his own expense and at the convenience of the Owner, any defects in workmanship, materials, ratings, capacities and/or characteristics occurring in the work within one (1) year or within such longer period as may be provided in the Drawings and/or Section of the Specifications, which guarantee period shall commence with the final acceptance of the entire Contract in accordance with provisions stated in the General Conditions, and the Contractor shall pay for all damage to the system resulting from defects in the work and all expenses necessary to remove, replace and/or repair and any other work which may be damaged in removing, replacing and/or repairing the work.

END OF SECTION

SECTION 23 0100

GENERAL CONDITIONS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 GENERAL CONDITIONS

- A. Before submitting a proposal, Bidders shall examine all related to this work and shall become fully informed as to the extent and character of the work required and its relation to the other work in the building.
- B. Before commencing work, the Contractor will examine all conditions of the project upon which his work is in any way dependent for perfect workmanship according to the intent of this Specification. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed by this Contractor and acceded to by the Owner's representative in writing before the Contractor begins any part of the work.
- C. The Contractor will pay for all licenses, permits and inspection fees required by civil authorities having jurisdiction. Comply with all laws, ordinances, regulations, and fire underwriter's requirements applicable to work herein specified without additional expense to the Owner.
- D. Small scale drilling through walls and floors or cutting of piping insulation which may contain asbestos shall be performed by a person with a "restricted asbestos handler allied trades certificate" and shall have a copy of it in his possession at all times while working of the project. This shall also apply to removal of piping, ductwork, or equipment insulation.
- E. It is specifically intended that anything (whether material or labor), which is usually furnished as a part of such equipment, as is hereinafter called for (and which is necessary for the completion and proper operation) shall be furnished as part of this Contract without additional cost the Owner, whether or not shown in detail or described in the Specifications.
- F. When Drawings and Specifications conflict or there is a question as to the proper intent of this Contract, the Contractor shall assume the greater quantity, the higher quality and/or the more expensive method in his pricing. All questions shall be directed to the Architect/Engineer in writing only and only up to ten (10) days prior to bidding.
- G. The Drawings indicate the general runs of the piping, ductwork, etc. systems and the location of equipment and apparatus, however it shall be understood that the right is reserved by the Architect/Engineer to change the location of piping work, ductwork, equipment and apparatus to a reasonable extent as building conditions may dictate, prior to their installation without extra cost to the Owner.
- H. All components supplied by this Contractor shall be UL listed and/or ETL labeled and shall conform to ASHRAE Standard 15.
- I. Any changes from the Drawings and Specifications and any interpretation thereof shall have the prior approval of the Architect/Engineer. The Contractor shall submit in writing, at the time of signing the Contract, any items of necessary labor and materials, which, in his opinion, are lacking in requirements of the Drawings and Specifications to insure a complete job in all respects. No consideration will be granted to alleged misunderstanding of materials to be furnished, work to be done, or conditions to be complied with, it being understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying Drawings.

END OF SECTION

SECTION 23 0110

SCOPE OF WORK

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 SCOPE OF WORK

- A. The work under this section includes all labor, materials, equipment, tools, transportation, and the performance of all work necessary and required for the furnishing and installation complete of all work as shown on the Contract Documents, including but not necessarily limited to the following:
1. Hot water heating boilers with combination propane/natural gas burners.
 2. Exhaust fans, supply fans and related appurtenances.
 3. Existing Exhaust Fans and related appurtenances.
 4. Existing Unit Ventilator units and related appurtenances.
 5. Existing air handling units and related appurtenances.
 6. All required piping, valves, and related specialties.
 7. Base mounted and inline centrifugal pumps.
 8. Variable frequency drives.
 9. Duct mounted reheat coils and related specialties.
 10. Fin-tube radiation, convectors, cabinet heaters, unit heaters and related appurtenances.
 11. Sheetmetal ductwork and related accessories.
 12. Duct and pipe insulation.
 13. Registers, diffusers, and dampers.
 14. Rigging of equipment.
 15. Furnish all combination motor starter/disconnects for equipment (with the exception of starters and electric items already mounted on equipment or equipment not requiring same). Fan motor starter/disconnects shall have contacts for ATC connection and a terminal block connection for Fire Alarm fan shutdown. Starters per manufacturers recommendations. Underwriters inspection and certificate required. Coordinate with Electrical Contractor.
 16. Air and Water Balancing.
 17. Automatic temperature controls with complete wiring (regardless of voltage).
 18. Testing, adjusting and start-up of equipment.

19. Painting and identification of all equipment and piping.
 20. Firestopping per NFPA requirements (UL approved systems).
 21. Operating and maintenance instructions.
 22. As-Built Drawings - Refer to Division 1.
 23. Cutting and Patching - Refer to Division 1.
- B. Coordination Drawings: Attention is directed to Division 1 for coordination drawing requirements for this project. These drawings are critical to the proper execution of the work and failure to honor these requirements may become the basis for denial of all claims for either or both "time" and "money".

1.2 REMOVALS

- A. Removals should be coordinated with other trades affected.
- B. Piping which penetrates the construction may be cut and capped provided capping is done beneath the finished surfaces so that construction over it can be achieved.
- C. Soot Removal: In connection with the dismantling of boilers, Contractor shall gather with a vacuum-cleaning machine all accumulations of soot and shall remove all soot from the base of the chimney.
- D. All removals shall be removed from the site.

1.3 ALTERATION WORK

- A. All equipment, piping, control components, etc. to be removed, shall be disposed of or salvaged as directed by the Owner. They shall not be removed from the premises without the Owner's approval.
- B. All piping to be removed shall be properly plugged or capped so that upon completion of all new work, all abandoned piping shall be concealed in finished areas.
- C. No dead ends shall be left on any piping upon completion of job. The existing system shall be left in perfect working order upon completion of new work.
- D. Location and sizes of existing piping, ductwork, equipment, etc. are approximate. Exact sizes and locations of all existing work shall be verified on the job.

END OF SECTION

SECTION 23 0120

GAS FIRED CONDENSING BOILERS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 SUMMARY

- A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, firetube duplex stainless steel ultra-high efficiency condensing boilers, trim and accessories for generating hot water.

1.2 REFERENCES

- A. ASME Section IV
- B. CAN-13.1-77, Industrial and Commercial Gas Fired Packaged Boilers
- C. CSD1, Controls and Safety Devices XL GAPS
- D. NEC, National Electric Code
- E. UL-795 7th Edition
- F. AHRI, BTS-2000
- G. ASHRAE 90.

1.3 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, technical product data, rated capacities of selected model, weights (shipping, installed and operating), installation and start-up instructions, and furnished accessory information.
- B. Shop Drawings: For boiler, standard boiler trim and accessories.
 - 1. End Assembly Drawing: Detail overall dimensions, connection sizes, connection locations, and clearance requirements.
 - 2. Wiring Diagrams: Detail electrical requirements for the boiler including ladder type wiring diagrams for power, interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.
- C. Certificate of Product Rating: Submit AHRI Certificate indicating Thermal Efficiency, Combustion Efficiency, Materials of Construction, Input, and Gross Output conform to the design basis.
- D. Thermal efficiency curves: Submit thermal efficiency curves for a minimum of 5 input rates between and including minimum and maximum rated capacities, for return water temperatures ranging from 80°F to 180°F.
- E. Water side pressure drop curve.
- F. Flue gas temperature curves: Submit flue gas temperature curves for minimum and maximum boiler capacity, for return water temperatures ranging from 80°F to 160°F. If submitted flue gas temperatures, minimum or maximum inputs are different from that of the basis of design manufacturer and model, the manufacturer shall be responsible for draft calculations and reselection of the flue gas exhaust system.
- G. Source quality-control test reports.
- H. Field quality-control test reports: Start-up by a factory authorized service company.

- I. Operation and Maintenance Data: Data to be included in Installation and Operation Manual.
- J. Warranty: Standard warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels, whose products have been in satisfactory use in service for not less than twenty-five (25) years. The manufacturer must be privately owned and headquartered in North America. The specifying engineer, contractor and end customer must have the option to visit the factory during the manufacture of the boilers and be able to witness test fire and other relevant procedures.
- B. Aftermarket Support and Service: The manufacturer shall have a factory authorized service training program, where boiler technicians can attend a training class and obtain certification to perform start-up, maintenance and basic troubleshooting specific to the product line.
- C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers", for a maximum allowable working pressure of 160 psig.
- E. CSD-1 Compliance: The boiler shall comply with ASME Controls and Safety Devices for Automatically Fired Boilers (CSD-1).
- F. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil-Fired Boilers - Minimum Efficiency Requirements."
- G. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by ETL.
- H. AHRI Compliance: Boilers shall be tested and rated according to the BTS-2000 test standard and verified by AHRI.
- I. NOx Emissions Compliance: Boiler shall be tested for compliance with SCAQMD and TCEQ.
- J. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.
- K. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
- L. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
- M. All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
- N. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

1.5 COORDINATION

- A. Mechanical contractor shall coordinate the size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete reinforcement and formwork requirements are specified in Division 03.

1.6 WARRANTY

- A. Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
1. Warranty Period for the Pressure Vessel and Heat Exchanger: The boiler manufacturer shall warranty against failure due to thermal shock, flue gas condensate corrosion, and/or defective material or workmanship for a period of 10 years, non-prorated, from the date of shipment from the factory provided the boiler is installed, controlled, operated and maintained in accordance with the Installation, Operation and Maintenance Manual.
 2. Warranty Period for the Burner: The boiler manufacturer shall warranty the burner against defective material or workmanship for a period of five (5) years, non-prorated, from the date of shipment from the factory.
 3. Warranty Period for all other components: The boiler manufacturer will repair or replace any part of the boiler that is found to be defective in workmanship or material within eighteen (18) months of shipment from the factory or twelve (12) months from start-up, whichever comes first.
 4. Warranties are only valid provided the boiler is installed, controlled, operated, and maintained in accordance with the Installation, Operation and Maintenance Manual.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. This specification is based on the Endura series boilers as manufactured by Fulton Heating Solutions, Inc. Equivalent units and manufacturers must meet all performance criteria and will be considered upon prior approval.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Fulton Heating Solutions, Inc.; Endura model EDR 1000 duplex stainless steel firetube condensing boiler.
- C. The boiler manufacturer shall have the capability to construct an engineered hydronic system, skid mounted, for the above referenced boilers incorporating single point electrical, supply water, return water, freshwater make-up, fuel, and drain. The boiler manufacturer shall have the engineering capabilities for all aspects of the mechanical, electrical and control design aspects of the skid mounted system.

2.2 CONSTRUCTION

- A. Description: Factory-fabricated, -assembled, and -pressure tested, duplex stainless steel firetube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including flue gas vent; combustion air intake connections, water supply, water return, condensate drain, and controls. The boiler, burner and controls shall be completely factory assembled as a self-contained unit. Each boiler shall be neatly finished, thoroughly tested, and properly packaged for shipping. Closed-loop water heating service only.
- B. Heat Exchanger: The heat exchanger is defined as the surfaces of the pressure vessel where flue gases transfer sensible and latent heat to the hydronic fluid. The heat exchanger shall be a three-pass firetube design constructed using only duplex alloys of stainless steel.
1. The boiler shall be a firetube design, such that all combustion chamber components are within water-backed areas. Water tube boilers will not be accepted.
 2. Furnace: First pass of the combustion chamber shall be constructed of duplex alloy stainless steel with a minimum wall thickness of 0.25" and a minimum bottom head thickness of 0.625".

3. Firetubes: Second and third passes of the combustion chamber shall be constructed of duplex alloys of stainless steel having a minimum wall thickness of EDR-1000/2000: 0.083".
 4. Furnace to tube connections shall be constructed with low weld intensity, a tube to tube minimum spacing of 2" center to center, minimum 5/8" tube to tube ligament, and shall not contain any overlapping welds.
 5. Heat exchange capability shall be maximized within the heat exchanger via the use of corrugated firetube technology. The corrugation process shall not remove any material from the tubes. Aluminum heat transfer enhancements are dissimilar metals and are unacceptable.
 6. Material: The heat exchanger shall have the following material characteristics and properties:
 - a. The metallic crystalline lattice microstructure shall contain approximately equal amounts of body center cubic (BCC) and face centered cubic (FCC) structures to offer high resistance to intergranular corrosion.
 - b. A minimum Pitting Resistance Equivalent Number (PREN) of 26.
 - c. A minimum Yield Strength of 65 ksi at 0.2% plastic strain.
 - d. A minimum Ultimate Tensile Strength of 94 ksi.
 - e. To minimize stresses caused by uneven expansion and contraction, the Coefficient of Thermal Expansion at 212°F shall not be less than 7.0 in/in °F 10⁻⁶ and shall not be greater than 7.5 in/in °F 10⁻⁶.
 - f. To increase resistance to pitting and crevice corrosion, the Chromium content shall not be less than 21% by mass.
 - g. For high mechanical strength, the Nitrogen content shall not be less than 0.17% by mass.
 - h. Boilers with heat exchangers constructed of austenitic stainless steels, such as 316L or 304, and ferritic stainless steels, such as 439, are unacceptable.
 - i. Boilers with heat exchangers constructed of cast aluminum, mild steel, cast iron or copper finned tube materials are unacceptable.
- C. Pressure Vessel: Design and construction shall be in accordance with Section IV of the ASME Code for heating boilers.
1. The shell shall be minimum EDR-1000: 0.25" thick steel, SA-790 or SA-516 Grade 70.
 2. The top head shall be a minimum 0.375" thick steel, SA-790 or SA-516 Grade 70.
 3. The water side of the pressure vessel shall be a counter-flow design with internal water-baffling plates.
 4. The boiler return water and supply water connections shall be EDR-1000: 2" threaded male NPT. The water connections shall not be designed to support an external structural load from the piping system.
 5. The water volume of the boiler shall not be less than EDR-1000: 50 Gallons.
 - a. For boilers with a lower water volume, the boiler manufacturer shall provide a buffer tank and all associated buffer tank ancillaries to make equivalent to the total volume of the design basis.
 6. The maximum water pressure drop across the boiler inlet and outlet connections, shall not exceed EDR1: 0.8 PSID at 100 GPM.
- D. Burner: Standard natural gas, forced draft.
1. Burner Head: Shall be a woven fiber premix design.
 2. Excess Air: The burner shall operate at no greater than 7.0% excess O₂ over the entire turndown range. Due to significant reductions in combustion efficiency at high levels of excess O₂, boilers exceeding 7.0% excess O₂ at any operating condition shall not be accepted.
 3. Emissions: When operating on natural gas, the boiler shall maintain a NO_x level of <20 ppm, and CO emissions less than 50 ppm, over the complete combustion range at a 3% O₂ correction.

- E. Blower: Variable speed, non-sparking, hardened aluminum impeller centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.
1. Motor: Brushless DC variable speed motor with hall effect sensor feedback; internal electronic commutation controller with built in speed control and protection features; long life, sealed, ball bearing with high temperature grease.
 2. Variable speed blower: PWM signal input with tachometer output.
- F. Main Fuel Train
1. The boiler shall have a pre-mix combustion system, capable of operating at a minimum 4" W.C. incoming natural gas pressure while simultaneously achieving emissions performance, full modulation, and full rated input capacity. Maximum natural gas pressure allowed to the inlet of the fuel train shall be no less than 28" W.C.
 2. A factory mounted main fuel train shall be supplied. The fuel train shall be fully assembled complete with high and low gas pressure switches, wired, and installed on the boiler and shall comply with CSD-1 code. The fuel train components shall be enclosed within the boiler cabinet.
 3. A lock up regulator upstream of the fuel train shall be furnished by the boiler manufacturer as a standard component integral to the boiler cabinet. Factory test fire of the boiler with the provided lock up regulator is required.
 4. Standard CSD-1 fuel train shall comply with IRI, which has been replaced by XL GAPS.
- G. Ignition: Direct spark ignition with transformer. A UV scanner shall be utilized to ensure precise communication of flame status back to the flame programmer.
- H. Boiler Enclosure
1. Sealed Cabinet: Jacketed steel enclosure with left hinged full height front access door, fully removable latching access panels, gasketed seams to maintain sealed combustion, mounted on a steel skid with steel plate decking.
 2. Control Enclosure: NEMA 250, Type 1.
 3. Finish: Internally and externally primed and painted finish.
 4. Combustion Air: Drawn from the inside of the sealed cabinet, preheating the combustion air.
- I. Rigging and Placement: The boiler shall come with lifting eyes and fork hole accessibility for rigging.
- J. Exhaust Manifold: Shall be constructed of stainless steel, with an area for the collection and disposal of flue gas condensate.
- K. Characteristics and Capacities
1. Heating Medium: Closed loop hot water with up to 50% propylene or ethylene glycol by volume. Standard capacities shall be based on 100% water.
 2. Design Water Pressure Rating: 160 psig.
 3. Safety Relief Valve Setting: 160 psig.

4. Minimum Return Water Temperature: No minimum temperature required.
 5. Maximum Allowable Water Temperature: 210°F.
 6. Minimum Water Flow Rate: No minimum flow rate required to protect the heat exchanger.
 7. Maximum Water Flow Rate: No maximum flow rate requirement.
 8. Minimum Delta-T: No minimum delta-T required.
 9. Maximum Delta-T: 100°F
 10. Minimum Side Clearance: Shall not exceed 1" between any number of boilers.
 11. Maximum Allowable Operating Setpoint: 200°F
 12. Jacket Losses: External convection and radiation heat losses to the boiler room from the boiler shall comply with IAW ASHRAE 103-2007 and shall not exceed 0.2% of the rated boiler input at maximum capacity.
- L. The boiler shall have its efficiency witnessed and certified by an independent third party, and the efficiency must be listed on the AHRI directory (www.ahridirectory.org) for natural gas operation. The test parameters for efficiency certification shall be the BTS-2000 standard. The certified thermal efficiency for natural gas firing shall not be less than EDR-1000: 95.3%.
- M. A zero flow or low flow condition shall not cause any harm to the pressure vessel or heat exchanger of the boiler. Flow switches, dedicated circulator pumps, or primary-secondary arrangements shall not be required to protect the boiler from thermal shock. Boilers requiring the use of flow switches or primary-secondary piping arrangements are unacceptable.
- N. The dimensions of the boiler shall not be more than (Height x Width x Depth) EDR-1000: 68" x 28" x 61".
- O. The dry weight of the boiler shall not be less than EDR-1000: 1,430 lbs.
- P. The equipment shall be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.

2.3 TRIM

- A. Safety Relief Valve: ASME Rated.
- B. Pressure and Temperature Gauge: Minimum 3-1/2" diameter, combination pressure and -temperature gauge. Gauges shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
1. Mounted in the field in the boiler supply water piping prior to the first isolation valve by the boiler installer.
- C. Combustion Air Inlet Filter: 50 Micron.
- D. Flue Gas Condensate Drain Trap: A flue gas condensate drain trap shall be provided to prevent positive pressure exhaust gases from entering the boiler room.

- E. Flue Gas Condensate Neutralization: pH neutralization accommodations available upon request.

2.4 CONTROLS

- A. The boiler electrical control panel shall include the following devices and features:

1. 7" color touch screen control display factory mounted on the front cabinet panel door.
2. The control display shall serve as a user interface for programming parameters, boiler control and monitoring; and shall feature a screen saver, screen disable for cleaning, contrast control, volume control for alarm features, boiler status, configuration, history and diagnostics.
3. The boiler control panel shall be constructed in a UL 508 approved panel shop.
4. 24 VAC control transformers.
5. Control relay for 120 VAC motorized isolation valve control.
6. The flame safeguard control on the boiler shall be integrated with temperature control and lead/lag sequencing modular boiler plant functionality.
7. All controls are to be cabinet, vessel or panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls. All controls shall be mounted and wired according to UL requirements.

- B. Burner Operating Controls: To maintain safe operating conditions, factory mounted, and wired burner safety controls limit burner operation:

1. High Limit: A single UL 353 temperature probe shall function as a dual-element outlet temperature sensor and shall comply with CSD-1 CW-400 requirements for 2 independent temperature control devices.
 - a. High limit sensor shall be NTC resistive 10KOhm +/- 1% at 77°F. Sensor shall have brass material bulb with 1.181 +/- 0.015" insertion and 0.370 +/- 0.005" bulb diameter.
 - b. Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cut Off: Electronic probe type mounted in the pressure vessel shall prevent burner operation on low water alarm.
3. Air Safety Switch: Prevent operation unless sufficient combustion air is proven.
4. High Condensate Probe: Prevent operation in the event of a blocked condensate drain.
5. Blocked Exhaust: Prevent operation in the event of a blocked flue gas exhaust stack.

- C. Boiler Operating Controls and Features:

1. Proportional Integral Derivative (PID) temperature load control capability for up to two loops, central heat and domestic hot water.
2. Operating temperature limit for automatic start and stop.
3. Flue gas exhaust temperature monitoring.

4. Return water temperature monitoring.
 5. Time of day display.
 6. Customizable boiler name display.
 7. Alarm history for 15 most recent alarms including equipment status at time of lockout.
 8. Password protection options.
 9. Indirect domestic hot water priority.
 10. Outdoor air temperature (OAT) reset controls with warm weather shutdown:
 - a. OAT reset shall automatically adjust the setpoint according to changes in the outdoor temperature.
 - b. The boiler manufacturer shall provide an OAT sensor and module.
 - c. The sensor shall have +/- 1.5°F accuracy at 70°F, field installed in an outdoor area not exposed to direct sunlight or the exhaust of other mechanical equipment, and field wired to the master boiler.
 - d. The control shall be field programmed with the outdoor reset schedule.
 - e. The control shall have the ability to disable the entire hydronic boiler system on warm weather shutdown based on a programmable OAT.
- D. Sequencing Control of Modular Boiler Plants: Sequencing capabilities (lead/lag) shall be integral to the boiler controller for up to 8 boilers installed in the same hydronic loop and shall not require an external panel.
1. The boiler manufacturer shall provide a supply water header temperature sensor. The sensor shall be NTC resistive 10KOhm +/- 1% at 77°F, field installed in the common supply water piping, and field wired to the master boiler.
 2. One (1) boiler in the system shall be field programmed as the master and subsequent boilers will be programmed as lag units.
 3. Sequence of Operation:
 - a. Upon call for heat and demand in the system, a boiler will be enabled at low fire and will modulate according to demand and PID settings up to the base load common value. The base load common shall be field adjustable with a default setting of 40%.
 - b. If the heating load exceeds the output at the base load common firing rate, the next boiler in the sequence will be enabled at low fire. Modular boilers will modulate up and down in parallel as a cohesive unit with infinite modulation points to meet heating load requirements.
 - c. This process continues until all available boilers are enabled, at which point they are released to modulate up to full fire if required.
 - d. As the load decreases, the boilers will be sequentially disabled.
 - e. Boiler sequence order shall be rotated on a programmable number of run hours.
 - f. A boiler in lockout alarm shall be automatically removed from the sequence order.
 - g. Lag boilers shall default to local control if the master boiler is fully powered off or removed.
 - h. Each individual boiler shall enable and disable a water circulation control device. The enable of the device, for example a motorized isolation valve or boiler circulator, will be simultaneous with the heat demand for that boiler. The disable of each device will be based

on a programmable time delay when the heat demand is no longer present. In variable primary arrangements, the control shall always hold the lead boiler isolation valve open.

- E. Building Automation System Interface: Hardware and software to enable building automation system (BAS) to monitor, control, and display boiler status and alarms.
1. Hardwired Contacts:
 - a. Monitoring: Boiler Status, Burner Demand, General Alarm, Firing Rate.
 - b. Control with Factory Installed Jumper: Safety Interlock for External Device, Remote Boiler Enable, Remote Lead/Lag Enable, Emergency Stop (E-Stop)
 - c. Remote Setpoint Signal: 4-20 mA.
 2. Communication Protocol: A communication interface with BAS shall enable BAS operator to remotely enable and monitor the boiler plant from an operator workstation.
 - a. The boilers will communicate with each other and the Building Automation System via a daisy chain addressed Modbus network. Field wiring between nodes shall be twisted pair low voltage with shielded ground.
 - b. A BACnet MSTP and IP protocol communication gateway shall be provided. The BACnet gateway is field installed on the MASTER boiler. Lag boilers shall not require a dedicated BACnet gateway for the BAS to monitor status. The BAS shall only be required to communicate through the MASTER boiler. A communication point mapping list shall be provided.
 - c.

2.5 ELECTRICAL POWER

- A. Single-Point Field Power Connection: Factory-installed and factory-wired switches, transformers, control and safety devices and other devices shall provide a single-point field power connection to the boiler.
- B. Electrical Characteristics
1. Voltage: 120 V.
 2. Phase: Single.
 3. Frequency: 60 Hz.

2.6 VENTING

- A. The boiler shall be capable of operating with a stack effect not exceeding -0.04" W.C. and a combined air intake and exhaust venting pressure drop not exceeding +1.50" W.C.
- B. Combustion Air Intake: It shall be acceptable to either direct vent the boiler using sealed combustion by drawing combustion air in from the outdoors or by drawing air from the mechanical space itself.
1. Sealed Combustion: Schedule 40 PVC pipe or smooth-walled galvanized steel, vent termination with 1/2" x 1/2" mesh bird screen.
 2. Mechanical Space: Adequate combustion air and ventilation shall be supplied to the boiler room in accordance with local codes.
- C. Flue Gas Exhaust: The flue gas exhaust stack shall be AL 29-4C or 316L stainless steel, listed and labeled to UL-1738 / C-UL S636 for use with Category II/IV appliances, guaranteed appropriate for the application by the manufacturer and supplier of the venting.
- D. The boiler shall be capable of common exhaust and intake venting. The draft system shall be designed to prevent the backflow of exhaust gases through idle boilers.

- E. Condensate drain piping must be galvanized, stainless steel, or Schedule 40 CPVC. Copper, carbon steel, or PVC pipe materials are not accepted.

2.7 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- B. Each boiler shall be installed and operated in a functioning hydronic system, inclusive of venting, as part of the manufacturing process. A factory test fire report corresponding to the boiler configuration shall be included with each boiler.

2.8 MODSYNC SE SEQUENCING SYSTEM

- A. When multiple hydronic boilers are to be installed in a common loop, a boiler sequencing control system shall be used. The sequencing system will monitor, enable/disable and control the firing rate of each boiler in the loop. To ensure accurate temperature control and optimized boiler operating efficiencies, a ModSync Sequencing System shall be used.
 - 1. The hydronic boilers shall be controlled as follows to maximize their operating efficiency:
 - a. The sequencing system shall monitor the outdoor temperature and calculate a hydronic loop temperature setpoint based on touchscreen selectable user-defined values. The boiler sequencing system will stage operation of the hydronic boilers based on the difference between the actual hydronic loop temperature and the calculated (outdoor air reset) hydronic loop temperature setpoint.
 - b. When a requirement for heat is determined by the boiler sequencing system, the lead boiler is energized, and its firing rate is maintained at low fire.
 - c. If the hydronic loop temperature continues to decrease, the boiler sequencing system will enable a lag boiler. The first lag boiler is energized, and the lag boiler's firing rate is maintained at low fire.
 - d. As additional heat is required, the boiler sequencing system will enable the remaining lag boiler stages individually until all of the available boilers in the hydronic loop have been energized. Each boiler will remain at low fire until all of the stages have been enabled.
 - e. If all of the hydronic boilers are enabled and additional heat is required, the boiler sequencing system will release the boilers to modulate. Operating hydronic boilers at lower firing rate levels provides significant efficiency gains. Therefore, hydronic boilers will modulate together as a single unit to keep the hydronic boiler system at the lowest possible firing rate, while satisfying the building load demands.
 - f. As the hydronic loop temperature increases, the boiler sequencing system will decrease the firing rate of the hydronic boilers to maintain the hydronic loop temperature. If all of the hydronic boilers are at low fire and the hydronic loop temperature continues to rise, the boiler sequencing system will begin to stage the boilers off. The first lag boiler stage energized will be the last stage to be disabled. The hydronic boilers will continue to be disabled by the boiler sequencing system based on the temperature rise of the hydronic loop.
 - g. The lead boiler is disabled when the hydronic loop temperature reaches a selectable value referenced around the hydronic loop setpoint.

