

SECTION 232000

HEATING VENTILATING AND AIR CONDITIONING (HVAC) SYSTEMS

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. Work under this section provides materials and equipment related to Heating, Air Conditioning and Refrigeration systems.
- B. Provide complete Mechanical Submittals and Shop drawings.

Discovery Elementary School:

AC A-1, AC A-2, AC A-3, AC C-1, AC C-4, AC D-1, AC D-2 AC D-3 AC D-4, AC D-5, AC Relo 1, AC Relo 2, AC Relo 23, Relo 26 and AC Relo 27.

- C. Mechanical Contractor shall dispose of the exiting units.
- D. Demo electrical disconnect, flex conduit/fittings, wiring and conduit for HVAC units which are to be replaced. Provide new electrical disconnect, electrical conduit, wiring and conduit.
- E. Include MERV 13 filters for new rooftop units.
- F. The exiting curbs and seismic attachments shall be reused.
- G. Disconnect gas piping for removal and reconnect gas piping when new HVAC rooftop unit is installed. Sand, prime with rust inhibitor and paint two coats all rooftop gas piping. New gas pipe/fittings shall be galvanized schedule 40 with threaded connections.
- H. Demolish rooftop condensate piping and roof supports. Provide new condensate system with piping and roof supports. New condensate pipe/fittings shall be copper type M with soldered connections.
- I. Remove R-22 refrigerant from the existing rooftop units. Store R-22 refrigerant from the existing rooftop units in refrigerant bottles. The Mechanical Contractor shall provide as many refrigerant bottles as needed.
- J. Clean, disinfect and coat existing supply and return air plenums for the rooftop units which are being replaced.
- K. Demolish and provide new rooftop duct work, flex connections and wall flanges as noted on the drawings.

1.02 DEFINITIONS

- A. Ductwork Sizes: Inside clear dimensions. For acoustically lined and internally insulated ductwork, maintain ductwork sizes inside lining or insulation.
- B. Low Pressure: Static pressure in duct 2" water gauge or less, velocity 2000 fpm or less.

1.03 EQUIPMENT AND COMPONENTS REVIEW

- A. Only Carrier equipment and components from those manufacturers indicated in this specification are acceptable.

1.04 SUBMITTALS

- A. Require Completed Submittals
 - 1. Duct work fittings and accessories.
 - 2. Duct Sealant.
 - 3. Filters.
 - 4. Carrier HVAC units.
 - 5. Disinfectant spray.
 - 6. Insulation Coating.

PART 2 - PRODUCTS

2.01 SHEET METAL

- A. Unless otherwise specified, sheet metal used for duct and plenum construction shall be G90 coated galvanized steel of lock forming grade conforming to ASTM standards A653-11. All duct work and supports shall be galvanized. All sheet metal round ducts shall be round spiral lock-seam construction. "Knock down" (KD) duct is not acceptable.
- B. The gauge of the duct and its construction shall be based on low pressure or medium pressure or low or medium velocity. The velocities can be obtained by the duct size and CFM values listed on the drawings. The static pressure for various systems is listed on the mechanical equipment schedule. Refer to the SMACNA standards for the correct duct construction based on the velocities and static pressures involved.
- C. Sealing of Duct Work: All supply and return duct work from mechanical units, all exhaust duct work and all outside air duct work shall have a high pressure Class A seal per SMACNA.
- D. Alumiflex type duct will not be permitted on this project. All ducts are to be rigid galvanized sheet metal.

2.02 DUCT SEALANT

- A. Acceptable manufacturers are Ductmate® Industries – PROseal® and FIBERseal®; and Hardcast, Inc – Sealing System.
- B. Metal to Metal - Duct sealer shall be flexible and self-curing and comply with UL 723 and UL 181B.
- C. Flex Duct - Duct sealer shall be flexible and self-curing and comply with UL 723 and UL 181B-M.
- D. Sealant shall have a flame spread less than 25 and the smoke developed less than 50 when dry.

