

heating, ventilation, air conditioning + plumbing design and engineering 6085 STATE FARM DR. #130 phone: 707.577.0363 ROHNERT PARK, CA 94928 fax: 707.577.0364

PROFESSIONAL PROFE

WATERFORD UNIFIED SCHOOL DISTRICT

219 N. REINWAY AVE, #2 WATERFORD, CA 95386

WATERFORD
JUNIOR HS
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12916 BENTLY STREET WATERFORD, CA 95386

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HVAC NOTES, LEGENDS & ABBREVIATIONS

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SCALE
PROJECT No.
1534
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GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The requirements of this section apply to all sections of Division 23.
- 1.02 WORK INCLUDED
- A. Provide all materials, equipment, labor, fabrication, specialties, and items necessary and incidental to the installations of a complete system or piece of equipment.
- B. Work included shall also include transportation, storage, utilities and required licenses and
- 1.03 RELATED WORK AND REQUIREMENTS
- A. The work of this Section shall require work in coordination with other Divisions outside of this Section as follows:
- 1. Section 01 00 00 General Requirements 2. Section 26 00 00 General Requirements, Electrical
- 1.04 QUALITY ASSURANCE
- A. Comply with Division 01 requirements regarding Quality Control.
- B. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in their respective industrial and institutional HVAC system, as applicable.
- C. Products Criteria:
- 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions
- 2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall
- 3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes
- are more stringent than those specified, the more stringent requirement shall be used. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of
- 1.05 SUBMITTALS
- A. Comply with Division 01 requirements regarding submittals.
- B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- D. Prior to submitting layout drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- Upon request by Engineer, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.
- F. Submittals and layout drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups. Submittals and shop drawings shall also incorporate the following items:
- 1. Clear and neat strike out of irrelevant information. 2. Clearly and neatly tag and mark equipment, options and specialties and special
- 3. Key tags to match tags on Drawings. a. If substituting on Specified equipment provide comprehensive written comparison of
- characteristics between specified and substituted equipment. 4. Provide information in an easily readable and legible format presentation. 5. Provide an index with corresponding labeled and tabbed dividers for sections, in a three

ring hard cover binder or hard cover binding folder. Loose leaf sections, provided

- separately, shall not be acceptable. Front index shall include, at a minimum: a. Full, formal, name and address, including zip code, for job.
- b. Company name, address, phone and fax numbers of General Contractor, including phone land line number of job trailer and cellular phone number and name of job site Superintendent.
- 6. Submit all items at same time, including all controls information, in one binder/folder. Excluding controls for a later, separate, review shall not be acceptable. 7. Unless specified otherwise in Division 01 requirements submit 5 copies of data.
- Engineer will return 4 copies while retaining one for internal office use as a Project Record Document. 8. Paper copies shall be the only acceptable submittal medium, electronic submittals are not permitted unless specifically required by Division 01.
- 9. Submittals shall be prepared and submitted in a timely fashion to allow adequate time for ordering of long lead time equipment and materials.
- 1.06 CODES, REGULATIONS, STANDARDS, AND GUIDELINES
- A. Work shall be in accordance with requirements of the latest jurisdiction adopted editions of the following:
- 1. CBC California Building Code, 2019 Edition
- 2. CMC California Mechanical Code, 2019 Edition 3. CPC - California Plumbing Code, 2019 Edition
- 4. CEC California Electrical Code, Latest Edition
- CFC California Fire Code, Latest Edition 6. CEC - California Energy Commission, Title 24, Part VI

- B. The work shall comply with the latest editions of the following guidelines and standards:
- AABC Associated Air Balance Council
- 2. AMCA Air Movement and Control Association ANSI American National Standards Institute
- 4 ARI American Refrigeration Institute
- 5. ASHRAE American Society of Heating Refrigerating and Air Conditioning Engineers 6. ASME American Society of Mechanical Engineers
- 7. ASTM American Society for Testing and Materials 8. NFPA National Fire Protection Association
- 9. SMACNA Sheetmetal and Air-Conditioning Contractors National Association 10. UL Underwriters Laboratories
- 11. When the work calls for more stringent requirements than the above listings the Specifications and Drawings shall take precedence.
- 1.07 SITE VISIT AND FAMILIARIZATION
- A. Visit the site and become familiar with the Drawings and Specifications. Examine the site and understand the conditions under which the Contract shall be performed.
- B. Refer to Division 01 for any Pre-Bid Conference requirements.
- PART 2 PRODUCTS
- 2.01 NOT USED
- PART 3 EXECUTION
- 3.01 PRODUCT DELIVERY, STORAGE AND HANDLING
- A. Delivery and handling shall be performed in accordance with manufacturer's recommendations. Provide dust and weather covers.
- B. Protect materials from loss or damage. Lost or damaged materials shall be replaced with new at no increase in Contract Sum.
- C. All mechanical equipment requiring power shall be installed with the required working spaces clearances required by the California Electrical Code, Table 110.26 (A)(1) Working
- D. All facility service piping and conduits shall be concealed behind finishes. No exposed piping or raceways will be permitted unless specifically noted in writing on the drawings. Coordinate with pertinent sections of other Divisions providing demolition and new finishes. Jointly determine extent of demolition and finish removal necessary to install all indicated facilities services systems concealed behind wall, floor, ceiling finishes.
- 3.02 PROTECTION OF WORK
- A. Cap all duct, pipe and equipment openings daily to protect from dust, moisture and incidental debris. Equipment not capped shall be thoroughly cleaned prior to recommencing construction.
- B. Porous materials that become wetted shall be replaced with new. Drying is not sufficient as it introduces the possibility of microbial growth. This applies to duct liner, insulation wrap, flex duct and any material that has the potential to absorb moisture.
- C. All air distribution shall be capped during construction to prevent accumulation of dirt, dust
- 3.03 CLEANING AND PRESENTATION
- A. Prepare Work for painting by leaving surfaces free of oil, dust, rust, scale, adhesions and
- B. Remove all shipping labels and tags.
- C. Exterior surfaces of piping, insulation, ducting and equipment shall be left clean.
- D. Inside visible portions of grille cans and adjacent ducting including insulation stick pins, dampers and specialties shall be painted with two coats of flat black paint.
- E. Scratched and marred surfaces of factory painted equipment and materials shall be touched up with matching color/type paint.
- 1. Clean as recommended by manufacturer. Do not use material or methods which may 1.04 ADMINISTRATION damage finish surface or surrounding construction.
- F. Cut ends of strut pieces and uncoated/non-galvanized steel materials exposed to the elements shall be painted with two coats of rust inhibiting paint with color and type matched

# 3.04 SAFETY

- A. The contractor shall be solely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This shall also apply to normal and non-normal working hours.
- 3.05 CUTTING OF STRUCTURE
- A. Do not cut beams, girders, columns, or any other structural members, or run any pipes, ducts or work through slabs, unless specifically shown on the Drawings, or unless written approval is obtained from the Owner.
- B. Cutting of walls, floors, or other parts of the building or repairing any work due to neglect of properly directing the locations of necessary openings and framing beforehand shall be done at no additional cost to the Owner.
- 3.06 RECORD DRAWINGS
- A. Contractor is required to provide record Drawings in accordance with Division 01 and this
- B. Keep and accurate record of job progress including as-built locations and of the Work. Keep record up-to-date on legible copies as job progresses. Drawings shall be of the same size as provided to the contractor. Make available to Owner and Owner representatives during job.
- 3.07 COMPLETION
- A. When work is completed, or when Owner or Owner representative directs, remove surplus
- equipment, material, waste, and rubbish and leave building in satisfactory condition. B. Adjust and program thermostats and controls per owner direction and as indicated within
- Division 23 requirements. 3.08 WARRANTEES AND GUARANTEES
- A. Contractor is required to provide warranties in accordance with Division 01 General
- 1. Collect all warranties and guarantees for materials and equipment and neatly fill out all required information for the Owner. Provide one copy of each certificate for turn over to Architect. Arrange certificates in a tabbed and indexed binder for Architect ease of use.
- A. At the completion of the work contractor shall guarantee to repair or replace materials and workmanship found defective for a period of one year from date of filing of Notice of Completion. This work shall be performed at no cost to the Owner. 1. Work of other trades damaged as a result of faulty workmanship or materials shall be
- repaired at no cost to the Owner. **END OF SECTION**

## 230001 - COORDINATION

- **SECTION 23 00 01**
- COORDINATION
- PART 1 GENERAL
- 1.01 SUMMARY
- A. Section Includes: Provision of coordination of the Work of the Contract
- 1.02 GENERAL COORDINATION
- A. Contractor shall be responsible for all project coordination.
- B. Coordinate schedules, submittals and work of the various trades to ensure efficient and orderly sequence of installation of construction, with provisions for accommodating items to be installed later. Coordinate the work among the Specifications and Drawings. Work shown on any drawing or specification is required by the Contract irrespective of the trade sub-division. Contractor shall require each trade subcontractor to review all other subdivisions of the documents for related work and shall coordinate the subcontracts accordingly.
- C. Require all parties involved in the performance of the Work to cooperate in the overall coordination of the work under the direction of the Contractor. Each party, when requested to do so, shall furnish information concerning its portion of the work and shall respond promptly and reasonably to the decisions and requests of persons designated with coordination, supervisory, administrative, or similar authority.
- D. The Drawings use graphic symbols to show certain physical relationships of the various elements and systems and their interfacing with other elements and systems. Establishing and coordinating the actual physical relationships is the responsibility of the Contractor. Layout and arrange all elements to contribute to safety and efficiency while maintaining the intent of the design. Before work proceeds in areas of potential conflict for installing different components of the work, Contractor shall prepare supplementary drawings for review by the Architect and resolve the conflict.
- Coordinate continuous checking of architectural and structural clearances for accessibility of equipment and mechanical and electrical systems. No allowances of any kind will be made for the Contractor's failure to coordinate sequence of installing materials/equipment into position. Contractor shall verify that equipment will fit within the prescribed equipment room spaces.
- F. Prior to installation of each major unit of work which requires coordination and interfacing with other work, meet at project site with installer and representatives of manufacturers and fabricators who are involved in or affected by unit of work. Review progress of other work and preparations for particular work under consideration.
- requirements of the Contract Documents.