- B. The boiler sequencing system will be a microprocessor-based process controller with a graphical user interface and touchscreen capabilities. Boiler sequencing systems designed with alpha-numeric displays will not be acceptable due to their limited functionality.
- C. The active touchscreen display area will be a minimum of 5.7" with a color TFT display resolution of 256 colors.
- D. The boiler sequencing system enclosure will be NEMA 4X construction. The enclosure shall be designed with the ability to be installed in outdoor environments. Mounting of the boiler sequencing system inside another panel to provide an outdoor rating will not be acceptable due to the increased access time requirements to view and modify the system parameters. Power requirements for the boiler sequencing panel will be 120/60/1.
- E. The boiler sequencing system will be a wall mounted, stand-alone unit. Local boiler controls with integrated lead/lag logic are not acceptable due to their limited logic capabilities and rewiring requirements in the event of a sensor or local controller error.
- F. Password requirements will prevent access to any of the screens where system configuration parameters can be adjusted, while maintaining the ability of viewing the system performance.
- G. Outdoor and Supply Header Temperature sensors supplied with the boiler sequencing system shall be PT-100 RTD type for precise temperature monitoring. Return Temperature monitoring capabilities shall be available and used when BTU calculation is used. The boiler sequencing system will have the ability to receive temperature values from the Building Management System through a communication protocol. Each temperature input shall have a selection button that allows for independent configuration of where the temperature value will be received from.
- H. The boiler sequencing system will provide a series of "Question and Answer" screens to simplify the commissioning process.
- I. Multiple Status and Configuration Screens will be available for easy interpretation of the hydronic loop status and simplified control configuration of the multiple hydronic boiler system.
 - 1. Minimum screens available shall include:
 - a. Outdoor Reset Configuration
 - b. Setback Schedule
 - c. Lead/Lag Configuration
 - d. Boiler Configuration
 - e. System Status
 - f. Alarm Status
 - g. Alarm History
- J. Outdoor Reset - The ability to adjust the hydronic loop temperature setpoint based on the outdoor temperature is a key element of hydronic system efficiency. As the outdoor temperature increases, the hydronic loop setpoint can decrease while still maintaining the desired building temperature. Lower return water temperatures can significantly increase the hydronic boiler system efficiency.
 - 1. The boiler sequencing system shall provide Outdoor Reset Configuration Screens that include all the parameters required to effectively configure the hydronic loop setpoint based on the outdoor temperature.
 - a. The boiler sequencing system will provide an adjustable reset schedule based on the outdoor temperature. A linear outdoor reset ratio will be determined based on user-defined hydronic loop temperatures at 50°F and 0°F outdoor temperatures. Outdoor

temperature configuration variables shall be adjustable through the touchscreen to match designed reset schedule requirements. A reference graphic detailing the calculated reset ratio will be displayed on the Outdoor Reset Configuration screen.

- b. Minimum and maximum loop temperature parameters will prevent the outdoor reset schedule from operating outside of a user-defined temperature range.
 - c. A user-defined Outdoor Temperature Disable parameter will be provided to disable the hydronic loop if a predetermined outdoor temperature is reached. A hysteresis variable will prevent the hydronic system from re-enabling until the outdoor temperature decreases a user-defined amount.
 - d. To meet multiple system control configurations, setpoint mode adjustment capabilities will be included as standard with the boiler sequencing system. Setpoint Modes will include Outdoor Reset, 4-20mA Remote Setpoint, BMS Communication or Manual. The setpoint mode shall be field adjustable by a touchscreen selection button on the Setpoint Configuration screen.
 - e. Provisions for Domestic Hot Water Priority shall be available if required. A temperature aquastat input is monitored and will automatically adjust the hydronic loop setpoint to meet the Domestic Hot Water demand. When the domestic load is satisfied, the boiler sequencing system will automatically switch the setpoint mode to outdoor reset.
- K. Setback Configuration Screens shall be provided to adjust the hydronic loop setpoint based on Day of the Week/Time of Day variables.
- 1. Multiple setback schedules shall be available based on whether the building is in Occupied or Unoccupied mode. Building Mode selection shall be determined by a user-defined Time of Day / Day of Week touchscreen entry. The Building Mode will automatically change between Occupied and Unoccupied based on the user programmed day and times. Manual Building Mode control shall also be available via a Setup menu. Building Mode shall be indicated on the Loop Status Screen for ease of reference.
 - 2. An Anticipation Mode feature shall be provided to automatically switch to Occupied Mode a selectable number of hours earlier than scheduled if the outdoor temperature lowers below a user-defined temperature during the Unoccupied Mode.
- L. Lead/Lag Configuration screens shall be used to configure how the hydronic boilers will be assigned and enabled in the control sequence.
- 1. The boiler sequencing system will include automatic rotation of the lead boiler based on a user configured lead boiler cycle count or run hours, whichever setting occurs first.
 - 2. When the lead cycle or run hours rotation value is reached, the boiler sequencing system will assign each boiler's position in the lead/lag sequence based on their previous operating history. Boiler sequencing systems that simply rotate the lead position to the next boiler in the sequence will not be acceptable due to their ineffective ability of maintaining an even cycle count across all the boiler stages in the hydronic loop.
 - 3. The boiler sequencing system will stage the boilers based on a PID generated control variable value. The Proportional, Integral and Derivative values shall be user-defined through the Lead/Lag Configuration screen. Each lag boiler stage will be enabled and disabled based on a user-defined control variable percentage. Properly tuned loops will provide temperature control accuracy up to +/- 2°F, based on load demand.

Lead boiler start and stop parameters shall be user-defined through the touchscreen operator interface. A Manual Reset parameter will allow the Proportional Band to be shifted around setpoint.

4. A user-defined time delay parameter will provide delays enabling and disabling of the lag boiler stages. This helps to decrease cycling of the lag stages when the building load is close to being satisfied.
 5. The boiler sequencing system will have the ability to monitor the outlet temperature of each hydronic boiler in the system. This feature is beneficial for systems that will incorporate variable flow designs. If the boiler outlet temperature exceeds setpoint by a user-defined amount, the boiler sequencing system will automatically lower the firing rate of the boiler to help prevent a high limit trip at the boiler. As the boiler outlet temperature decreases below a defined variable, the boiler sequencing system will allow the firing rate of the boiler to increase.
- M. Boiler Configuration screens will display information regarding each boiler stage in the hydronic loop.
1. The boiler configuration screens will detail and provide:
 - Hydronic Boiler Status.
 - Hydronic Boiler Cycles, Run Hours and Cycle/Hour Ratio calculation.
 - Hydronic Boiler Outlet Temperature.
 - Hydronic Boiler Enable/Disable touchscreen selection.
 - Hydronic Boiler Auto/Manual touchscreen control mode selection.
 - Hydronic Boiler Manual touchscreen Start/Stop and Firing Rate control.
 2. The boiler sequencing system shall include capabilities to enable/disable the boilers through the operator interface. Boilers that are disabled will not be included in the sequencing logic.
- N. The boiler sequencing system will monitor the operation and status of all temperature sensors and hydronic boilers in the loop. Sensor errors will be annunciated on the boiler sequencing systems alarm screen. If an outdoor temperature sensor error occurs, the boiler sequencing system will automatically switch to manual setpoint mode and will annunciate the alarm condition.
- O. The boiler sequencing system will start a timer when each boiler stage is enabled to run. If the main gas valves do not energize within the user-defined timeframe then a local limit is preventing the boiler from operating. The boiler sequencing system will immediately remove the boiler from the lead/lag sequence and annunciate that a local boiler error exists. An automatic reset option will allow the boiler to be re-enabled after a user-defined timeframe has elapsed.
- P. An Alarm Status screen will give a text description of any current alarm conditions. Boiler sequencing systems that use codes or symbols to detail alarm conditions will not be acceptable. The boiler sequencing system will automatically adjust the boiler sequencing status and remove the boiler from the sequencing logic if an alarm occurs. The boiler will automatically be added back into the rotation loop as soon as the boiler sequencing system senses that the alarm has been cleared.
- Q. The boiler sequencing panel will include an Alarm History screen that allows for the last 100 alarm conditions to be viewed. A Date/Time stamp and text description of each alarm condition in the history will be available.
- R. A System Status screen will detail current outdoor, hydronic system and control variable values. The status screen will also display enable/disable and firing rate information for each of the boilers in the hydronic loop.
- S. Trending of the supply temperature, system setpoint and outdoor temperature will be displayed to provide system operational history for tuning of the PID and lead/lag parameters.

- T. The boiler sequencing system will have the ability to communicate to a Building Management System using multiple protocols including Modbus RTU, BACnet, LonWorks or N2. Standard point mapping will be provided with the boiler sequencing system. Selection of ModBus serial connectivity (RS-232/RS-485) and baud rate will be field-adjustable using a configuration screen on the boiler sequencing system
- U. The ModSync SE will be field configurable for different features. Configurable features include:
 - 1. Lead/Lag up to eight Fulton boilers with I/O, LMV3, LMV5, Sola, and EDR+ controls.
 - 2. Boiler Isolation Valve or Boiler Pump Control (constant speed and VFD pump control available)
 - 3. Boiler Isolation Valve or Boiler Pump Interlock
 - 4. General Alarm Contact
 - 5. E-Stop Status Input
 - 6. Boiler Alarm Output
 - 7. Boiler Status Output
 - 8. 2-4 system pump control (Constant speed and VFD pump control available)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
 - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after satisfactory conditions have been verified.

3.2 BOILER INSTALLATION

- A. Install boilers level on concrete base, minimum 4 inches high. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- B. Install gas-fired boilers according to NFPA 54. Equipment and materials shall be installed in an approved manner and in accordance with the boiler manufacturer's installation requirements.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with the boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

- C. Connect gas piping to boiler gas train inlet with isolation valve and union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- D. Connect hot water supply and return water connections with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to the nearest floor drain.
- F. Install piping from flue gas condensate drain connection to the condensate drain trap and to the nearest floor drain.
- G. Boiler Venting
 - 1. Install flue venting and combustion air-intake.
 - 2. Connect to boiler connections, flue size and type as recommended by the manufacturer.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. After boiler installation is completed, the manufacturer shall provide the services of a field representative to inspect components, assemblies, and equipment installations, including connections and provide startup of the boiler and training to the operator.
 - 2. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.
- B. Tests and inspections
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 12 months of startup, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other than normal occupancy hours for this purpose.

END OF SECTION

SECTION 23 0130

BOILER START-UP AND TESTING

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 BOILER START-UP AND TESTING

- A. Before any water is added to the boiler for testing or other purposes, a sufficient amount of sodium sulphite (to provide a residual of 100 PPM) shall be added to the boiler water to prevent deterioration due to dissolved oxygen in the boiler water. When ready for firing the Contractor shall clean the boiler internal surfaces in the following manner:
- B. Fill the boiler with fresh water.
- C. Dissolve Metro Boiling Out Compound (or mixture of equal parts of trisodium phosphate, caustic soda and soda ash) at the rate of 1 pound per 20 gallons.
- D. Dosage: 50 pounds per 1000 gallons of water content of the boiler.
- E. Connect 2" full size blowoff line to blow off tapping located near the boilers normal water line. The discharge of this shall be piped full size to a suitable drain.
- F. Heat the boiler for a period of 16-24 hours without generating steam.
- G. Open the blow off valve and feed the boiler with fresh water, maintaining a "normal" water line while "skimming" all oil and grease from the top blowoff line.
- H. Continue this procedure until the water is clear and free of any oil or grease.
- I. Drain the boiler and flush thoroughly with a hose through the manhole opening until all signs of debris, oil, grease and mill scale are removed.
- J. Fill with fresh water, treated with Chem Aqua 999 boiler treatment (hot water systems) to raise the level to 100 PPM.
- K. Raise the level of the water to the steaming point to remove as much dissolved oxygen as possible.
- L. Re-test the level of boiler water treatment, adding sufficient to raise protection to the proper level.
- M. Note: In the event of a boiler contaminated with large quantities of oil or grease it may be required to repeat this procedure. Procedure shall be repeated until ALL traces of oil and grease are removed from the boiler.
- N. Contractor shall operate the boiler for a minimum of eight hours, following the above procedure, during which time valves to system and terminal units shall be in the open position and all returning water shall be wasted to drain. The purpose to remove as much scale and dirt from the piping system. During this period of operation, the residual level of water treatment shall not be allowed to fall below 100 PPM.
- O. Upon completion of the above, the Contractor shall close manholes and handhole mating surfaces.

- P. Provide automatic chemical feeder AXIOM INDUSTRIES LTD. Model SF-100D-P, 55 gallon, two pressure pumps with thermal cut-out, 115V/60HZ/1PH 0.7 A, double pressure reducing valve, pressure gauge, system connector hose and check valve to allow for independent pressure supply to a second system, low level alarm panel c/w remote monitoring dry contacts and selectable audible alarm, and containment tank Model SF100-2240 or by-pass feeders equal to Griswold DB-5-SB-CS-2, 5-gallon pot feeder, domed bottom, ASME rated, 600 psi @ 250 degrees F.

END OF SECTION

SECTION 23 0140

DOUBLE WALL BOILER BREECHING SYSTEM

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 PREFABRICATED BREECHING AND CHIMNEYS

- A. For Category II, III or IV appliances.
 - 1. All portions of the vent system shall be double-wall special gas vent, tested and listed to UL1738 'Standard for Venting Systems for Gas-burning Appliances, Categories II, III, and IV.' The vent system shall have a materials or equipment acceptance number.
 - 2. All portions of the vent system shall be supplied, including appliance adapters, straight lengths, adjustable lengths, elbows, drain sections, reducers, boot tees, tee caps, support plates, storm collar, flashing and chimney top.
 - 3. Special gas vent shall have an AL 29-4C inner wall, a 430-outer wall, and a 1" air space in between the walls. For special gas vent diameters 16"ID and under, all joints shall be sealed with factory-adhered seals. Field-applied sealant is acceptable for sizes 18"ID and larger.
 - 4. The vent system shall be installed per the vent manufacturer's recommendations and in conformance with the manufacturer's limited warranty.
 - 5. System configuration must conform to the equipment manufacturer's venting recommendations, pertinent local codes, and the most recent edition of NFPA 54 and NFPA 211. Systems not conforming to the most recent edition of NFPA 54 and NFPA 211, a chimney automation system may be selected by Chimney Design Solutions at 212-685-7077.
 - 6. Field-verified layout drawings and draft calculations must be submitted for review and approval of the engineer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0190

PUMPS

PART 1 - GENERAL

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 IN-LINE PUMPS

- A. Furnish and install where indicated on Drawings, ITT Bell & Gossett pumps of model and size indicated on Drawing schedule.
- B. The pumps shall be of the horizontal oil lubricated type specifically designed and guaranteed for quiet operation and suitable for minimum 125-psig working pressure.
- C. The pumps shall have a ground and polished steel shaft with a hardened integral thrust collar. The shaft shall be supported by two (2) horizontal sleeves bearing designed to circulate oil. The pumps are to be equipped with a watertight seal to prevent leakage. Mechanical seal faces to be carbon on ceramic. The motor shall be non-overloading at any point on pump curve.
- D. The motor shall be of the drip-proof, sleeve bearing, quiet operation, and rubber mounted construction.
- E. The Contractor shall furnish and install a magnetic starter for each booster pump with at least two (2) thermal overload protectors. The starter shall be equipped with manual reset buttons.

2.2 BASE MOUNTED PUMPS

- A. The pumps shall be model series 1510 as manufactured by ITT Bell & Gossett with performances noted on the Drawing schedule.
- B. The pumps shall be single stage, vertical split case design in cast iron and bronze construction. The pump's internals shall be capable of being serviced without disturbing piping connections or motor. The impeller shall be of the enclosed type, dynamically balanced and keyed to shaft and secured with a suitable locknut.
- C. Pump seal shall be standard single mechanical seal with carbon seal ring and Remite (or equal) seat. A replaceable shaft sleeve shall be furnished to cover the wetted area of the shaft under the seal of packing.
- D. The bearing frame assembly of the pump shall be fitted with re-greaseable ball bearings equivalent to electric motor bearing standards for quiet operation. The pump and motor shall be mounted on a common baseplate of heavy structural steel design with securely welded cross members and open grouting area.
- E. The pumps shall be factory tested at the operating conditions, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. A set of installation instructions shall be included with the pump at the time of shipment.
- F. The Contractor shall furnish a variable frequency drive for each pump, installed by EC.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0200

HYDRONIC SPECIALTIES

PART 1 - GENERAL

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 AIR SEPARATOR

- A. Furnish and install as shown on Drawings, an external low velocity air separator unit consisting of a steel tank with screwed piping connections and a tapping to connect the air separator directly to the compression tank with screwed piping connections and a tapping to connect the air separator directly to compression tank.
- B. The unit is to be furnished with a steel base and constructed in accordance with ASME boiler pressure vessel code and stamped 125 psi working pressure. The air separator shall be ITT Bell & Gossett "Rolairtrol" or approved equal.

2.2 EXPANSION TANKS

- A. Furnish and install pre-charged bladder type expansion tank of size and capacity as shown on Drawings. Tank shall have carbon steel shell and heavy-duty butyl rubber bladder.
- B. Tank to be constructed for 125 psig working pressure and to be guaranteed leakproof by manufacturer. Tank to be stamped with "U" symbol and Form U-1 furnished denoting compliance with paragraph U-69 for Construction of Unfired Pressure Vessels Section VIII ASME.

2.3 AIR VENTS

- A. Install at all high points automatic air vents to eliminate air binding. All automatic air vents shall be approved heavy duty type equipped with petcocks and tubing for manual venting. All vents installed in coils, etc. shall be of manual key operated type.
- B. All vents concealed from view shall be accessible through access doors. Vents shall be by Hoffman, Anderson, or ITT Bell & Gossett, 125 psig rated.

2.4 PRESSURE GAUGES

- A. Furnish and install pressure gauges on suction and discharge sides of each pump and as required to check operation of equipment; pressure gauges shall have 4-1/2" diameter dials, Ashton, Ashcroft or approved equal.

2.5 THERMOMETERS

- A. Install thermometers at all locations in piping system as noted on Drawings and as required to check system performance. Thermometers shall be installed at the supply and return of coils and 3-way diverting valves as manufactured by Trerice, Weksler or Moeller, with 4-1/2 inch face, cast aluminum case, chrome plated steel ring, white background with black embossed markings, glass window, stainless steel pointer, brass movement, 316 stainless steel bulb. Provide separable, universal angle sockets for all thermometers.

2.6 TRIPLE DUTY VALVES

- A. Furnish and install at each pump a non-slam check valve with a spring-loaded disc and a calibrated adjustment feature permitting regulation of pump discharge flow and shut-off. Valves shall be designed to permit repacking under full line pressure.
- B. Unit shall be installed on discharge side of pump in a horizontal or vertical position with the stem up. Allow for minimum clearance of valve stem. This unit shall be cast iron body construction suitable for maximum working pressure of 175 psig and maximum operating temperature of 300 degrees F.
- C. All units shall be ITT Bell & Gossett Triple Duty Valve model or approved equal.

2.7 SUCTION DIFFUSERS

- A. Furnish and install at each pump a suction diffuser. Units shall consist of angle type body with inlet vanes and combination Diffuser-Strainer-Orifice Cylinder with 3/16-inch diameter openings for pump protection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning.
- B. The orifice cylinder shall be equipped with a disposable fine mesh strainer, which shall be removed after system startup. Orifice cylinder shall have a free area equal to five times cross section area of pump suction opening. Vane length shall be no less than 2-1/2 times the pump connection diameter. Unit shall be provided with adjustable support foot to carry weight of suction piping. Each Suction Diffuser to be ITT Bell & Gossett model, or approved equal.

2.8 COMBINATION BALANCING / SHUT-OFF VALVES (Circuit Sensors /Setters and Flow Meters)

- A. Provide Circuit Sensor/Setter balance valves as manufactured by Bell & Gossett or approved equal.
- B. Circuit Sensors: Furnish and install as shown on Drawings, a cast iron wafer-type flow meter designed for low pressure drop operation.
 - 1. The flow meter will be equipped with brass readout valves (with integral check valve) for taking differential pressure readings across the orifice of the flow meter.
 - 2. The flow meter shall be designed to operate at a maximum working pressure of 300 psig at 250 degrees F.
 - 3. The flow meter must be furnished with a calibrated nameplate for determining an accurate system flow rate.
 - 4. Each flow meter shall be ITT Bell & Gossett Circuit Sensor Flow Meter model no. OP.
- C. Circuit Setters: Furnish and install as shown on Drawings and with manufacturer's recommendations model no. CB calibrated balance valves with model MCY valve kit and braided flexible pipe connections.
 - 1. Valves to be designed to allow installing Contractor to pre-set balance points for proportional system balance prior to system start-up.
 - 2. All valves 1/2 inch to 3-inch pipe size to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings.
 - 3. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be filled with internal EPT inert and check valve.
 - 4. Valve bodies to have 1/4-inch NPT tapped drain/purge port.

5. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve settings. Valves to be leak-tight at full rated working pressure. Valves 4 inch pipe size to be of cast iron body/brass vane construction with differential pressure read-out ports fitted with internal EPT insert and check valve.
- D. Readout Meters: Provide a portable Readout Meter with provision for hanging, capable of indicating pressure differential across a system component. Unit to be complete with all necessary hoses, shut-off and vent valves, and carrying case. Reading range to be .5' to .16'. Read Out Kits to be ITT Bell & Gossett model no. RO-3.

2.9 CHEMICAL FEEDING EQUIPMENT

- A. Chemical Feed System Description:
 1. Closed-Loop System: Provide one bypass feeder on each system with isolating and drain valves with inlet piping connecting to discharge of circulating pumps, and outlet side of feeder connected to suction side of pump unless otherwise indicated. Introduce chemical treatment through bypass feeder when required or indicated by test.
- B. Provide automatic chemical by-pass feeder for new boiler heating plant.
 1. Axiom industries ltd. model SF100-DS. System shall include 55 us gallon storage/mixing tank with cover; pump suction hose with inlet strainer; two pressure pumps with thermal cut-out, pump isolation valves, integral pressure switches; integral check valve; cord and plug; pre-charged accumulator tank with EPDM diaphragm, manual diverter valve for purging air and agitating contents of storage tank, pressure regulating valve adjustable (5 – 55 psig) complete with pressure gauge, integral replaceable strainer, built-in check valve; union connection, 12 mm (½”) x 900 mm (36”) long flexible connection hose with check valve; low level pump cut-out. pressure pumps shall be capable of running dry without damage. power supply 115V/60Hz/1Ph, 0.7 Amps. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard c22.2 no 68.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0280

VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 CONTRACT REQUIREMENTS

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.2 DESCRIPTION

- A. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.
- B. The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFD's that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

- 1. Institute of Electrical and Electronic Engineers (IEEE)
 - a. Standard 519-1992, IEEE Guide for Harmonic Content and Control.
- 2. Underwriters laboratories
 - a. UL508C
- 3. National Electrical Manufacturer's Association (NEMA)
 - a. ICS 7.0, AC Adjustable Speed Drives
- 4. IEC 16800 Parts 1 and 2
- 5. National Electric Code (NEC)
 - a. NEC 430.120, Adjustable-Speed Drive Systems
- 6. International Building Code (IBC)
 - a. IBC 2006 Seismic – referencing ASC 7-05 and ICC AC-156

B. Qualifications:

- 1. VFDs and options shall be UL listed as a complete assembly. VFD's that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs with red label UL stickers, requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.
- 2. CE Mark – The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

3. The entire VFD enclosure, including the bypass shall be seismically certified and labeled as such in accordance with the 2006 International Building Code (IBC):
 - a. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
 - b. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
 - c. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion.
4. Acceptable Manufactures
 - a. ABB ACH Series.
 - b. Alternate manufacturer's requests must be submitted in writing to the Engineer for approval at least 20 working days prior to bid. Approval does not relieve the supplier of specification requirements.
5. The VFD manufacturer shall have available a comprehensive, HVAC Drive Computer Based Training (CBT) product. The CBT product shall include detailed, interactive sections covering VFD unpacking, proper mechanical and electrical installation, and programming. The CBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user's site. The CBT product shall be repeatable, precise and shall include record keeping capability. The CBT product shall record answers to simulations and tests by student ID number. The CBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

1.4 SUBMITTALS

- A. Submittals shall include the following information:
 1. Outline dimensions, conduit entry locations and weight.
 2. Customer connection and power wiring diagrams.
 3. Complete technical product description include a complete list of options provided. **Any portions of this specification not meet must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.**
 4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
 - a. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD's shall include a minimum of 5% impedance reactors, **no exceptions.**

PART 2 – PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

- A. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, exceeding NEMA enclosure design criteria (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
 1. Environmental operating conditions: VFDs shall be capable of continuous operation at 0 to 50° C (32 to 122° F) ambient temperature as per VFD manufacturers documented/submittal data or VFD must be oversized to meet these temperature requirements. Not acceptable are VFD's that can only operate at 40° C intermittently (average during a 24 hour period) and therefore must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.

2. Enclosure shall be rated UL Type 1 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable. NEMA only type 1 enclosures are not acceptable (must be UL Type 1).
 3. Provide NEMA 3R enclosures where exposed to outside weather or wet conditions.
- B. All VFDs shall have the following standard features:
1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
 2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
 3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. Capacitor back-up is not acceptable. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output Form-C relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
 4. The VFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
 5. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, the VFD shall cycle the cooling fans on and off as required.
 6. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
 7. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
 8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
 9. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add an AC line reactor.
 10. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120. Input and output current ratings must be shown on the VFD nameplate.

11. The VFD shall include a coordinated AC transient surge protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
12. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.
13. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure / jam condition causing motor overload
14. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.
15. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.
16. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
17. Provide drive with circuit breaker option and remote panel mounting kit.

C. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (ie. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
4. Two (2) programmable analog inputs shall accept current or voltage signals.
5. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data..