2.03 FLEXIBLE CONNECTIONS

- A. Provide flexible connections at inlet and discharge connections of fans and air handling equipment to prevent mechanical noises from being transmitted to connecting ductwork.
- B. Acceptable manufacturers are Ventfabrics, Inc., and Duro Dyne Corp. UL listed, fire-retardant, neoprene-coated woven glass fiber fabric to NFPA 90A and crimped into metal edging strip.
- C. Ventglas® shall be used for flexible duct connections when not exposed to the weather.

- D. Ventlon® shall be used for flexible duct connections exposed to the weather.

2.04 FILTERS

- A. Provide a set of MERV 13 air filters for each HVAC unit.
- B. Air filters for rooftop HVAC units shall be equal to MERV 13 2" medium efficiency pleated, disposable type filters.
- C. Filters shall have a composite fire hazard rating as tested by ASTM E84, NFPA 255, or UL 723 not to exceed 25 flame spread and 50 smoke developed. Materials labeled accordingly.
- D. Air Filters shall be a California State Fire Marshal approved and listed type. Preformed filters having combustible framing shall be tested as a complete assembly. Air filters in all occupancies shall be Class 2 or better (as shown in the State Fire Marshal Listing). Air filters shall be accessible for cleaning or replacement.
- E. Filters shall conform to ASHRAE 90A-1980 and NFPA 90.

2.05 ROOFTOP PACKAGED HEATING, VENTILATING AND AIR CONDITIONING (HVAC) UNITS AND ACCESSORIES

- A. Acceptable manufacturer of rooftop package HVAC units is Carrier. Refer to Carrier Quote for information on HVAC Rooftop Units.
- B. HVAC Rooftop Units
 - 1. The casing shall be constructed of coated steel meeting SMACNA or ASHRAE Standards. Internal insulation shall meet the requirements of NFPA Bulletin 90-A and UL 181.
 - 2. The unit manufacturer shall furnish, when requested, certified sound power levels for both discharge sound and casing radiated sound, tested in accordance with ASHRAE Standard 36-72.
 - 3. Controls: The units shall be equipped for and shall interface with Honeywell Lon DDC (Direct Digital Controls) systems.
 - 4. Arrangement and configuration as indicated on drawings and as described on the equipment schedule. Condensing section shall be designed for outdoor duty. Performance shall be certified in accordance with Air Conditioning and Refrigeration institute (ARI) Standard for rooftop HVAC units. Fans to be rated by AMCA.
 - 5. Provide and flex connections on supply and return duct plenums for the isolation of mechanical equipment. These flex connections are for the avoidance of excessive noise or vibration in the building due to the operation of equipment.

2.07 DUCT WORK INSULATION

- A. Rectangular Duct Liner: Johns Manville Linacoustic Mat Faced or Permacote meeting ASTM C1071 or equal; flexible blanket.
 - 1. 'K' ('KSI') Value: ASTM C518, 0.25 at 75 degrees F (0.036 at 24 degrees C).
 - 2. Noise Reduction Coefficient: .65 or higher based on "Type A mounting". Comply with ASTM C423A Absorption Coefficients, ASTM E84, UL 723 and NFPA 255.

3. Maximum Velocity on Mat or Coated Air Side: 4,000 ft/min.
4. Adhesive: UL listed waterproof type.
5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
6. Absolute roughness of exposed surface not to exceed 0.0013 coated.

2.08 IDENTIFICATION OF EQUIPMENT

- A. Each item of equipment shall be permanently labeled with a plastic nameplate of sufficient size to clearly indicate the identification designation appearing on the construction drawings. Letters shall be a minimum of 2 inches high.

2.09 DUCT LINER CLEANER AND SEALANT

- A. Sporidicin® Disinfectant Solution shall be used on all exposed duct liner.
- B. Design Polymerics 2545 protective coating shall be used on all exposed duct liner.

2.10 ELECTRICAL

- A. Each new rooftop HVAC unit shall receive a fusible outdoor fused disconnect switch assembly: NEMA Type Heavy Duty; with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class R, Class J or Class CC (motors) cartridge type fuses. Outdoors: NEMA 3R code gauge zinc coated steel with baked enamel finish. Provide manufacturer's equipment ground kit in all disconnect switches. Fuses 600 Amperes and Less: Dual element, time delay, UL Class. Provide three (3) spares of each size and type fuse.
- B. New electrical power conduit and wiring shall match the existing conduit and wire size and gauge which was demolished
- C. Outdoor conduit and fittings shall be Liquid-Tight Cordgrip non-metallic flexible conduit and aluminum metal fittings.