G. Coordinate the tolerances of all materials to ensure a proper fit in achieving the

- H. Coordinate matching finish, texture, color, etc. for the new work on existing components in
- Coordinate work of like materials by submitting pilot samples to the Architect for review of acceptable ranges of finish textures and color variation.
- Coordinate completion and cleanup Work of various trades in preparation for the Substantial Completion and for occupancy of the Building.
- 1.03 SUBCONTRACT COORDINATION
- A. The General Contractor shall coordinate the Work and do not delegate responsibility for coordination to any Subcontractor.
- B. Anticipate the interrelationship of all Subcontractors and their relationship with the Work.
- C. Resolve differences or disputes between Subcontractors concerning coordination. interference, or extent of work between sections of the specifications. Contractor's decisions, if consistent with the Contract Document requirements, shall be final.
- D. Coordinate the work of Subcontractors so that their portions of the work are performed in a manner that minimizes interference with the progress of the Work.
- A. General: Prepare a written memorandum on required coordination activities. Include such items as required notices, reports and attendance at meetings. Distribute this memorandum to each trade performing work at the project site. Prepare similar memorandum for separate contractors where interfacing of their work is required.
- B. Coordination Meetings: Conduct general project coordination meetings with Subcontractors at least weekly at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special preinstallation meetings. Request representation at each meeting by every party currently involved in coordination or planning for the work of the entire project. Keep the Owner Representatives informed about coordination meetings. Conduct meetings in a manner which will resolve coordination problems. Record results and minutes of each meeting and distribute copies to everyone in attendance and to the Owner Representatives. Owner Representatives may attend weekly jobsite meetings with
- C. Superintendent: Provide a full-time Superintendent experienced in administration and supervision of building construction. This Superintendent shall be authorized to act as general coordinator of interfaces between units of work. This Superintendent shall be on site, continuously during the construction period. Construction coordination shall be his/her
- principal duty. 1. For the purpose of this provision, "interface" is defined to include scheduling and sequencing of work, sharing of access to work spaces, installations, protection of each other's work, cutting and patching, tolerances, cleaning, selections for compatibility, preparation of coordination drawings, inspections, tests and temporary facilities and
- 2. Mechanical/Electrical Coordinator: Provide a single individual, a mechanical/ electrical coordinator, experienced in administrative and supervisory coordination of mechanical and electrical work. This experience in coordination shall include coordination of the type of mechanical/electrical work required for this project. The mechanical/electrical coordinator is required to act as the specialized coordinator of interfaces both within mechanical/electrical work and between that work and other trades. The Mechanical/Electrical Coordinator shall be on site, full time during the construction period. Project Superintendent may serve as mechanical/electrical coordinator.

# 1.05 COORDINATION DRAWINGS AND SUBMISSION

- A. Prepare Coordination Drawings where required before beginning fabrication or delivery of materials and equipment to the jobsite. 1. Coordination Drawings shall clearly indicate coordination of mechanical, plumbing, fire protection, electrical, lighting, signal and equipment installations with structural, architectural and finish elements. 2. Scale: 1/2" = 1'-0". Scale may be revised to 1/4"=1'-0" with consent of all involved
- subcontractors. B. Keep copies of Coordination Drawings at the jobsite.

Coordination Drawings to prevent conflicts in the field.

- C. Contractor shall provide the Owner with a record copy of initial Coordination Drawings and with revisions to Coordination Drawings, within three (3) working days of completion of each drawing or revised drawing and 30 days before work begins. The Owner will verify that Coordination Drawings have been made, but no approval of these drawings will be made. Include in submission of drawings the names of coordination staff.
- D. Coordination Drawings shall include, but are not limited to: structural, fire protection, plumbing, heating, ventilation and air conditioning, electrical power and lighting, security, life safety, data, telephone system, existing or reinstalled equipment and new equipment.
- E. Coordination Drawings, shall indicate layout of Work for all trades, for purposes of showing overlavs and potential conflicts of crossover work and adjoining work.
- F. Conditionally revise Coordination Drawings as subsequent work is added to areas containing existing work. G. Provide dimensions and elevations where conflicts may exist and coordinate conflicts on

#### H. Contractor shall require Subcontractors to develop Subcontractor Coordination Plans of the SECTION 23 05 93 same scale as Contractor's Coordination Drawings to assist in making transcripts for transfer to Coordination Drawings; use approved Shop Drawings for Coordination Drawings TESTING, ADJUSTING AND BALANCING

230001 - COORDINATION

only; make runs parallel with lines of building.

- Coordination Drawings shall include dates and signatures of Contractor and Subcontractors involved in coordination; signed Coordination Drawings shall be subject to examination by
- the Owner at any time. Failure to maintain up-to-date drawings will be considered nonconformance with Contract Documents and progress payment will be withheld.
- J. Failure of Contractor to provide adequate coordination and Coordination Drawings shall not be grounds for adjustment of Project cost or extension of time.
- 1.06 STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL COORDINATION A. Use Coordination Drawings of structural, mechanical, plumbing and electrical Work, together with shop drawings and layout drawings of affected Work to check, coordinate and
- integrate the Work to prevent interferences. B. Coordinate space requirements and installation of mechanical and electrical Work which
- are indicated by graphic symbols on Contract Documents. C. Routing shown for pipes, ducts and conduits on Drawings are shown by graphic symbols
- D. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance
- E. Conceal pipes, ducts and wiring in finished areas, unless otherwise indicated; coordinate locations of fixtures and outlets with finish elements.
- F. Where there is a potential conflict in the layout or interferences between the work, including structural and architectural, layout the work with tape or other means to depict the layout on site to reduce or resolve the conflict and to allow the Owner to review the work prior to execution. The tape or other means to depict layout shall not cause any damage, change in color or appearance of any work to remain, or leave a residue.
- G. Contractor shall coordinate steel shop drawings to include any and all penetrations of framing members resulting from the coordination of and with the work of the mechanical and electrical subcontractors. See Section 05120 for additional structural coordination

1. Steel shop drawings shall be reviewed and approved by the mechanical, electrical and

- plumbing subcontractors prior to submission and fabrication. 1.07 INTERSTITIAL SPACE COORDINATION
- A. Contractor shall provide Coordination Drawings for the Interstitial Spaces to resolve installation conflicts prior to final approval of any shop drawings.
- B. All conflicts shall be brought to the attention of the Architect.
- C. Elements to include in the Coordination Drawings:
- 1. Mechanical ducts and pipes, including floor penetrations. Plumbing pipes
- 3. Fire branch lines and sprinkler heads. 4. Electrical bus ducts.
- 5. Telephone communication and data lines. Interstitial space access.
- . Structural elements including, but not limited to, beams, columns, slabs, hangers and seismic bracing.
- Suspended ceilings. Insulation 10. Security system elements.
- 11. Others as necessary.
- D. Schedule of Submission 1. Refer to ACoordination Drawings and Submission@ specified in this Section. 2. Review of the coordinated drawings shall be required prior to approval of any of the
- E. An as-built version of this drawing should be required at the end of installation.

sub-system shop drawings for the elements listed above.

- PART 2 PRODUCTS
- NOT USED
- PART 3 EXECUTION
- END OF SECTION

NOT USED

# 230593 - TAB

- PART 1 GENERAL
- 1.01 DESCRIPTION OF WORK
- A. Work Included: This Section covers requirements for testing, adjusting, and balancing work for the air distribution systems and associated equipment and apparatus described herein.
- B. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS -HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC).
- 1.02 QUALITY ASSURANCE
- A. Engage the services of an independent balancing and testing agency specializing in the balancing and testing of heating, ventilating and air conditioning systems to perform the

performed by the predecessor agency.

an approved successor.

standard, AABC.

- 1. The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
- 2. The TAB agency shall be a certified member of AABC to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Engineer of Record and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by AABC within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work
- 1. The TAB specialist shall be a member of AABC. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by the AABC within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by
- notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include: a. Shall directly supervise all TAB work. b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall

be accompanied by report forms and schematic drawings required by the TAB

2. TAB Specialist shall be identified by the General Contractor within 60 days after the

- c. Would follow all TAB work through its satisfactory completion. d. Shall provide final markings of settings of all HVAC adjustment devices.
- e. Permanently mark location of duct test ports. 3. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing.
- requirements established by AABC National Standards. Provide calibration history of the instruments to be used for test and balance purpose. Tab Criteria: a. One or more of the applicable AABC or SMACNA publications, supplemented by
- ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports. b. Exhaust hoods/cabinets: 0 percent to plus 10 percent.

4. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration

- 7. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 2 percent to plus I0 percent except if the air to a space is 100 CFM or less the tolerance would be 0 to plus 5 percent. a. Systems shall be adjusted for energy efficient operation as described in PART 3. b. Typical TAB procedures and results shall be demonstrated to the Resident
- three rooms) and one hydronic system (pumps and three coils) as follows: . When field TAB work begins. 2. During each partial final inspection and the final inspection for the project if

Engineer for one air distribution system (including all fans, three terminal units,

- D. AABC Compliance: Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to mechanical air distribution systems and associated equipment and apparatus, except as otherwise specified. E. Industry Standards: Comply with American Society of Heating, Refrigerating and Air
- instruments and testing, adjusting and balancing, except as otherwise specified.
- 1.03 SUBMITTALS

requested by VA.

6. Minimum outside air: 0 percent to plus 10 percent.

A. Comply with Submittal Requirements of Division 01. B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after

the notice to proceed. Submit information on three recently completed projects and a list of

Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements,

- proposed test equipment. C. For use by the Resident Engineer staff, submit one complete set of applicable AABC
- publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval: 1. Systems inspection report on equipment and installation for conformance with design. 2. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- 3. Submit certification that balancing personnel have been trained in accordance with AABC standards.
- 4. Submit certification of test equipment calibration and currency. 5. Maintenance Data: Include in maintenance manuals, copies of certified test reports. 6. Submit certified test reports signed by the Test and Balance Supervisor who performed testing and balancing work. In addition, have report certified by a Registered

Professional Engineer who is familiar with testing and balancing work and also with

- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance
- report for the area.
- F. Make all other submittals specified under this Section. 1.04 JOB CONDITIONS
  - A. Do not proceed with TAB work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.
- PART 2 PRODUCTS
- 2.01 GENERAL
- A. PATCHING MATERIALS: Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. In each case, patching shall be completed by original installer.
- B. TEST INSTRUMENTS: Utilize test instruments and equipment for testing and balancing work required, of type, precision, and capacity as recommended in AABC's Manual MN-1 "AABC National Standards".

- 230593 TAB
- A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

A. Provide for repair of insulation removed or damaged for TAB work.

- 2.03 INSULATION REPAIR MATERIAL

- PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with testing and balancing work until unsatisfactory conditions have been corrected in manner acceptable to
- B. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test
- C. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers and similar controls and devices, to show final settings at completion of testing and balancing work. Provide markings with paint or other suitable permanent identification materials.
- Prepare a report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced, including, where necessary, modifications which exceed requirements of the Contract Documents. Submit report to the Engineer for review. Carry out corrective modifications as approved by the Engineer.
- E. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

F. Units shall not be operated without air filters. Air filters shall be replaced completely after

construction is complete and just prior to air balancing.