6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC or 24VAC.
 7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
 8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.
 9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.
 10. Seven (7) programmable preset speeds.
 11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
 12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
 13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
 14. The VFD shall include password protection against parameter changes.
- D. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
1. Start-up assistant
 2. Parameter assistants
 - a. PID assistant
 - b. Reference assistant
 - c. I/O assistant
 - d. Serial communications assistant
 - e. Option module assistant
 - f. Panel display assistant
 - g. Low noise set-up assistant

3. Maintenance assistant
 4. Troubleshooting assistant
 5. Drive optimizer assistants
- E. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
1. Output Frequency
 2. Motor Speed (RPM, %, or Engineering units)
 3. Motor Current
 4. Motor Torque
 5. Motor Power (kW)
 6. DC Bus Voltage
 7. Output Voltage
- F. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
- G. Serial Communications
1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available. Protocol provided shall match ATC system in Building. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
 2. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - a. Data Sharing – Read Property – B.
 - b. Data Sharing – Write Property – B.
 - c. Device Management – Dynamic Device Binding (Who-Is; I-Am).
 - d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
 - e. Device Management – Communication Control – B.
 3. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
 4. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input

status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

5. Serial communication in bypass shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.
 6. The VFD / bypass shall allow the DDC to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the DDC system. This allows for remote monitoring of which (of up to 4) safeties are open.
 7. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.
- H. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.
- I. All VFD's through 75HP at 480 V shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not sustain damage from this power mis-wiring condition.
- J. OPTIONAL FEATURES – Optional features shall be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
1. Door interlocked, pad-lockable disconnect switch that will disconnect all input power from the drive and all internally mounted options. Disconnect option shall be available with or without systems requiring bypass.
 2. Field-bus adapters - Protocols such as BACnet IP shall be a plug in modules.
- K. Bypass
1. A complete factory wired and tested bypass system consisting of a door interlocked, pad-lockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.
 2. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the "Off" position before either enclosure may be accessed.
 3. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 Amps and this rating shall be indicated on the UL data label.
 4. The drive and bypass package shall be seismic certified and labeled to the IBC:

- a. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake table test data as defined by ICC AC-156.
5. Drive Isolation Fuses - To ensure maximum possible bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted. Third contactor "isolation contactors" are not an acceptable alternative to fuses, as contactors could weld closed and are not an NEC recognized disconnecting device.
6. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.
7. Motor protection from single phase power conditions - the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.
8. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed. Bypass systems that do not maintain full functionality with the drive removed are not acceptable.
9. Serial communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP.
 - a. Serial communication capabilities shall include, but not be limited to: bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and / or via a Form-C relay output – keypad "Hand" or "Auto" selected, bypass selected, and broken belt indication. The BAS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.
 - b. The bypass serial communications shall allow control of the drive/bypass (system) digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The system digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. All system analog and digital I/O shall be capable of being monitored by the BAS system.
10. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the BAS and / or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause a warning or system shutdown.
11. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 mA of 24 VDC for use by others to power external devices.
12. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open before the motor can run. When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded

- to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override / smoke control mode.
13. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to activate a Form-C relay output, and / or over the serial communications protocol.
 14. The bypass control shall include a programmable time delay bypass start including keypad indication of the time delay. A Form C relay output commands the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.
 15. There shall be a keypad adjustment to select manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will result in an automatic transfer to bypass mode and which faults require a manual transfer to bypass. The user may select whether the system shall automatically transfer from drive to bypass mode on the following drive fault conditions:
 - a. Over current
 - b. Over voltage
 - c. Under voltage
 - d. Loss of analog input
 16. The following operators shall be provided:
 - a. Bypass Hand-Off-Auto
 - b. Drive mode selector
 - c. Bypass mode selector
 - d. Bypass fault reset
 17. The bypass shall include a two line, 20 character LCD displays. The display shall allow the user to access and view:
 - a. Energy savings – in US dollars
 - b. Bypass motor amps
 - c. Bypass input voltage– average and individual phase voltage
 - d. Bypass power (kW)
 - e. Bypass faults and fault logs
 - f. Bypass warnings
 - g. Bypass operating time (resettable)
 - h. Bypass energy (kilowatt hours – resettable)
 - i. I/O status
 - j. Parameter settings / programming
 - k. Printed circuit board temperature
 18. The following indicating lights (LED type) or keypad display indications shall be provided. A test mode or push to test feature shall be provided.
 - a. Power-on (Ready)
 - b. Run enable
 - c. Drive mode selected
 - d. Bypass mode selected
 - e. Drive running
 - f. Bypass running
 - g. Drive fault
 - h. Bypass fault
 - i. Bypass H-O-A mode
 - j. Automatic transfer to bypass selected
 - k. Safety open
 - l. Damper opening
 - m. Damper end-switch made
 19. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS system even with the VFD removed.

20. The on-board Form-C relay outputs in the bypass shall be programmable for any of the following indications.
 - a. System started
 - b. System running
 - c. Bypass override enabled
 - d. Drive fault
 - e. Bypass fault
 - f. Bypass H-O-A position
 - g. Motor proof-of-flow (broken belt)
 - h. Overload
 - i. Bypass selected
 - j. Bypass run
 - k. System started (damper opening)
 - l. Bypass alarm
 - m. Over temperature
21. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
22. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFD's analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps even with the VFD out of service.
23. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat", "FreezStat", "Over pressure" and "Low suction". The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
24. Smoke Control Override Mode (Override 1) – The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire / Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User's Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties. All keypad control, serial communications control, and normal customer start / stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.
25. Fireman's Override Mode (Override 2) – the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the local Authority Having Jurisdiction (AHJ) requires. The Override 2 action may be programmed for "Run-to-Destruction". The user may also force the unit into Override 2 via the serial communications link.
26. Class 10, 20, or 30 (programmable) electronic motor overload protections shall be included.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The VFD shall be furnished by the mechanical contractor and installed by the EC. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.
- B. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current. Caution: VFDs supplied without internal reactors have substantially higher input current ratings, which may require larger input power wiring and branch circuit protection. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.
- B. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

3.4 WARRANTY

- A. The VFD Product Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION

SECTION 23 0300

FANS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 FANS

- A. Furnish and install fans of the type, models, size and capacity indicated on the Drawings. Models indicated are as manufactured by Carnes Company. ACME or Greenheck, with equivalent characteristics will be considered.
- B. Refer to Drawing schedule for required accessories and related appurtenances.

2.2 ROOF EXHAUST FANS

- A. All roof exhaust fans shall be centrifugal roof exhausters of aluminum rustproof construction.
- B. Units shall be direct connected with full ball-bearing motor. Power unit shall be isolated against vibration by means of oil resistant rubber or spring steel mounting.
- C. Provide square insulated curb cap of aluminum with aluminum liner as an integral part of the unit. Each unit shall be equipped with a back draft or automatic damper, disconnect switch for the motor and birdscreens.

2.3 IN LINE FANS

- A. Construction: Unit exterior shall be constructed of heavy gauge galvanized steel. The fan housing shall be square in shape and readily attachable to building ductwork. Unit side panels shall be removable for easy access for maintenance and service. The power assembly shall be removable as a complete module.
- B. Wheel: Wheels shall be of the centrifugal backward inclined type. Wheels shall be constructed of aluminum and contain a matching inlet venturi for optimum performance. Wheels shall be statically and dynamically balanced.
- C. Shaft: Fan shafts shall be precision ground and polished. Shafts shall have a first critical speed of at least 125% of the fan's maximum operating speed.
- D. Bearings: Bearings shall be of the one piece, cast iron, pillow block type with relubricable zerk fittings. Bearings shall be designed for final system balancing.
- E. Drive: Drives shall be sized for a minimum of 150% of driven horsepower. Machined, cast iron motor sheaves shall be adjustable for final system balancing.
- F. Motor: Motor shall be heavy duty ball bearing type, closely matched to the fan load. All motors shall be listed by UL and/or CSA. A disconnect switch shall be factory installed and wired to the fan motors as standard. Motors shall be mounted on the outside of the unit isolated from the airstream. The belt and pillow block ball bearings shall be protected from the airstream by an enclosure.
- G. Backdraft Damper: When no motorized damper is indicated on Drawings at discharge of fan, provide gravity backdraft damper.

- H. Fans shall bear the AMCA ratings seal for Sound and Air performance. Fans shall carry the UL and/or CSA listing mark. Fans shall bear a permanently attached nameplate displaying model and serial number of the unit for future identification.

2.4 CEILING MOUNTED EXHAUST FANS

- A. Ceiling mounted exhaust fans shall be of the centrifugal direct driven type. The wheel shall be of the forward curved design, balanced for extremely low sound levels. The motor shall be a low RPM and permanently lubricated for continuous operation. The motor shall be resilient mount to help reduce vibration.
- B. Duct connectors shall be provided and will include built-in automatic backdraft dampers. Grilles shall be of a durable, low profile design with a white finish. 8-way adjustable mounting brackets will be provided to permit a variety of mounting options. Cabinets shall be constructed of heavy gauge galvanized steel and shall include an acoustic lining.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt, and other foreign substances.

END OF SECTION

SECTION 23 0310

HOT WATER CABINET HEATERS

PART 1 - GENERAL

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 HOT WATER CABINET HEATERS

- A. Furnish and install where indicated on the Drawings hot water cabinet heaters as manufactured by Sterling Co. of model, capacity and performance noted on the Drawing schedule.
- B. The cabinet shall be 16-gauge steel, four side overlap front panels, with M-shaped stiffener running entire panel length as standard. Integral, stamped, inlet and outlet insulated over entire coil section.
- C. Front panel removed with two tamperproof screws and shall be of finish as selected by Architect. Unit to be equipped with factory mounted fan cycling thermostat. Fans are forwardly curved double-inlet centrifugal of aluminum construction and are modular in design.
- D. The water coil is constructed of copper tubing mechanically expanded into aluminum fins. All joints are brazed with high temperature silver alloy. Water coils have a plugged drain tube and vent tube extended into the unit end compartment. Automatic air vent fittings shall be provided. Coils are field reversible.
- E. Filters are removable by removing front panel. 1" woven glass filters standard to be used.
- F. Provide factory finished trim flange for all semi-recessed applications.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0320

HOT WATER UNIT HEATERS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 HOT WATER UNIT HEATERS

- A. Furnish and install where shown on the Drawings model as manufactured by Sterling Co. or approved equal and shall be of sizes noted on the Drawing.
- B. Casing shall be 20-gauge die-formed steel. Casing substrates shall be prepared for finishing with a hot wash, iron phosphatizing clear rinse, chromic acid rinse and oven drying. Paint finish shall be of lead-free, chromate-free, alkyd melamine resin base and applied with an electrostatic two-pass system.
- C. Coil elements and headers shall be of heavy wall drawn seamless copper tubing. Element tubes shall be brazed into extruded header junctions. Pipe connection saddles shall be of cast bronze. Aluminum fins shall have drawn collars to assure permanent bond with expanded element tubes and exact spacing.
- D. Motors shall be totally enclosed, resilient mounted with class B windings. All motors shall be designed for horizontal mounting.
- E. Fans shall be of the aluminum blade, steel hub type designed and balanced to assure maximum air delivery, low motor horsepower requirements and quiet operation. Blades are spark proof. Fan guards shall be welded steel, zinc plated or painted.
- F. Units shall be equipped with horizontal, individually adjustable louvers. Vertical louvers for 4-way air control shall be available as an optional extra.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0330

HOT WATER CONVECTORS

PART 1 - GENERAL

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 CONVECTORS

- A. Furnish and install Convectors as manufactured by Sterling Co., Airtherm Co. and American Air Filer Co. considered equal as indicated on the Drawings. Type and size as noted on Drawing. Unit shall be installed in a neat and workmanlike manner in accordance with the Specifications and manufacturer's recommendations.
- B. Convector element shall be constructed of copper tubes expanded and rolled into cast iron headers with contact further strengthened by brass bushings, aluminum fins, ribbed steel side plates and fin tube supports.
- C. Cabinet shall have a one piece 14-gauge steel front panel. Front panel shall be held in place by camlock fasteners.
- D. Dampers shall be factory mounted on the element to reduce heating capacity up to 70% when closed. Key operated damper tamperproof. Baked enamel finish shall be provided in standard manufacturer's colors as selected by the Architect. Unit shall have (camlock) access doors to provide access to valves.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0340

FIN-TUBE RADIATION

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 FIN TUBE RADIATION

- A. Furnish and install fin-tube heating elements and enclosures, indicated on Drawings, together with required mounting components and accessories.
- B. Materials shall be as manufactured by Sterling Radiator Co., Vulcan Radiator Co. or Standard Fin-Pipe Radiator Corp.
- C. Heating Elements
 - 1. Various lengths and assemblies are indicated on the plan together with their pipe sizes, fin sizes, and spacing. Elements shall be completely independent of and shall not touch enclosures to assure low surface temperature.
 - 2. Heating elements shall consist of full-hard aluminum plate fins not less than .20" thick, permanently bonded to copper seamless drawn tube and guaranteed for working pressure at 300 degrees F not less than 200 psi for 1-1/4" tube. Fins shall be actually embedded in the copper tube.
- D. Enclosure and Accessories
 - 1. Enclosures and accessories shall be of style and dimensions indicated on our Drawings and shall be fabricated from zinc-coated steel. Enclosures shall be 16 gauge. On wall-to-wall applications, enclosures shall be furnished in one piece up to a maximum of 10' - 10" enclosure length for rooms or spaces measuring a maximum of 10' - 10" wall length, using a 6" end trim each end. Enclosures shall be furnished in two or more lengths for wall lengths exceeding 10' - 10".
 - 2. Left end of all enclosures shall have spot-welded back-up angles. The mating right end shall be fastened securely with screws. End enclosures shall have same method of joining.
 - 3. End trims, furnished with roll-flanged edges, shall be used between ends of enclosures and walls on wall-to-wall applications. End trims to be 6" maximum length and shall be attached without visible fasteners. End enclosures shall be furnished where indicated, shall be same gauge as enclosures, and be factory-welded to enclosures.
 - 4. Enclosures shall be supported at top and bottom by means of heavy gauge mounting channel and allow installation and removal of enclosures without scraping walls or disturbing paint lines. Enclosures are securely fastened to the bottom support.
 - 5. Access doors shall be provided where noted on Drawings. Doors shall be 8" x 8" and shall be located directly in the enclosures. Doors shall be hinged. Where radiation is located behind casework coordinate access door locations with casework vendor.

6. Provide vertical and horizontal enclosure for pipe risers and runouts which are exposed above/below/adjacent to radiation enclosure. Riser enclosure shall be of same gauge and finish as radiation enclosure. Provide wall plate which enclosure shall snap onto without exposed fasteners. Sterling model PCH (V).
 7. Enclosure finish shall be as selected by Architect (and shall match unit ventilator finish when unit ventilators are also specified for the project).
- E. Enclosure Brackets and Element Hangers
1. Enclosure bracket and element hangers shall be installed not farther than 4' apart. Brackets shall be die-formed from 3/16" thick stock, 1-1/2" wide, and shall be lanced to support and position lower flange of enclosure. Enclosures shall be firmly attached to brackets by set screws, operated from under the enclosure. Devices, which do not provide positive fastening of enclosures, are not acceptable. Brackets shall be inserted in pre-punched slots in mounted channel to ensure correct alignment and shall be fastened securely to wall at bottom.
 2. Sliding saddles shall support heating elements and provide positive positioning of element in enclosure to insure maximum heating efficiency while preventing any possibility of fin impingement on brackets or enclosure joints during expansion or contraction. Element supports shall be a double saddle design fabrication from 16-gauge zinc-coated steel.
 3. Saddle shall slide freely on saddle support arm bolted to support bracket. Support arm shall allow 1-1/2" height adjustment for pinch. The element support saddle shall allow 1-5/8" lateral movement for expansion and contraction of heating element. Rod or wire hangers not acceptable.
 4. Submit shop drawings of all heating elements and enclosures. Enclosure measurements and accessories are not to be fabricated until after verified measurements have been taken at the site.
- F. Piping Enclosures: Where concealed piping in ceilings and wall of finished spaces is not possible, provide vertical or horizontal metal piping enclosures equal to "Sterling" model PCH (horizontal) or PCHV (vertical). Provide all required hangers, supports, corners, brackets, etc. color per Architect.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0400

SHEETMETAL WORK AND RELATED ACCESSORIES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements shall govern work in this section. Submit shop drawings for checking and approval.

PART 2 - PRODUCTS

2.1 SHEETMETAL DUCTWORK

- A. Contractor shall furnish and install all sheetmetal ducts as shown on the Drawings. While the Drawings shall be adhered to as closely as possible, the Engineer reserves the right to vary the run and size to meet the field conditions. Any duct size not shown shall be sized in proportion to the air carried at the same resistance in similar ductwork, or of size as directed.
- B. All ductwork shall be constructed of galvanized steel gauges in accordance with the latest edition of the ASHRAE/SMACNA Guide. Bracing angles for ductwork shall be hot dipped galvanized for steel ductwork and appropriate gauge for aluminum ductwork. All ducts 18" and over in width shall be cross broken to prevent flutter.
- C. Round ductwork shall be galvanized steel, spiral lock seam construction of gauges in accordance with the latest edition of ASHRAE/SMACNA guide. Fittings shall be constructed in standing seam manner. All seams, joints and collars shall be sealed in accordance with SMACNA guidelines for medium pressure ductwork to minimize noise and streaking. Ductwork and fittings shall be connected with sheetmetal couplings and sealed as to allow no leakage.
- D. Ducts shall be braced as follows:
 - 1. All ducts not exceeding 24" on one side shall be assembled with airtight slip joints.
 - 2. 25" to 40" larger dimension 1" x 1" x 1/8" angles.
 - 3. 41" to 60" larger dimension 1-1/2" x 1-1/2" x 1/8" angles.
 - 4. All bracing angles shall be a minimum of 4' apart along the length of the duct.
 - 5. Furnish and install all angles and frames for all registers, diffusers, grilles, and louvers.
 - 6. Support horizontal ducts with hangers spaced not more than 8' apart. Place hangers at all changes in direction. Use strap hangers for cuts up to 30" wide.
- E. Comply with all State and Local regulations regarding fire stopping and fireproofing. Provide fusible link fire dampers as required by State, local and Underwriter authorities and where indicated on the Drawings. Each fire damper shall be installed in such a manner as to permit ready access for inspection and maintenance purposes.
- F. Provide splitter and butterfly dampers, deflecting vanes for control of air volume and direction and for balancing systems, where indicated, specified, directed and as required for the proper operation of the systems. Dampers shall be of the same material as the duct, at least one gauge heavier than the duct, reinforced where indicating quadrant and locking device for adjusting damper and locking in position.

- G. Where ducts fewer than 100 square inches penetrate a rated wall, steel ductwork system of a minimum 0.0127-inch thickness shall be used.
- H. All elbows shall have a minimum center line radius of 150% of duct width. If the radius is smaller, turning vanes shall be used: Turning vanes shall be double thickness, fitted into slide strips and screwed or riveted to duct below.
- I. Contractor shall furnish and install all access doors in ducts as required. Access doors shall be of the pan type 1" thick and shall be provided with two galvanized hinges and suitable latched. Access doors insulated with same thickness material as duct and shall be double casing construction.

2.2 REGISTERS AND DIFFUSERS

- A. Registers and diffusers shall be installed where shown on the Drawings and shall be of the sizes specified and the type indicated on the drawing schedule.
- B. All registers and diffusers shall be installed in accordance with manufacturer's recommendations.
- C. Registers and diffusers shall be as manufactured by Carnes, Hart and Cooley or Anemostat Co.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0410

PIPING, FITTINGS, VALVES AND NOTES (HOT WATER)

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements shall govern work in this section. Submit shop drawings for checking and approval.

1.1 PIPING NOTES

- A. The Contractor shall erect all pipe, fittings, valves, hangers, anchors, expansion joints and all accessories specified, indicated on the Drawings, or required to assure proper operation of all piping systems installed under this Contract. All piping shall be maintained at a proper level to assure satisfactory operation, venting and drainage. Piping and valves in any locality where possible shall be grouped neatly and shall be run to avoid reducing headroom or passage clearance.
- B. All piping shall be new and of the material and weight specified under various services. Steel and wrought iron pipe 2" and larger shall be seamless or lap welded. All piping shall have the maker's name and brand rolled on each length of pipe.
- C. All piping, fittings, valves and strainers shall be cleaned of grease, dirt and scale before installation. All temporary pipe openings shall be kept closed during the performance of the work. The ends of all piping shall be reamed smooth and all burrs removed before installation.
- D. All piping shall be cut accurately to measurements taken on the job. Offset connections shall be installed alignment of vertical to horizontal piping and where required to make a true connection and to provide for expansion. Bent or sprung pipe shall not be installed where shown on Drawings and where necessary to provide for expansion of piping. Cold spring hot lines one-half estimated distance of maximum expansion. Suitable pipe anchors shall be installed where shown or required.
- E. Piping connections shall have unions where necessary for replacement and repair of equipment. Gate valves and controls valves shall be installed where shown and where necessary for proper operation and service.
- F. Vertical piping shall be plumb and horizontal piping shall be parallel to walls and partitions. Piping shall be supported as required to prevent the transmission of noise and vibration.
- G. Work shall include all pipe, fittings, offsets, and requirements for the installation of piping of other work including ducts and conduit. Reducing fittings shall be used where pipe changes size. All piping shall be installed with ample clearance to center accurately in sleeves through floors, and walls and partitions.
- H. Piping shall be downgraded to drain connections at low points and upgraded to vent connections at high points unless otherwise noted. Drain connections shall be valved and piped to a floor drain. Vent connections on mains shall be equipped with air vent valves fitted with a copper tube drip line extended to a drain outlet. Vent connections on branches and equipment shall be fitted with key type manual vent cocks.
- I. Drain piping shall be installed from all equipment as required. The Contractor shall extend drain piping and turn down over floor drains.

PART 2 - PRODUCTS

2.1 PIPING (ABOVEGROUND)

- A. All piping installed under this Section of the Specifications shall be in accordance with the following schedule.
 - 1. All piping, except where indicated differently, (i.e. underground piping) shall be standard weight black steel pipe Schedule 40, Grade A53, black steel. Pipe 2" and smaller, cast iron screwed fittings. Pipe 2-1/2" and larger, steel welding fittings. Pipe and fittings as manufactured by National, Wheeling, Bethlehem or equal, manufactured in accordance with ASTM current edition. All pipes must be reamed before installation.
 - 2. Where the Contractor elects to use copper piping, it shall be rigid Type "L" copper, Chase, Anaconda or approved equal. Fittings shall be wrot copper, Nibco, Anaconda, Mueller or approved equal. Where copper piping is used, make all additional provisions for expansion. All condensate piping shall be Type "M" copper, rigid, full size of unit drain tapping, or larger as shown on Drawings.
 - 3. All drainage pipelines, 2" larger except where galvanized screw pipe is shown on the Drawings or specified hereafter, shall be extra heavy cast iron soil pipe and fittings.
- B. Piping installation shall be arranged for draining through accessible valves at low points.
- C. Threaded short and close nipples shall be Schedule 80, extra heavy weight of the same material as pipe in system in which they are installed.
- D. All bare copper pipe, tubing and fittings shall be cleaned with steel wool and all excess solder shall be removed.

2.3 VALVES

- A. All valves, unless specified or noted otherwise, shall be designed for a working pressure of not less than 200 psi water or 125 psi steam with name and pressure rating of valve cast in body. All valves shall be of the same manufacturer, unless specified otherwise. Valves for cut-off shall be gate valves, unless otherwise specified.
- B. All valves of same manufacturer: similar to Jenkins Bros., Walworth, Kennedy or approved equal.
- C. Four inch and larger, flanged; smaller sizes, screwed.
- D. All Gate and Globe valves shall be installed with handle in an upright position.
- E. The Contractor shall furnish and install all valves shown on Drawings and all valves that are necessary for proper operation and maintenance of systems and equipment. All piping connections to each piece of equipment and all branch connections to mains shall have cut-off valves.
- F. The following schedule of valves for steam condensate, hot water, etc. is based on Jenkins Brothers, Inc. catalog numbers (except as noted); equivalent Lukenheimer, Walworth, O-I-C, Crane Fairbanks Company valves will be acceptable.
- G. Ball Valves
 - 1. 1/4" to 2-1/2" rated for 600 psi wog, with brass body, chrome plated brass ball, virgin PTFE seats, and full port with threaded or solder connections.

2. 2-1/2" and larger rated for 200 psi with carbon steel body, stainless steel full port ball, RTFE seats, lever operated to 4" gear operated 6" and above, with flanged end connections.

H. Gate Valves

1. Up to 2": Bronze gate solid wedge, inside screw traveling stem union bonnet, -Fig. 47U
2. 2-1/2" and 3": Iron body, bronze-mounted gate, solid wedge, OS&Y rising stem, -Fig. 650-A
3. 4" and larger: Iron body, bronze-mounted gate, solid wedge, OS&Y rising stem, -Fig. 651-A

I. Globe Valves

1. Up to 2": Bronze body, regrinding seat ring and plug, union bonnet, -Fig. 546P
2. 2-1/2" and 3": Iron body, bronze-mounted globe and angle, regrinding disc and seat ring, OS&Y - Fig. 613
3. All gate valves 6" and larger: Fitted 3/4" by-pass globe valve.

J. Plug Valves

1. Up to 2": Lubricated, semi-steel short pattern wrench operated, -Fig. 142
2. 2-1/2" and larger: Lubricated, semi-steel short pattern wrench operated, -Fig. 143
3. Similar to Rockwell Mgd. Co., Jenkins, Kennedy or approved equal.

K. Butterfly Valves used for chilled water, condenser water and hot water shall be the following:

1. 2-1/2" to 12" rated for 175 psi bubble tight close off, 14" and larger for 150 psi close-off.
2. Full lug cast iron body, aluminum bronze disc, stainless steel stem EPDM peroxide cured seat.
3. 2-14" to 6" valves to be equipped with 10 position notch plate and lever lock handle. 8" and larger with handwheel gear operator.
4. On installation, valves to be in fully open position when flange bolts are tightened and stem in a horizontal position except when equipped with a chainwheel gear operator.
5. Provide chain wheel gear operator on all valves installed 7 feet or higher.
6. Valves to be designed with replaceable seat and parts kits.
7. Valve to be Bray series 31, Dezurik 637 or Demco.

L. Check Valves

1. 150 psi WSP class.
2. Up to 2" : Bronze, regrinding bronze disc, screw-in cap, -Fig. 762A
3. 2-1/2" and 3" : Iron body, bronze mounted regrinding bronze seat ring and disc, -Fig. 623
4. 4" and larger: Iron body, bronze mounted regrinding bronze seat ring and disc, -Fig. 624

- M. Drain Valves: All low points shall have drain valves, with hose ends. Where 1/2" and 3/4" sizes are indicated, "Standard" hose end drain valves shall be used. Provide brass hose end drain caps at each drain valve. Where larger than 3/4" drains are shown, gate valve shall be used. Provide brass nipples and reducer from drain valve size to 3/4" terminating with 3/4" hose end drain valve and cap.

2.4 FITTINGS

A. Nipples

1. All nipples shall have clean cut threads and shall be made from new pipe, standard weight for all lengths, except that close and shoulder nipples shall be extra heavy.
2. Fittings - 2-1/2 and Smaller: All fittings shall be standard weight steam pattern gray cast iron, Grinnell, Stockholm or equal approved.
3. Fitting - 3" and Larger: The Contractor has the option to use screwed, flanged or welded fittings so long as all ASME requirements are met.

B. Joints and Unions

1. Threaded joints shall be full and clean cut. The ends of pipe shall be reamed to the full inside diameter, all burrs shall be removed and no more than three threads shall be exposed beyond fittings when made up. Joints shall be made up tight with graphite base pipe joint compound. Exposed threads of ferrous pipe shall be painted with acid-resisting paint after caulking, lampwick or other material will be allowed for correction of defective joints.
2. Flange joints shall be made up perfectly square and tight. Screwed flanges and loose flanges shall be cast iron and welding flanges shall be steel. Flanges shall be faced true and bolted up tight with 1/16" Carlock ring type gasket.
3. Bolts shall be high quality steel with hexagon nuts and heads. The Contractor shall apply grease to threads of bolt.
4. Welded joints in piping shall be by the electric or oxyacetylene process using welding rods if the characteristics similar to pipe material and as recommended by the pipe manufacturer and shall be done in accordance with the ASME Code for pressure piping. Welding shall be done by qualified welders under the requirements of the ASME Boiler and Pressure Vessel Code.
5. The pipe lengths shall be aligned with welding rings and the abutting pipe ends shall be concentric. Prior to welding, the groove and adjacent surfaces shall be thoroughly cleaned of all grease, scale, or rust. During welding, all slag, or flux remaining on the bead shall be removed before laying down the next bead. The welding metal shall be thoroughly fused with the base metal at all sections of the weld. Short lengths of pipe may be beveled on the job with oxyacetylene torch, provided all scale and oxides are removed.
6. Joints shall be butt-welded, single V-type. All fittings shall be steel welding fittings. Elbows and fittings formed with coupling or welded cut pipe sections shall not be acceptable.
7. Bonney Weldolets or welding saddles may be used for branch connections, which are less than one-half the size of the main to which they connect.
8. Ground Joint Unions, Flange Connections, Reaming & Filling Ground joint unions shall be 200 lb. s.w.p. for brass. Flanges shall be 150 lb. s.w.p. for brass, 125 lb. s.w.p. for cast iron.

