

**SECTION 23 0125**  
**MECHANICAL SPECIFICATIONS**

**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. The work to be completed under this division of the specifications shall include the furnishing of all supplies, equipment, labor, supervision and all materials not specifically mentioned, ready for use, in accordance with all applicable codes and authorities having jurisdiction, including heating, ventilation, air conditioning, plumbing, sprinkler equipment, associated items and Automatic Temperature Control components. It is the intention of these specifications and drawings to indicate finished work that is tested and ready for operation including but not limited to:
  - 1. Removals.
  - 2. Cutting and Patching
  - 3. Piping.
  - 4. Drainage from noted equipment to floor drains, roof, sink, or funnel drains.
  - 5. Piping connections to equipment.
  - 6. Vibration isolation elements for piping and equipment.
  - 7. Equipment isolation bases.
  - 8. Seismic restraints for isolated and non-isolated ductwork, VAV boxes, and equipment
  - 9. Testing.
- B. The data indicated in these drawings and specifications are as exact as could be secured. But their absolute accuracy is not guaranteed. Do not scale drawings. Exact locations, distances, levels and other conditions will be governed by the building. Use the drawings and specifications for guidance and secure the engineer's approval of changes in locations.
- C. Construction methods and good installation practice.
  - 1. The contractor shall visit the site and become thoroughly familiar with all existing conditions under which the work and work of other trades will be installed. This contract includes all necessary offsets, transitions, modifications and relocation required to install all new equipment in new or existing spaces. Contractor shall include any modifications required in existing ductwork and/or equipment for installation of new HVAC equipment and new equipment of other trades. All new and existing equipment and systems shall be fully operational under this contract before the project is considered complete.
  - 2. The contractor shall be held responsible for any assumptions that are made, any omissions or errors made as a result of failure to visit the site and become thoroughly familiar with the existing conditions and the contract documents of all trades.

**1.3 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary of Contract: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.
- B. Section 01 2000 - Price and Payment Procedures: Applications for payment, Schedule of Values, modifications procedures, closeout procedures.
- C. Section 01 2100 - Allowances: Cash, testing, and contingency allowances.
- D. Section 01 2200 - Unit Prices: Descriptions of unit price items, administrative requirements.

YONKERS PUBLIC SCHOOLS  
CAPITAL IMPROVEMENT REHABILITATION PHASE 3  
CHARLES E. GORTON HIGH SCHOOL YPS #10909  
MECHANICAL SPECIFICATIONS

- E. Section 01 2300 - Alternates: Descriptions of items, administrative requirements.
- F. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- G. Section 01 3050 - Design Procedures and Substantiation Requirements.
- H. Section 01 3114 - Facility Services Coordination.
- I. Section 01 3216 - Construction Progress Schedule.
- J. Section 01 3329 - Sustainable Design Reporting.
- K. Section 01 3553 - Site Safety and Security Procedures.
- L. Section 01 4000 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.
- M. Section 01 4100 - Regulatory Requirements.
- N. Section 01 4216 - Definitions.
- O. Section 01 4219 - Reference Standards: Consolidated list of citations with edition dates.
- P. Section 01 4533 - Code-Required Special Inspections and Procedures.
- Q. Section 01 5000 - Temporary Facilities and Controls.
- R. Section 01 5100 - Temporary Utilities.
- S. Section 01 5213 - Field Offices and Sheds.
- T. Section 01 5500 - Vehicular Access and Parking.
- U. Section 01 5713 - Temporary Erosion and Sediment Control.
- V. Section 01 5719 - Temporary Environmental Controls: Procedures and testing.
- W. Section 01 5813 - Temporary Project Signage.
- X. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- Y. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- Z. Section 01 6116.01 - Accessory Material VOC Content Certification Form.
- AA. Section 01 7000 - Execution: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.
- AB. Section 01 7419 - Construction Waste Management and Disposal.
- AC. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.
- AD. Section 01 7900 - Demonstration and Training: Detailed requirements.
- AE. Section 01 9113 - General Commissioning Requirements.
- AF. Section 02 4100 - Demolition: Selective demolition, site demolition, structure removal.
- AG. Section \_\_\_\_\_: \_\_\_\_\_.