3.02 BALANCING PROCEDURES - AIR SYSTEMS

- A. Prior to balancing, the Contractor shall complete construction of air handling system with all components installed, and controls operative and calibrated. Schedule balancing for completion four calendar weeks prior to the completion of the building or the area the air system is servicing.
- B. Before balancing, check alignment of fan and motor sheaves.
- Set all fans at rated speeds for design volumes and pressure. Simultaneously operate all supply and exhaust systems serving common areas on 100% outside air or full recirculation throughout the balancing period.
- Measure flow and pressure in ducts by means of pitot tube and manometer or U-gage having a minimum sensitivity of 0.02 inch of water.
- be not more than 6 inches. Take readings as far downstream of fittings as is practicable up to an equivalent of seven duct diameters. . Measure fan and motor speed with a direct reading tachometer and Strobo Tach. Measure

E. For rectangular ducts, take readings at the center point of equal rectangles with not less

than 16 and a maximum of 64 readings. Center distances between rectangular areas shall

- amperage and voltage with direct connected or clamp-on instruments. G. Measure flow at air outlets and inlets with velometer in accordance with air outlet manufacturer's instructions.
- H. Submit to the Engineer duplicate copies of final test and balancing measurements, drawings and operating data on fan curves. Determine actual air volume delivery of all fans by measuring fan performance point on fan
- J. Test and record static pressure drop across all filters and note the condition of the filter at

K. Kest and record entering and leaving db and wb temperature after the air systems have

- been balanced. Note whether system is on the heating or ventilation cycle. L. After all fans have been adjusted, proceed with balancing of systems. Adjust outside quantities by temperature of outside air, recirculated air and mixture on a day in which outside air is at least 30 °F colder than room air. Maximum and minimum air volumes through outdoor, return and exhaust air combination are to be adjusted in conjunction with
- automatic controls manufactured by means of linkage stops on damper motors. M. Where duct joints present leakage, the contractor shall reseal joints with 3M EC-800
- N. The following data shall be measured and recorded for all systems after balancing and
- adjusting to within limits specified herein, for submission of balancing report: Fan Data:

cement, or equal.

- a. Manufacturer and model number (where available) b. CFM, design vs. actual d. Inlet static pressure
- e. Discharge static pressure f. Total static pressure g. For purpose of balancing, fan BHP shall be calculated as follows:

Motor Data

a. Manufacturer model number b. Horsepower c. Phase

d. Frequency

- e. NEMA code letter Rated vs. actual volts Rated vs. actual amperes
- h. Calculated operating BHP Locked rotor amperes
- purpose of test b. Air outlet manufacturer and model number where available

e. CFM, actual

b. Return air temperature

3. Air Outlet Data:

c. Size d. CFM, design

f. CFM, percentage above or below design 4. Outdoor Air Data: a. Outdoor air temperature

a. Schedule showing all air outlet locations and numbers assigned to outlets for

c. Mixed air temperature with averaged traverse readings END OF SECTION

6085 STATE FARM DR. #130 phone: 707.577.0363 ROHNERT PARK, CA 94928



WATERFORD UNIFIED

# WATERFORD JUNIOR HS **GYMNASIUM**

12916 BENTLY STREET WATERFORD, CA 95386

PLAN SET INTENDED FOR PERMIT INTAKE AND REVIEW ONLY. BIDDING, ESTIMATING AND/OR CONSTRUCTION OF THIS PROJECT IS NOT AUTHORIZED BY THE MEOR UNTIL THIS NOTE IS REMOVED FROM THE DRAWINGS.

DATE

RLY

HVAC SPECIFICATIONS

# | REVISION

**ISSUE DATE** 09/09/2020 PERMIT INTAKE **ISSUE TYPE** DRAWN BY

NOT FOR CONSTRUCTION

CHECKED BY SCALE PROJECT No.

SCHOOL DISTRICT 219 N. REINWAY AVE, #2 WATERFORD, CA 95386

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work covered under this section consists of providing all necessary labor, supervision, materials, equipment and services to completely execute the complete HVAC system insulation work for equipment, piping, ductwork and other items where shown on the drawings and required herein.

B. All insulation that is exposed to weather shall be protected with weather covers of stainless steel or aluminum jacketing.

C. Insulate equipment and products at the following locations;

1. Where the fluid being transported is 60 degrees Fahrenheit or below in temperature. 2. Where the fluid being transported is 100 degrees Fahrenheit or above in temperature. 3. All hot surfaces above 120 degrees in temperature to prevent personnel burns. All condensate pans serving HVAC equipment.

5. All piping, equipment, ducting, valves, etc., which require insulation but come uninsulated from the manufacturer.

1.02 REFERENCES

A. Insulation work shall comply with the requirements of the 2019 California Energy Commission requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fire Rating of all insulation shall have a composite (insulation, jacket/facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard, as tested by ASTM E84, UL 263, and UL 723, not to exceed a flame spread of 25 and smoke developed by 50.

2.02 REFRIGERANT PIPING INSULATION

2.03 DUCT AND PLENUM INSULATION

A. Insulation shall be flexible, closed cell elastomeric pipe insulation: AP Armaflex, AC

1. Adhesive shall be Armaflex 520 or 520 BLV Adhesive. Insulation shall conform to

ASTM C534 Grade 1, Type 1

1. Duct linings shall be flexible, coated, fiberglass, 1 inch minimum thickness (2 inch minimum thickness for exterior ducts), minimum density of 1.5 pounds per cubic foot, maximum thermal conductivity of 0.26 BTUH per sq. ft. degree F/in. at 75 degrees, and minimum noise reduction coefficient of 0.60 for 1 inch thickness. 2. Plenum linings shall be rigid, neoprene coated fiberglass board, 2 inch thickness,

minimum density of 3.0 pounds per cubic foot, maximum thermal conductivity of 0.23 btu/h per sq. ft. degree F/in. at 75 degrees, and minimum noise reduction coefficient of 0.90 for 2 inch thickness.

3. Comply with SMACNA Duct Liner Application Standard and manufacturers recommendations.

2.04 PIPE INSULATION METAL JACKETING

A. Provide 0.016 inch thick factory made pipe insulation waterproof aluminum jacketing for all insulated pipe installed outside, exposed to weather. Metal jacketing shall include Z-joints at longitudinal seams arranged to prevent water from entering, and use factory applied stainless steel butt straps at transverse joints.

B. All insulation ends, longitudinal seams, and transverse joints shall be sealed with tape sealant to prevent rainwater from entering the insulating system. At valves, gauges and other hydronic specialties requiring periodic access provide outdoor type removable and re sealable weatherproof jackets.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation products in accordance with the manufacturer's written instruction, commercial and industrial standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces shall be thoroughly cleaned with all testing successfully completed prior to insulating.

B. Provide complete weather protection for all outdoor piping insulation.

3.02 INSULATION LOCATIONS

A. Apply insulation by type and location as follows:

 Refrigerant Piping a. Insulate suction lines continuously from outlet of evaporator coil to the suction valve at the compressor

b. Insulation thickness shall be 1 inch, minimum.

surfaces. Insulation shall not be stretched when adhering.

3.03 REFRIGERANT PIPING APPLICATION

A. All refrigerant piping shall be free of extraneous chemicals such as corrosive cleaners or building material's dust prior installation

B. Refrigerant piping shall be sealed while slipping on insulation to prevent foreign matter from C. Insulation is to be slid onto pipes. Longitudinal slitting of the insulation shall not be allowed

except on mitered sections. Insulation shall be pushed, not pulled. D. Insulation shall be mitered, pre-adhered and longitudinally slit inside throat to fit over traps,

tees, elbows or bens over 90 degrees. E. All butt joints and mitered seams shall be adhered with full coverage of adhesive on both

F. Hangers clamped directly to the pipes shall be insulated over the hanger; insulation shall be fully adhered to the hanger. All seams shall be sealed with adhesive.

G. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of WB Armaflex Finish or two coats of weather resistant coating.

3.04 DUCTWORK APPLICATION

A. After ductwork testing has been completed insulate ductwork as specified. On ducts over 18 inches wide apply weld clips or stick clips to bottom of duct, space 18 inches on center each way, maximum. Seal all longitudinal and transverse seams and all punctures caused by weld clips or stick clips with 2" wide SMACNA labeled, and manufacturer approved, duct

B. Provide staples, bands, wires, tape, anchors, corner angles, cements, adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by the insulation manufacturer to the applications indicated.

C. Insulate all air distribution (grilles, register and diffusers) not factory insulated with

fiberglass duct-wrap where located in ceilings or spaces not used as return air plenums.

D. Install insulation materials with smooth, even surfaces.

E. Clean and dry all ductwork prior to insulating. Butt insulation joints firmly together to ensure

complete and tight fit over surfaces to be covered. F. Extend duct-wrap insulation without interruption though walls, floors, and similar ductwork penetrations, except where otherwise indicated.

END OF SECTION

### 232300 - REFRIGERANT PIPING

**SECTION 23 23 00** 

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide complete piping, specialties, installation and tests in conformity with applicable codes and authorities having jurisdiction for the Work as required by this Section for HVAC equipment indicated on the Contract Drawings and contained herein.

1. Field refrigerant piping for direct expansion HVAC system & Field refrigerant piping and associated drain and condenser water piping for walk-in coolers and freezers, including required pipe insulation.

PART 2 - PRODUCTS

2.01 PIPING AND FITTINGS

B. Refrigerant systems include:

A. Refrigerant Piping: For piping up to 4 inches use Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer. For piping over 4 inch use A53 Black SML

B. Fittings, Valves and Accessories:

1. Copper fittings: Wrought copper fittings, ASME B16.22. a. Brazed Joints, refrigerant tubing: Cadmium free, AWS A5.8/A5.8M, 45 percent silver brazing alloy, Class BAg-5

b. Solder Joints, water and drain: 95-5 tin-antimony, ASTM B32 (95TA). . Flanges and flanged fittings: ASME B16.24.

Refrigeration Valves: a. Stop Valves: Brass or bronze alloy, pack-less, or packed type with gas tight cap,

frost proof, back seating. b. Solenoid Valves: Comply with ARI 760 and UL 429, UL-listed, two-position, direct acting or pilot-operated, moisture and vapor-proof type of corrosion resisting materials, designed for intended service, and solder-end connections. Fitted with suitable NEMA 250 enclosure of type required by location and normally closed holding coil.

c. Thermostatic Expansion Valves: Comply with ARI 750. Brass body with stainlesssteel or non-corrosive nonferrous internal parts, diaphragm and spring-loaded (direct-operated) type with sensing bulb and distributor having side connection for hot-gas bypass and external equalizer. Size and operating characteristics as recommended by manufacturer of evaporator and factory set for superheat requirements. Solder-end connections. Testing and rating in accordance with ASHRAE Standard 17.

d. Strainers: Designed to permit removing screen without removing strainer from piping system, and provided with screens 80 to 100 mesh in liquid lines NPS 1 and smaller, 60 mesh in liquid lines larger than NPS 1, and 40 mesh in suction lines. Provide strainers in liquid line serving each thermostatic expansion valve, and in suction line serving each refrigerant compressor not equipped with integral strainer.