9. Ground joint unions of flanges shall be used only on exposed accessible piping. Where concealed, right and left nipples and couplings must be used. Where flanged connections are used, full size gaskets must be inserted.
- C. Threads: Shall be standard, clean cut and tapered. All piping shall be reamed free from burrs. All piping shall be kept free of scale and dirt. Caulking of threads will not be permitted. All piping shall be threaded and made up in accordance with the current edition of the ASA Standard Specifications for pipe threads.
- D. Unions
1. Unions for use on ferrous pipe 2" and smaller shall be malleable iron with brass to iron ground joint spherical seat and threaded connections. Unions 2 1/2" and over shall be flanged type with gasket.
 2. Unions for copper tubing shall be cast bronze conforming to ASA B16. The Contractor shall furnish adapters where required for copper pipe.
 3. Where copper pipe connects to ferrous pipe or metals, the Contractor shall furnish EPCO isolating type dielectric unions. Plastic type isolating bushings are not acceptable.
 4. Unions shall be installed wherever necessary for repair or replacement of equipment, valves, strainers, etc. Final connections to equipment shall be made in a manner that will permit removal without cutting of pipelines.
- E. Solder
1. All sweat joints shall be made up with 95/5 solder.
 2. Solder shall be National Lead or approved equal. Flux shall be non-toxic and non-corrosive.
 3. All copper tubing ends shall be reamed, filed and cleared of burrs and rough edges. All pipes shall be reamed after cutting and threading.
- F. Expansion
1. The entire piping installation shall be installed with adequate provision for expansion. No rigid connections will be permitted.
 2. Branches shall be of sufficient length and have 3 elbow swings to allow for pipe expansion.
 3. Provide expansion joints, guides, and anchors equal to "Metra-Flex Metra Loops" where indicated on Drawings and where necessary for proper expansion compensation. Submit shop drawing.
 4. Any breaks in the piping within the guarantee period due to improper provision for expansion must be replaced at the expense of this Contractor, and the conditions corrected to prevent future recurrence.
 5. Any damages to surrounding areas and equipment due to this failure shall also be repaired and paid for at the expense of the Contractor.
 6. Joints to have 150 psi rating, ANSI-B16.5 with liner and cover.

2.5 PIPING SLEEVES

- A. Furnish sleeves built into place for all piping passing through walls, floors or building construction. Sleeves, not less than 1/2" larger in diameter than piping and its covering, if any, and extending full depth of construction pierced. Pack sleeves through walls/floors in accordance with Underwriters' Requirements.

- B. Sleeves piercing exterior walls, integral waterproofed walls shall be standard weight steel piping. Furnish welded center flange buried in construction for sleeves through exterior walls below grade. At exterior walls, make pipes watertight in sleeves with oakum packing and caulked lead joints on both sides of wall. All other sleeves: Galvanized sheet steel with lock seam joints, #22 USSG for 3" or under. Sleeves for piping 4" and larger, #18 USSG.
- C. Pipes passing through interior membrane waterproofed floors, cast iron flashing sleeve, with integral flashing flange and clamping ring, similar to Josam Series #1880. Adjust sleeves to floor construction with steel or wrought iron pipe nipples top and bottom, extending 3" above finished floor. Burn & J.R. Smith are equal.
- D. Pipes passing through membrane waterproofed walls, cast iron flashing sleeve with internal flashing flange and clamping ring similar to Josam Series #1870. Make pipes watertight in sleeves with oakum packing and caulked lead joints. Burn & J.R. Smith are equal.
- E. For flashing sleeves specified in Pars. C and D, lead flashing extended at least 10" around flashing sleeves, securely held in place by clamping device.

2.6 PIPING ENCLOSURES

- A. Where concealed piping in ceilings and wall of finished spaces is not possible vertical or horizontal metal piping enclosures equal to "Sterling" model PCH (horizontal) or PCHV (vertical). Provide all required hangers, supports, corners, brackets, etc. color per Architect.

PART 3 - EXECUTION

3.1 GENERAL NOTES - PIPING NOTES, DRAINING, VENTING AND MISCELLANEOUS WATER SPECIALTIES

- A. Piping shall be installed as indicated on Drawings. Elevations and dimensions are indicated as a guide only and are subject to change with actual job conditions.
- B. Except for drainage piping, which shall pitch down with flow, mains shall pitch upward or be installed dead level as indicated. Horizontal runs shall be parallel to walls.
- C. In general, all branch connections shall be top of bottom 45 degree or 90 degree, pitching up or down from mains.
- D. Where indicated, flexible connectors shall be installed. All final connections to equipment, pumps, units, etc. shall have companion flanged, flange unions or ground joint unions. (125 lbs.)
- E. All piping shall be adequately supported with approved type hangers so as to prevent absolutely any sagging of lines, or any undue strain on pipes or fittings. All pipelines shall be capped during construction to prevent entry of dirt or other foreign material. All piping lines after erection shall be blown or flushed out to render the piping system as clean as possible before system water is added for operation.
- F. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.
- G. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

- H. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.2 DRAINING

- A. All low points shall have drain valves with hose ends. Where 1/2" and 3/4" sizes are indicated, "Standard" hose end drain valves shall be used. Provide brass hose end drain caps at each drain valve. Where larger than 3/4" drains are shown, gate valve shall be used. Provide brass nipple and reducer from drain valve size to 3/4" terminating with 3/4" hose end drain valve and cap.

3.3 VENTING (For Hot Water)

- A. All high points in piping shall be vented automatically with float vents. At all high points of piping, whether specifically indicated or not, provide Maid-o-Mist or B&G No. 7 or 27 Air Eliminators with shut off cock, auxiliary key vent and copper tubing overflow carried to floor along wall as indicated or directed.

3.4 WATER SPECIALTIES

- A. Air Vents: Install at all high points automatic air vents to eliminate air binding. All automatic air vents shall be approved heavy duty type equipped with petcocks and tubing for manual venting. All vents installed in coils, etc. shall be of manual key operated type. All vents concealed from view shall be accessible through access doors. Vents shall be by Hoffman, Anderson or Bell & Gossett, 125 psig rated.
- B. Pressure Gauge: Furnish and install pressure gauges on suction and discharge sides of each pump and as required to check operation of equipment; pressure gauges shall have 4-1/2" diameter dials, Ashton, Ashcroft or approved equal.
- C. Install thermometers at all locations in piping system as noted on Drawings and as required to check system performance. Thermometers shall be installed at the supply and return of coils and 3-way diverting valves as manufactured by Trerice, Weksler or Moeller, with 4-1/2 inch face, cast aluminum case, chrome plated steel ring, white background with black embossed markings, glass window, stainless steel pointer, brass movement, 316 stainless steel bulb. Provide separable, universal angle sockets for all thermometers.

END OF SECTION

SECTION 23 0420

SUPPORTS, SLEEVES AND PLATES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. This Contractor shall furnish and install all plates, hangers and supports for his equipment including piping, headers, fans expansion tank, ductwork, etc.
- B. All ductwork, piping and equipment shall be hung or supported from structural members only.

PART 2 - PRODUCTS

2.1 PIPING, DUCTWORK AND EQUIPMENT

- A. All piping shall be supported from building structure in a neat and workmanlike manner wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze hangers. Vertical risers shall be supported at each floor line with steel pipe clamps. Use of wire perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted.
- B. Necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations shall be furnished and installed. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.
- C. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot.
- D. Pipe hangers shall be as manufactured by Grinnell, whose catalog numbers are given herein, or equivalent Carpenter and Paterson, or F&S Mfg. Co.
- E. Piping shall be supported as follows unless otherwise indicated on the Drawings:
 - 1. Heating piping shall be 1-1/2 " and smaller Fig. #260 adjustable clevis hanger. 2" and larger Fig. #174 one-rod swivel roll hanger.
 - 2. Two-rod hangers shall be used for piping close to the ceiling slab or where conditions prohibit use of other hanger types.
 - 3. Anchors for hanger rods shall be Phillips "Red Head" self-drilling type. Anchors shall be placed only in vertical surfaces.
 - 4. Spacing of pipe supports shall not exceed 8 feet for pipes up to 1-1/2" and 10 feet on all other piping.
 - 5. Hangers shall pass around insulation and a 16-gauge steel protective cradle; 12" long shall be inserted between hangers and insulation. Insulation under cradle shall be high density calcium silicate or approved equal to prevent crushing.

6. All piping shall be supported to allow free movement where expanding or contracting. Pipe shall be anchored as required or directed.
 7. All lateral runs of piping shall be securely supported on hangers, rolls, brackets, etc. and in manner to allow for proper expansion and elimination of vibration.
 8. 2" and smaller pipe, where run on walls, shall be supported on wrought iron "J" hook brackets with anchor bolts.
 9. All horizontal pipe, where run overhead or on walls, shall be supported as follows unless otherwise indicated: On adjustable steel clevis type hangers suspended on hanger rods, pipe sizes up to and including 4".
- F. Space limitations in hung ceilings spaces and conditions in other locations may require use of other type of hangers than those specified above. Suitable and approved pipe hangers shall be provided for such job conditions.
- G. All supports shall be fastened to structural members or additional steel supports furnished by this Contractor.
- H. Hanger rods shall be steel, threaded with nuts and lock nuts sizes in accordance with the following schedule:
- | <u>Pipe Size</u> | <u>Rod Size</u> |
|-------------------------|-----------------|
| 3/4" to 2" inclusive | 3/8" |
| 2-1/2" and 3' inclusive | 1/2" |
| 4" and 5" inclusive | 5/8" |
| 6" | 3/4" |
| 8" to 12" inclusive | 7/8" |
- I. Hangers for copper tubing shall be tacked up with formed lead sheet on which tubing or pipe shall be placed.
- J. Where pipes pass through masonry, concrete walls, foundations, or floors, this Contractor shall set sleeves as are necessary for passage of pipes. These sleeves shall be of sufficient size to permit insulation where required to be provided around pipe passing through. This Contractor shall be responsible for exact location of these sleeves.
- K. Sleeves shall not be used in any portion of building where use of same would impair strength of construction features of the building. Inserts for supporting lateral pipes and equipment shall be placed and secured to form work, and all sleeves inserts locations shall be thoroughly checked with Architect so as not to conflict with other trades.
- L. Where pipes pass through floor or walls, they shall be provided with chromium plated escutcheons.
- M. Anchor horizontal piping where indicated and wherever necessary to localize expansion or prevent undue strain on branches. Anchors: Heavy forged construction entirely separate from supports.
- N. Anchor vertical piping wherever indicated and wherever necessary to prevent undue strain on offsets and branches. Anchors, unless otherwise noted: Heavy steel clamps securely bolted and welded to pipes. Extension ends shall bear on building construction.

- O. Ducts shall be hung with 1" x 1/8" metal straps. When width of duct is less than 48", hangers shall be fastened to side of ducts. Auxiliary steel supports that may be required for all mechanical equipment shall be furnished and installed by this Contractor. All operating equipment including fans, piping, etc. shall be supported so as to produce minimum amount of noise transmission.
- P. Refer to "General Requirements for Mechanical and Electrical Trades" as well.

2.3 POWDER-ACTUATED FASTENERS IN PRECAST CONCRETE

- A. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type required and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance to ASTM E 1190 conducted by a qualified independent agency. Anchors shall not be installed where reinforcing strands are located in plank. Review precast plank shop drawings to determine location.
- B. Refer to precast concrete plank shop drawings for location of strand reinforcing and cores. Do not anchor where reinforcing is located. Use powder-actuated fasteners in concrete, toggle bolts or thru core anchors with plates supported on top of plank in cores.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION

SECTION 23 0430

INSULATION AND COVERINGS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 DESCRIPTION OF WORK

- A. Furnish insulation for all piping, equipment and sheetmetal work as noted.
- B. Insulate no piping, ducts or equipment until tested and approved for tightness. All piping and ducts shall be dry when covered. Where existing insulation has been damaged, altered or removed during the course of the work, it shall be replaced with new insulation in a neat manner to match the adjacent insulation.
- C. All insulation must be done by an approved Sub-Contractor or by mechanics skilled in this line of work.
- D. Fire hazard classification shall be 2550 per ASTM E-84, NFPA 255 and UL 723. Insulation shall be rated non-combustible type classified flame spread - 25, smoke developed - 50.

PART 2 - PRODUCTS

2.1 DUCTWORK (INDOOR)

- A. All supply, outside air intake and exhaust (on discharge side of fan) and return (in unconditioned spaces) ductwork shall be covered with fiberglass with aluminum foil vapor barrier. All joints shall be lapped so maximum coverage is achieved.
- B. All insulated ductwork shall be insulated with fiberglass board insulation with canvas finish in areas where ductwork is exposed.
- C. Insulation thickness shall be in accordance with the latest edition of the New York State Energy Conservation Construction Code.
- D. Thermal acoustic lining of ductwork shall be 1-1/2" thick elastomeric foam duct lining Armacel Model AP Coil-Flex. The lining shall provide energy efficiency, indoor air quality and acoustic reducing properties and shall meet the Life Safety Standards as established by NFPA 90A and 9B and conform to the requirements of ASTM C 1071.
- E. Insulate Kitchen exhaust ductwork per NFPA requirements (double layer flexible fire barrier duct wrap (for 3hour rating) or minimum 2" thick calcium silicate insulation) and all other agencies having jurisdiction.

2.2 DUCTWORK (OUTDOOR)

- A. All exposed ductwork shall be insulated with 2" thick closed cell, flexible elastomeric foam thermal and acoustic insulation (Armacel Model AP Armatuff SA or approved equal with weatherproof liner).
- B. Cover insulation watertight with a weather-proofing cladding composite membrane consisting of a multiply embossed UV-resistant aluminum foil/polymer laminate to which is applied a layer of rubberized asphalt specially formulated for use on insulated duct and piping applications. The rubberized asphalt acts as the substrate adhesive and provides the self-healing characteristics necessary to seal around punctures. Protecting the rubberized asphalt is an easily removed plastic release liner which gives its peel and stick functionality.

- C. Insulation and covering shall be installed per manufactures recommendations and requirements. Make proper provision with ductwork support(s) so that insulation is not crushed.
- D. Make proper provision with ductwork support(s) so that insulation is not crushed.

2.3 PIPING / EQUIPMENT (INDOOR)

- A. All new or altered hydronic water system supply and return piping (not located in the crawl space or pipe tunnels shall be covered with Manville Micro-Lok or equal approved fiberglass insulation with all service (factory applied) vapor retardant jacket. Seal with type H mastic. All new or altered hydronic water system supply and return piping (located within the crawl space or pipe tunnels shall be insulated with elastomeric type closed cell Armacel Armaflex Tubes pipe insulation or approved equal. The lining shall provide energy efficiency, indoor air quality and acoustic reducing properties and shall meet the Life Safety Standards as established by NFPA 90A and 9B and conform to the requirements of ASTM C 1071.
- B. Fittings shall be insulated with same material and thickness as adjoining pipe insulation and shall be pre-molded fittings or miter cut segmental insulation wired on. Over the fiberglass insulation, apply a wrapper of OCF glass cloth sealed with type H mastic. Apply aluminum bands on pipe covering in addition to self-sealing feature.
- C. Fiberglass Insulation Material: Molded fibrous glass insulation, density not less than 4 lbs. per cubic foot.
- D. Insulation Thickness: Shall be in accordance with the latest edition of the New York State Energy Conservation Construction Code.
- E. Fiberglass Insulation Jacket and Finish: White flame-retardant type, meeting all requirements of "Fire Hazard Classification" of NFPA, similar to "Fiberglass" Type FRJ, Insul-Coustic, Johns-Manville or approved equal.
- F. Insulation and Finishes for Fittings, Valves and Flanges
 - 1. Valves, fittings and flanges other than vapor seal insulation: Insulated in same manner and same thickness as piping in which installed.
 - 2. Use pre-molded sectional covering where available; otherwise use mitered segments of pipe covering.
 - 3. Obtain written approval prior to using other than molded sectional covering.
- G. Vapor seal Insulation for Valves, Fittings and Flanges: Same as above, except joints sealed with vapor barrier adhesive and wrapped with glass mesh tape. Each fitting shall be finished with two coats of vapor seal mastic adhesive.
- H. Jacket and Finishes: Exposed fittings - 6 oz. canvas jacket adhered with lagging adhesive.
- I. Concealed fittings: Standard weight canvas jacket adhered with lagging adhesive and with bands of 18-gauge copper coated steel - 2 bands at elbows, 3 at tee.
- J. Insulation at Pipe Hangers
 - 1. Where shields are specified at hangers on piping with fibrous glass covering, provide load bearing calcium silicate between shields and piping as follows:
 - a. For pipe covering without vapor barrier jacket, furnish at each shield 12" - long calcium silicate section with canvas section with canvas jacket continuous between shield and insulation.

- b. For pipe covering with vapor barrier jacket, furnish at each shield 12" - long vapor barrier jacket section with section of fibrous glass replaced with section of calcium silicate. Vapor barrier jacket, continuous between shield and insulation for continuous vapor barrier.
- K. Condensate drain and refrigerant piping shall be insulated with 1/2" Imcosheild un-split polyolefin insulation.
- L. Equipment
 - 1. Secure fibrous glass block or board insulation in place with wire or galvanized steel bands.
 - a. Small Areas: Secure insulation with 16-gauge wire on maximum 6" centers.
 - b. Large Areas: Secure insulation with 14-gauge wire or .015" thick by 1/2" wide galvanized steel bands on maximum 10" centers. Stagger insulation joints.
 - c. Irregular Surfaces: Where application of block or board insulation is not practical insulate with insulating cement built-up to same thickness as adjoining insulation.
 - 2. Fill joints, voids, and irregular surfaces with insulating cement to a uniform thickness.
 - 3. Stretch wire mesh over entire insulated surface and secure to anchors with wire edges laced together.
 - 4. Apply finishing cement, total of 1/2" thick, in 1/4" thick coats. Trowel second coat to a smooth hard finish.
 - 5. Neatly bevel insulation around handholes, cleanouts, ASME stamp, manufacturer's nametag and catalog number.
- M. Insulated Covers for Pumps: Do not extend pump insulation beyond or interfere with stuffing boxes or interfere with adjustment and servicing of parts regular maintenance or operating attention.

2.4 PIPING (OUTDOOR)

- A. All supply and return hydronic piping shall be covered with 2" thickness insulation.
- B. Insulation shall be calcium silicate with aluminum jacket or elastomeric type closed cell Armacel Armaflex Tubes pipe insulation with weatherproof cladding or approved equal. Cladding composite membrane shall consist of a multiply embossed UV-resistant aluminum foil/polymer laminate to which is applied a layer of rubberized asphalt specially formulated for use on insulated piping applications. The rubberized asphalt acts as the substrate adhesive and provides the self-healing characteristics necessary to seal around punctures. Protecting the rubberized asphalt is an easily removed plastic release liner which gives its peel and stick functionality.
- C. Calcium silicate insulation shall conform with ASTM C 533, Type I, and shall be Manville "Thermo-12" or approved equal.
- D. Insulation jacket shall be 0.016-inch-thick aluminum for pipes 2-1/2 inches and larger, and 0.010-inch-thick for pipes 2 inches and smaller with a built-in isolation felt. All seams and joints shall be weatherproof.
- E. Refrigerant piping shall be insulated with 1/2" Imcosheild un-split polyolefin insulation.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt, and other foreign substances.

END OF SECTION

SECTION 23 0460

AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 QUALIFICATIONS OF BIDDER

- A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 10 years.
- B. All bidders must have an office in the within 50 miles of jobsite.
- C. All bidders must be authorized distributors or branch offices of the manufacturers specified.
- D. All bidders must have a trained staff of application Engineers, who have been certified by the manufacturer in the configuration, programming and service of the automation system.

1.2 SCOPE OF WORK

- A. This Contractor shall furnish an electronic system of temperature controls. The District has standardized on Andover, Schneider Electric. All submitted controls shall be directly compatible with existing hardware and software without patch panels or translators or any kind. The ATC Sub-Contractor shall be subject to the District's approval. Communications between the schools is via their Ethernet LAN and remote access is via the Web or Local Intranet. The intent of this specification is to extend and interoperate with this system and to provide a peer-to-peer, networked, distributed control system for the temperature control work that is part of this project. All components, software and operation shall be interoperable with the existing building automation system via the Niagara Framework in the District. The installed system will interface directly with the existing proprietary as well as open protocol systems, including the existing District network, dynamic color graphics software and programming software. The existing software and database will be modified to accept the new equipment being installed under this project to maintain integrity for centralized scheduling, trending, programming and alarming. PC Desktop icons that "link" to a separate EMS system are not acceptable. Any costs associated with connecting to the existing energy management system, including licensed software, programming, training etc. shall be part of the controls contractor's bid. The contractor must demonstrate their ability to perform the integration to the existing Schneider Electric systems prior to submittal acceptance and invoicing.
- B. As a part of this project, the Contractor shall covert the Districts' control front end backbone to the latest "ECOSTRUXURE" operation software. This includes:
 - 1. Provide New Enterprise Server
 - a. Physical and virtual machine.
 - b. Quad core, 2 GHz or better with 16GB of RAM or better.
 - c. Microsoft Windows Server 2019.
 - d. Hard disk drive – at least 200GB available.
 - e. Ethernet NIC.
 - 3. Site Preparation
 - a. Installation of Enterprise Server
 - i. Windows Server hosted

- ii. Provides web-based access to EcoStruxure systems in buildings
 - iii. Single point of administration
 - iv. Centralized coordination of site-scoped data (login accounts, etc.)
4. Per Building Preparation/Conversion
- a. Provide a AS-P hardware automation server replacement for each Continuum bCX and CX.
 - b. Existing b3 and i2 field controllers remain.
 - c. Conversion steps per bCX and CX
 - i. Create text dump of bCX/CX using Continuum Cyberstation
 - ii. EcoStruxure Project Configuration Tool (PCT) – converts text dump to an EBO project
 - Deploy project to hardware AS-P
 - iii. Using Cyberstation reset all b3 or i2 field controllers on bCX/CX
 - iv. Move field bus wiring from bCX/CX to AS-P
 - v. Using EBO workstation download all field controllers attached to the AS-P
 - d. Configure EBO graphics, alarms, schedules
- C. Only licensed software toolsets will be acceptable for integration work. All systems as described in the sequence of operation will be shown via dynamic Web based graphics with all pertinent system alarms for proper operation and maintenance. The use of separate PC workstations, gateways, metalinks, replacement of existing controllers and control devices and additional software graphic packages to accomplish this integration will not be accepted.
- C. Prospective bidders shall visit the School District Buildings to verify existing DDC controls equipment and Contractor's ability to be compatible with these controls before bid. Contact the Schools Supt. of Buildings and Grounds for details. Contractor shall provide Web based graphics for controlled equipment that matches the functionality and appearance of the graphics already in use on the existing system. Contractor shall configure graphic display to meet Owner and Engineer requirements.
- D. The Temperature Controls Contractor (TCC) shall provide each of the following portions of the complete EMCS as a standalone system that can communicate with any other DDC system which is following the same protocol.
- Operator Workstations: Upgrade software and Databases in the district and provide guaranteed seamless two way communications via the Internet and District LAN, including full control, with both all existing DDC systems currently under control and the DDC system provided as a part of this project. The OWS's shall monitor, display, and control information from the DDC systems through one software package. Rebooting of the OWS to access the existing building's multiple systems is not acceptable. Use of separate "Icons" to access multiple DDC systems is not acceptable. The existing database shall be modified to incorporate the work of this project.
- a. The system OWS's shall meet the hardware and performance requirements of this specification.
 - b. The OWS's shall allow customization of the system as described in this specification.
2. The OWS's shall:
- a. Provide new color graphic control screens for all equipment provided or modified as part of this project, as outlined below and on the drawings.
 - b. Allow operators to view and work (read and write) all DDC points associated with all DDC equipment provided or modified as part of this project, including all existing DDC points.
 - c. Allow for custom graphics and/or control programming generation for any existing or new equipment.

- d. Provide seamless continuity of graphics and existing functionality for all existing Owner's equipment currently under DDC control.
- E. All proposed controls contractors that intend on interoperating with the existing DDC system utilizing DDC controls other than those presently installed in the district, shall submit a Technical Proposal, complete with the diagrams, Specifications Compliance Reports, product information, and supporting documentation outlined below. The technical proposal will be utilized to evaluate the methodology that will be used to implement the interoperation and integration of the new controls of this project into the existing district wide energy management system. It will also be used as a basis for vendor qualification on for the project. Arrange the Technical Proposal in order of the specification article numbers.
 - 1. Provide a list of local jobs (three minimum) of similar type and size the bidder has installed, utilizing the products proposed for this project, with owner's representatives' names and telephone numbers for reference. This list should directly reflect:
 - a. Projects that include direct integration to third party microprocessor controllers of the type specified within the scope where an integration and interoperation of Lon Works controls has been successfully achieved between two different manufacturers' controls systems.
 - i. EMCS network wiring diagram showing interconnection of all panels, workstations, system printer(s) etc. A diagram describing system architecture for this project with product code numbers for workstation, network controllers, application specific controllers, transducers, sensors, communication network, etc.
 - 2. Provide information on owner training provided as part of the bid package as well as additional opportunities and factory schools available with associated cost. Include details of operator HVAC Training System as specified herein.
 - 3. Specification Compliance Report. Provide specification compliance report that addresses every paragraph within this specification section utilizing an outline format, as follows:
 - a. Comply-bid package complies without exception;
 - b. Exception – bid package meets the functional intent, but not the letter of the specification. For each paragraph that an exception is taken, identify all deviations from what is specified in the given paragraph and provide a description of what is excluded, what is included, and how the contractor intends to meet the functional intent;
 - c. Does not comply – bid package cannot meet specified function and will not be provided.
 - d. For all paragraphs in this specification section, indicates as “Comply” or “Exception” or “Does not comply”. Provide and reference factory product documentation to substantiate compliance.
 - 4. Provide a statement that all products used on this project are of current manufacture and are readily available through multiple distribution channels. Products in “field testing” status are not acceptable.
- G. The BAS Contractor shall review and study all HVAC Drawings and the entire Specification to familiarize himself with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
- H. Prior to commencement of schedule programming meet with Owner to discuss block/individual scheduling of system/equipment and alarm protocols. Review equipment designations and graphics screens to be provided. Take minutes of this meeting and issue them to the Construction Manager/Owner's representative.