**1.4 DEFINITIONS**

- A. Refer to Section 01 4216 - Definitions.

**1.5 CODES, REGULATIONS AND STANDARDS**

- A. Refer to Section 01 4100 - Regulatory Requirements for additional requirements
- B. Published specifications, standards tests, or recommended methods of trade, industry or governmental organizations apply to work in all Sections as noted below:

FULLER AND D'ANGELO, P.C.  
ARCHITECTS AND PLANNERS

YONKERS PUBLIC SCHOOLS  
CAPITAL IMPROVEMENT REHABILITATION PHASE 3  
CHARLES E. GORTON HIGH SCHOOL YPS #10909  
MECHANICAL SPECIFICATIONS

1. ASHRAE - American Society of heating, Refrigerating and Air Conditioning engineers.
2. AABC - Associated Air Balance Controls.
3. AMCA - Air Moving and Conditioning Association.
4. ADC - Air Diffuser Council.
5. NEMA - National Electrical Manufacturers' Association.
6. ANSI - American National Standards Institute.
7. ASME - American Society of Mechanical Engineers.
8. ASTM - American Society for Testing and Materials.
9. EPA - Environmental Protection Agency
10. NFPA - National Fire Protection Association.
11. NFPA 101 - Life Safety Code
12. NFPA 70 - National Electrical Code
13. NFPA 72 - National Fire Alarm Code
14. ARI - Air-Conditioning and Refrigeration Institute.
15. UL - Underwriters' Laboratories, Inc.
16. OSHA - Occupational Safety and Health Administration Regulations

**1.6 PERMITS, FEES AND INSPECTIONS**

- A. The contractor shall give all necessary notices, obtain all permits, and pay for all government, state sales taxes and applicable fees. The contractor shall file all drawings, complete all documents and obtain all necessary approvals from the proper authorities or agency having jurisdiction. Obtain all required certificates of inspection covering work. The contractor shall see that all required inspections and tests are made and shall cooperate to make these tests as thorough and as readily made as possible.

**1.7 MATERIALS AND WORKMANSHIP**

- A. Refer to Section 01 4000 - Quality Requirements for additional requirements.
- B. All materials and apparatus required for the work, except as otherwise specified, shall be new and of first-class quality. It shall be furnished, delivered, erected, connected, finished in every detail and so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality material is given, a first-class standard article as accepted by the engineer shall be furnished.
- C. All equipment and materials shall be specification grade and bear the underwriter's label. No substitute or alternate equipment, material, etc. Will be considered for this project.
- D. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The engineer/owner reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or in an unserviceable manner. The contractor shall replace rejected work in a satisfactory manner at no extra cost to the owner.

**1.8 GUARANTEE AND SERVICE**

- A. The contractor shall. Guarantee all workmanship and materials for a period of two year from the date of acceptance of the installation. In addition, the contractor shall Provide, free of charge, one year 's maintenance guarantee on maintained service and adjustment of all equipment in this contract.

**1.9 RECORD DRAWINGS**

- A. Refer to Section 01 7800 - Closeout Submittals for additional requirements.
- B. Maintain, at the job site, a set of drawings indicating all changes in location of the equipment, devices, etc. From the original layout. Clearly mark in red all changes on the drawings. At the completion of the project the contractor shall turn over the record drawings to the engineer/owner.

**1.10 COORDINATION**

- A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference.