4. Refrigerant Moisture/Liquid Indicators: Double-ported type having heavy sight glasses sealed into forged bronze body and incorporating means of indicating refrigerant charge and moisture indication. Provide screwed brass seal caps. 5. Refrigerant Filter/Dryers: UL listed, angle or in-line type, as shown on drawings. Conform to ARI Standard 730 and ASHRAE Standard 63.1. Heavy gage steel shell protected with corrosion-resistant paint; perforated baffle plates to prevent desiccant

bypass. Size as recommended by manufacturer for service and capacity of system with

connection not less than the line size in which installed. Filter driers with replaceable filters shall be furnished with one spare element of each type and size. 6. Flexible Metal Hose: Seamless bronze corrugated hose, covered with bronze wire braid, with standard copper tube ends. Provide in suction and discharge piping of each

2.03 PIPE INSULATION FOR DX HVAC SYSTEMS

A. Refer to Section 23 07 00 Thermal Insulation for Mechanical Systems.

2.04 PIPE INSULATION FOR WALK-IN COOLERS AND ERFEZERS

A. Insulate refrigerant suction piping from unit cooler to condensing unit. Use 3/4-inch thick insulation on piping inside the refrigerator or freezer and 1-1/2 inch thick insulation (double layer required) on piping outside the refrigerated space.

B. Insulate unit cooler drain piping in freezer units, over electric heat tracing system, to prevent drain from freezing during defrost.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5

. Install piping as short as possible, with a minimum number of joints, elbow and fittings. 2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 1 inch minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness

3. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing.

4. Use copper tubing in protective conduit when installed below ground. 5. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's

recommendations. 6. Verify refrigerant pipe sizes and install in accordance with manufacturer's pipe size recommendations

B. Joint Construction: 1. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials

complying with AWS A5.8/A5.8M. a. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.

b. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel. c. Swab fittings and valves with manufacturer's recommended cleaning fluid to

remove oil and other compounds prior to installation. d. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

D. Pipe relief valve discharge to outdoors for systems containing more than 100 lbs. of

E. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with

firestop material. 3.02 PIPE AND TUBING INSULATION

A. Apply two coats of weather-resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

3.04 SYSTEM TEST AND CHARGING

A. System Test and Charging: As recommended by the equipment manufacturer. END OF SECTION

233113 - METAL DUCTS

**SECTION 23 31 13** METAL DUCTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide complete materials, equipment, fabrications, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: Ductwork and Plenums

Balancing dampers 3. Backdraft dampers All duct accessories

1.02 QUALITY ASSURANCE

A. In addition to Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING quality assurance requirements the ductwork shall: 1. Duct System Construction and Installation: Referenced SMACNA Standards are the

minimum acceptable quality 2. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.

3. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

1.03 APPLICABLE PUBLICATIONS

PART 2 - PRODUCTS

2.01 DUCT MATERIALS AND SEALANTS

A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

2.02 DUCT CONSTRUCTION AND INSTALLATION

design shown on the drawings.

A. Kitchen and Grill Hood (Ventilator) Exhaust Ducts: Comply with NFPA 96. 1. Material: 16 gauge steel sheet (black iron), ASTM A1011, or 18 gage stainless steel.

Use stainless steel for exposed duct in occupied areas. See Optional Duct Materials. 2. Construction: Liquid tight with continuous external weld for all seams and joints. Provide access doors or panels for duct cleaning inside of horizontal duct at 20 feet intervals, and at each change of direction.

3. Access doors or panels shall be of the same material and thickness of the duct with

gaskets and sealants that are rated 1500 degrees F and shall be grease-tight.

B. Round Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct

Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 20 inches wide by 48 - 54 inches high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

D. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multiblade Volume Dampers.

E. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct

2.03 DUCT LINER

2.04 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream, in the following Each duct mounted coil.

2. Each fire damper (for link service), smoke damper and automatic control damper. 3. Each duct mounted smoke detector. 4. For kitchen hood exhaust duct, locate access doors at 20 feet intervals and at each

A. Duct sizes shown on drawings for lined duct are clear opening inside lining.

change in duct direction. B. Openings shall be as large as feasible in small ducts, 12 inch by 12 inch minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent

shatterproof covers are preferred for uninsulated ducts. 1. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards

2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

2.05 FIRE DAMPERS

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 160 degrees F fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

B. Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.

C. Minimum requirements for fire dampers:

1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 14 gage, required to provide installation equivalent to the damper manufacturer's UL test installation.

2.06 SMOKE DAMPERS

A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 1500 fpm. Maximum static

2. Submit manufacturer's installation instructions conforming to UL rating test.

pressure loss: 0.13 inch W.G. B. Maximum air leakage, closed damper: 4.0 CFM per square foot at 3 inch W.G. differential

pressure. C. Minimum requirements for dampers:

1. Shall comply with requirements of Table 6-1 of UL 555S, except for the Fire Endurance and Hose Stream Test. 2. Blades: Galvanized steel, parallel type preferably, 12 inch maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for

duct mounted dampers. D. Motor operator (actuator): Provide electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.07 COMBINATION FIRE AND SMOKE DAMPERS

A. Combination fire and smoke dampers: Multi-blade type units meeting all requirements of both fire dampers and smoke dampers shall be used where shown and may be used at the Contractor's option where applicable.

PART 3 - EXECUTION 3.01 GENERAL INSTALLATION

A. Fabricate and install ductwork and accessories in accordance with referenced SMACNA

233113 - METAL DUCTS

1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the owner. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance

difficulties. 2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound. . Provide bolted construction and tie-rod reinforcement in accordance with SMACNA

4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

B. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.

C. Install fire dampers, smoke dampers and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the Resident Engineer. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate re-setting of fire dampers and operation of smoke dampers to the Engineer.

D. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

E. Low Pressure Duct Liner: Install in accordance with SMACNA, Duct Liner Application F. Ducts exposed to the weather:

1. Make ducts watertight with tops sloped to shed water. Standing pools of water on top

of ducts shall not be allowed. a. Arrange seams to not act as dams.

duct sealant for both interior and exterior applications.

ducts with CMC required gauges when penetrating rated construction.

b. Place longitudinal seams at bottom of ducts. c. Insure water runoff by sloping entire top of duct down toward sides. d. Longitudinal seams and non-bolted joints shall be sealed with SMACNA approved

corner to provide a weather cap. The sides, end and bottom shall have intermediate 6" pieces of metal cleats so that any water can drain away. G. Construct with gauges, joints, bracing, reinforcing, and other details per latest edition of the CMC, AHSRAE, SMACNA and NFPA. Comply with most stringent requirement. Provide

e. Bolted duct joints: Top of duct shall have a continuous metal cleat from corner to

H. Provide for duct rigidity by either beading at 12 inches on center, maximum, or crossbreaking outward in ducts with positive pressures and crossbreaking inward for ducts having negative pressures. The exception is for ducts exposed to weather which shall crossbreak outward on top of duct.

At exposed duct penetrations of walls, floors and ceilings provide sheet metal angle type escutcheons with no sharp corners or edges. For round ducts factory angle rings may be

J. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions.

1. Pitch sides of ducts in diverging or converging airflow with a maximum 1 to 4 taper.

Abrupt bushing type fitting shall not be permitted.

1. Provide openings to accommodate instrumentation, thermometers, smoke detectors, controllers and miscellaneous components. Insert through airtight rubber grommets. 2. Where openings are provided in insulated ductwork for insertion of instruments install

3. At fire dampers allow adequate length of duct to install access door.

insulation material inside metal ring for use as a plug.

contractor's option for ducts less than 24 inches longest side. 2. Longitudinal seams shall be Pittsburge type. Snaplock shall not be allowed. N. Connections to air distribution (grilles, registers and diffusers) shall be by full radius elbow or by a straight duct connection for one duct diameter or greater.

1. In medium pressure ductwork transverse joints shall be Ductmate. In low pressure

ductwork transverse joints shall be Ductmate except that slip and drive may be used at

1. Where space is tight use side inlet plenums (cans) fabricated of minimum 24 gauge galvanized sheet metal, at least as tall as the connecting duct, with turning vanes. O. Duct hangers and supports 1. Support horizontal ducts with hangers of size and spacing per SMACNA HVAC Duct Construction Standards with attachments to suit structure type and seismic restraints

P. Volume and Dampers shall be provided at locations shown on the drawings. In addition, volume dampers shall be provided for each air terminal per the following requirements; 1. Volume dampers shall be installed as far away from air outlets as functionally

reasonable to avoid noise in the occupied spaces. 2. Provide also in wyes and spin-ins to outlets whether shown on drawings or not, except: a. Where dampers are not shown above inaccessible ceilings. b. To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be

provided).

END OF SECTION

233713 - DIFFUSERS/REGISTERS

SECTION 23 37 13

DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 DESCRIPTION A. Provide all air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment. Outlets and inlets shall have, as a minimum, throw and noise criteria ratings for each size device as listed in manufacturers current data, rated as

required by the applicable publications and standards. PART 2 - PRODUCTS

2.01 GENERAL A. Manufacturer shall examine and approve of application of each item of air distribution.

B. Noise level at design capabilities: no larger than diffuser selections shown on drawings. C. Do not provide volume dampers built into air distribution or directly attached to air

D. Air distribution frame shall be suitable for the ceiling or wall construction indicated. E. Match finish color sample as directed by the Owner's Representative

distribution unless specifically called out on drawings.

2.02 AIR OUTLETS AND INLETS

A. Materials: 1. Steel or aluminum unless specifically indicated within the documents. Provide manufacturer's standard gasket.

233713 - DIFFUSERS/REGISTERS 233116 - PHENOLIC DUCTS

B. Air Supply Outlets: 1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings,

damper with removable key operator.

removable key operator for registers.

aluminum finish.

3.02 MOUNTING AND ALIGNMENT

PART 3 - EXECUTION

3.01 INSTALLATION

**END OF SECTION** 

PART 1 – GENERAL

A. Section includes:

1.4 SPECIFICATION COMPLIANCE

3. Burning Test

Puncture Test

Static Load Test

11. Cone Calorimeter

14. DW144, Class B

21. NFPA Compliance:

**Building Materials** 

1.5 PRODUCT DELIVERY AND STORAGE

transport and storage.