- I. All temperature control wiring regardless of voltage shall be done by this Contractor. This shall include power wiring of control panels/components from available spare circuits in electrical panels. The automatic temperature control manufacturer shall provide wiring diagrams, field supervision and one (1) year guarantee on the installed DDC system and three (3) year factory warrantee on all control equipment manufactured by the DDC manufacturer.
- J. Thermostats, temperature sensors, heating control devices, etc. are indicated on the Drawings in general. Provide any additional devices required to carry out project intent as herein described.
- K. Thermostats/Temperature sensors in areas subject to vandalism shall have in addition separately mounted extra heavy guards. Submit sample.
- L. Contractor shall include all new heating control devices, thermostats, etc. indicated on Drawings or that is part of a new system.
- M. Contractor shall furnish all necessary electrical controls, motor starters, switches, etc. for proper operation of equipment furnished by him under this Contract, and as herein noted.
- N. Point and component lists are to be used as a guide. If the sequence of operation requires additional points/control devices, this Contractor shall be responsible for providing same.
- O. All control system components installed shall be manufactured by the DDC system manufacturer.
- P. Communications cabling shall be run in hallways above hung ceiling with plenum cable and wiremold where exposed.
- Q. Removals shall include switches, relays, electric components not required for the new intent. Do not leave behind items with no function. Provide appropriate blanking plates/patching where removals occur in finished spaces.
- R. Provide services and manpower necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor, Owner's representative, and Commissioning Authority.

1.3 SOFTWARE CODE

- A. Owner shall be furnished with a complete, hard-bound copy of all installed software code. Final payment shall be contingent upon this requirement being met.

1.4 CODE COMPLIANCE

- A. Provide components and ancillary equipment, which are UL-916 listed and labeled.
- B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.
- C. All wiring shall conform to the National Electrical Code.
- D. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
- E. Comply with FCC, Part 68 rules for telephone modems and data sets.

1.5 SUBMITTALS

- A. All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the Drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger.

- B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical will be allowed where appropriate.
- C. Submittal data shall contain manufacturer's data on all hardware and software products required by the Specification. Valve damper and airflow station schedules shall indicate size, configuration, capacity and location of all equipment.
- D. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring binder with an index and tabs.
- E. Submit submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all Documents for accuracy.
- F. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

1.6 SYSTEM STARTUP AND COMMISSIONING

- A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the commissioning phase. A written report will be submitted to the Owner indicating that the installed system has been started and balanced in accordance with the Drawings and Specifications.
- B. The ATC Contractor shall set in operating condition all major equipment and systems, such as heating, cooling, heat recovery and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives. The ATC contractor shall work with the Commissioning Authority as required until all associated HVAC equipment is fully commissioned to the satisfaction of the Commissioning Authority.
- C. The ATC Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor, Balancing Contractor, and Commissioning Authority in testing, adjusting, and balancing all systems in the building Scope of Work. The Contractor shall have a trained technician available on request during the balancing and commissioning of the systems. The Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and Commissioning Authority and shall include all labor and materials in his Contract.
- D. Refer to specification section 23 0485 HVAC Systems Commissioning.

1.7 OPERATING AND MAINTENANCE MANUALS

- A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation and parts procurement for the entire system. This documentation shall include specific part numbers and software versions and dates. A complete list of recommended spare parts shall be included with the lead-time and expected frequency of use of each part clearly identified.
- B. Following project completion and testing, the Contractor will submit As-Built Drawings reflecting the exact installation of the system. The as-built documentation shall also include a copy of all application software both in written form and on CD.

1.8 WARRANTY

- A. The Contractor shall provide system warranty for 12 months after system acceptance or beneficial use by the Owner. During the warranty period, the Contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the Specification.
- B. Updates to the manufacturer's software shall be provided at no charge during the warranty period.

1.9 SPECIFICATION NOMENCLATURE

- A. Acronyms used in this specification are as follows:
 - 1. EMCS Energy Management and Control System
 - 2. NAC Network Area Controller
 - 3. IDC Interoperable Digital Controller
 - 4. FUI Full User Interface
 - 5. BUI Browser User Interface
 - 6. POT Portable Operator's Terminal
 - 7. PMI Power Measurement Interface
 - 8. DDC Direct Digital Controls
 - 9. LAN Local Area Network
 - 10. WAN Wide Area Network
 - 11. OOT Object Oriented Technology
 - 12. PICS Product Interoperability Compliance Statement

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Energy Management Control System (EMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, portable operator terminals, printers, network devices and other devices as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall EMCS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate Lon Works and Schneider Electric Network 8000 technology communication protocols in one open, interoperable system.
- B. The programming computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, to assure interoperability between all system components is required. For each Lon Works device that does not have Lon Work certification, the device supplier must provide an XIF file for the device. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- C. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database

parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database or proprietary user interface programs shall not be acceptable.

- D. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

- A. The Local Area Network (LAN) shall be either a 10 or 100 Megabits/sec Ethernet network supporting, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), Browser User Interfaces (BUIs) and/or Full User Interfaces (FUIs).
- B. Local area network minimum physical and media access requirements:
1. Ethernet; IEEE standard 802.3
 2. Cable; 10 Base-T, UTP-8 wire, category 5
 3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

2.4 NETWORK ACCESS

- A. Remote Access
1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, and ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Owner agrees to pay monthly access charges for connection and ISP.
 2. Where no Local Area Network exists, EMCS supplier shall provide the following:
 - a. 8 Port Ethernet hub (3Com, or equal)
 - b. Ethernet router (Cisco or equal)
 3. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line or T1 Line. Owner agrees to pay monthly access charges for connection and ISP.

2.5 NETWORK AREA CONTROLLER (NAC)

- A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
1. Calendar functions
 2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Time synchronization
 6. Integration of Lon Works controller data
 7. Network Management functions for all Lon Works based devices

- B. The Network Area Controller must provide the following hardware features as a minimum:
1. One Ethernet Port -10 / 100 Mbps.
 2. One RS-232 port.
 3. One Lon Works Interface Port – 78KB FTT-10A.
 4. Battery Backup.
 5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 6. The NAC must be capable of operation over a temperature range of 0 to 55°C.
 7. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C.
 8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing.
- C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- E. Event Alarm Notification and Actions
1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 4. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 5. Provide timed (schedule) routing of alarms by class, object, group, or node.
 6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- F. Control equipment and network failures shall be treated as alarms and annunciated.
- G. Alarms shall be annunciated in any of the following manners as defined by the user:
1. Screen message text
 2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 3. Pagers via paging services that initiate a page on receipt of email message
 4. Graphic with flashing alarm object(s)
 5. Printed message, routed directly to a dedicated alarm printer

- H. The following shall be recorded by the NAC for each alarm (at a minimum):
 - 1. Time and date
 - 2. Location (building, floor, zone, office number, etc.)
 - 3. Equipment (air handler #, access way, etc.)
 - 4. Acknowledge time, date, and user who issued acknowledgement.
 - 5. Number of occurrences since last acknowledgement.
- I. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- L. Provide a “query” feature to allow review of specific alarms by user-defined parameters.
- M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.6 DATA COLLECTION AND STORAGE

- A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
- B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - 1. Designating the log as interval or deviation.
 - 2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - 3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - 4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - 5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
- D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- E. All log data shall be available to the user in the following data formats:
 - 1. HTML
 - 2. XML
 - 3. Plain Text

4. Comma or tab separated values
- F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
- G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
1. Archive on time of day.
 2. Archive on user-defined number of data stores in the log (buffer size).
 3. Archive when log has reached its user-defined capacity of data stores.
 4. Provide ability to clear logs once archived.

2.7 AUDIT LOG

- A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date
 2. User ID
 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.8 DATABASE BACKUP AND STORAGE

- A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.9 INTEROPERABLE DIGITAL CONTROLLER (IDC)

- A. Controls shall be microprocessor based Interoperable Lon Mark™ or Lon Works Controllers (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable Lon Mark™ interoperability logo on each product delivered.
- B. HVAC control shall be accomplished using Lon Mark™ based devices where the application has a Lon Mark profile defined. Where Lon Mark devices are not available for a particular application, devices based on Lon Works shall be acceptable. For each Lon Works device that does not have Lon Mark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each Lon Works / Lon Mark controller defining the programming or setup of each device. All programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation shall be provided.
- C. The Lon Works network trunk shall be run to the nearest Network Area Controller (NAC). A maximum of 126 devices may occupy any one Lon Works trunk and must be installed in buss architecture using the appropriate trunk termination device. All Lon Works and Lon Mark devices must be supplied using FTT-10A Lon Works communications transceivers.
- D. The Network Area Controller will provide all scheduling, alarming, trending, and network management for the Lon Mark / Lon Works based devices.

- E. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.
- F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- G. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.10 FULL USER INTERFACE SOFTWARE

- A. Operating System: The FUI shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.
- B. The FUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- C. Real-Time Displays. The FUI, shall at a minimum, support the following graphical features and functions:
 - 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the FUI shall support the use of scanned pictures.
 - 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 - 3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
 - 4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - 5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - 6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
- D. System Configuration: At a minimum, the FUI shall permit the operator to perform the following tasks, with proper password access:
 - 1. Create, delete or modify control strategies.
 - 2. Add/delete objects to the system.
 - 3. Tune control loops through the adjustment of control loop parameters.
 - 4. Enable or disable control strategies.

5. Generate hard copy records or control strategies on a printer.
 6. Select points to be alarmable and define the alarm state.
 7. Select points to be trended over a period of time and initiate the recording of values automatically.
- E. On-line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
- F. On-line Documentation: Provide a context sensitive, on-line documentation system to assist the operator in operation and trouble shooting of each integrated system. On-line help shall be available for all applications and shall provide the relevant data for that particular monitoring screen. As a minimum, provide a link to the Sequence of Operation, input/output summary, and cut sheets in either Adobe Acrobat™ or HTML format.
- G. Security: Each operator shall be required to log on to that system with a username and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- H. System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- I. Alarm Console
1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
 2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.11 BROWSER USER INTERFACE SOFTWARE

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Full User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens developed for the FUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the FUI shall be supported by the Web browser interface.
3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - c. View logs and charts
 - d. View and acknowledge alarms
7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to a pre-defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.12 SYSTEM PROGRAMMING

- A. The Full User Interface software (FUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the FUI shall be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface display shall not be acceptable.

Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages

for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.13 OBJECT LIBRARIES

- A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- D. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
 1. Lon Mark/Lon Works devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide Lon Mark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the Lon Mark profile shall be supported. Information (type and function) regarding network variables not defined in the Lon Mark profile shall be provided by the device manufacturer.
 2. For devices not conforming to the Lon Mark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

2.14 LONWORKS NETWORK MANAGEMENT

- A. The Full User Interface software (FUI) shall provide a complete set of integrated Lon Works network management tools for working with Lon Works networks. These tools shall manage a database for all Lon Works devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between Lon Works devices, known as "binding". Systems requiring the use of third party Lon Works network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

- C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing Lon Works network, regardless of what network management tool(s) were used to install the existing network, so that existing Lon Works devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, and within the control system shall not be accepted.

2.15 OTHER CONTROL SYSTEM HARDWARE

- A. Motorized Control Dampers: Coordinate with the other trades for the exact quantity, size and location of all dampers. Dampers shall be black enamel finish or galvanized, with nylon bearings. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide maximum and frame shall be of welded channel iron. Dampers with both dimensions less than 18 inches may have strap iron frames. Ruskin CD-46 or Equal.
- B. Control Damper and Valve Actuators: Coordinate with other trades for exact quantity, size and location of all dampers. Provide all dampers unless Two-position or proportional electric actuators shall be direct-mount type. All actuators shall be spring return type. Provide one actuator per damper minimum.
- C. Control Valves: Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be ‘line’ size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves with sizes up to and including 2 inches shall be “screwed” configuration and 2-1/2 inch and larger valves shall be “flanged” configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment.
- D. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller; provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator’s terminal described elsewhere in this specification.
- E. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of $\pm 0.2^{\circ}\text{C}$. Outside air sensors shall include an integral sun shield.
- F. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- G. Water Flow Meters (when required): Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters shall be ‘insertion’ type complete with ‘hot-tap’ isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be $\pm 2\%$ of actual reading from 0.4 to 20 feet per second flow velocities.
- H. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All electrical devices within a control panel shall be factory wired. All external wiring

shall be connected to terminal strips mounted within the panel. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

2.16 INPUT DEVICES

- A. System accuracy of sensed conditions shall be as follows:
 - 1. +/- .5°F for space temperature in the 0-130°F range
 - 2. +/- .5°F for duct temperatures in the 40-130°F range
 - 3. +/- 1.0°F for outside air temperatures in the (-30)-230°F range
 - 4. +/- 1.0°F for water temperatures in the 30-230°F range
 - 5. +/- .1 inch for filter status differential over a 0-2 inch range
- B. The system shall maintain the specified analog end-to-end accuracy throughout the warranty period from sensor to controller readout.
- C. Packaging: Sensors (transducers) will be appropriately packaged for the location.
 - 1. Architectural housing for space mounting.
 - 2. Weatherproof/sunshield housing for outdoors.
 - 3. Thermal well housing for water applications.
 - 4. Protective housing for duct mounting.
- D. Environmental Ratings - The sensor/transducer shall be selected to withstand ambient conditions where:
 - 1. Moisture or condensation is a factor.
 - 2. Vibration exists from ductwork, equipment, etc.
 - 3. Reasonably expected transient conditions exist for temperatures, pressures, humidity's, etc. outside the normal sensing range.
- E. Temperature Sensors
 - 1. Temperature sensors will be by the use of thermistors (10K ohm at 77°F) or RTDs (PT100 curve).
 - 2. Sensors in the return or discharge duct shall be of the single point type. Sensors in the mixed air will be of the average type.
 - 3. Thermowells shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.
 - 4. Room temperature sensors: Sensing element only.
- F. Digital Sensors
 - 1. All digital inputs will be provided by dry contacts. The contacts will be wired normally open or normally closed as required.
 - 2. Motor status (pumps, fans, etc.) shall be determined by current-operated switch.

2.17 OUTPUT DEVICES

- A. The use of multiplexers will not be accepted.
- B. Relays and Contactors

1. All digital outputs will be electrically isolated from the digital controller by interface relays.
2. Field relays shall have a minimum life of 1 million cycles without failure.
3. Contactors shall have a minimum life of ten thousand cycles without failure.

2.18 ACTUATORS

- A. Standard manufacturer damper and valve actuators, proportional or two-position as required, sized to properly operate device. Damper actuators shall be of the direct coupled type, Belimo or equal.

2.19 WIRING AND CONDUIT

- A. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
- B. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
- C. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
- D. Junction boxes shall be provided at all cable splices, equipment terminations, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
- E. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire alarm system shall be in conduit.

2.20 ENCLOSURES

- A. All controllers and field interface panels shall be mounted in new enclosures unless otherwise stated in this specification.
- B. All outside mounted enclosures shall meet the NEMA-4 rating.
- C. Wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

2.21 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class indicated. Where type or body material is not indicated, make selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature rating of piping system.
- B. Globe Pattern: As follows:
 1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity re-packable under pressure.

2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems: As follows:
 - a. Rating: Service at 125 psi WSP and 250°F.
 - b. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
 - Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
 - Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
 - c. Sizing: 3-psi maximum pressure drop at design flow rate.
 - d. Flow Characteristics: 2-way valves have equal percentage characteristics; 3-way valves have linear characteristics. Select operators to close valves against pump shutoff head.
- C. Terminal Unit Control Valves: Bronze body, bronze trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.
 1. Rating: Service at 125 psi WSP and 250°F.
 2. Sizing: 3-psi maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: 2-way valves have equal percentage characteristics; 3-way valves have linear characteristics.
 4. Operators (2 Position): Synchronous motor with enclosed gear train, dual-return springs, valve-position indicator. Valves spring return to normal position for temperature protection.
 5. Operators (Modulating): Self-contained, linear motor, actuator with 60-second full travel, with transformer and single-throw, double-pole contacts.

2.22 DAMPERS

- A. Dampers: AMCA-rated, parallel or opposed blade design; form frames from not less than 0.1084-inch galvanized steel with mounting holes for duct mounting; damper blades not less than 0.0635-inch galvanized steel, with maximum blade width of 8 inches.
 1. Blades secured to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass. Ends sealed against spring-stainless-steel blade bearings. Thrust bearings at each end of every blade.
 2. Operating Temperature Range: From -40 to 200°F.
 3. For standard applications as indicated, (as selected by manufacturer's sizing techniques) with optional closed-cell neoprene edging.
 4. Provide low-leakage parallel or opposed blade design (as selected by manufacturer's sizing techniques) with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm/sq.ft. of damper area, at differential pressure of 4 inches wg when damper is being held by torque of 50 inch-pounds; test in accordance with AMCA 500. Ruskin CD-46 or equal.

2.23 ACTUATORS

- A. Electronic Actuators: The actuator shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator shall have electronic overload

circuitry to prevent damage. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-spring return actuators shall have an external manual gear release to allow positioning of the damper when the actuator is not powered.

- B. All valves shall be fully proportioning, unless otherwise specified, quiet in operation, and shall be arranged to fail safe, in either a normally open or normally closed position, in the event of power failure. The open or closed position shall be as specified or as required to suit job conditions. All valves shall be capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.
- C. Where valves operate in sequence with other valves or damper operators, provide on each valve a pilot positioner to provide adjustable operating ranges and starting points and positive close off at the required control signal pressure. Positioners must be directly connected to the valve stem. Ratio relays are not acceptable.
- D. Valves shall be sized by the Temperature Control Manufacturer and guaranteed to meet the heating or requirements as specified and indicated on the Drawings. Unless otherwise specified, all shall conform to the requirements herein specified for the piping system in which they are installed.

2.24 CENTRAL CONTROL PANEL

- A. Integrate new controls into existing central control touch screen panel. This central panel will allow for time clock scheduling, setpoints, monitoring of points and alarm. All freezestats will be reset manually at the central panel. All alarms will be displayed and reset manually at central panel.
- B. All exhaust fans shall be controlled by the central control panel.
- C. Central control panel shall be connected to existing District IT Network. District shall provide data drop.

2.25 AUXILIARY EQUIPMENT/DEVICES

- A. Analog Sensors
 - 1. Duct sensors (greater than four square feet): Monitoring range to suit application. Platinum or nickel wound RTD Type + 0.1% of range. Factory calibration point – 70 Deg. F at 1000 OHMS.
 - 2. Space Temperature Sensors: Space Temperature Sensors shall be 5,000 or 10,000 ohm thermistor with wall plate adapter and blank cover assembly. The sensor shall include an integral occupancy override button and shall also include a RJ11 communications port. Space Temperature Sensors shall include space temperature adjustment slides where shown on the plans. The Space Temperature Sensors shall be mounted approximately 60” above the floor.
 - 3. Hydronic Well Temperature Sensors: Water Temperature Sensors shall be well mounted 5,000 or 10,000 ohm thermistors.
 - 4. Status Indication- Status indication for fans and pumps shall be provided by a current sensing sensor. The sensor shall be installed at the motor starter or motor to provide load indication. The unit shall consist of a current transformer, a solid state current sensing circuit (with adjustable set point) and a solid state switch. A red light emitting diode (LED) shall indicate the on off status of the unit. The switch shall provide a N.O. contact for wiring back to the Field Installed Controller.
 - 5. Combination CO2 and Space Temperature Sensors: CO2 and space sensors are comprised of two sensors housed in one unit designed to measure both CO2 in the air and the building air temperature. Combination sensor shall have the following features:
 - a. Self Calibration CO₂ sensor with 5 year calibration interval.

- b. Push button over ride.
- c. CO₂ sensitivity +/- 20 ppm.
- d. CO₂ accuracy +/- 100 ppm.
- e. Space sensor: 5 or 10K thermistor.

2.26 DDC SENSORS AND POINT HARDWARE

A. Temperature Sensors

1. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of – 30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
2. Standard space sensors shall be available in an off white enclosure for mounting on a standard electrical box.
3. Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
4. Where a local display is specified, the sensor shall incorporate either an LED or LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons; operators shall be able to adjust setpoints directly from the sensor.
5. Duct temperature sensors shall incorporate a thermistor bead embedded at the tip of a stainless steel tube. Probe style duct sensors are useable in air handling applications where the coil or duct area is less than 14 square feet.
6. Averaging sensors shall be employed in ducts, which are larger than 14 square feet. The averaging sensor tube must contain at least one thermistor for every 3 feet, with a minimum tube length of 12 feet.
7. Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250 degrees F. and 300 series stainless steel for all other applications.
8. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Sensors

1. Humidity devices shall be accurate to +/- 5% at full scale for space and +/- 3% for duct and outside air applications. Suppliers shall be able to demonstrate that accuracy is NIST traceable.
2. Provide a hand held field calibration tool that both reads the output of the sensor and contains a reference sensor for ongoing calibration.

C. Pressure Sensors

1. Air pressure measurements in the range of 0 to 10" water column will be accurate to +/- 1% using a solid-state sensing element. Acceptable manufacturers include Modus Instruments and Mamac.
2. Differential pressure measurements of liquids or gases shall be accurate to +/- 0.5% of range. The housing shall be NEMA 4 rated.

D. Current and KW Sensors

1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in solid and split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris or approved equal.
2. Measurement of three-phase power shall be accomplished with a kW/kWH transducer. This device shall utilize direct current transformer inputs to calculate the instantaneous value (kW) and a pulsed output proportional to the energy usage (kWH). Provide Veris Model 6000 Power Transducer or approved equal.

E. Flow Sensors

1. Provide an insertion vortex flow meter for measurement of liquid or gas flows in pipe sizes above 3 inches.
2. Install the flow meter on an isolation valve to permit removal without process shutdown.
3. Sensors shall be manufactured by EMCO or approved equal.

F. Carbon Dioxide Sensors

1. Non-Dispersive Infrared (NDIR), 0-2000 PPM.
2. Power Requirement, 18-30 VDC.
3. Voltage output, 0-10- VDC Full Scale.
4. Current output, 4-20 mA

2.27 AIRFLOW MEASURING STATIONS

- A. Provide a thermal anemometer using instrument grade self heated thermistor sensors with thermistor temperature sensors. The flow station shall operate over a range of 0 to 5,000 feet/min with an accuracy of +/- 2% over 500 feet/min and +/- 10 ft/min for reading less than 500 feet/min.
- B. The output signal shall be linear with field selectable ranges including 0-5 VDC, 0-10VDC and 4-20 mA.
- C. Furnish Ebtron Series 3000 airflow stations or approved equal.

PART 3 – EXECUTION

3.1 GENERAL

- A. All DDC Controllers shall be networked to Central Communications controller.
- B. Existing Front End Workstation in B & G office shall be configured for High School Addition access. Text/Graphic screens for each system shall match existing.
- C. Communications cabling shall be run in hallways above hung ceiling with plenum cable and wiremold where exposed.

3.2 CONTRACTOR RESPONSIBILITIES

- A. General: The Contractor or a Sub-Contractor shall perform installation of the building automation system. However, all installations shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete.

- B. Demolition: Remove controls, which do not remain as part of the building automation system, all associated abandoned wiring and conduit and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment, which is to be removed, that will remain the property of the Owner. The Contractor will dispose of all other equipment that is removed.
- C. Access to Site: Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner's representative.
- D. Code Compliance: All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring Specifications in Division 26 and Division 22, wiring requirements of Division 26 will prevail for work specified in Division 26.
- E. Cleanup: At the completion of the work, all equipment pertinent to this Contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this Contract. Clean the exposed surfaces of tubing, hangers, and other exposed metal of grease, plaster, or other foreign materials.

3.3 WIRING, CONDUIT, TUBING AND CABLE

- A. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 volt
Communications	Per Mfr.	Per Mfr.

- B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.
- C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
- D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Setscrew fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
- E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
- F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasket covers.
- G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.

- H. Coaxial cable shall conform to RG62 or RG59 rating. Provide plenum rated coaxial cable when running in return air plenums.

3.4 HARDWARE INSTALLATION

A. Installation Practices for Wiring and Tubing

1. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
2. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral, and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
3. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
4. Wires are to be attached to the building proper at regular intervals such that wiring does not drop. Wires are not to be affixed to or supported by pipes, conduit, etc.
5. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, and furred spaces and wall construction. Exception: metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
6. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
7. Wires are to be kept a minimum of three (3) inches from hot water or condense piping.
8. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.

B. Installation Practices for Field Devices

1. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
2. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
3. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
4. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
5. For duct static pressure sensors, the high-pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low-pressure port shall be left open to the plenum area at the point that the high-pressure port is tapped into the ductwork.
6. For building static pressure sensors, the high-pressure port shall be inserted into the space via a metal tube. Pipe the low-pressure port to the outside of the building.

C. Enclosures

1. For all I/O requiring field interface devices, these devices, where practical, will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure, which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
2. FIP's shall contain power supplies for sensors, interface relays and Contractors, safety circuits, and I/P transducers.
3. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for 20% spare mounting space. All locks will be keyed identically.
4. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
5. All outside mounted enclosures shall meet the NEMA-4 rating.
6. The tubing and wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

D. Identification

1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with As-Built Drawings.
2. Identify all pneumatic tubing with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with As-Built Drawings.
3. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
4. Junction box covers will be marked to indicate that they are a part of the BAS system.
5. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with nameplates.
6. All I/O field devices inside FIP's shall be labeled.

E. Control System Switch-Over

1. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.
2. Switched over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch over.
3. The Contractor shall minimize control system downtime during switch over. Sufficient installation mechanics will be on site so that the entire switch over can be accomplished in a reasonable time frame.

F. Location

1. The location of sensors is per Mechanical and Architectural Drawings.
2. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
3. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.5 SOFTWARE INSTALLATION

- A. General: The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.
- B. Database Configuration: The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.
- C. Color Graphic Slides: Unless otherwise directed by the Owner, the Contractor will provide color graphic displays as depicted in the Mechanical Drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for set point changes as required by the Owner.
- D. Reports
 1. The Contractor will configure a minimum of 6 reports for the Owner as listed below:
 - a. Central Plant Status Report
 - b. Air Handler Status Report
 - c. Energy Consumption Report
 - d. Space Temperature Report
 - e. Specialty Equipment Status Report

E. Documentation

1. As-Built software documentation will include the following:
 - a. Descriptive point lists
 - b. Application program listing
 - c. Application programs with comments
 - d. Printouts of all reports
 - e. Alarm list
 - f. Printouts of all graphics

3.6 COMMISSIONING AND SYSTEM STARTUP

A. Point-to-Point Checkout

Each I/O device (field mounted as well as those located in FIP's) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the Owner or Owner's representative.

B. Controller and Workstation Checkout:

A field checkout of all controllers and miscellaneous equipment shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the Owner or Owner's representative by the completion of the project.