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### **1.11 SHOP DRAWING**

- A. Refer to Section 01 3000 - Administrative Requirements for additional requirements.
- 1. Prior to delivery to the work area, but well in advance of requirements necessary to allow engineer ample time for review, contractor shall submit for approval, in PDF format of each shop drawing. Indicate on each submission:
  - a. Location
  - b. Architect/Engineers names
  - c. Item identification/description
  - d. Approval stamp of prime contractor
  - e. All shop drawings and coordination drawings shall include locations and sizes of existing equipment along with new work. Drawings shall include locations and sizes of existing equipment along with new work. Drawings shall indicate locations of hangers, supports, expansion joints, guides, anchors and anchor loads. Submit shop drawings for the following
    - a) Piping.
    - b) Pipe insulation.
    - c) Duct insulation.
    - d) Valves
    - e) Ductwork layout, coordination drawings, sheet metal standards and details
    - f) Air outlets (exhaust grilles
    - g) Air and piping balancing reports
    - h) Heating element covers
    - i) Fans
    - j) Dielectric fittings.
    - k) Through-penetration firestop assemblies.
    - l) Design Calculations: Signed and sealed by a qualified professional engineer, licensed in the state where the work is being performed for selecting seismic restraints
    - m) Testing.
    - n) Controls

### **1.12 OPERATING INSTRUCTIONS**

- A. Refer to Section 01 7800 - Closeout Submittals for submittal and additional requirements.
- B. The contractor shall furnish to the architect/engineer instructions for operating and maintaining all systems and equipment.
  - 1. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions
- C. The contractor, in the above- mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this division.
- D. An authorized manufacturer's representative shall attest in writing that his equipment has been properly installed prior to startup. These letters will be bound into operating and maintenance books.

### **1.13 MANUFACTURER'S INSTRUCTION**

- A. Install all equipment in accordance with manufacturer's instructions or requirements for proper operation and maintenance.

### **1.14 CUTTING, PATCHING, REPAIRING AND PAINTING**

- A. Refer to Section 01 7000 Execution for additional requirements.
- B. The general contractor shall perform all cutting, patching, repairing and painting for all electrical items and equipment called for under this contract.

**1.15 TEMPORARY FACILITIES AND CONTROLS**

- A. Refer to Section 01 5000 - Temporary Facilities and Controls for additional requirements.

**1.16 DRAWING AND INTENT**

- A. Drawings are intended as working drawings for general layout of the various items of equipment. However Layout of accessories, specialties, equipment and piping systems are diagrammatic unless specifically dimensioned, and do not necessarily indicate every required valve, fittings, elbow, pipe, transitions, trap, junction or pull box, offsets or similar items required for the installation to be complete

**1.17 INSURANCE**

- A. Refer to General Conditions Article 10

**1.18 CONTINUITY OF EXISTING SYSTEM;**

- A. Maintain continuity of the existing vent, waste, soil, hot and cold water systems to the areas not affected by the alteration.

**1.19 INTERRUPTION OF SERVICE**

- A. Contractor shall request shut down of service for all mechanical and electrical systems. Contractor shall coordinate with Owner's Representative. All shut downs shall be scheduled by the Owner's Representative.

**1.20 WORK NOT INCLUDED**

- A. All electrical work, cutting and patching, piers lintels, all concrete work and all painting. This contractor shall furnish the general contractor with the sizes and locations of chases and openings which occur in walls, partitions, floors, etc., required for the installation of the work called for under this contract, will be done by the general contractor. Except cutting required for the installation of hangers.

**1.21 MEASUREMENTS**

- A. All measurements taken at the building shall take precedence over scale dimensions. Every part of the plans shall be fitted to the actual conditions at the building. If there is a conflict with the scale dimensions. Contact architect and/or engineer for direction/clarification

**1.22 PROTECTION OF EQUIPMENT MATERIALS AND FIXTURES**

- A. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

**1.23 SCAFFOLDING, RIGGING AND HOISTING:**

- A. Unless otherwise specified, contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for the erection and delivery into the premises of any equipment and apparatus furnished. This will apply to any equipment that is being removed from the premises.

**1.24 HOUSEKEEPING**

- A. This contractor shall be responsible for keeping stock of materials and equipment stored on premises in a tidy and orderly manner and, at all times, keep the premises free from accumulation of waste material or rubbish caused by their employees at work. He shall remove his rubbish and surplus materials from the job site and shall have the premises and their work in a clean and well maintained condition.