PART 2 – PRODUCTS

1. UL-94 Flammability V-0

2.1 PHENOLIC RECTANGULAR DUCT AND FITTINGS

compressive strength of 28 psi (.2 MPa).

or ambient temperature surrounding ducts.

product must pass UL bacteria growth testing.

unless indicated otherwise on the print.

Procedure A.

Mounting A.

Materials and Assemblies

16. ASTM C 423 noise reduction

18. ASTM C 1071 for erosion

8. Impact Test

developed

B. This section does not include:

2. Flame Penetration Test

4. Mold Growth and Humidity Test

1.1 SUMMARY

baked enamel white finish, square or round neck connection as shown on the drawings. Provide plaster frame for units in plaster ceilings. a. Square, louver, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the drawings. Provide equalizing or control grid and volume control damper.

b. Louver face type: Square or rectangular, removable core for one, two, three or four-

way directional pattern. Provide equalizing or control grid and opposed blade 2. Supply Registers: Double deflection type with horizontal face bars and opposed blade

prime coat for field painting, or shall be extruded with manufacturer's standard

1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime

2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 1-1/4

3. Egg Crate Grilles: Aluminum or Painted Steel 1/2 by 1/2 by 1/2 inch grid providing 90%

coat for field painting, or shall be extruded aluminum with manufacturer's standard

3. Supply Grilles: Same as registers but without the opposed blade damper.

Return and Exhaust Registers and Grilles: Provide opposed blade damper without

A. Install air distribution in accordance with manufacturers written installation instructions.

B. Return and exhaust grilles: install with blades oriented to prevent sight through outlets.

A. All air distribution shall be secured to building. Ceiling distribution shall be secured to

prevent falling from ceiling during construction or service with minimum of two 16-gauge

ceiling wires, two 22-gauge by 1 inch galvanized sheet metal strap or two #10 sheet metal

1. Non-Fibrous, Closed Cell, Phenolic Ductwork for exterior applications

10" w.g. negative (as documented on product labeling).

B. Phenolic duct shall incorporate a fortified inner liner compliant to UL (C-UL) 181

Standard for Safety Listed, Class 1 system, with included testing and passing the

12. ASTM E2257 Standard Test Method for Room Fire Test of Wall and Ceiling

13. ASTM E 84 tested, Tunnel Test, Does not exceed 25 flame spread, 50 smoke

15. NRTL product approval, (Subpart S of 29 CFR Part 1910, OSHA)

19. ASTM C 518: 2004, Standard Test Method for Steady–State Thermal

20. UL 723, Test for Surface Burning Characteristics of Building Materials

a. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"

B. Phenolic duct outer shell shall be a UV stable 1000 micron high impact resistant

A. Prevent objectionable aesthetic damage to the outer surface of duct segments during

A. The panel shall be manufactured of closed cell rigid thermoset resin thermally bonded

on both sides to a factory applied .001" (25 micron) aluminum foil facing reinforced with a

fiberglass scrim. An added UV stable, IR reflective 1000-micron high impact resistant

titanium infused vinyl is factory bonded using a full lamination process. The lamination

process shall permanently bond the vinyl clad to the outer surfaces of the phenolic foam

panel to provide a zero-permeability water tight barrier and to form a structurally insulated

lamination process are not acceptable. Self-applied adhesives such as tapes, caulks or

B. The thermal conductivity shall be no greater than 0.146BTU • in/Hr •ft2•°F (.018W/m•°

C. The density of the panel foam shall not be less than 3.5 pcf (56 Kg/m3) with a minimum

1. Maximum Temperature: Continuous rating of 185 degrees F (70 deg C) inside ducts

2. Maximum Thermal Conductivity: 0.146 Btu x in./h x sq. ft. x deg F at 75 deg F mean

3. Permeability: 0.00 perms maximum when tested according to ASTM E 96/E 96M,

4. Antimicrobial Agent: Additive for antimicrobial shall not be used but instead, raw

6. Required Markings: All interior duct liner shall bear UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for internal closure

7. All insulation materials shall be closed cell with a closed cell content of >90%.

5. Noise-Reduction Coefficient: 0.05 minimum when tested according to ASTM C 423,

C), the thermal conductivity shall be no greater than 0.146BTU • in/Hr •ft2•°F (.018W/m•°

D. The standard panel is (31 mm) thickness panel with R-8.1 (1.5 RSI) shall be utilized

panel (SIP) in which to form duct segments. Processes that do not employ a full

cladding that incorporate pressure sensitive or spray adhesives are not acceptable.

B. Store duct segments under cover and protect from excessive moisture prior to

b. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"

c. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of

Transmission Properties by Means of the Heat Flow Meter Apparatus

1. Air passages rated over a continuous internal static pressure of 10" w.g.

positive, 10" negative, or with test pressure rating over: 10" w.g. startup and

C. Air distribution cans visible through grilles painted flat black.

3. Adjust distribution throw patterns as shown on drawings.

233116 - PHENOLIC DUCTS

A. Duct Leakage Class, follow SMACNA Leakage Class 3 or less.

5. Low Temperature Test and High Temperature Test

9. Pressure Test and Collapse (negative pressure) Test

17. ASTM E 96/E 96M Procedure A for permeability

titanium infused vinyl with included testing as following;

2. ASTM D-638 Tensile Strength of 6250 psi

4. ASTM D-4226 Drop Impact Resistance

5. ASTM D-4216 Cell Classification

3. ASTM D-790 Flexible Strength of 11,000 psi

10. High Temperature and Humidity for 90 days

1. Test for Surface Burning Characteristics

a. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a

3. Polymeric Sealing System: a. Structural Membrane: Aluminum scrim with woven glass fiber with UV stable vinvl clad applied b. Minimum Seam Cover Width: 2 7/8" inches (75 mm)

a. 1 3/16 inch (31 mm) Thick Panel: 8.1 R

9. Pressure Class design must be specified prior to fabrication.

1. V-Groove Adhesive: Silicone (interior only).

F. Closure Materials:

b. 2 3/8" Double wall (62 mm) Thick Panel: 16.2 R

2. UV stable 1000 micron high impact resistant titanium infused vinyl (exterior).

c. Water resistant titanium infused welded vinyl seams.

a. Factory manufactured seamless corners for zero perms.

b. Cohesive bonded over-lap at corner seam covers for zero perms.

c. Sealant: Low VOC. d. Color: White (colors, matched by architect optional).

e. Water resistant. f. Mold and mildew resistant. Duct Connectors.

d. Mold and mildew resistant.

G. Outdoor Cladding 1. Outdoor Installations: Duct segments shall incorporate UV stable 1000 micron high impact resistant titanium infused vinyl which is introduced during the manufacturing

a. Factory manufactured galvanized 4-bolt flange.

H. Flange coverings 1. Flanges are field sealed airtight before flange covers are installed. Flange covering consists of the following:

2. Air gap (heating only application) with molded 39 mil covers. J. Reinforcement 1. Product shall provide designed and built with adequate reinforcement to both; withstand air pressure forces from within the duct from blower pressure and shall be built to handle expected snow load for the location where the product is being installed. Product will employ factory-installed internal reinforcement system when

1. Foam tape insulation with molded 39 mil covers.

both specified static pressure and duct sizes dictate the need. 1. Product shall provide low weight stresses on the building framing and support members. Assembled product shall have a weight of 0.86 lbs. per square foot to maximum weight of 2.7 lbs. per square foot (depending on R-value and reinforcement requirement). Hangers and tie-downs are to be detailed in the manufacturer Installation Manual for review prior to installation but not exceeding 13' for duct girth <84" and 8' for duct girth >85" between hangers and designed to carry the weight and

PART 3 - EXECUTION

wind load of the ductwork.

3.1 Shop Fabrication A. Certification:

1. Ducts shall be detailed and fully factory manufactured by the manufacturer's authorized facility system. All fabrication labor will be certified "yellow label" building trade professionals, compliant to SMWIA and SMACNA labor guidelines (work preservation observed).

B. Fabrication: 1. Fabricated joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to manufacturer's written and detailed instructions. 2. Fabricated 90-degree mitered elbows to include turning vanes. 3. Fabricated duct segments in accordance with manufacturer's written details.

4. Duct Fittings shall include 6 inches of connecting material, as measured, from last bend line to the end of the duct. Connections on machine manufactured duct may be 4 5. Fabricated duct segments utilizing v-groove method of fabrication. Factory welded or cohesively bonded seams will apply to fully manufactured ductwork and fittings. Internal seams will be supplied with an unbroken layer of low VOC silicone or bonding (for paint shop applications). Each duct segment will be factory supplied with either aluminum grip pro-file or pre-insulated duct connectors in accordance with manufacturer's detailed submittal guide. Applied duct reinforcement to protect against side deformation from both positive and negative pressure per manufacturer's design guide based on specified ductwork size and system pressure. 6. Designed and fabricated duct segments and fittings will be in accordance with "SMACNA Phenolic Duct Construction Standards" latest edition. 7. Both positive and negative ductwork and fittings shall be constructed to incorporate a UL Listed as a Class 1 air duct to Standard for Safety UL 181 liner with an exterior

clad for permanent protection against water intrusion. 8. Duct shall be constructed to exceed requirements for snow and wind loads. .2 DUCT INSTALLATION A. Duct segments shall be installed per the manufacturer's Installation Manual by

competent HVAC installers. B. Install ducts and fittings to comply with manufacturer's installation instructions as Install ducts with fewest possible joints.

2. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines. 3. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. 4. Protect duct interiors from the moisture, construction debris and dust, and other

foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction

5. Use prescribed duct support spacing as described in this specification and manufacturer's recommendations. C. Air Leakage: Duct air leakage rates to be in compliance with "SMACNA HVAC Air Duct Leakage Test Manual" latest version per applicable leakage class based on pressure.

A. Contractor to ensure that the ductwork system is properly and adequately supported per the manufacturer's Installation Manual. 1. Ensure that the chosen method is compatible with the specific ductwork system requirements per manufacturer's installation detail drawings. Pre-installation should be provided prior to work commencement by installing contractor for approval. 2. Install upper attachments to structures. Select and size upper attachments with pullout, tension, and shear capacities appropriate for supported loads and building

B. Supports on straight runs of ductwork shall be positioned at centers not exceeding 13

feet (3.96 m) for duct sections when fabricated in 13 foot (3.96 m) lengths with duct girth less than 84". Larger duct sizes and short segments with duct girth greater than 84" are to be supported at 8 foot centers or less, in accordance with the manufacturer's Installation Manual provided prior to work commencement. C. Ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, parallel under turning vanes and all duct accessories such as dampers, etc.