C. System Acceptance Testing

1. All application software will be verified and compared against the sequences of operation. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
2. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the Owner.
3. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the Owner.
4. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

3.7 SEQUENCES OF OPERATION

A. New and Existing Boilers with Associated Pumps and Appurtenances (B)

1. Point List
 - a. Outdoor Air Temperature
 - b. Outdoor Relative Humidity

- c. HW Supply Temperature (Primary Loop)
- d. HW Return Temperature (Primary Loop)
- e. HW Supply Temperature (Secondary Loop)
- f. HW Return Temperature (Secondary Loop)
- g. HW Pump HWP-1 Start/Stop
- h. HW Pump HWP-2 Start/Stop
- i. HW Pump HWP-3 Start/Stop
- j. HW Pump HWP-4 Start/Stop
- k. HW Flow Status (4)
- l. Boiler Start/Stop (B-1,2)
- m. Boiler Start/Stop (B-3,4)
- n. Boiler Auto Signal
- o. Boiler Trouble Signal
- p. Boiler Flame Modulation

2. Sequence of Operation

- a. Boilers will be optimized on for occupied schedule when outside air temperature is below 60 degrees (adjustable) and average room temperature is below 70 degrees (adjustable). Boilers will be off during unoccupied schedule unless outside air temperature drops below 38 degrees (adjustable). Whenever outside air is below 60 degrees, Primary high efficiency condensing boilers will sequence and stage to maintain desired water temperature (adjustable) in condensing mode where supply water temperature is a maximum of 160 degrees Fahrenheit. If water temperature continues to drop after all the primary boilers are operating at full capacity, then Primary boilers will sequence into non-condensing mode of operation to maintain water temperature. If water temp continues to drop then one of the two Secondary non-condensing cast iron boilers shall sequence on to maintain desired water temperature a maximum of 190 degrees Fahrenheit (adjustable). If water temp continues to drop or not meet setpoint temperature, then second noncondensing cast iron boiler shall activate. If all boilers are operating and water temperatures continues to drop or not meet set point than alarm signal shall be sent to BMS work operator station.
- b. The boiler start/stop and firing rate will be controlled by the stand-alone direct digital controller mounted in the new hot water system programmable local control panel. Boiler monitoring and alarming will be done at the central panel touch screen. The three-way control valves will modulate through DDC system to schedule the hot water supply through outside air sensor. Three-way valves shall be sized for proper flow control without hunting. Three-way valve modulation shall be arranged to limit cold water return to the boiler during warm-up mode to prevent thermal shock to the boilers.
- c. Hot water circulating pump shall be energized when outside air temperature is below 60 degrees (adjustable). Should a pump fail to start its standby pump shall be energized and an alarm sent to the central control panel. Boiler water blend pump shall be hardwired interlocked with hot water circulating pump operation.

B. Hot Water Heating Pumps (HWP)

- 1. Point List
 - a. HW Pump Start/Stop (4)
 - b. HW Pump Status (4)
- 2. Sequence of Operation
 - a. Occupied Mode: Pump shall start when the outdoor air temperature drops below 60 ° F. (adjustable).

- b. Unoccupied Mode: Pump shall start when the outdoor air temperature drops below 40 ° F. (adjustable).
- c. Lead / Lag: When the system calls for heat, the lead pump shall start, if the pump current sensor, does not sense proper current within 4 minutes, the lead pump shall shutdown and the lag pump shall become lead.

C. Existing Unit Ventilators with new dual temperature Heating/Cooling coil (UV)

1. Point List

- a. Space Temperature
- b. Space Temperature Setpoint
- c. Discharge Air Temperature
- d. Freezestat Status
- e. Fan Start/Stop
- f. OA/RA Damper Modulation
- g. Face and Bypass Damper Modulation
- h. Radiation Valve Modulation
- i. End of Cycle Valve Open/Close

2. Sequence of Operation:

- a. Unoccupied Mode: The end of cycle valve shall be open, outside air damper shall be closed, the return damper shall be open, and the F&B damper shall be in full face position. During the heating mode of operation, the perimeter radiation control valve shall modulate to maintain night setback heating setpoint temperature. Should the radiation alone fail to maintain the space setpoint temperature, the unit fan shall be energized, and dual temperature control valve shall modulate to maintain night setback heating setpoint temperature (adjustable). During the cooling mode of operation, the perimeter radiation control valve shall be closed, the unit fan shall be energized, and dual temperature control valve shall modulate to maintain night setback cooling setpoint temperature (adjustable).
- b. Occupied Mode: Unit fan shall run continuously. During morning warm-up/cool down mode (room temperature more than 2 degrees below/above daytime setpoint), outside air damper shall be closed. As room temperature rises/falls, outside air damper shall modulate to minimum position. **Note: Morning warm-up/cooldown shall be scheduled to occur prior to space occupancy.** During morning warmup/cooldown, should room temperature continue to rise/drop past setpoint, radiation control valve shall modulate closed, F&B damper shall modulate to full bypass, end of cycle valve shall close and then outside air damper shall modulate further open to provide free cooling (based on differential enthalpy). As room temperature decreases the reverse shall occur. A Freezestat shall stop fan, close outside air damper, place F&B damper in full bypass position and open the end of cycle valve.

3. Additional Information for Cooling Operation

- a. The chilled water-cooling cycle shall be locked out whenever the outdoor air temperature is 58 degrees F or below (adjustable) and cooling shall be provided by modulating the outdoor air damper as required. Whenever the outdoor air temperature is above 59 degrees F, A differential enthalpy calculation shall occur to determine if outdoor air can be used for free cooling, otherwise, mechanical cooling shall be energized with the outdoor air damper being in the minimum position. Prior to mechanical cooling being energized the dual temperature coil end-of-cycle valve shall close and the F&BP damper shall be driven to the full-face position.

- b. A 6-degree dead band shall prevent continuous compressor cycling.

D. Fin-Tube Radiation (FT)

1. Point List

- a. Space Temperature
- b. Hot Water Control Valve Modulation

2. Sequence of Operation

- a. Unoccupied Mode: Modulate control valve to maintain night setback temperature setpoint.
- b. Occupied Mode: Modulate control valve to maintain daytime temperature setpoint.

E. Cabinet Heaters (CH), Unit Heaters (UH)

1. Point List

- a. Space Temperature
- b. Space Temperature Setpoint
- c. Hot Water Control Valve Modulation
- d. Fan Start/Stop

2. Sequence of Operation: Unit fan and control valve shall cycle based on space temperature setpoint. An aquastat shall not allow fan operation if water supply temperature is below 140 degrees F.

F. Convectors (Conv)

1. Point List

- a. Space Temperature
- b. Space Temperature Setpoint
- c. Hot Water Control Valve Modulation

2. Sequence of Operation

- a. Unit control valve shall cycle based on space temperature setpoint.

G. Air Handling Unit (AHU)

1. Point List

- a. OA Temperature
- b. Discharge Air Temperature
- c. Space Temperature
- d. Freeze-stat
- e. Occupied/Unoccupied
- f. Fan Start/Stop
- g. Dual Temperature Water Control Valve Modulation
- h. Outside Air/Return Air Damper Modulations

2. Sequence of Operation

- a. Un-Occupied Mode: The outside air damper shall close; the return damper shall open. On a call for heating, the unit fan shall energize, dual temperature control valve shall modulate to maintain night setback temperature setpoint. Any associated exhaust fans shall be off and exhaust dampers closed. Perimeter radiation valves will be the first stage of heating and open as needed to maintain the space temperature setpoint (adj.). Should additional heating be required the AHU unit shall cycle fan and modulate the dual temperature control valve to maintain the heating setpoint (adj.). On a call for cooling, fan de-energized and dual temperature valve closed.
- b. Occupied Mode: The supply fan shall start, outdoor air damper shall modulate open, return damper closed and the dual temperature control valve shall modulate to maintain set point (adj.) temperature. Any associated exhaust fans shall start and exhaust dampers open. Perimeter radiation valves will be the first stage of heating and modulate as needed to maintain the space temperature heating setpoint (adj.). Should additional heating be required the AHU unit shall modulate the dual temperature valve to maintain the heating setpoint (adj.).

H. Exhaust Fans (EF)

1. Point List

- a. Fan Start/Stop
- b. Fan Status

2. Sequence of Operation

- a. Unoccupied Mode: Fan Off, Dampers Closed.
- b. Occupied Mode: Fan On, Dampers Open.

I. Boiler Room Supply Fan (SF)

1. Point List

- a. Space Temperature
- b. OA Damper Position
- c. RA Damper Position
- d. Supply Fan Start/Stop

2. Sequence of Operation

- a. When the boiler room space temperature rises above the 80°F (adjustable) set point, the fresh air shall be commanded to start, and the return outside air dampers shall modulate to maintain a 40°F (adjustable) discharge air temperature. When the desired boiler room space temperature is reached, the fan shall be disabled, the outside air damper shall close, and the return damper shall open.

J. Boiler Draft Fan (DF)

1. Point List

- a. Fan Status
- b. Damper Positions
- c. Fan Start/Stop

2. Sequence of Operation

- a. Each heating appliance shall be interlocked with the draft fan control panel. Upon a call for heat, the control panel shall activate the draft inducer fan to establish draft in the chimney system. all external mechanical limits are monitored for status. Once all these conditions are met the control system will release the flame programmer or gas valve of the appliance calling for heat. The sequence is repeated every time an initial appliance calls for heat. Each additional call for heat the control will not delay the sequencing of the additional heating appliances.
- b. When a appliance shut downs the draft inducer fan will continue to run in post-purge mode for a set period of time to remove residual flue gases.
- c. Once the post-purge cycle is completed the system secures and the control panel enters stand-by mode.
- d. If proper draft cannot be maintained or an external mechanical limit opens because of mechanical or electrical failure, the control will go in alarm mode and the integrated proven draft function will shut down all the appliances within 15 seconds. while in alarm mode, the control constantly monitors the draft and limit inputs. if the failure corrects itself or is corrected via intervention, the system will restart automatically. if the failure is not corrected before the adjustable system release fault timer expires, the control will disable and lockout the system for freeze protection.
- e. If proper draft cannot be maintained or an external mechanical limit opens because of mechanical or electrical failure, the control will go in alarm mode and the integrated proven draft function will shut down all the appliances within 15 seconds. while in alarm mode, the control constantly monitors the draft and limit inputs. if the failure corrects itself or is corrected via intervention, the system will restart automatically. if the failure is not corrected before the adjustable system release fault timer expires, the control will disable and lockout the system for freeze protection.
- f. When the fan test is enabled, the control panel will run a self-diagnostic on the status of the vent system each heating cycle to verify that the system is functioning properly. if the fan test fails, the control panel will alarm, lockout system and annunciate the test failure.

K. Summer / Winter Change Over Valves

1. Point List

- a. Supply Water Temperature
- b. Valve position

2. Sequence of Operation

- a. During cooling mode of operation, Summer/Winter control valve shall modulate to the fully closed position.
- b. During heating mode of operation, Summer/Winter control valve shall modulate to the fully open position.

3.8 TRAINING

- A. The Contractor shall supply personnel to train key customer personnel in the operation and maintenance of the installed system. The training program shall be designed to provide a comprehensive understanding and basic level of competence with the system. It shall be sufficiently detailed to allow customer personnel to operate the system independent of any outside assistance. On-line context sensitive HELP screens shall be incorporated into the system to further facilitate training and operation.
- B. The training plan shall include detailed session outlines and related reference materials. The customer personnel shall be able to utilize these materials in the subsequent training of their co-workers.
 - 1. Training time shall not be less than a total of 40 hours, and shall consist of:
 - a. 16 hours during normal day shift periods for system operators. Specific schedules shall be established at the convenience of the customer.
 - b. 24 hours of system training shall be provided to customer supervisory personnel so that they are familiar with system operation.
 - c. The specified training schedule shall be coordinated with the customer and will follow the training outline submitted by the Contractor as part of the submittal process.
 - d. Provide an as built Video training tape, showing and explaining all animated graphics in detail, all controllers and equipment the FMS operates (Four (4) Copies shall be supplied).
 - e. If further training is needed, the Contractor shall provide another 40 hours at no extra cost.
 - 2. All training sessions shall be scheduled by the Construction Manager. The Contractor shall provide sign-in sheets and distribute minutes of each session prior to the subsequent session. This documentation shall be included in the Operation and Maintenance manuals.

END OF SECTION

SECTION 23 0470

TESTING, START-UP AND ADJUSTMENTS

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 TESTING, START-UP AND ADJUSTMENTS

- A. Furnish all materials, supplies, labor and power required for testing. Make preliminary tests and prove work satisfactory. Notify Architect and all authorities having jurisdiction in ample time to be present for final testing of all piping. Test before insulating or concealing any piping. Repair defects disclosed by tests, or if required by Architect, replace defective work with new work without additional cost to Owner. Make tests in stages if so ordered by Architect to facilitate work of others. Use of wicking in tightening leaking joints not permitted.
- B. HVAC Contractor is responsible for work of other trades disturbed or damaged by tests and/or repair and replacement of his work, and shall cause work so disturbed or damaged to be restored to its original condition at his own expense.
- C. Unless otherwise specified, all piping systems shall be hydrostatically tested to 150 psig. Tests shall be of four (4) hour duration during which time piping shall show no leaks and during time no sealing of leaks will be permitted.
- D. HVAC Contractor shall balance out system and submit test reports showing operating data to include the following:
 - 1. C.F.M. of all air handling equipment.
 - 2. C.F.M. at each air outlet.
 - 3. G.P.M. for equipment.
 - 4. R.P.M. for each fan and fan motor.
 - 5. Motor power consumption.
 - 6. Air temperature readings before and after coils.
 - 7. Water temperature readings in and out of coils and through equipment.
 - 8. Pressure gauge readings before and out of all pertinent equipment.
- E. If the performance of the systems does not conform to the design parameters the Contractor shall return to the site until the systems perform as designed.
- F. HVAC Contractor shall furnish services of qualified personnel, thoroughly familiar with job, to operate and make all adjustments so that system and control equipment shall operate as intended. This shall include adjustment/replacement of sheaves/impellers to achieve design performance. Adjustments shall be made including balancing of water and air systems in cooperation with qualified representatives of mechanical equipment manufacturers and temperature control manufacturer. This shall include any required adjustment/replacement of sheaves, belts, impellers, etc. to achieve design performance. Architect/Engineer is to be notified when this balancing is to be performed.
- G. When all work is in an acceptable operating condition, furnish operating and maintenance manuals as specified in General Requirements.
- H. All HVAC equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces.

- I. Contractor shall include in his Bid, adjustment of air quantity below scheduled C.F.M. for air systems deemed “noisy” by Owner subsequent to initial balancing.
- J. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.
- K. Final inspection and approval shall be made only after proper completion of all of above requirements.

END OF SECTION

SECTION 23 0480

GENERAL LABELING, VALVE CHARTS AND PIPING IDENTIFICATION

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 GENERAL LABELING AND VALVE CHARTS

- A. This Contractor shall have appropriate descriptive labels, identification tags and nameplates of equipment, valves, etc. furnished and installed under this Contract and shall be properly placed and permanently secured to (or adjacent to) the item being installed. All such labels, identifications, tags, nameplates, etc. shall be selected by the Architect/Engineer.
- B. In general, labels shall be the lamacoid type of sufficient size to permit easy identification, black coated, white edged, with letters 3/16" high. Major equipment, apparatus, control panels, etc. shall have 8" x 4" lamacoid plates with lettering of appropriate size.
- C. Provide tags for all valves, automatic and manual dampers. Tags shall be Type #2020 anodized aluminum of #1420 lamacoid engraved. Tags may not necessarily be standard. Fasten tags to valve or damper with brass chain.
- D. All nameplates, labels, identifications and tags shall be as manufactured by the Seton Name Plate Co., of New Haven, CT or approved equal. Submit complete schedules, listings and descriptive data together with samples for checking and approval before purchasing. Labeling shall include the "number" of the equipment, valve, dampers, switch, etc. and service of the valve.
- E. Mount on laminated plastic boards with transparent surface all valves, wiring diagrams, control diagrams, instruction charts, permits, etc. Valve chart shall be non-fading with original copies laminated.

1.2 IDENTIFICATION OF PIPING

- A. This Contractor shall provide on all piping, semi-rigid, wrap around plastic identification markers equal to Seton Snap-Around and/or Seton Strap-On pipe markers.
- B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe. Directions of flow arrows are to be included on each marker.
- C. Identification of all piping shall be adjacent to each valve, at each pipe passage through wall, floor and ceiling construction and at each branch and riser take-off.
- D. Identification shall be on all horizontal pipe runs, marked every 15 ft. as well as at each inlet outlet of equipment.

END OF SECTION

SECTION 23 0485

HVAC SYSTEMS COMMISSIONING

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

1.1 RELATED DOCUMENTS

- A. Section 01 9100 – Commissioning Requirements, including drawings and general provisions of the Contract, including General and Supplementary Conditions, and other Division 01 Specification Sections.
- B. In the case of a conflict between this and any other section in the project specifications, the more stringent or detailed requirements shall apply.

1.2 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.

1.3 DESCRIPTION

- A. The systems that shall be commissioned in this project include but are not limited to the following:
 - 1. Central Building Automation System including packaged unitary controllers.
 - 2. Equipment of the heating, ventilating and air conditioning systems.

1.4 OVERVIEW OF CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning inspections and tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing (TAB) review and coordination meetings.
- D. Participate in HVAC systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- G. Provide detailed startup procedures.
- H. Provide copies of all submittals, including all changes thereto, with details as required in the appropriate subsection of 3.1 Responsibilities.
- I. Facilitate the coordination of the commissioning process and incorporate commissioning activities into

overall project schedule (OPS).

- J. Ensure all subcontractors and vendors execute their commissioning responsibilities according to the contract documents and the OPS.
- K. Provide required demonstration and training of owner's personnel.
- L. Review and accept construction checklists provided by commissioning authority (CxA).
- M. Prepare O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
- N. Cooperate with the CxA for resolution of issues recorded in the "Issues Log"
- O. Prepare and provide all documentation as necessary for the compilation of the Systems Manual.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The HVAC Contractor shall provide all standard testing equipment required to perform startup, initial checkout, and testing requirements of Division 23.
- B. The Controls Contractor shall provide all standard testing equipment required to test the Building Automation and Automatic Temperature Control System (BAS), including calibration of valve and damper actuators and all sensors. Trend logs for functional testing shall be generated through the BAS interface as requested by the CxA.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the following tolerances. Temperature sensors and digital thermometers shall have a certified calibration, performed within the past year, to an accuracy of 0.5°F and a resolution of ± 0.1 °F. Pressure sensors shall have an accuracy of $\pm 2.0\%$ of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 RESPONSIBILITIES

- A. HVAC, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the HVAC, Controls and TAB Contractors of Division 23 are follows:
 - 1. Attend the initial commissioning meeting conducted at the start of construction, the commissioning meeting held 30 days prior to startup of the primary equipment, and all commissioning team meetings.
 - 2. Provide a copy of approved shop drawings and startup reports for all commissioned equipment to the CxA. Supplement the shop drawing data with the manufacturer's installation and start-up procedures. This material should be identical to the literature which will be included in the Operation and Maintenance Manuals.
 - 3. The Operation and Maintenance Manuals shall be submitted to the CM prior to the start of training (three (3) weeks before startup and training and at least sixty (60) days before substantial completion).

4. Perform and document results of Pre-functional Inspections at the direction of the CxA. Ensure that the inspection checklists are completed before startup or as specified by the CxA.
 5. During the startup and initial checkout process, execute all portions of the manufacturer's start-up checklists for all commissioned HVAC equipment.
 6. Perform and clearly document all completed startup and system operational checkout procedures and provide a copy to the CxA.
 7. Perform and document results of equipment functional testing at the direction of the CxA. Ensure that the testing is completed in the timeline specified by the CxA.
 8. Address current A/E punch list items and Commissioning corrective action items on the "Issues Log" before functional testing. Air and water TAB shall be completed, with discrepancies and problems remedied, before functional testing of the respective air-or water-related systems.
 9. Provide skilled technicians to execute starting of equipment and to perform tests in accordance with all Division 23 sections. Where specified, startup shall be performed by a factory authorized service representative. Ensure that they are available and present during the agreed-upon schedules for the sufficient duration to complete the necessary tests, adjustments and problem-solving.
 10. Correct deficiencies (differences between specified and observed performance as interpreted by the CxA and A/E) and retest the equipment.
 11. Provide training of Owner's operating staff as specified in Division 23 Sections. Use expert qualified personnel.
 12. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
 13. Correct deficiencies and make necessary adjustments to O&M manuals for applicable issues identified in any seasonal testing.
- B. HVAC Contractor. The responsibilities of the HVAC Contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. Provide startup for all HVAC equipment.
 2. Prepare a preliminary schedule for Division 23 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the PM and CxA. Update the schedule as appropriate.
 3. Notify the PM and CxA when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment, and TAB will occur. Be proactive in seeing that commissioning processes are executed and that the CxA has the scheduling information needed to efficiently facilitate the commission process.
 4. Calibrations: The HVAC Contractor is responsible to calibrate all factory-installed sensors and actuators. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated by the HVAC Contractor.
 5. Supervise all commissioning activities executed by subcontractors, including the Controls Contractor.
 6. List and clearly identify on the as-built duct and piping drawings the locations of all flow meters, fire

and smoke dampers, duct detectors, temperature sensors, relative humidity sensors, CO2 sensors, static and differential pressure sensors (air, water and building pressure).

C. Controls Contractor - The commissioning responsibilities of the Controls Contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. The submitted sequences shall generally include the following, but can vary according to project needs:

- a. An overview narrative of the system (one or two paragraphs) generally describing its purpose, components and function.
- b. Logic diagrams detailing the flow of information for each control algorithm. These diagrams should include all inputs, outputs, and computations.
- c. All interactions and interlocks with other systems.
- d. Detailed delineation of control between any packaged controls and the building automation system, listing which points the only monitored at the BAS, and which points can be controlled by and adjusted at the BAS.
- e. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included but will generally require additional narrative).
- f. Start-up sequences.
- g. Warm-up mode sequences.
- h. Normal operating mode sequences.
- i. Unoccupied mode sequences.
- j. Shutdown sequences.
- k. Capacity control sequences and equipment staging.
- l. Temperature and pressure control: setbacks, setups, resets, etc.
- m. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
- n. Effects of power or equipment failure with all standby component functions.
- o. Sequences for all alarms and emergency shut downs.
- p. Seasonal operational differences and recommendations.
- q. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
- r. Daily/weekly/monthly schedules, as appropriate, if known.
- s. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. Where possible, the numbering sequence shall correspond with Section 23 0460 Automatic Temperature Controls.

2. Control Drawings Submittal:

- a. The control drawings shall have a key to all abbreviations.
- b. The control drawings shall contain graphic schematic depictions of the system and each component.
- c. The schematics shall include the system and component layout of any equipment that the control system monitors, enables, or controls, even if the equipment is primarily controlled by packaged or integral controls.
- d. Provide a full points list with at least the following included for each point:
 1. Controlled system.
 2. Point abbreviation

3. Point description
 4. Display unit.
 5. Control point or setpoint (Yes/No)
 6. Input point (Yes/No)
 7. Output point (Yes/No)
- e. The controls contractor shall keep the A/E, CxA, HVAC and TAB Contractor informed, in a timely manner, of all changes to this list during programming and setup.
3. Submit a written checkout plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional testing. At minimum, the checkout plan shall include for each type of equipment controlled by the building automation system:
 - a. System name.
 - b. List of devices.
 - c. Step-by-step procedures for testing each controller after installation, including:
 1. Process of verifying proper hardware and wiring installation.
 2. Process of downloading programs to local controllers and verifying that they are addressed correctly.
 3. Process for performing and documenting point-to-point checkout for each digital and analog input and output.
 4. Process of performing operational checks of each controlled component.
 5. Plan and process for calibrating valve and damper actuators and all sensors.
 6. A description of the expected field adjustments for transmitter, controllers and control actuators should control responses fall outside of expected values.
 - d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor, controller or command has “passed” and is operating within the contract parameters.
 - e. A description of the instrumentation required for testing.
 - f. Indicate the portion of the controls checkout plan that should be completed prior to TAB using the controls system for TAB work. Coordinate with the CxA and TAB Contractor for this determination.
4. Point-to-Point Checkout: Include in the checkout plan a point-to-point checkout. Each control point tied to a central control system shall be verified to be commanding, reporting and controlling according to its intended purpose. For each output, commands shall be initiated and verified to be functioning by visually observing and documenting the status of the controlled device in the field (e.g. valve or damper actuator response, pump or fan status). For each input, the system or conditions shall be altered to initiate the input response being tested and the response in the control system observed and recorded (e.g. high duct static pressure alarm).
5. Calibrations: The Controls Contractor is responsible to calibrate all field installed sensors and actuators using test and documentation methods approved by the CxA. The HVAC Contractor is responsible to calibrate all factory installed sensors and actuators.
 - a. Sensors installed in the unit at the factory, with a calibration certification provided, need not be field calibrated by the HVAC Contractor.

- b. Valve leak-by tests shall be conducted by the Contractor when shown on a construction checklist.
 - c. All procedures used shall be fully documented by the Controls Contractor on suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
- 6. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as indicated in the Specifications.
- 7. Provide an official notice to proceed to the CxA and project team upon completion of the Building Automation System (BAS) and Automatic Temperature Control System (ATC) installation, including checkout and calibration of each controlled device, to confirm that all system programming is complete as to all respects of the Contract Documents. This shall be submitted by the Controls Contractor prior to the start of functional testing by the CxA.
- D. TAB Contractor: The scope of work for the TAB Contractor is provided in Section 230460.

3.2 SUBMITTALS

- A. The Contractor shall send one copy of product data, shop drawings and similar submittals to the CxA at the same time they are submitted to the A/E. The CxA will review the submittals and provide any comments to the A/E for inclusion in their comments. The Architect will transmit to the CxA, for the CxA's use in preparing functional test procedures; one reviewed and approved copy of product data, shop drawings and similar submittals received from the HVAC, Controls and TAB Contractors, pertinent to equipment and systems to be commissioned.

3.3 STARTUP

- A. The HVAC, Controls and TAB Contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section. Equipment start-up is required to complete systems and sub-systems so they are fully functional, in compliance with the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility, or partially shift that responsibility to any extent onto the Commissioning Agent or Owner.
- B. Testing is intended to begin upon completion of a system. Refer to Section 019100 for additional information related to scheduling.

3.4 TESTS

- A. The HVAC and Controls Contractors shall provide the necessary support to the CxA to complete functional testing. The Controls Contractor shall fully test and verify all aspects of the BAS Contract Work on a point / system / integrated operational basis for all points, features and functions specified. The following requirements apply to all mechanical and control systems and features that are to be commissioned when referenced below. Tests shall:
 - 1. Verify functionality and compliance with the basis of design for each individual sequence module in the sequence of operations. Verify proper operation of all control strategies, energy efficiency and self-diagnostics features by stepping through each sequence and documenting equipment and system performance. Tests shall include startup, normal operation, shutdown, scheduled 'on' and 'off', unoccupied and manual modes, safeties, alarms, over-rides, lockouts and power failure.
 - 2. Verify operation of systems and components that may be impacted during low, normal and high

load conditions and during combinations of environmental and interacting equipment conditions that could reasonably exist and potentially result in adverse system reaction.

3. Verify all alarm and high and low limit functions and messages generated on all points with alarm settings.
 4. Verify integrated performance of all components and control system components, including all interlocks and interactions with other equipment and systems.
 5. Verify shutdown and restart capabilities for both scheduled and unscheduled events (e.g. power failure recovery and normal scheduled start/stop).
 6. Verify proper sequencing of heat transfer elements as required to prevent simultaneous heating and cooling, unless specifically required for dehumidification operation.
 7. Verify system response and stability of control loops under different load conditions and determine if additional loop tuning is required for dehumidification operation.
 8. When applicable, demonstrate a full cycle from 'off' to 'on' and 'no load' to 'full load' and then to 'no load' and 'off'.
 9. Verify time of day schedules and setpoints.
 10. Verify all energy saving control strategies.
 11. Verify that all control system graphics are complete, that graphics are representative of the systems, and that all points and control elements are shown in the same location on the graphics as they are located in the field.
 12. Verify operation control of all adjustable system control points, including proper access level as agreed to during the controls system demonstration.
- B. In addition to specific details, and/or standards referenced for acceptance testing indicated in other Division 23 sections, the following common acceptance criteria shall apply to all mechanical equipment, assemblies, and features:
1. For the conditions, sequences and modes tested, the equipment, integral components and related equipment shall respond to varying loads and changing conditions and parameters appropriately as expected, according to the sequence of operation, as specified, according to acceptable operating practice and the manufacturer's performance specifications.
 2. Systems shall accomplish their intended function and performance (e.g. provide supply air and water at designated temperature and flow rate, etc., and maintain space conditions in terms of air temperature, relative humidity, and CO2 concentration) at specified levels at varying conditions.
 3. Control loops shall be stable under all operating conditions. Control loops shall exhibit a quarter decay ratio type response to a step change or other upset and return to stable operation in a time frame that is reasonable and realistic for the system that they are associated with.
 4. Resetting a manual safety shall result in a stable, safe, and predictable return to normal operation by the system.
 5. Safety circuits and permissive control circuits shall function in all possible combinations of selector switch positions (hand, auto, inverter, bypass etc.).