**1.25 QUIET OPERATION**

- A. All work shall operate under all conditions of load without my sound or vibration which is offensive in the opinion of the engineer. In the case of the moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoying inside given room, will be consider unacceptable by the engineer and shall be remedied in approved manner by the contractor at their own expense

**1.26 COORDINATION DRAWINGS**

- A. Coordination drawings shall indicate all MEP equipment, ducts and pipes. Mounting height shall be noted on drawings

**1.27 EQUIPMENT SUBSTITUTIONS**

- A. Refer to Section 01 6000 - Product Requirements

**1.28 ELECTRICAL CONNECTIONS**

- A. Power supply and alarm wiring will be provided under Division 26, and connections made to any new equipment, pumps, valves, fixtures, and other items receiving electrical connection.
- B. To facilitate electrical connections provide electrical items with NEMA enclosures having sufficient knockouts, connectors, terminal blocks and/or contacts.

**1.29 ACCESSIBILITY**

- A. Place valves, unions Drains, and items requiring maintenance, adjustment, or repair, in accessible locations. Coordinate final location of access panels with architect.

**1.30 OWNER'S INSTRUCTIONS AND SYSTEM OPERATION**

- A. Refer to Section 01 7900 - Demonstration and Training

**1.31 At the time of the job's acceptance by the owner, contractor shall furnish one complete set of approved certified drawings to the owner. In addition the contractor shall furnished maintenance and operating instructions for all equipment. The instructions shall be written in layman's terms and shall be inserted in vinyl-covered three ring binder. The information in the binder shall be first sent to and approved by the architect/engineer before turning over to the owner.**

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. All materials and equipment provided under this section shall be new, first grade, best of their respective kinds and in no way shall they be less than the quality and intent set forth under this section. They shall meet the requirements of all standards set up to govern the manufacturer of HVAC materials and comply with all applicable codes and standards

**2.2 SLEEVES**

- A. Provide No. 22 USSG galvanized iron sleeves extend through construction in ceilings, walls and partitions. For insulated piping sized to allow insulation to pass through the sleeve. Provide 1/2" space between pipe and/or insulation and sleeve. Seal all sleeves in accordance with building code and fire department requirements.

**2.3 EXPANSION HANGERS**

- A. Suspend hangers from expansion anchors in solid concrete slabs similar to Hilti HDI. Provide hanger in place with double nuts. Provide protection shields in insulated pipes. Install hangers over insulations and shields. Where overhead construction does not permit fastening hanger rods in required locations, provide additional steel framing as required and reviewed.

**2.4 LABELING**

- A. On all piping in ceiling. 10' on center indicating system size and direction of flow.

**2.5 DISSIMILAR METALS:**

- A. Where copper or brass alloy connected to galvanized metal, the two shall be separated with an insulation connection fitting.

## **2.6 HANGERS AND SUPPORT**

- A. Hanging and supporting - piping shall not be supported by other piping, but shall be supported with copper pipe hangers suitable for the size of pipe and proper strength and quantity at proper intervals so that the piping cannot be move accidentally from the installed positions follows:
- |                                  |                   |
|----------------------------------|-------------------|
| 1. 1/2" pipe or tubing           | 6 feet            |
| 2. 3/4" or 1" pipe or tubing     | 8 feet            |
| 3. 1-1/4" or larger (horizontal) | 10 feet           |
| 4. 1-1/4" or larger (vertical)   | every floor level |

## **2.7 SEISMIC RESTRAINTS**

- A. Provide required bracing material. Ductwork shall be supported and braced to resist all directional (lateral, longitudinal and vertical) forces equal to 10x of the weight of the system of duct as a whole
- B. Seismic restraints designed and constructed for latera forces in any direction shall be provided for all mechanical equipment in accordance with the state building code.
- C. Seismic restraints shall not be required for the following:
1. Piping in boiler and mechanical rooms less that 1-1/4" inside diameter.
  2. All other piping less than 2-1/2" inside diameter.
  3. All rectangular air handling ducts less than 6 square feet in cross sectional area.
  4. All round air handling ducts less than 26" in diameter.
  5. All piping suspended by individual hangers 12" or less in length from the top of the pipe to the bottom of the support for the hanger.
  6. All duct suspended by hangers 12" or less in length from the top of the duct to the bottom of the support for the hanger.