2.11 ROOF PIPE AND DUCT SUPPORTS

- A. Pipe supports: DURA-BLOK DB Series with 1" high galvanized channel. 5" high X 6" wide X field measured length. For condensate piping which needs to slope provide varying lengths of all-thread vertical rods and horizontal channel.
- B. Duct supports: DURA-BLOC DB_DS Series. Two base supports with 12 ga galvanized channel and vertical and horizontal channels to support ductwork.

PART 3 – EXECUTION

3.01 DUCT CONSTRUCTION AND INSTALLATION

- A. Ductwork construction and installation including sheet metal gauges, reinforcement, joint sealing, air leakage and details not specifically shown on the drawings shall be in accordance with SMACNA Publication HVAC Duct Construction Standards - Metal and Flexible current edition and SMACNA Publication Seismic Restraint Manual: Guidelines for Mechanical Systems current edition.
- B. Use Ductmate Duct Connection System for all transverse joints in ducts.

- C. Seal seams, joints, duct connections, elbow gores with Hardcast high pressure Class A SMACNA sealant.

3.02 FLEXIBLE CONNECTIONS

- A. Provide flexible connections at inlet and discharge connections of fans and air handling equipment to prevent mechanical noises from being transmitted to connecting ductwork. Align sheet metal duct with fan or fan casing opening in all three dimensions prior to installation of flexible connection, so that duct opening nearly coincides and are almost equally spaced from one another all around. Do not install flexible connection until above requirements are met. Fans or fan casings and ducts shall be able to move 1" in any direction relative to each other without short-circuiting metal to metal or stretching taut the flexible connection.

3.03 ROOFTOP HVAC UNITS

- A. Install equipment in accordance with manufacturer's recommendations, good industry standards and SMACNA Installation Standards for Heating, Air Conditioning and Solar systems.
- B. Provide high pressure air seal around ducts and units.
- C. Coordinate with other work, including ductwork, floor construction, and electrical work as necessary to interface installation of air handling equipment with other work.
- D. Ensure equipment is wired properly, with rotation in direction indicated and intended for proper performance. If there is no rotation arrow supplied by the manufacturer, install a correct rotation arrow.
- E. Inlet and outlet connections to all equipment shall be made with neoprene coated glass fabric flexible connection not less than four inches full length with one inch slack. Weather exposed connections shall be same as above except to be hypalon coated in lieu of neoprene.

3.04 ELECTRICAL OUTDOOR FUSED DISCONNECTS

- A. Remove and dispose of existing electrical disconnects and wiring and conduit from disconnect to demolished HVAC unit.
- A. Keep electrical wiring for future connection.
- B. Provide new fused disconnects located in the same location on the new units as the existing disconnects were location on the demolish units. Provide new wiring and conduit from new disconnects to new rooftop units
- C. If the disconnects are equipment mounted provide them similar locations as the existing so the wiring from the electrical panel to the new disconnect does not have to change. Provide new conduit and wiring supports from roof connection to new disconnect.

3.05 DUCT CLEANING

- A. Provide all material and manpower necessary to complete work specified as per specifications and drawings for the Air Duct Cleaning Project.
- B. Clean supply and return air duct drops from curbs to bottom of drops.
- C. Use nondestructive method to clean and vacuum.