4 FIELD QUALITY CONTROL A. Inspection: Arrange for manufacturer's representative to inspect completed installation and provide written report that installation complies with manufacturer's written

D. The load of such accessories to the ductwork shall be neutralized by the accessory

1. Remove and replace duct system where inspection indicates that it does not

B. Perform additional testing and inspecting, at the Contractor's expense, to determine compliance of replaced or additional work with specified requirements. 3.5 DUCT SCHEDULE

A. Outdoor Ducts and Fittings:

comply with specified requirements.

1. Rectangular Ducts and Fittings:

instructions.

3.3 HANGER AND SUPPORT INSTALLATION

materials where used.

a. Minimum Panel Thickness: 31 mm b. Cladding: minimum 0.038 inch

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HVAC SPECIFICATIONS

**ISSUE DATE** 09/09/2020 PERMIT INTAKE **ISSUE TYPE DRAWN BY** RLY CHECKED BY SCALE

PROJECT No.

NOT FOR CONSTRUCTION



# 238000 - HVAC EQUIPMENT

#### PART 1 - GENERAL

A. This Section covers the furnishing and installation of Heating, Ventilating and Air Conditioning (HVAC) equipment as indicated on the contract drawings, schedules and

### 1.02 SUBMITTALS

A. Manufacturer's literature and data:

1. Sufficient information, including capacities, pressure drops and piping connections clearly presented, shall be included to determine compliance with drawings and specifications for units noted below: a. Unitary air conditioners:

Split systems

3. Unit Dimensions required clearances, operating weights accessories and start-up

4. Electrical requirements, wiring diagrams, interlocking and control wiring showing factory installed and portions to be field installed.

5. Mounting and flashing of the roof curb to the roofing structure with coordinating requirements for the roof membrane system.

B. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to Resident Engineer three weeks prior to final inspection.

#### PART 2 - PRODUCTS

2.01 EQUIPMENT - REFER TO SCHEDULES.

### PART 3 - EXECUTION

3.01 INSTALLATION

A. Roof Curb: Install where indicated on the Drawings, level and secure, according to ARI Guideline B. Secure rooftop units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

B. Rooftop Unit Support: Install unit level on structural curbs, unless otherwise indicated on the Drawings. Coordinate wall penetrations and flashing with wall construction. Secure rooftop units to structural support with anchor bolts. C. Install units level and plumb maintaining manufacturer's recommended clearances and

D. Install ground-mounting, compressor-condenser components on 4-inch thick, reinforced concrete base; 4 inches larger on each side than unit.

E. Install seismic restraints. F. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings.

Install tubing to allow access to unit. G. Install wall sleeves in finished wall assembly and weatherproof. Install and anchor wall sleeves to withstand, without damage seismic forces as required by code.

#### 3.02 CONNECTIONS

A. Verify condensate drainage requirements.

B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain or as indicated on the Drawings.

C. Install ducts to termination at top of roof curb. Cut roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

D. Connect refrigerant piping to coils with shutoff valves on the suction and liquid lines at the coil and a union or flange at each connection at the coil and condenser. E. Install ducts to the units with flexible duct connections.

END OF SECTION

# 233716 - FABRIC AIR DISTRIBUTION

#### PART 1- GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of non-metal ductwork is indicated on drawings and by requirements of this
- B. Types of non-metal ductwork required for this project include the following:

# a. Textile Air Dispersion Products.

1.2 QUALITY ASSURANCE:

A. Building Codes and Standards: B. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and UL 2518. Also Classified by UL-C (Canada) S102.2, BS 5867 Part 2, 1980; GB8624-2006.

C. All product sections must be labeled with the logo and classification marking of

Underwriter's Laboratories. D. Design & Quality Control

E. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

### 1.3 WARRANTY:

A. Manufacturer must provide a 15 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

### 1.4 DELIVERY, STORAGE AND HANDLING:

A. Protect textile air dispersion system and internal suspension components from damage during shipping, storage, and handling.

B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

#### PART 2 - PRODUCTS

2.1 TEXTILE AIR DISPERSION SYSTEM:

- A. Air diffusers shall be constructed with internal tensioning frame.
- B. System shall cylindrically tension textile along the entire length of textile duct, including all fittings(crosses, elbows, reducers and tees). C. Tensioning system shall include full 360 degree tensioning and intermediate rings with
- quick connection spacer tubes concealed inside the fabric system. D. Interior structure to include multiple mechanically adjustable tension devices. To provide proper textile tensioning, structural and textile system shall be configured in segments of no more than 45 feet.
- E. Textile components supported solely by metal cylindrical rings. F. Each cylindrical ring shall require a vertical metal to metal cable safety attachment.
- a. Vertical supports are Galvanized steel with available lengths of 5'(standard), 10', 15', & 30'. G. Available for diameters from 8" – 84".

a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.

- b. Air Permeability: 2 (+2/-1) CFM/ft2 per ASTM D737, Frazier
- c. Weight: 6.8 oz. /yd2 per ASTM D3776 d. Warranty: 15 years with standard inlet velocity.

I. TEXTILE SYSTEM FABRICATION REQUIREMENTS:

a. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps, and mid-sections) and top access zippers for vertical cable safety attachment.

b. Integrated air dispersion shall be specified and approved by manufacturer. Linear Vents

A. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface. B. Size of vent openings and location of linear vents to be specified and

approved by manufacturer. c. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw

fastener – supplied by contractor. d. Inlet connection includes zipper for easy removal / maintenance.

 Lengths to include required intermediate zippers as specified by manufacture f. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.

g. End cap includes zipper for easy maintenance. h. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

J. DESIGN PARAMETERS:

1. Textile air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard. 2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and

180 degrees F (-17.8 degrees C and 82 degrees C).

3. System overall design; diameter, length, airflow, operating static pressure and

dispersion shall be designed or approved by the manufacturer.

4. Do not use textile diffusers in concealed locations. 5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

# PART 3 – INSTALLATION

3.1 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM:

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with

3.2 CLEANING AND PROTECTION:

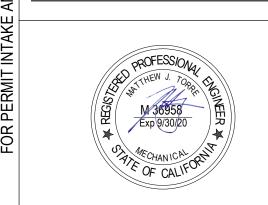
A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If fabric duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