6. Additional acceptance criteria may be defined by the CxA when detailed tested procedures are developed.
7. At the CxA's discretion, if large numbers of deficiencies or repeated deficiencies are encountered, the CxA shall suspend functional testing until the Contractor corrects the deficiencies and troubleshoots all remaining systems at issue on their own. The Contractor shall be responsible for any resulting schedule delays that increase the overall time period to complete functional testing.
8. Retesting: The CxA will direct the retesting of the equipment once at no charge to the Owner for their time. The CxA's time and expenses incurred for a second retest, if required due to no fault of the CxA, will be reviewed by the Owner to determine the appropriate means of compensation to the CxA for extension of services. The functional testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including startup, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction checkout by the installing contractors and spot-checked by the CxA during functional testing.

3.5 WRITTEN WORK PRODUCTS

- A. Written work products of Contractors shall consist of the filled out start-up, initial checkout, and test documentation in accordance with all Division 23 sections.

END OF SECTION

SECTION 23 0490

GUARANTEE

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 GUARANTEE

- A. The Contractor shall remove, replace and/or repair at his own expense and at the convenience of the Owner, any defects in workmanship, materials, ratings, capacities and/or characteristics occurring in the work within one (1) year or within such longer period as may be provided in the Drawings and/or Section of the Specifications, which guarantee period shall commence with the final acceptance of the entire Contract in accordance with the guarantee provisions stated in the General Conditions, and the Contractor shall pay for all damage to the system resulting from defects in the work and all expenses necessary to remove, replace, and/or repair any other work which may be damaged in removing, replacing and/or repairing the work.

END OF SECTION

SECTION 26 0100

GENERAL CONDITIONS

PART 1 - GENERAL

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section.

1.1 DESCRIPTION OF WORK

- A. It is the intention of the Specification and Drawings to call for finish work, tested and ready for operation.
- B. Any apparatus, appliance material or work not shown on the Drawings but mentioned in the Specifications, or vice versa, or any incidental accessories or ancillary devices necessary to make ready for operation even if not particularly specified, shall be furnished, delivered and installed under their respective Division without additional expense to the Owner.
- C. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work as though they were hereinafter specified or shown.
- D. Work under each section shall include giving written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules and regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each section has included the cost of all necessary items for the approved satisfactory functioning of the entire system without extra compensation.
- E. Small scale drilling through walls and floors which may contain asbestos shall be performed by a person with a "restricted asbestos handler allied trades certificate" and shall have a copy of it in his possession at all times while working of the project.

1.2 DRAWINGS

- A. Drawings are diagrammatic and indicate the general arrangement of the system and work included in the Contract. (Do not scale the drawings). Consult the Architectural Drawings and details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the general construction supervisor.
- B. Work under each section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; do not begin work until unsatisfactory conditions are corrected.
- C. Make reasonable modifications in the layout as needed to prevent conflict with work of other Sections of the Specifications or for proper execution of the work.
- D. It shall be understood that the right is reserved by the Architect/Engineer to change the location of equipment and apparatus to a reasonable extent as building conditions may dictate, prior to their installation without extra cost to the Owner.

1.3 SURVEYS AND MEASUREMENTS

- A. Base all measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- B. Before proceeding with the work resolve discrepancies between actual measurements and those indicated, which prevent following good practice or intent of the Drawings or Specifications.

1.4 CODES AND STANDARDS

- A. The Codes and Standards listed below apply to all Electrical work codes or standards that are mentioned in these Specifications; the latest edition or revision shall be followed:
 - 1. NEMA - Standards
 - 2. ANSI CI - National Electrical Code (NFPA 70)
 - 3. ANSI C50.13 - Rotating Electrical Machinery
 - 4. NEMA MG2 - Construction and guide for selection, installation and use of electric motors.
 - 5. NEMA MG1 - Motors and Generators
- B. The following State and Local Codes shall apply: New York State Uniform Fire Prevention and Building Code, and Local Building Codes.
- C. The following abbreviations are used within this Division of the Specifications:
 - 1. IES - Illuminating Engineering Society.
 - 2. NEC - National Electrical Code
 - 3. ANSI - American National Standards Institute
 - 4. ASTM - American Society for testing and materials
 - 5. EPA - Environmental Protection Agency
 - 6. IEEE - Institute of Electrical and Electronic Engineers
 - 7. NEMA - National Electrical Manufacturers Association
 - 8. NFPA - National Fire Protection Association.
 - 9. OSHA - Occupational Safety and Health Administration
 - 10. UL - Underwriter's Laboratories

1.5 PERMITS AND FEES

- A. Give all necessary notices, obtain all permits and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with work of this Division. File all necessary plans, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction; obtain all necessary certificates of inspections for his work and deliver a copy to the Architect before request for acceptance and final payment for the work. Pay fees for utility construction/connections.
- B. Include in the work, without extra cost to the Owner, any labor, materials, services, and apparatus, Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the Drawings and/or specified.
- C. All materials furnished and all work installed shall comply with the rules and recommendations of the National Fire Protection Association, with the requirements of the local utility companies, with the recommendations of fire insurance rating organization having jurisdiction and with the requirements of all governmental departments having jurisdiction.
- D. All materials and equipment for the electrical portion of the mechanical systems shall bear the approval label of or shall be listed by the Underwriter's Laboratories, Inc.

1.6 TEMPORARY LIGHT AND POWER

- A. The Contractor shall furnish, install, maintain and, upon direction to do so, remove system of temporary lighting and power for the use of all construction trades.
- B. The Electrical Contractor shall provide adequate electrical service for the needs of all Contracting Trades.

- C. Wiring shall be provided for temporary use during building construction, including grounding and fused main cut-off switches. Temporary electric lines with branch switches shall be provided for lighting and for taps for electric tools, pumps and other temporary equipment; all connected to a main line looped through floor spaces and up stair wells or shafts. All power outlets shall be grounded to an equipment ground wire in an approved manner. Electric lines shall be extended to power tools, which cannot be located within reach of extension cords.
- D. Light bulbs shall be provided in sufficient quantity to light the building for safety purposes. Extension cords shall be provided as may be essential to the proper execution of the work. Temporary lighting shall be provided for all stairs and other locations where needed for safety or the proper execution of the work.
- E. The Electrical Contractor shall maintain temporary lighting and power systems in good working condition, including the relocation and reinstallation when required to avoid interference with the progress of construction.
- F. Provide ground-fault personnel ampere protection for all single phase, 15 and 20 ampere receptacles. All receptacles and portable cord connectors shall have NEMA standard locking type configurations.
- G. The Electrical Contractor shall turn lights on and off at the beginning and end of each working day of any trade unless otherwise directed. He shall arrange for all temporary light and power for all trades which do not have holidays (days off) similar to the electrical trade. The Electrical Contractor shall patch and repair all openings left damaged by the installation and removal of the temporary light and power.

1.7 MANUFACTURER'S IDENTIFICATION

- A. Manufacturer's nameplate, name or trademark and address shall be attached permanently to all equipment and materials furnished under this Division. The nameplate of a contractor or distributor may not be used.

1.8 SHOP DRAWINGS

- A. Submit for approval detailed shop drawings of all equipment and materials in accordance with working procedures.
- B. Furnish all necessary templates and patterns for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as necessary.
- C. Submit shop drawings for the following:
 - 1. Light Fixtures.
 - 2. Receptacles, Switches, Occupancy Sensors.
 - 3. Overcurrent Protective Devices.
 - 4. Panelboards and Switchboard.
 - 5. Public Address system.
 - 6. Fire Alarm system components.
 - 7. Generator and Automatic Transfer Switch.

1.9 MATERIALS AND WORKMANSHIP

- A. All materials and apparatus necessary for the work, except as specifically indicated otherwise, shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first class standard article as accepted by the Architect shall be furnished.
- B. Furnish the services of an experienced Superintendent who shall be constantly in charge of the installation of the work, together with all skilled workmen, helpers, and labor to unload, transfer, erect, connect up, adjust, start, operate and test each system.

- C. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

1.10 PROTECTION

- A. Work under each Section shall include protecting the work and materials of all other Sections from damage from work or workmen and shall include making good all damage thus caused. Be responsible for work and equipment until finally inspected, tested, and accepted; protect work against theft, injury or damage; and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing or other foreign material.
- B. Work under each section includes receiving, unloading, uncrating, storing, protecting, setting in place and connecting up completely of any equipment supplied under each section. Work under each section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the above equipment and fixtures which are missing or damaged by reason of mishandling or failure to protect on the part of the Contractor.

1.11 BASES AND SUPPORTS

- A. Unless specifically noted otherwise, provide all necessary supports, pads, bases, and piers required for all equipment under this Division. Provide all temporary bases and supports as required.
- B. All equipment, unless shown otherwise, shall be securely attached to the building structure. Attachments shall be of a strong and durable nature; any attachments that are, insufficient, shall be replaced as directed by the Architect.

1.12 SLEEVES, INSERTS AND ANCHOR BOLTS

- A. All conduits passing through floors, walls or partitions shall be provided with sleeves having an internal diameter one inch larger than the outside diameter of the conduit, or insulation enclosing the conduit.
- B. Furnish all sleeves, inserts, and anchor bolts necessary to be installed under other sections of the Specifications to accommodate work of this section.
- C. Sleeves through outside walls shall be cast iron sleeves with intermediate integral flange. Sleeves shall be set with ends flush with each face of wall. The remaining space shall be packed with oakum to within 2 inches of each face of the wall. The remaining shall be packed and made watertight with a waterproof compound.
- D. Sleeves through concrete floors or interior masonry walls shall be schedule 40 black steel pipe, set flush with finished walls or ceiling surfaces but extending 2 inches above finished floors.
- E. Sleeves through interior partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces or partitions.
- F. Inserts shall be individual or strip type of pressed steel construction with accommodation for removable nuts and threaded rods up to 3/4" inch diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods up to 1/2" diameter to be passed through the insert body. Strip inserts shall have attached rods having hooked ends to allow fastening to reinforcing rods. Inserts shall be as manufactured by Carpenter and Patterson, Inc. or Grinnell Co., Inc.
- G. Penetrations through fire-rated walls, ceilings and floors in which cables, conduits pass, shall be sealed by a UL approved fire stop fitting classified for an hourly rating equal to the fire rating of the floor, wall or ceiling shall be Gedney Fire Seal Type CFSF of CAPS.

1.13 PAINTING

- A. All finish painting in finished areas shall be performed by others.
- B. All materials shipped to the job site under the Division, such as panels and plates, shall have a prime coat and standard manufacturer's finish unless otherwise specified.
- C. Inaccessible conduits, hangers, supports and anchors and ducts shall be coated prior to installing.
- D. All components of the fire alarm system raceway shall be painted red. This includes but is not limited to conduit, junction boxes, pull boxes.

1.14 CUTTING AND PATCHING

- A. All cutting and patching required for the work of this Division shall be done by this Division.
- B. Work under this Division shall include furnishing, locating and setting inserts and/or sleeves. Do all drilling and cutting necessary for the installation.
- C. All holes cut through concrete slabs and structural steel shall be punched or drilled from the underside. No structural member shall be cut without the written acceptance of the Architect and all such cutting shall be done in a manner directed by him.
- D. Refer to Division 1 for additional requirements.

1.15 SCAFFOLDING, RIGGING, HOISTING

- A. Furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished under this Division. Remove same from premises when no longer needed.

1.16 EXCAVATING AND BACKFILLING

- A. All excavation and backfilling for the work of this Division shall be performed by Division 2.

1.17 WATERPROOFING

- A. Where any work penetrates waterproofing, including waterproof concrete and floors in wet areas. Submit proposed method of installation for review by the Architect before beginning work. Furnish all necessary sleeves, caulking and flashing necessary to make opening absolutely watertight.

1.18 ACCESSIBILITY AND ACCESS PANELS

- A. Be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and the adequate clearance in double partitions and hung ceilings for the proper installation of the work of this Division.
- B. Locate all equipment, which must be serviced, operated or maintained in fully accessible positions. Minor deviations from Drawings may be allowed for better accessibility with approval of the Architect.

1.19 SHUTDOWNS

- A. When installation of a new system necessitates the temporary shutdown of an existing utility operating system the connection of the new system shall be performed at such time as designated by and in consultation with the Utility Company. Work required after normal business hours shall be done so at no additional cost to the Owner.

1.20 CLEANING

- A. Thoroughly clean all equipment of all foreign substances inside and out before being placed in operation.
- B. If any foreign matter should stop any part of a system after being placed in operation, the system shall be disconnected, cleaned and reconnected whenever necessary to locate and remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.
- C. Upon completion of work remove from the premises all rubbish, debris, and excess materials. Any oil or grease stains on floor areas caused by work of this Division shall be removed and floor areas left clean.

1.21 RECORD DRAWINGS

- A. Maintain at the job site a record set of Electrical Drawings on which any changes in location of equipment, panels, devices, and major conduits shall be recorded. Indicate dimensions of all items installed underground or in concrete.

1.22 OPERATING INSTRUCTIONS

- A. Upon completion of all work and all tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall instruct the Owner or his representative fully in the operation, adjustment and maintenance of all equipment furnished. Give at least 7 days' notice to the Owner in advance of this period.
- B. Furnish four complete bound sets for delivery to the Architect of typewritten or blueprinted instructions for operating and maintaining all systems and equipment included in this Division. All instruction shall be submitted in draft for review prior to final issue. Manufacturer's advertising literature or catalogs may not be used for operating and maintenance instruction.
- C. In the above-mentioned instructions, include the maintenance schedule for the principal items of equipment furnished under this Division.
- D. The manufacturer shall attest in writing that his equipment has been properly installed prior to start. The following is some of the equipment necessary for this inspection: fire alarm system. These letters will be bound into the operating and maintenance books.

1.23 ADJUSTING AND TESTING

- A. After all equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests as will assure the Architect that they are in proper adjustment and in satisfactory permanent operating condition.
- B. This particular work shall include the services of a factory engineer to inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, there shall be furnished the service of said engineer for the purpose of supervising the initial operation of the equipment and to instruct the personnel responsible for operation and maintenance of the equipment.
- C. At the completion of the job when all panels, devices, etc. are at full working load the Contractor shall provide infrared scan thermographic inspection test of all connection points, terminals, etc. of wires #8 AWG and larger to detect "hot-spots" in the electrical current flow. Correct all hot-spots.

1.24 UNDERWRITER'S LABEL

- A. All electrical equipment and materials shall be new and shall comply with the standards of and shall bear the label of the Underwriter's Laboratories.

1.25 ELECTRICAL SAFETY INSPECTION

- A. Electrical Contractor shall arrange for an Electrical Safety Inspection to be performed by the Local Inspection Agency (i.e.: New York Electrical Inspection Services, Atlantic Inland, Middle Department Inspection Agency). A Certificate of Compliance "Underwriter's Certificate" shall be issued to the Owner. All costs and coordination required shall be included in this Contractors Base Bid.

1.26 REMOVALS

- A. The scope of removals shown on the Drawings are diagrammatic only and indicate the intent of the work to be performed and not the complete scope of demolition and/or removal work. It shall be the responsibility of this Contractor to remove any electrical devices even if not specifically indicated to be removed on these Drawings in order to accommodate new work.
- B. All power conductors, control wiring and conduit associated with mechanical equipment such as fans, pumps, etc. designated for removal on the HVAC Drawings shall be removed clear back to the source of power and disconnected. All motor starters, disconnect switches, control devices, etc. shall be removed. Refer to HVAC Drawings for extent of HVAC removals.
- C. Any device removed shall include (but shall not be limited to) the removal of all associated wiring, conduit, boxes, and auxiliary devices back to the previous device on the circuit, or back to the panelboard or origin of the circuit or any other items that are not incorporated in new layout, until such removal is complete. If the removal of any device interrupts service of any other device that is to remain, the Contractor shall provide all materials and labor to ensure continuity of service to those devices to remain.
- D. Junction boxes, pullboxes, wireways, conduits, or any other devices required to reconnect circuitry shall be installed concealed within the ceilings, partitions and/or walls, floors, no surface or exposed circuiting shall be permitted, unless specifically indicated.
- E. The Electrical Contractor shall patch all openings in walls, ceilings or roof that are left open as a result of removals. Refer to cutting and patching section. Any electrical device removed including but not limited to disconnect switches, panelboards, etc. shall be cleaned, protected and turned over to the Owner or disposed of as directed by Owner.

END OF SECTION

SECTION 26 0125

SCOPE OF WORK

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 SCOPE OF WORK

- A. The work under this section includes all labor, materials, equipment, tools, transportation and the performance of all work necessary and required for furnishing and installing all Electrical work shown on the Contract Documents, as specified herein and as otherwise required by job conditions or reasonably implied, including, but not necessarily limited to the following:
1. The addition of new fire alarm devices (i.e., automatic fan shutdown, for new HVAC equipment) and the replacement of the existing ones as shown on Drawings.
 2. The contractor shall dispose of all debris, including but not limited to fixtures, equipment, lamps, ballast, wiring devices and the like in accordance with, as defined by governing law and regulations of the jurisdiction where the work is being performed.
 3. Provide final electrical connections to the construction trailer provided on site.
 4. Modifications to existing electrical distribution system as indicated on the Drawings.
 5. Conduit, conduit fittings, junction and pull boxes and all appurtenances necessary for the raceway systems including necessary supports and fasteners.
 6. Electrical conductors, connectors, fittings and connection lugs.
 7. Branch circuit devices, outlet boxes, pull boxes, motor disconnect switches, etc.
 8. Power wiring to HVAC and Plumbing equipment including disconnect switches as shown and/or required by NEC.
 9. Lighting fixtures and lamps including and occupancy sensor.
 10. Core drilled holes for conduit passing through walls, ceilings and floors.
 11. All necessary cutting, patching and core drilling incidental to the electrical work.
 12. Temporary light and power.
 13. Licenses, permits, inspection and approvals.
 14. Grounding as required as per NEC.
 15. Sleeves for conduit and watertight caulking between conduit and sleeve.
 16. Testing.
 17. Cutting, patching and drilling.

- B. Coordination Drawings (if applicable): Attention is directed to Division 1 for coordination drawing requirements for this project. These drawings are critical to the proper execution of the work and failure to honor these requirements may become the basis for denial of any and all claims for either or both “time” and “money”.

1.2 WORK NOT INCLUDED

- A. The following related items will be done by others:

1. Furnishing motors and controllers.
2. Concrete work.
3. Excavation and backfill.

END OF SECTION

SECTION 26 0150

APPROVED MANUFACTURERS

PART 1 - GENERAL

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 APPROVED MANUFACTURERS

- A. The following list of manufacturers constitutes an approved list:
- | | | |
|-----|--------------------------|--|
| 1. | Panelboards | Siemens, Square D, GE |
| 2. | Disconnect Switches | Siemens, Square D, GE |
| 3. | Conduit (steel) | Walker, Youngstown, Steelduct, Triangle |
| 4. | Conduit Fittings (steel) | Appleton, Crouse-Hind, O-Z, T & B, M & W |
| 5. | Wire and Cable | General, South Wire, Triangle, Rome, Hatfield, Crescent, Cerro |
| 6. | Splicing Connectors | 3M, O-Z, Thomas & Betts |
| 7. | Outlet Boxes | Appleton, National, Steel City, Raco |
| 8. | Wiring Devices | Arrow-Hart, Hubbell, P & S |
| 9. | Fuses | Bussman, Ferraz-Shawmut, Littlefuse |
| 10. | Motion Sensors | Watt Stopper, Sensorswitch |
- B. All materials and appliances shall have listing of Underwriters Laboratories, Inc. and be so labeled, or shall conform to their requirements, in which case certified statements to that effect shall be furnished by the manufacturer with a copy of an examination report by a recognized independent testing laboratory acceptable to the Architect and his Engineer. Use new materials and appliances throughout.
- C. Where several types or makes of materials are specified, the Contractor has the option of using any of these, but after a type or make has been selected and has received the approval of the Architect, it shall be used throughout.
- D. The Contractor shall provide all structural supports for the proper attachment of equipment supplied by him and also for all equipment supplied to him under other sections of the Specifications for mounting and connections.
- E. Secure all equipment to the building structure independently. Do not secure to work of other trades such as ceiling lath, piping racks, etc., unless specified or noted otherwise.
- F. Wall mounted equipment shall be directly secured to wall by means of steel bolts. Maintain at least 1/4" air space between equipment and supporting wall. Pre-fabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf and Unistrut, shall be used for mounting arrays of equipment.

- G. All fastening, supports, hangers, anchors, etc., shall be of a type made for the specific purpose. On masonry walls, metallic expansion shield and machine screws shall be used. Screws with wooden plugs or anchors will not be acceptable on any part of the work.

END OF SECTION

SECTION 26 0200

CONDUIT

PART 1 - GENERAL

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all material, labor, tools, and services necessary to install rigid metal conduit, electrical metallic tubing and liquid tight flexible metal conduit, including all fittings to complete all work shown on the Drawings or specified herein.

1.2 RELATED WORK

- A. Cutting and patching.
- B. Trenching: Excavation and backfill for conduit and utility on site.
- C. Sheet metal flashing and trim.

PART 2 - PRODUCTS

2.1 RIGID STEEL CONDUIT

- A. Industry standard heavy wall conduit.
- B. Minimum 3/4" trade size.
- C. Threaded.
- D. Hot dipped galvanized finish by means of plating after cutting of threads.

2.2 INTERMEDIATE METAL CONDUIT

- A. Industry standard steel conduit.
- B. Minimum 3/4" trade size.
- C. Threaded.
- D. Hot dipped galvanized finish by means of plating after cutting of threads.

2.3 ELECTRICAL METALLIC TUBING

- A. Industry standard thin wall conduit of galvanized steel only.
- B. Minimum 3/4" trade size.
- C. Maximum 4" trade size.

2.4 FLEXIBLE METAL CONDUIT

- A. Galvanized steel tape formed into an industry standard interlocking coil.
- B. Minimum 3/4" trade size except for connection of lighting fixtures.
- C. Grounding type.
- D. Separate ground conductor.
- E. Use for short connections to motor terminal box, other vibrating equipment using a minimum length of 18" with 50% slack and a maximum of 6'.
- F. From outlet box to recessed lighting fixtures with a maximum length of 6'.

2.5 WIREWAYS

- A. Lay-in type, UL listed as wireway or auxiliary gutter.
- B. Wireway shall be of code gauge steel construction (UL standard for Wireway Auxiliary Gutters and Associated Fittings) with removable cover. Tamperproof screws shall be provided for sealing covers to prevent access by unauthorized personnel. Wireway shall be provided with knockouts.
- C. Connector and covers shall be attached so that removal of connectors is not necessary to utilize the lay-in feature.
- D. Finish: All sheet metal parts shall be provided with a rust inhibiting phosphating coating and baked enamel finish. All hardware shall be plated to prevent corrosion. All screws extending into the wireway shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

2.6 CONDUIT SUPPORTS

- A. Conduit clamps, straps and supports: Steel or malleable iron.

2.7 CONDUIT FITTINGS

- A. Use compression fittings for all EMT in exposed areas. Utilize set screw fittings only above hung ceilings and concealed areas.

2.8 SURFACE METAL RACEWAY

- A. Metal raceway shall be of a two-piece design with a base and snap-on cover.
- B. Raceway and all components shall be listed by Underwriters Laboratories
- C. Single Channel: Steel, zinc plated, off-white finish suitable for repainting. Two piece design with metal base and snap-on cover. Provide Wiremold V700, Hubbell Inc. 750 Series, or Panduit PMR5/PMR7.
- D. Dual Channel: Steel, galvanized, off-white finish but suitable for repainting. Two-piece design with metal base and snap-on cover, minimum 0.04" thick base and cover. Base shall be divided by a removable barrier section. Provide duplex receptacles mounted in top cell and communication outlets in the bottom cell. Coordinate communications jack requirements with owner's IT personnel. Provide Wiremold V4000, Wiremold DS4000 Series, Hubbell Inc. 4000 Series or Panduit PMR40.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT AND SUPPORT

- A. Minimum size - 3/4". Provide grounding bushings on all conduits 1-1/4" and larger.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- D. Draw up couplings and fittings full and tight. Protect threads cut in field from corrosion. Paint newly threaded joints of steel conduit with T & B "Kopershield" compound before installation. Running threads prohibited; use three-piece unions or split couplings instead. Use only compression fittings for all EMT in areas where it will be exposed in finished and unfinished areas. Provide set screw fittings only when installed above hung ceilings.
- E. Maintain minimum 6-inch clearance between conduit and piping. Maintain 12-inch clearance between conduit and heat sources such as flues; steam pipes and heating appliances.
- F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- H. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction before conductors are pulled.
- I. Exposed conduit on ceiling shall be parallel or perpendicular to wall and vice versa to ceiling when installed on wall. Secure conduit clamps and supports to masonry materials by toggle bolt, expansion bolt or steel insert. Spacing of conduit supports shall not exceed 7 feet.

3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or pipe cutter, Deburr cut ends.
- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Install no more than the equivalent of three 90-degree bends between boxes.
- E. Use conduit bodies to make sharp changes in direction, as around beams.
- F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size.
- G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- I. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.

- J. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.
- K. Where conduit penetrates fire-rated walls and floors, provide pipe sleeves two sizes larger than conduit; Pack void around conduit with fire-stop fittings with UL listed fire rating equal to wall or floor ratings; Seal opening around conduit with UL listed foamed silicone elastomer compound.
- L. Installation of conduit in slab shall comply with ACI 318.
- M. Route conduit through roof openings for piping and duct work where possible; otherwise, route through roof with pitch pocket.
- N. Maximum size conduit in slabs above grade: 1 inch. Do not route conduits to cross each other in slabs above grade. Conduits crossing each other may not be larger than 3/4 inch.
- O. All conduit used for fire alarm system shall be painted red.

3.3 CONDUIT INSTALLATION OF SCHEDULE

- A. Underground installations: PVC minimum Schedule 40 conduit, unless otherwise noted on Drawings.
- B. Installations in or under concrete slab: PVC minimum Schedule 40 conduit, unless otherwise noted on Drawings.
- C. Exposed outdoor locations: Rigid galvanized steel conduit.
- D. Wet interior locations: Rigid galvanized steel conduit.
- E. Concealed dry interior locations and above accessible ceiling for receptacle and lighting branch wiring: Electrical metallic tubing up to first junction box and flexible metallic tubing (MC cable only) thereafter.
- F. Concealed dry interior locations other than receptacle and lighting branch wiring: Electrical metallic tubing.
- G. Concealed dry interior locations and above accessible ceiling for fire alarm runs: Fire alarm armored cable type MC with red stripe as manufactured by AFC series 1800.
- H. Concealed and exposed dry interior location for feeder runs: Electric metallic tubing.
- I. Exposed dry interior in unfinished locations other than Boiler Rooms: Electric metallic tubing.
- J. Final connections to motors: Flexible metallic tubing (MC cable). Minimum of 10" to maximum of 6' for connections to motors.
- K. Existing exposed dry interior locations (finished spaces), for branch wiring and fire alarm wiring, one-piece steel raceway (similar to Wiremold V-500, V-700).
- L. Final connections to motors: Flexible metallic tubing (MC cable). Minimum of 18" to maximum of 6' for connections to motors.
- M. All conduit installed in boiler room up to 10'-0" AFF and lower shall be rigid galvanized steel conduit. All conduit above 10'-0" shall be electric metallic tubing.
- N. Final connections to equipment and/or motors in boiler room, outdoors and potentially wet indoor areas: liquid tight, flexible; minimum of 18" to maximum 6'-0" connections.