## **2.8 DUCT INSULATIONATION**

- A. Where indicated of the drawings, ductwork shall be lined with Manville Permacote Linacoustic. Thickness, unless otherwise indicated, shall 1" liner shall be applied to duct in strict accordance with manufacturer's instructions and SMACNA guidelines, latest edition. Where sound insulation Is indicated, ductwork sizes indicated are the clear inside dimensions after the insulation has been installed. Cover all unlined supply ductwork with 1-1/2" fiberglass duct wrap equal to Manville R-series Microute with F.R.G. vapor barrier. Exposed ductwork does not require insulation.

## **2.9 DUCT INSULATION - EXTERIOR DUCTWORK**

- A. Exterior ductwork should first be wrapped with 1-1/2" fiberglass insulation, covered with F907 mastic weatherproof membrane applied and wrapped for the entire length, then re-apply mastic as a final sealing agent.

## **2.10 SHEET METAL DUCTWORK**

- A. All ductwork shall be constructed of # 1 quality first sheets of galvanized steel free of cracks or blemishes. When pittsburging or snap locking a joint, the galvanized steel shall not be clipped off.
- B. All parts of the sheet metal duct system shall be constructed and installed in strict accordance with the first edition 1985 for pressures 2" w.g. maximum static pressure as outlined and detailed by SMACNA., April 1966.
- C. Flexible duct may be used to connect rigid ductwork to supply diffusers. Duct shall be SMACNA Form M-1" insulated metal liner. Flexible duct shall not exceed 3' in length. If longer branch duct is required, Contractor shall extend galvanized sheet metal to a point within 3'-0"(max.) of diffuser.

## **2.11 FLEXIBLE CONNECTIONS**

- A. Shall be 29 oz. Neoprene coated fiberglass, 6" wide. Burning properties shall conform to NFPA 90A. Fasten to ductwork per manufacturer's recommendations. Fabric shall not be stressed other than by air pressure. Allow at least one inch slack to insure that no vibration is transmitted.



**2.12 SEISMIC RESTRAINT FOR DUCTWORK**

- A. Provide required bracing material, ductwork shall be supported and braced to resist all directional (traverse, longitudinal and vertical) forces equal to 10x of the weight of the system of duct as a whole

**2.13 VOLUME DAMPERS**

- A. Single blade or opposed blade multi-louver type as detailed in SMACNA standards. Refer to figure 2-11 and 2-12. Provide end bearing for all dampers. Quadrant or other operator for externally insulated duct shall have stand-off mount so operation is clear of the insulation.

**2.14 SMOKE AND/OR FIRE DAMPERS**

- A. Provide smoke and or fire dampers, as required, weather shown or not, at all fire and smoke rated partitions. Architect's plans must be reviewed and coordinated for all fire and smoke rated partitions.

**2.15 FIRE DAMPERS**

- A. Fire dampers shall be Ruskin IBD2, vertical or horizontal, Style B or Style C for round ducts, or equal. Each shall be furnished and installed in accordance with NFPA 90A latest edition and includes a UL label and shall conform to bulletin UL 555. Fire dampers to be installed in all fire rated walls and ceilings as required and/or indicated on drawings.

**2.16 DUCT ACCESS DOORS**

- A. Provide access doors, sized and located for maintenance work, upstream where possible, for each fire damper. Access sections in insulated duct shall be double-wail insulated. Refer to SMACNA LPDS Figure 2-24.
- B. Provide lock type 2 (door latch, not a sash lock)

**2.17 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 Anemostat Co., Carnes or Hart and Cooley

**2.18 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

**2.19 ROOF EXHAUST FANS**

- A. All roof exhaust fans shall be centrifugal roof exhausters of aluminum rustproof construction.
- B. Units shall be direct connected with direct drive motor out of airstream. Power unit shall be isolated against vibration heavy duty neoprene vibration isolators.
- 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.