\*\*\*END OF SECTION\*\*\*

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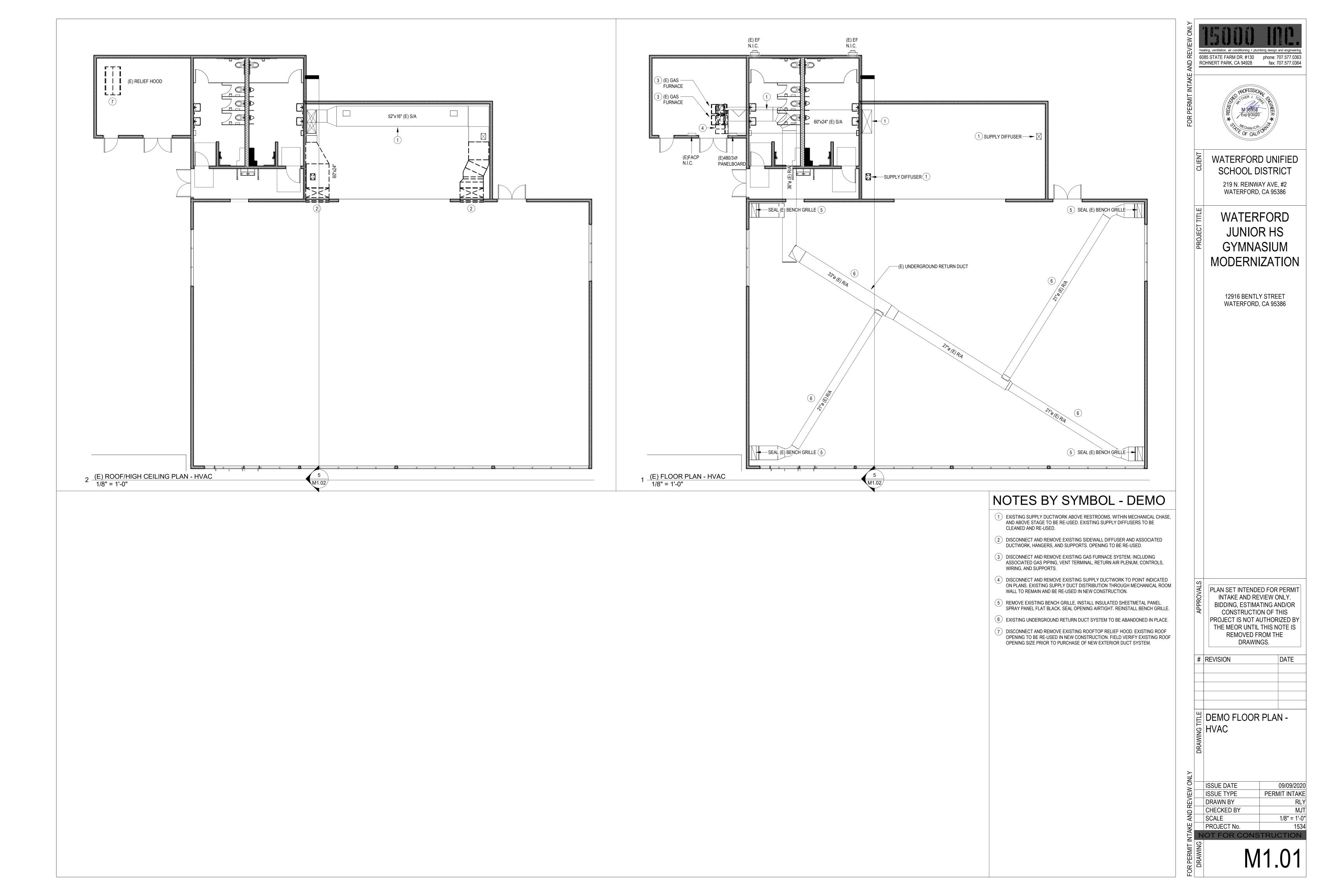
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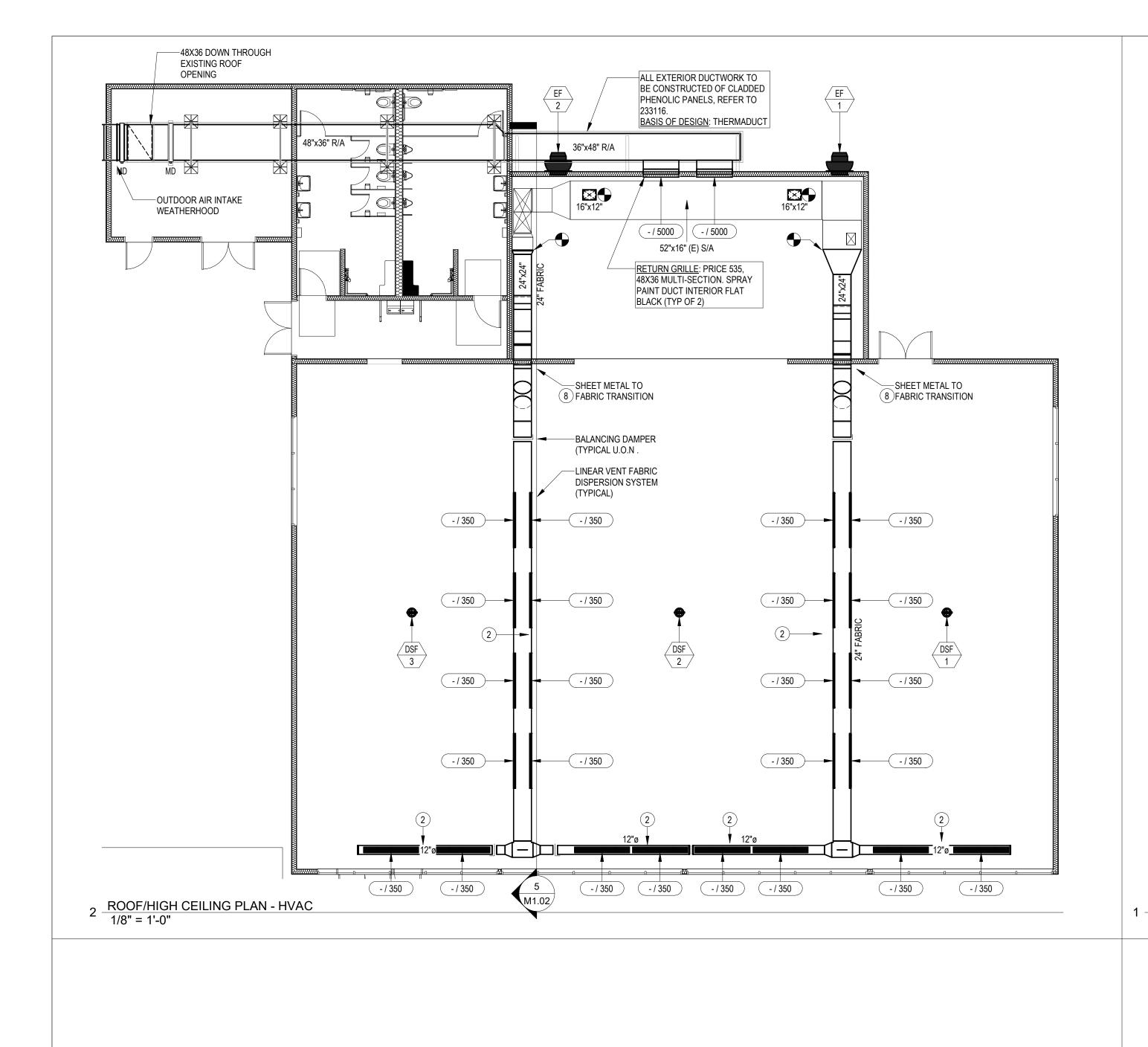
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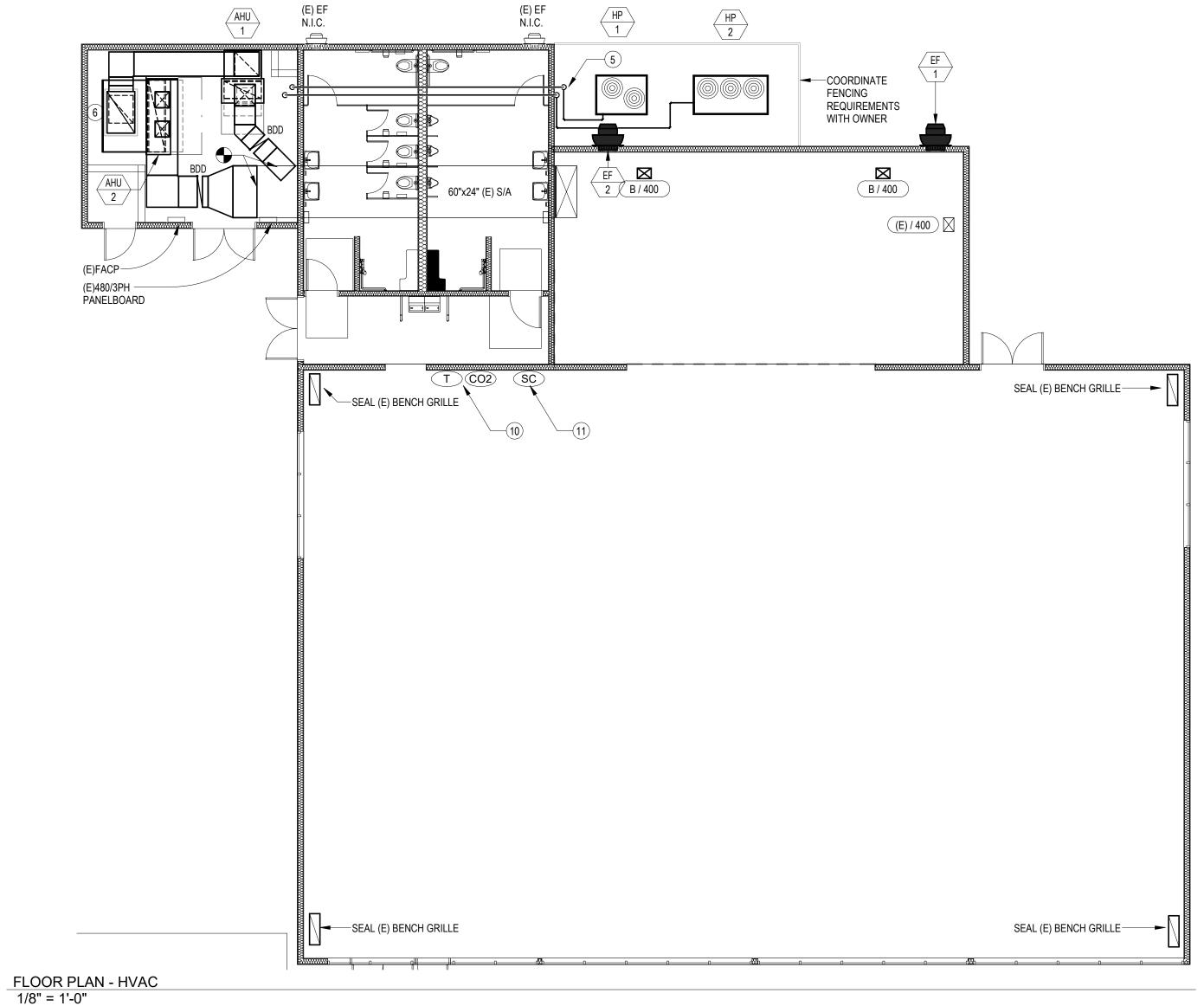
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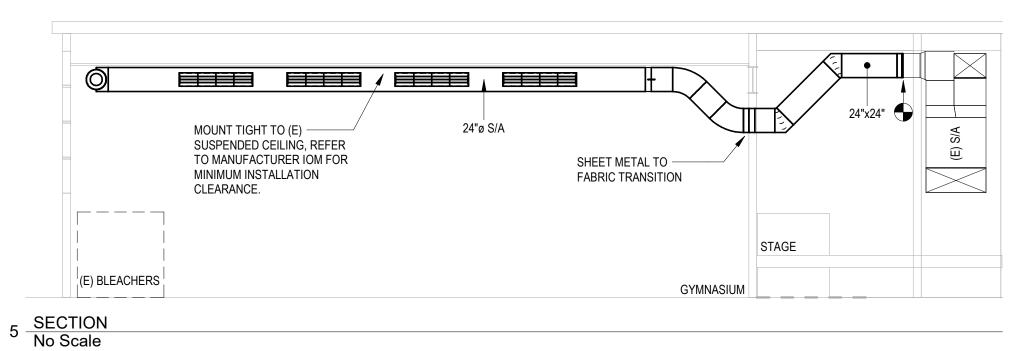
비VAC SPECIFICATIONS

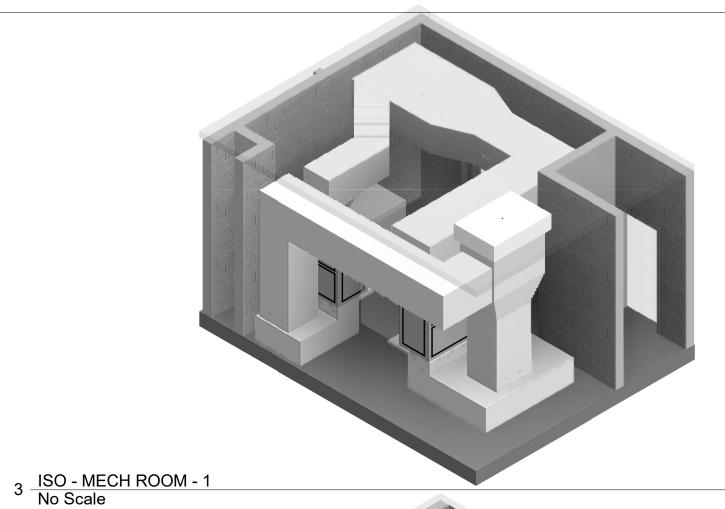
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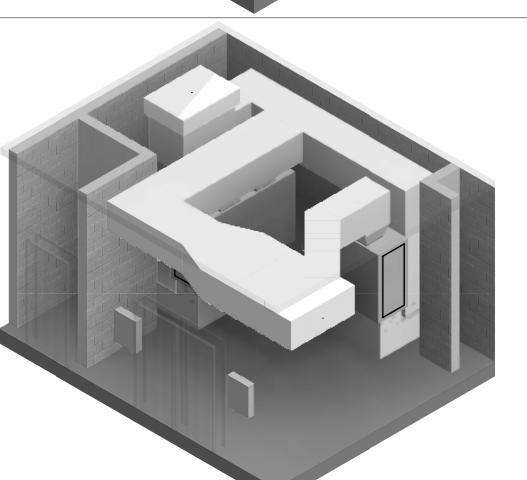