END OF SECTION

SECTION 26 0300

WIRE AND CABLE

PART 1 - GENERAL

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to wire and cable in raceway specified in other sections to complete all work shown on the Drawings or specified herein.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Thermoplastic-insulated building wire: Type THHN.
- B. Rubber insulated building wire: NEMA WC 3.
- C. Feeders and branch circuits larger than number 6 AWG: Copper, stranded conductor, 600 volt insulation, type THHN.
- D. Feeder and branch circuits 6 AWG and smaller: Copper conductor, 600 volt insulation, THWN/THHN, 6 and 8 AWG, stranded conductor; Smaller than 8 AWG, solid conductor.
- E. Service feeders and branch circuits in conduit in contact with earth shall be type XHHW.
- F. Control circuits: Copper, stranded conductor 600 volt insulation, THHN.

2.2 ARMORED CABLE

- A. BX or pre-manufactured cables are not acceptable except for Type MC for branch wiring after the first junction box (for receptacle and lighting branch circuits) and final connections to motors in interior dry accessible locations, minimum length shall be 18" with a maximum length of 6' for motors.
- B. Type MC fire alarm cable with red stripe for concealed fire alarm wiring as manufactured by AFC series 1800.
- C. Armored cable, Type MC size 14 through 6 AWG: Copper conductor, 600 volt thermoplastic insulation, rated 90 degrees C., with separate green ground conductor.

2.3 REMOTE CONTROL AND SIGNAL CABLE

- A. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degree C, individual conductors twisted together shielded and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts and plenums. Verify wiring type with manufacturer.

2.4 COLOR CODING

- A. All wiring shall be color-coded. Neutral wire shall be white throughout and each phase wire shall be identified any place in the system by its color code. All conductors in panel boxes and junction boxes shall be properly tagged with red non-flammable tags properly attached.
- B. Wire shall be color coded as follows:
- | <u>120/208 volt system</u> | | <u>Fire Alarm</u> |
|----------------------------|-------|-------------------|
| A Phase | Black | Red |
| B Phase | Red | |
| C Phase | Blue | |
- C. Equipment ground wires or ground jumpers shall be Green.
- D. In addition to the basic color-coding described the following additional identification and tagging shall apply.
1. The switch legs for the local wall switches and in switch panel shall have distinctive stripes. In instances where color-coding is not practicable, such as short runs of heavy feeder cables, taping the ends of the cable with coded colors as indicated above or tagging will be permitted.
 2. Cables shall be tagged in all pull boxes, wireways and wiring gutters of panels.
 3. Where two (2) or more circuits run to or through a control device, outlet box or junction box, each circuit shall be tagged as a guide in making connections.
 4. Tags shall identify wire or cable by number and/or piece of equipment served as shown on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet and for 20 ampere.
- C. Use 10 AWG conductor for 20 ampere, 277 volt branch circuit home runs longer than 200 feet for 20 ampere.
- D. Place an equal number of conductors for each phase of a circuit in same raceway or cable. No more than one of each phase shall be supported by a single neutral.
- E. Splice only in junction or outlet boxes.
- F. Neatly tag, identify, train and lace wiring inside boxes, equipment and panelboards.
- G. Make conductor lengths for parallel circuits equal.

3.2 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricate for pulling 4 AWG and larger wires.

- B. Completely and thoroughly swab raceway system before installing conductors.
- C. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

3.3 CABLE INSTALLATION

- A. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips or metal cable ties to support cables from structure (not ceiling suspension system). Include bridle rings or drive rings.
- B. Use suitable cable fitting and connectors.

3.4 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Use solderless pressure connections with insulating covers for copper wire splices and tape, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- C. Provide extended gutters and tap blocks or pull boxes with tap rail systems similar to Burndy MT Series or Burndy Electroraill system for wire splices 6 AWG and larger.
- D. Tape uninsulated conductors with electrical tape to 150 percent of the insulation value of conductor.
- E. Thoroughly clean wires before installing lugs and connectors.
- F. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- G. Terminate spare conductors with electrical tape.

3.5 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the Specifications.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Torque test conductor connections and terminations to manufacturer's recommended values.
- D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.6 WIRE AND CABLE INSTALLATION SCHEDULE

- A. All wiring and cable shall be installed in conduit unless otherwise noted. Refer to conduit section 26 0200 for conduit types at various location.

END OF SECTION

SECTION 26 0320

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. Work of this section includes all labor, materials, equipment and services necessary to complete the electrical work as shown of the Drawings and specified herein, including, but not limited to, the following:
- B. Fuses
 - 1. Current limiting cartridge fuses.
 - 2. Time delay cartridge fuses.
- C. Circuit Breakers
 - 1. Standard molded case circuit breakers "bolted in" type.
 - 2. Solid state circuit breakers.
 - 3. Current limiting circuit breakers.
 - 4. Enclosed circuit breakers.

1.2 SUBMITTALS

- A. Shop drawings showing dimensions, location of equipment and method of installation.
- B. Product Data: Manufacturer's printed data, catalog cuts.

1.3 DISCONNECT SWITCHES

- A. Fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover when switch is in ON position. Handle lockable in OFF position. Fuse clips shall be designed to accommodate Class R, J fuses.
- B. Non-fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover when switch is in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA Type 1, 3R or 4 as required.

1.4 FUSES

- A. Voltage ratings of fuses shall be suitable for the supply characteristics to which they are applied.
- B. Fuse type and size shall be suitable for installation in related disconnect switch or circuit breaker.

C. Current limiting fuses shall be as follows:

1. Regardless of actual available fault current, they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical or 280,000 amperes RMS asymmetrical, deliverable at the line side of the fuse.
2. They shall have average melting time-current characteristics to meet the Underwriters' Laboratories requirements for "Class RK-1" 0-600 amp fuses.

D. Regardless of actual available fault current, they shall be capable of limiting peak let through current to the following values based on 200,000 amperes RMS symmetrical or 280,000 amperes asymmetrical being available:

<u>Rating In Amperes</u>	<u>Peak Let Through Current In Amps</u>
15-30	6,000
35-50	8,000
70-100	12,000
125-200	20,000
225-601	38,000

E. Fuses shall be rejection type. Fuse clip shall be rejection type.

F. Fuse Type and Application Table:

<u>Category of Application</u>	<u>Acceptable Fuse Types</u> (Bussman Designations @ 600V)
Motor feeder	LPS below 600A
Power panel feeders	LPS below 600A
Safety switches	LPS

1.5 CIRCUIT BREAKERS

- A. "Bolted-In" type, manually operated, quick-make, quick-break, mechanically trip-free operating mechanisms for simultaneous operation, of all poles, with contacts, arc interrupters and trip elements for each pole. "Plug-in" breakers are not permitted.
- B. Tripping units shall be "thermal-magnetic" type having bimetallic elements for time delay overload protection, and magnetic elements for short circuit protection.
- C. Manually operable by mean of toggle type operating handles having tripped positions midway between the "on-off" position. Handle to be clearly labeled as to breaker rating.
- D. Minimum frame size for all circuit breakers, 1, 2, or 3 pole shall be 100 amperes.
- E. Their interrupting rating shall not be less than 25,000 amperes RMS symmetrical at 208 volt for distribution panels and 10,000 amperes for power panels.

1.6 APPLICATIONS

- A. Category of Application for Fuses
 - 1. Feeders on switchboards.
 - 2. Branch fused switch unit in distribution panel.
 - 3. Fused safety switch.
 - 4. Combination motor starters.
- B. Category of Application for Circuit Breakers
 - 1. Panelboards.
 - 2. Switchboards.
 - 3. Individual enclosures.
 - 4. Combination motor starters.

1.7 SPARE FUSES

- A. Upon Engineer's acceptance of the electrical distribution system, provide spare fuses as follows: 10% of each type and rating installed 600 amperes and smaller (minimum of 3). Provide spare fuse cabinet with directory to store all spare fuses. Locate as directed by Engineer and/or Owner.

1.8 APPROVED MANUFACTURERS

- A. Fuses: Bussman, Ferraz-Shawmut.
- B. Circuit Breakers: Siemens, General Electric, Square D.

1.9 INSTALLATION

- A. All material installation shall be in accordance with manufacturer recommendations and the provisions of all applicable codes.
- B. All fuses and circuit breakers shall be selectively coordinated.
- C. Install disconnect switches where indicated on Drawings.
- D. Install fuses in fusible disconnect switches.
- E. Disconnects shall have NEMA 3R enclosure.

1.10 RECORD DRAWINGS

- A. Shop drawings showing dimensions, location of equipment and method of installation.
- B. Product Data: Manufacturer's printed data, catalog cuts, performance curves.

END OF SECTION

SECTION 26 0350

BOXES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install wall and ceiling outlet boxes, floor boxes, pull and junction boxes to complete all work shown on the Drawings or specified herein.

1.2 RELATED WORK

- A. Access doors.
- B. Wiring devices: Service fittings and fire-rated poke-through fittings for floor boxes.
- C. Cabinets and enclosures.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

- A. Sheet metal outlet boxes: ANSI/NEMA OS 1; Galvanized steel, with 1/2 inch male fixture studs where required.
- B. Cast boxes: Cast ferroalloy, deep type, gasketed cover, threaded hubs.
- C. Typical receptacle box shall be 4" square metal boxes, 30.8 cubic inch capacity with brackets as required. Provide 4" square raised device covers.

2.2 PULL AND JUNCTION BOXES

- A. Sheetmetal boxes: ANSI/NEMA OS 1; Galvanized steel.
- B. Sheetmetal boxes larger than 12 inches in any dimension: Hinged enclosure in accordance with Section 26 0450.
- C. Cast metal boxes for outdoor and wet location installations: NEMA 250; Type 4 and type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast metal boxes for underground installation: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless cover screws.

PART 3 - EXECUTION

3.1 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as required in excess of that shown on Drawings and as required for splices, taps, wire pulling, equipment connections and code compliance.

- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Where installations are accessible, coordinate locations and sizes of required access doors with Division 1.
- D. Locate and install to maintain headroom and to present neat appearance.

3.2 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.
- B. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- C. Provide knockout closures for unused openings.
- D. Support boxes independently of conduit except for cast iron boxes that are connected of rigid metal conduits, both supported within 12 inches of box.
- E. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- F. Install boxes in wall without damaging wall insulation.
- G. Coordinate mounting heights and locations of outlets mounted above counters, benches and backspaces.
- H. Position outlets to locate luminaries as shown on reflected ceiling plans.
- I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- L. Provide cast outlet boxes in exterior locations exposed to the weather and wet locations.

3.3 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.

3.4 FLOOR BOX INSTALLATION

- A. Set boxes level and flush with finish flooring material.
- B. Use cast iron floor boxes for installation in slab on grade.

END OF SECTION

SECTION 26 0400

WIRING DEVICES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install receptacles, service fittings device plates and box covers to complete all work shown on the Drawings or specified herein.

1.2 REFERENCES

- A. FS W-C-596 - Electrical power connector, plug, receptacles and cable outlet.
- B. FS W-S-896 - Switch, toggle.
- C. NEMA WD 1 - General purpose wiring devices.
- D. NEMA WD 5 - Specific-purpose wiring devices.

1.3 SUBMITTALS

- A. Submit product data under Provisions of Contract and Division 1.
- B. Provide product data showing configurations, finishes, dimensions and manufacturer's instructions.

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. Convenience and straight-blade receptacles: 125 V, 2 pole, 3 wire, 20 ampere specification grade, ground fault interrupting or isolated ground type.
- B. Internal ground clip of receptacles shall be in one piece with the receptacle mounts.
- C. Receptacles with riveted ground clips will not be accepted.
- D. Isolated ground type receptacle shall be orange in color.

2.2 WALL SWITCHES

- A. Wall switches for lighting circuits and motor loads under 1/2 hp: AC general use snap switch with toggle handle, rated 20 amperes and 120-277 volts AC.
- B. Handle: Ivory plastic.
- C. Pilot light type: Lighted handle. Pilot strap in adjacent gang.
- D. Locator type: Lighted handle.

2.3 COVER PLATES

- A. Decorative cover plate: Stainless steel 302/304 smooth Hubbell "S" series.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install receptacles on roof along parapet wall.
- B. Install specific use receptacles at heights shown on contract drawings.
- C. Drill opening for poke - through fitting installation in accordance with manufacturer's instructions.
- D. Install plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- E. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.
- F. Install devices and wall plates flush and level.

END OF SECTION

SECTION 26 0450

CABINETS AND ENCLOSURES

PART 1 - GENERAL

Applicable Provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install hinged cover enclosures to complete all work shown on the Drawings or specified herein.

1.2 REFERENCES

- A. NEMA 250 - Enclosures for electrical equipment (1000 volts maximum).
- B. Submittals - Submit product data under Provisions of Contract and Division 1.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250; Type 1 and 3R steel.
- B. Finished: Manufacturer's standard enamel finish.
- C. Covers: Continuous hinge, held closed by operable by key.
- D. Provide barriers between normal and emergency wiring. Barriers shall be of non-current carrying material of adequate thickness for mechanical strength but in no case less than 1/4". Each barrier shall have an angle iron framing support all around.

2.2 FABRICATION

- A. Shop assemble enclosures in accordance with ANSI/NEMA ISC 6.
- B. Provide knockouts on enclosures.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosures plumb; Anchor securely to wall and structural supports at each corner, minimum.
- B. Provide necessary feet for free-standing equipment enclosures.
- C. Install trim plumb.

END OF SECTION

SECTION 26 0500

SUPPORTING DEVICES

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install rigid metal conduit, electrical metallic tubing and flexible metal conduit, including all fittings to complete all work shown on the Drawings or specified herein.

1.2 RELATED WORK

- A. Conduit and equipment supports.
- B. Fastening hardware.

1.3 REFERENCES

- A. Conduit supports.

1.4 QUALITY ASSURANCE

- A. Support system shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Support channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, outlet, junction boxes to building structure using preset inserts, beam clamps and spring steel clips.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; Expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- D. Do not use powder-actuated anchors.
- E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

- F. In wet locations install free-standing electrical equipment on concrete pads.
- G. Install surface mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.
- H. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

END OF SECTION

SECTION 26 0550

GENERAL LABELING AND IDENTIFICATION

PART 1 - GENERAL

Applicable Provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install nameplates, tape labels, wire markers, conduit color coding to complete all work shown on the Drawings or specified herein.

1.2 RELATED WORK

- A. Painting.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Division 1.
- B. Include schedule for nameplates and tape labels.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Tape labels: Embossed adhesive tape with 3/16 inch black letters on a white background.
- C. Wire and cable markers: Cloth markers, split sleeve or tubing type.

PART 3 - EXECUTION

3.1 INSTALLATION

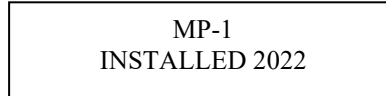
- A. De-grease and clean surfaces to receive nameplates and tape labels.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- D. Embossed tape will not be permitted for any application. Use embossed tape only for identification of individual wall switches and receptacles and control device stations.

3.2 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes and at load connection. Identify each branch circuit or feeder number for power and lighting circuits and each control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

3.3 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates to identify all electrical distribution, control equipment and loads served including year of installation. Letter height: 1/2 inch for individual switches, loads served, distributions and control equipment identification. For example:



- B. Panelboards: 3/4 inch, identify equipment designation. 1/2 inch, identify voltage rating and source of power.
- C. Individual circuit breakers, switches and motor starters in panelboards, switchboards and motor control centers: 1/4 inch, identify circuit and load served, including location.
- D. Individual circuit breakers, enclosed switches and motor starters: 1/2 inch, identify load served.

3.4 FIRE ALARM

- A. All fire alarm raceway components shall be painted red and identified.

END OF SECTION

SECTION 26 0600

DISCONNECT SWITCHES

PART 1 - GENERAL

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install disconnect switches, fuses and enclosures to complete all work shown on the Drawings or specified herein.

1.2 SUBMITTALS

- A. Submit product data under Provisions of Contract and Division 1.
- B. Include outline Drawings with dimensions, equipment ratings for voltage, capacity, horsepower and short circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - DISCONNECT SWITCHES

- A. Siemens.
- B. Square 'D'.
- C. General Electric.
- D. Or approved equal.

2.2 DISCONNECT SWITCHES

- A. Fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch is in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate class R, J fuses.
- B. Non-fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA Type 1; 3R; 4 as indicated on Drawings.

2.3 ACCEPTABLE MANUFACTURERS - FUSES

- A. Bussman.
- B. Ferraz-Shawmut.
- C. Or approved equal.

2.4 FUSES

- A. Fuses 600 amperes and less: ANSI/UL 198E, class RK1; RK5; Dual element, current limiting, time delay, 250 volt.
- B. Interrupting rating: 200,000 rms amperes.
- C. An additional fuse of each size required to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on Drawings.
- B. Install fuses in fusible disconnect switches.
- C. Disconnects installed outdoors shall have NEMA 3R enclosures.
- D. Disconnects installed indoors in dry locations shall have NEMA 1 enclosure.

END OF SECTION

SECTION 26 0650

GROUNDING

PART 1 - GENERAL

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install the power system grounding to complete all work shown on the Drawings or specified herein.

1.2 RELATED WORK

- A. Panelboards.
- B. Raceways.
- C. Connection Equipment.
- D. Electric Equipment.
- E. Tests and Acceptance.
- F. Transformers.
- G. Electric Service.

1.3 SUBMITTALS

- A. Manufacturers' data, catalog cuts of ground rods, connectors, bushings, etc., along with recommended installation procedures.

PART 2 - PRODUCTS

2.1 WIRING

- A. All wiring used for grounding shall be insulated copper, unless otherwise noted. Size shall be in accordance with code for the application, minimum #12.
- B. Where used in conjunction with computer equipment, grounding conductors shall be equal in size to the phase conductors.
- C. Avoid splices in ground conductors.

2.2 RACEWAY

- A. Grounding continuity shall be maintained for all metallic raceways.
- B. Provide bonding jumpers across metal parts separated by non-conducting materials.
- C. Where a grounding conductor is installed as a supplement to metallic raceway serving as the equipment grounding conductor, bonding conductor to the raceway at each end.
- D. All raceway accessories, such as locknuts, bushings, expansion fittings, etc. shall be installed to provide maximum metal-to-metal bonding.

2.3 CLAMPS

- A. Provide approved ground clamps for connecting grounding conductors to pipe, conduits, wireways, building steel, grounding rods, etc.
- B. Where bond will be in an inaccessible location or as an alternate to ground clamps, provide exothermic weld, similar to Cadweld.

2.4 ACCESSORIES

- A. Provide all necessary accessories of appropriate size and material for connection or termination of grounding conductors including:
 - 1. Straps.
 - 2. Clamps.
 - 3. Lugs.
 - 4. Bars and buses.
 - 5. Isolators (where applicable).
 - 6. Locknuts and bushings.

2.5 ACCEPTABLE MANUFACTURERS

- A. Copperweld.
- B. Cadweld (for exothermic welds).
- C. O.Z. Gedney.
- D. Burndy.

PART 3 - EXECUTION

3.1 SERVICE ENTRANCE/SWITCH

- A. Coordinate all bonding and grounding requirements of the service entrance with the utility company.
- B. Provide ground lug in each switchboard, minimum 25% of phase bus, along entire length of switchboard.
- C. Separately connect each ground to existing grounding electrode. Test existing grounding electrode for proper resistance values and provide all necessary modifications required.

3.2 TRANSFORMERS

- A. Bond each transformer secondary neutral to nearest building structural column or beam via transformer case grounding stud.
- B. Provide jumper between transformer case and all conduit bushings.
- C. Where a separate equipment-grounding conductor is provided the primary and/or secondary feeders; bond to transformer grounding stud.
- D. Where isolation shield is provided, bond to transformer grounding stud.
- E. Where a separate ground riser is provided in addition to or instead of building steel; bond transformer-grounding stud to the ground riser.

3.3 STRUCTURAL STEEL BUILDINGS

- A. Select a column common to aligned electric closets as the bonding column for grounding of transformer neutrals, isolated grounds and separate equipment grounding conductors.
- B. All grounding conductors in each closet shall be bonded in close proximity to one another.
- C. Where a grounding conductor to be bonded is not in proximity to the common column, bond to the nearest column or structural beam.
- D. Provide bonding jumper strap across all structural expansion joints where the grounding integrity of the structural system is reduced

3.4 RACEWAYS

- A. Grounding continuity is to be maintained for all metallic raceways. Provide necessary clamps, bushings, straps and locknuts to assure continuity.
- B. For non-metallic or flexible raceways, provide a separate equipment-grounding conductor bonded to both ends.
- C. Where indicated, an additional equipment-grounding conductor shall be provided in metallic raceway.
- D. Where indicated, an isolated ground conductor shall be provided in addition to the equipment-grounding conductor. Bond at each end to the isolated ground terminal identified.

3.5 EQUIPMENT

- A. All equipment shall be grounded.
- B. Where isolated grounding is indicated, it shall be for the isolation of internal equipment components only. All metallic enclosures of such equipment shall be connected to the equipment ground system.

3.6 PANELBOARDS

- A. All panelboards and distribution panels shall be provided with a ground bar bonded to the enclosure. Provide an isolated ground bar connected to the incoming feeder ground where indicated.

3.7 TESTING

- A. Upon completion of the installation, confirm the grounding continuity of all raceways, conductors and equipment. Maximum allowable resistance is 25 ohms.

3.8 RECORD DRAWINGS

- A. Submit record As-Built Drawings indicating the location of all points where grounding conductors are bonded to steel, rods, plates, etc.
- B. Indicate the location of all grounding buses not installed within distribution equipment.

END OF SECTION

SECTION 26 0700

PANELBOARDS

PART 1 - GENERAL

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 WORK INCLUDED

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install the panelboards and to complete all work shown on the Drawings or specified herein.

1.2 RELATED WORK

- A. Grounding
- B. Overcurrent Protection

1.3 SUBMITTALS

- A. Submit shop drawings for equipment and component devices under provisions of Division 1.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Furnish two (2) sets of keys to Owner.

1.4 REFERENCES

- A. FS W-C-375 - Circuit breakers, molded case, branch circuit and service.
- B. FS W-P-115 - Power distribution panel.
- C. NEMA AB 1 - Molded case circuit breakers.
- D. NEMA KS 1 - Enclosed switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instruction for safe installation, operation and maintenance of panelboard rated 600 volts or less.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PANELBOARD AND LOAD CENTERS

- A. Siemens.
- B. Square "D".
- C. General Electric.
- D. Or approved equal.

2.2 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and appliance branch circuit panelboards: NEMA PB 1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1.
- C. Cabinet size: Approximately 6 inches deep; 20 inches wide for 240 volt and less panelboards. Verify field conditions and alter dimensions to suit at no additional cost.
- D. Provide surface cabinet front door-in-door with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, rating as scheduled on Drawings. Provide copper ground bus in all panelboards and isolated ground bus in those as indicated on Drawings.
- F. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt rated for 125 amps or less, 22,000 amperes rms symmetrical for 240 volt rated greater than 125 amps to 225 amps and 30,000 amperes for emergency power panelboards (verify in field). If panelboard is noted as a main distribution panelboard, than panel shall be rated as a distribution panelboard. Contractor shall provide short circuit study to ensure adequacy.
- G. Molded case circuit breakers: Bolt-on type thermal magnetic trip handle for all poles. Provide circuit breakers UL listed as type SWD for lighting circuits. Breaker handle to indicate ampere rating.

2.3 DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1, circuit breaker type. The bus of all panels rated a minimum 400 amps shall be distribution type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: 65,000 amperes rms symmetrical for 240 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, unless otherwise noted on Drawings.
- D. Model Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR as specified on Drawings.
- E. Enclosure: NEMA PB 1, Type 1.
- F. Cabinet Front: Surface type, fastened with screws. Double hinged doors with flush lock, metal directory frame, finished in manufacturer's standard gray enamel. One hinged door to access breakers, the other to access wiring compartment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards flush or surface mounted as indicated on Drawings.
- B. Mounting height maximum 6 ft. (2 m) to top circuit breaker.
- C. Provide filler plates for unused spaces in panelboards.

- D. Provide type written circuit directory for each branch circuit panelboard. Indicate loads served and panel name by matching that shown on panel schedules on Drawings. Revise directory to reflect circuiting changes required to balance phase loads. Provide a second copy and turn over to Owner.
- E. Provide 3/4" thick plywood backboard for mounting of panels. Paint backboard with fire retardant paint.
- F. Provide nameplates as indicated in Section 26 0550.

3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and mechanical inspection: Inspect for physical damage, proper alignment, anchorage and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches and fuses.
- C. Provide thermographic inspections in accordance with Section 26 0100.

3.3 TESTS

- A. Submit certification that each panelboard has withstood, without breakdown, a factory dielectric (Hi-Pot) test consisting of a one minute application of a 60 cycle AC test voltage applied between phase legs and from each phase leg to enclosure.
- B. The applied test voltage shall have an RMS value of at least twice the line to line system voltage to which the panelboard is to be applied, plus one thousand volts (minimum 1500V).

3.4 RECORD DRAWINGS

- A. Submit as-built Drawings indicating the location of all panelboards.

END OF SECTION

ADDRESSABLE FIRE PROTECTIVE SIGNALING SYSTEM

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

1.1 FIRE ALARM SYSTEM

- A. The existing fire alarm system is an addressable system. The fire alarm control panel is located in the boiler room.
- B. Add and modify as required to the existing system, as specified/shown on the drawings and as per field requirements. All devices shall be suitable for operation and compatible with existing system. Provide relays modules, cards, power supplies, etc. as required.
- C. Provide sufficient quantity of relays for fan shutdown as specified/shown on Drawings.
- D. Connect, test and leave the system in first class operating condition.
- E. The system shall maintain all applicable Local, State and National Codes including the National Electrical Code, NFPA-72, NFPA-101, ADA 1971 and NEC. The system shall be listed by Underwriter's Laboratories, Inc.
- F. The Electrical Contractor shall provide a manufacturers certified technician to supervise installation, adjustments, final connection and system testing.
- G. Fire alarm wiring and cable shall be per manufacturer's requirements.
- H. Fire alarm system test shall be in accordance with NFPA-72 and local fire department requirements.

END OF SECTION

SECTION 26 0900

GUARANTEE

PART 1 - GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

1.1 GUARANTEE

- A. The Contractor shall remove, replace and/or repair at his own expense and at the convenience of the Owner, any defects in workmanship, materials, ratings, capacities and/or characteristics occurring in the work within one (1) year or within such longer period as may be provided in the Drawings and/or Section of the Specifications, which guarantee period shall commence with the final acceptance of the entire Contract in accordance with the guarantee provisions stated in the General Conditions, and the Contractor shall pay for all damage to the system resulting from defects in the work and all expenses necessary to remove, replace, and/or repair any other work which may be damaged in removing, replacing and/or repairing the work.

END OF SECTION