**2.20 OUTDOOR CONDENSING UNIT**

- A. Outdoor mounted, air-cooled unit suitable for ground installatio.
- B. Refer to Drawung schedule for required accessories and related appurtenances.

**2.21 HEAT PUMP**

- A. Ceiling cassette with built-in condensate pump, cleanable filter, auto and seletable fan speed including:
  - 1. In ceiling grill.
  - 2. Wired room control.



3. Room control wiring for kit for future multiple unit.
4. Power ventilation kit.
5. Wind baffle.

## **2.22 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.

## **2.23 TEST AND BALANCE**

- A. Completely Test and balance all supply, return and exhaust air systems and hot water systems and prove: the capacities of the system and the system components. Submit results to engineer for approval. Also provide single line drawings of the system with locations and capacities of all diffusers and equipment.

## **2.24 HOT WATER PIPING**

- A. Water supply and return piping shall be Type L copper tubing with sweat fittings made up with 95-5 solder or standard weight schedule 40, open hearth steel, National or equal. Fittings for steel pipe shall be as follows: generally, butt welding fittings over two inches shall be used and either socket-weld or screwed for two inches or under. Welding fittings shall be standard forged steel with chamfered ends. All branches shall be welded with either Weldolete or tees.
- B. All steel pipe, all fittings shall be of the best gray cast iron by Crane or Walworth with true clean tapered treads, free of sand holds or other defects. Flanges shall be below 8 inches, 150 lb. welding neck.

## **2.25 BALANCING FITTINGS**

- A. Provide B&G circuit setter balancing fittings on each hot water coil and whenever required for balancing of systems.

## **2.26 HOT WATER PIPING INSULATION**

- A. Insulate with rigid preformed fiberglass with AP-T Plus jacket. Schuller Micro-Lok or equal. Insulation thickness shall be 1" for below 2" piping, 1-1/2" for 2" to 3" piping and 2" for 4" and above piping. Provide Zeston covers on all fittings.

## **2.27 PIPE SUPPORT**

- A. All pipes shall be supported in a good, firm and substantial manner by means of adjustable malleable iron or copper hangers or approved method.

## **2.28 HOT WATER VALVES:**

- A. Valves shall be ball. Type Jamesbury Clincher or Apollo, or gate type, Milwaukee #F-2885M (flanged), OS&Y. Iron body, bronze mounted or #148 (screwed), bronze. rising stem.

## **2.29 THERMOMETERS**

- A. Thermometers shall be Trerice Universal Angle Type #L80732, solid liquid filled, 4.5 dial size furnish with separable socket with 2" extension neck.

### **2.30 GENERAL. PIPE TEST**

- A. Unless otherwise noted:
- B. Test all piping hydrostatically at not less than 200 psi pressure for two hours and all defective material shall be replaced. Before making final approval the subcontractor should produce a written statement signed by a representative of the owner's underwriter, that the work has been completed and tested in accordance with approved specifications and plans.
- C. Unless otherwise noted, perform pressure tests and obtain approval of test results before starting cleaning or concealing of pipe under insulation or other finish. Insulation removal and re-installation which is required because insulation was not installed prior to testing shall be done at the contractor's expense.
- D. Tests are satisfactory only when joints show no visible leaks and test pressure remains constant after continuous test period. Repair leaks, and remove and replace defective pipe, fittings and joists with new material, until accepted by architect/engineer and inspecting authority. Wicking, caulking, compounding, peening, or other make shift type of repairs are unacceptable and will not be approved.
- E. Repeat tests after repairs until systems are proven tight.

### **2.31 HOT WATER PIPE TEST**

- A. Tests shall be maintained as long as necessary to completely inspect piping (minimum 4 hours).
- B. Test water piping by applying hydrostatic pressure using pump. Ensure that lines are vented of all air.
- C. Following precautions shall be taken during pressure tests:
  - 1. Hot water system relief valve shall be removed.
  - 2. Pressure gauges with scale ranges lower than test pressure shall be removed or isolated.
  - 3. Water control valves shall be removed.