4 ISO - MECH ROOM - 2 No Scale

# NOTES BY SYMBOL - NEW

- 1 SPLIT AIR HANDLING UNIT ELEVATED WITH MOUNTING LEGS ABOVE COMMON RETURN DUCT PLENUM, REFER TO DETAIL.
- 2 SUSPEND FABRIC DUCT SYSTEM TIGHT TO UNDERSIDE OF EXISTING STRUCTURE.
- (3) PROVIDE 1/4" WIRE MESH SCREEN OVER EXHAUST OPENING. HEM ALL EXPOSED EDGES. PROVIDE MOTORIZED DAMPER WITH END SWITCH FOR DELAYED FAN START (POWERED OPEN, SPRING RETURN CLOSED)
- (4) INSTALL RETURN GRILLE LOW ON WALL, MAINTAIN DUCTWORK ABOVE RESTROOM CEILING.
- (5) CONCEAL EXTERIOR REFRIGERANT AND CONTROL WIRING WITHIN INSULATED METAL JACKETING, REFER TO DETAIL.
- (6) 48X36 R/A THROUGH (E) ROOF OPENING. CONTRACTOR TO FIELD VERIFY OPENING DIMENSIONS PRIOR TO INSTALLATION. PROVIDE MANUAL BALANCING DAMPERS ON RETURN DUCT TAKEOFFS TO AHU PLENUM CONNECTIONS.
- 7 ENCLOSE THERMOSTAT/SENSOR CONTROL WIRING WITHIN WIRE RACEWAY, COORDINATE COLOR REQUIREMENTS WITH ARCH PRIOR TO INSTALLATION.
- (8) 24X24 S/A THROUGH (E) WALL OPENING. PATCH AND REPAIR WALL TO MATCH EXISTING ADJACENT SURFACES.
- 9 SINGLE-PANEL RETURN DUCT THROUGH WALL OPENING. PATCH AND REPAIR WALL PENETRATION, SEAL WATERTIGHT.
- (10) COMBINATION CO2/THERMOSTAT CONTROLLER MOUNT TOP OF CONTROL DEVICE MAXIMUM 48" A.F.F.
- (11) DESTRATIFICATION FAN SPEED CONTROLLER MOUNT TOP OF CONTROL DEVICE MAXIMUM 48" A.F.F.

# **DESCRIPTION OF WORK**

# BASE BID:

- INSTALLATION OF NEW DX SPLIT HEAT PUMPS (10+15 TON UNITS) AND ASSOCIATED TOP DISCHARGE, BOTTOM RETURN AIR HANDLING UNITS.
- INSTALLATION OF NEW SHEETMETAL SUPPLY AND RETURN DUCT SYSTEMS IN MECHANICAL ROOM AND THEATRE.
- INSTALLATION OF NEW FABRIC SUPPLY DUCT SYSTEM IN MAIN GYMNASIUM
- INSTALLATION OF NEW PHENOLIC PANEL DUCT SYSTEM ON BUILDING
- EXTERIOR/ROOF. INSTALLATION OF ECONOMIZER-CONTROLLED POWERED EXHAUST FANS
- INTERLOCKED TO AHU-1 AND AHU-2.
- INSTALLATION OF GYMNASIUM DESTRATIFICATION FANS. SEALING AND CLOSURE OF EXISTING SUBSLAB RETURN DUCT SYSTEM.

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WATERFORD JUNIOR HS **GYMNASIUM MODERNIZATION** 

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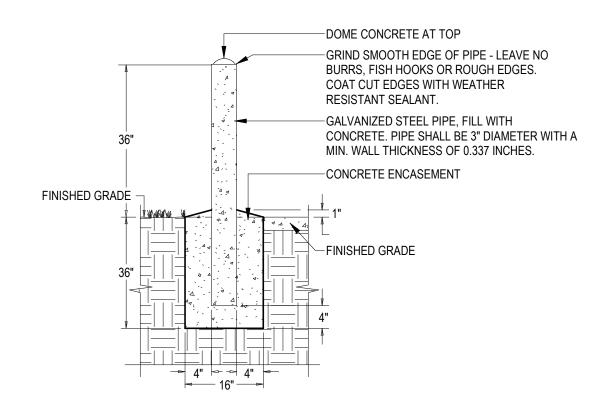
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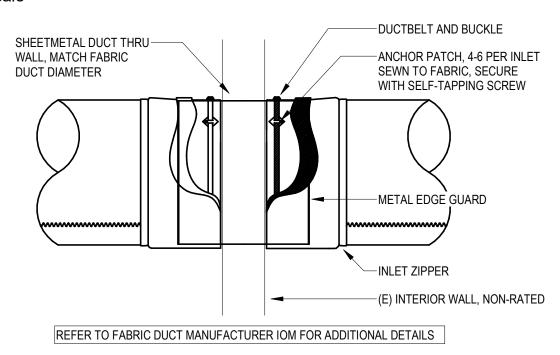
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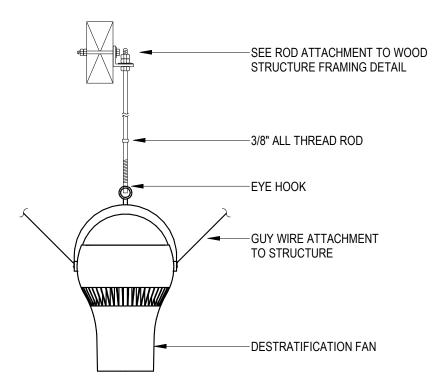


4 BOLLARD DETAIL
No Scale

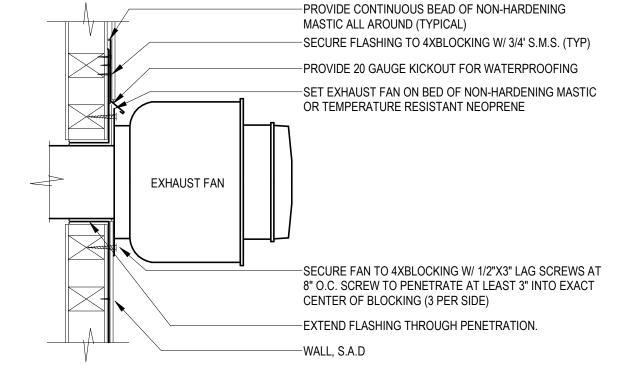


THIS DETAIL APPLICABLE TO SHEET METAL INLET ATTACHMENT.

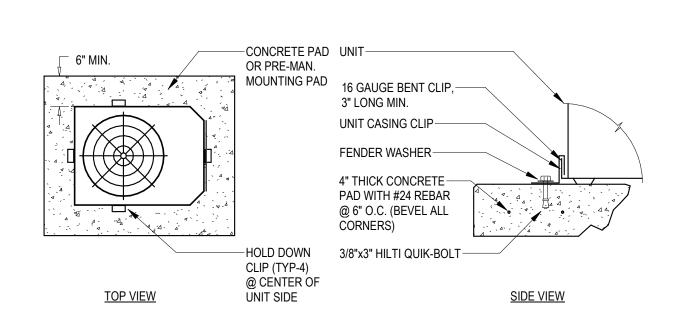
8 FABRIC DUCT WALL PENETRATION DETAIL No Scale



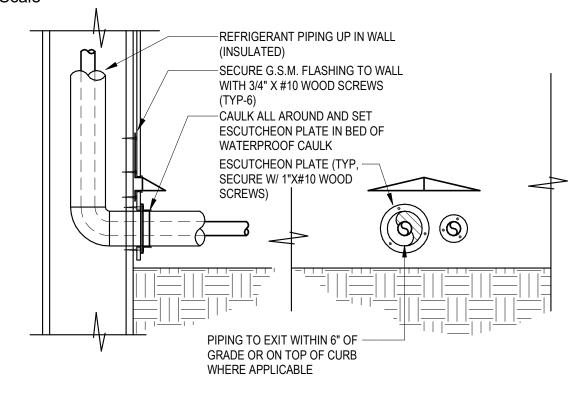
3 DESTRATIFICATION FAN DETAIL No Scale



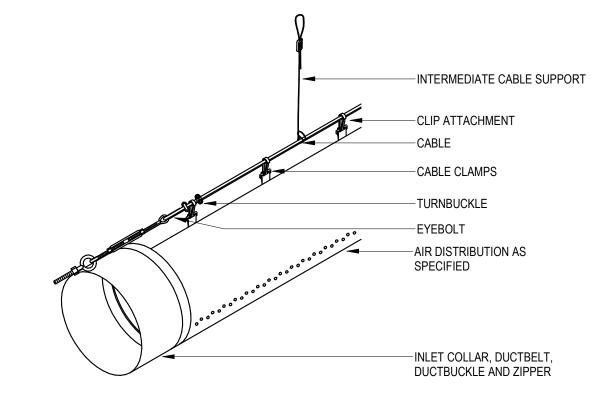
7 EXHAUST FAN MOUNTING DETAIL No Scale



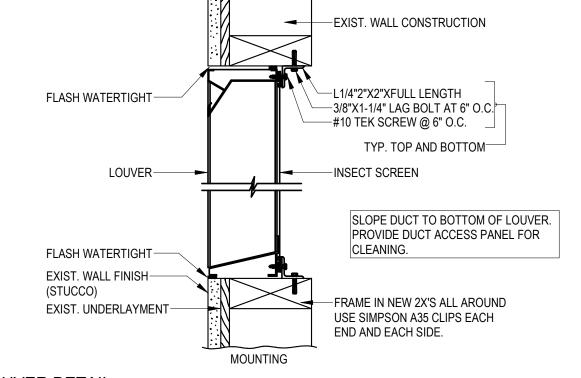
2 HEAT PUMP MOUNTING DETAIL
No Scale



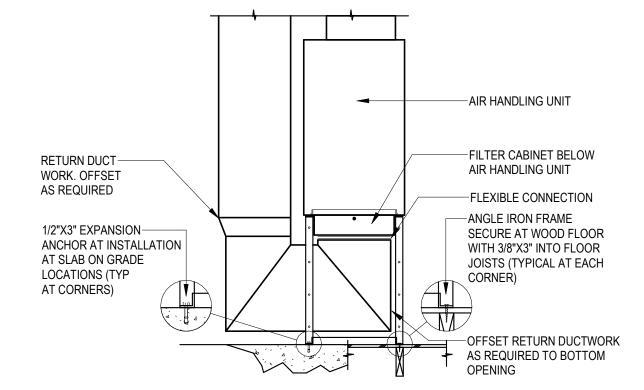
REFRIGERANT PIPING PENETRATION



1 FABRIC DUCT SUSPENSION DETAIL
No Scale



No Scale



9 AIR HANDLING UNIT INSTALLATION DETAIL No Scale



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HVAC DETAILS

HVAC DETAILS

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CHECKED BY MJT
SCALE 1/8" = 1'-0"
PROJECT No. 1534

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