- D. Spray Sporidicin® Disinfectant Solution according to label instructions. This solution is effective against many organisms. Sporidicin shall be sprayed into supply and return air plenums. Replace damaged duct lining as a result of this work.
- E. The surface of all unreplaced liner shall be coated. Any small tears in fiberglass will be repaired with lagging materials and then encapsulated.
- F. Secure new and existing duct lining / insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
- G. Seal existing and new duct liner surface and joints with DP 2545 white protective coating.
- H. Shall maintain a daily work log showing work progress, materials delivered or installed on site, and names of crewmembers on site. This log will be presented to the project coordinator on request.
- I. Shall become familiar with building availability, building layout, security requirements, vehicle access, fire extinguishers, exits and breaker panels.
- J. Needs to be NADCA certified and at least one ASCS certified on staff in company. All workers shall have thorough knowledge and experience in the cleaning of air delivery systems per NADCA and ASCS standards and certification.
- K. Shall furnish all labor, materials, supplies, tools, equipment, supervision, transportation and other services or items necessary to accomplish the work.
- L. Shall leave area surrounding project in the same condition as when work started.
- M. All tools shall be clearly marked and securely stored when not in use.
- N. Shall keep job-site free of all surplus material and debris. Upon completion of each shift, all debris shall be disposed of at the location selected by Owner
- O. Work shall be done coordinated with the Mechanical Contractor between the removal of the old units and replacement of the new units. Work schedules are to be agreed upon before work begins. Any changes to the agreed upon schedule by either party shall be confirmed as early as possible but no less than six (6) hours before the start of a shift.
- P. Suitable protective covering and respiration equipment shall be used.
- Q. Report the existence of any unsafe conditions that prevent the performance of agreed services to the project coordinator.
- R. All furnishings and equipment will be protected with a plastic tarp while work is being performed.
- S. The cleaning process shall include a thorough visual inspection of the interior of the system. Upon completion every interior surface will have been cleaned and free of visible dust and debris.
- T. Any mechanical problems discovered during the course of cleaning will be reported in writing within 24 hours to the project coordinator.
- U. Upon total completion of the project, representatives of Client will do a quality control inspection. Any area that does not meet the standards of these specification shall be redone at no additional cost.

- V. Compliance with Cal OSHA and EPA regulations.
- W. Electrical equipment, sensors and control devices shall be masked, or blocked off where required for protection for water or chemicals.
- X. Disinfectant, Osporiden is to be used and shall be applied in accordance with the manufacturer's instructions, and will be used prior to coating application. System shall be dried after application of disinfectant.
- Y. HVAC coating, DP 2545 White Protective Coating, to be used and shall be applied in accordance with the manufacturer's instructions. Coating shall be sprayed, brushed, or rolled directly onto interior ductwork liner surface. A continuous film of coating must be achieved on all liner material.
- Z. All sheet metal access plates shall be of same type and gauge as existing duct work and shall be affixed with compatible screws.
- AA. All duct sealant shall be a water-based product and be specifically rated for sealing ductwork.
- BB. All chemicals shall be of type recommended by the manufacturer for use in air delivery systems, and be EPA approved for such application. Material Safety Data Sheets (MSDS) shall be provided.
- CC. When used, Biocide shall be a non-acid type recommended and used in accordance with manufacturer's instructions. Product must be EPA registered for use in air delivery systems.
- DD. Coatings shall be of a type designed for application to HVAC system surfaces. Only coatings approved by Cal OSHA and EPA for use in HVAC systems shall be used.

3.06 RECORD DRAWINGS

- A. Maintain at the site, a set of record drawings, upon which shall be clearly indicated (by shading, coloring, or some other acceptable method) the day by day extent of the work installed. Indicate all changes to the original design at the end of each day.
- B. At the completion of the construction phase, furnish to the Owner's Representative all necessary drawings showing work which was not installed as shown in the contract drawings. A minimum of one set of originals and three copied sets shall be furnished. Indicate all pertinent information, i.e., valve locations, pipe routing (dimensionally located), etc. All underground piping shall be located on the record drawings by two or more dimensions. All elevations (inverts) shall be shown with the point of elevation change clearly located. All valves shall be numbered and lettered to correspond with the numbers and letters on the site.

3.07 GUARANTEES AND WARRANTIES

- A. All work shall be guaranteed to be free from defects in material and workmanship for a period of one year from the date of final acceptance of the work, or a longer period if stipulated under specific headings. Replace at no additional cost any material, fixtures or equipment developing defects and also pay for any damage caused by such defects, or the correction of defects.
- B. Use warrantee terms for specific items of equipment, relative to the work guarantee requirements of this specification.

END OF SECTION