### **2.32 AUTOMATIC TEMPERATURE CONTROLS**

- A. Provide all required controls for new equipment as an extension of existing building/District control panel including all valves, dampers, sensors, relays and panels and wiring. Provide new graphics programming as required to indicate all new controlled devices on existing central work station as directed by the town.
  - 1. Yonkers Public Schools to review and approve all systems and functions.
  - 2. All devices etc. to be compatible to existing systems.
  - 3. Input of block and individual schedules shall be reviewed with Yonkers Public Schools.
  - 4. All new graphic shall match existing.
  - 5. Sequence of operation shall match existing building standards and be approved by Yonkers Public Schools

### **2.33 SEQUENCE OF OPERATION**

- A. Exhaust Fans
  - 1. Provide start/stop signal for new exhaust fans with occupied/unoccupied schedule.
- B. Radiant Panels
  - 1. Provide 2 position normally open hot water control valve to open on a call for heat from local wall sensor with building set back schedule.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that existing conditions are acceptable prior to starting installations.
- B. Preinstallation Testing: Test substrate for existing fire alarms system prior to modifications.

### **3.2 PREPARATION**

- A. Protection of In-Place Conditions: Prior to removals and during new work protect existing, floor, walls, ceilings, equipment and furnishings.

- B. Removal: Removing existing equipment, ductwork, devices, wiring as required to install new work.
- C. Measure indicated mounting heights to bottom of unit, devices, registers, etc. for suspended items and to center of unit for wall-mounting items.
- D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

### **3.3 INSTALLATION GENERAL**

- A. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- B. Right of Way: Give to piping systems installed at a required slope.
- C. All work, materials and manner of installing same shall be in strict accordance with the latest code.
- D. Unless otherwise indicated all wiring exposed in finished and occupied areas shall be wire mold (2000 series or equal). Conduit shall be installed within new stud partitions, mechanical room, above ceilings in rigid galvanized steel conduit (RGS) shall be used for wiring in the following locations:
  - 1. Exposed to moisture or mechanical damage.
- E. Electrical metallic tubing (EMT) shall be used for concealed and exposed wiring in dry locations as follows:
  - 1. Interior receptacle and power branch circuit wiring
- F. All conduit shall be installed in parallel and perpendicular to the building lines. All conduit shall be supported using cadmium plated conduit straps and hangers. Separate conduit systems shall be installed for normal, and low voltage power.
- G. Mechanical equipment shall be isolated from the building structure by means of noise and vibration isolators as scheduled on the drawings or within these specifications.
- H. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation systems herein specified.
- I. Electrical circuit connections to isolated equipment shall be looped to allow free motion of isolated equipment.
- J. The contractor shall not install any equipment, piping or conduit which makes rigid contact with the "building" unless permitted in this Specification. Building includes, but is not limited to, slabs, beams, columns, studs and walls.
- K. Isolation mounting deflection shall be minimum as specified or scheduled on drawings.
- L. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.

### **3.4 DUCT INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
- J. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Standard Duct Sealing Requirements," unless otherwise indicated.

### **3.5 PIPING INSTALLATIONS**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves in accessible locations. Coordinate final location of access panels with architect.
- Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated. Slip-on flanges shall be back welded.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff
- T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as required.

### **3.6 EXHAUST FAN INSTALLATION**

- A. Inspection
  - 1. 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.
- B. Installation
  - 1. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
  - 2. 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.
- C. Cleaning
  - 1. 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

### **3.7 ADJUSTING**

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

### **3.8 CLEANING AND PROTECTING**

- A. Thoroughly clean all electrical equipment, devices and enclosures upon completion of all work. Repaint any equipment whose finish is damaged or rusted. Match manufacturer's original finish.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Properly and completely protect against all damage, all apparatus, equipment, etc., included in this contract. The contractor will be held responsible for any damage to furnished apparatus, equipment, etc., until final acceptance.
- D. The contractor shall take whatever means necessary and/or required to protect owner's property within the working areas from dust, debris and other matter generated by the work. No work shall commence in areas where protection is required until approval has been given to the contractor by the owner.

**END OF SECTION**