

SECTION 230000 – HVAC GENERAL CONDITIONS	
PART 1 GENERAL	
1.01 APPLICABILITY	A. This section supplements all sections of the Specifications for Division 23 and shall apply to all phases of work hereinafter specified, shown on the Drawings, or required to provide a complete installation of approved HVAC systems.
1.02 DEFINITIONS	A. "Work" is hereby defined as, "The construction and services required by the Contract Documents whether completed or partially completed and includes all labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The work may constitute the whole or a part of the project." B. "Furnish" is hereby defined as, "To supply and deliver, unload, and inspect for damage." C. "Install" is hereby defined as, "To unpack, assemble, erect, apply, place, finish, cure, protect, clean, connect, and place into operation into the work." D. "Provide" is hereby defined as, "To furnish and install." E. "Connect" is hereby defined as, "To bring service to the equipment and make final attachment including necessary ductwork, piping, wiring, etc." F. "Concealed" is hereby defined as, "Hidden from sight in chases, turned spaces, shafts, hung ceilings, embedded in construction, in crawl spaces, or buried." G. "Exposed" is hereby defined as, "Not installed underground nor concealed as defined by the Specifications." H. "Drawings" is hereby defined as, "All plans, details, equipment schedules, diagrams, schedules, etc. issued for the construction of the work."
1.03 CODES AND STANDARDS	A. Perform work in accordance with the applicable Building Code, Electrical Code, Fire Code, Mechanical Code, Plumbing Code, Energy Code, and all other applicable codes, amendments, and ordinances. Also perform all work in accordance with the Americans with Disabilities Act (ADA) and the Authority Having Jurisdiction (AHJ) including Fire Marshal(s). B. Perform work in accordance with Landlord requirements, including any Tenant Criteria Manuals and Lease Exhibits, where applicable. C. Perform work in accordance with the applicable utility companies serving the project. Make all arrangements with the utility companies for proper coordination of the work. D. Recognized Standards: Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these Specifications shall conform to the latest publications or standard rules of Underwriters Laboratories, Inc. (UL), American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), and National Electrical Code (NEC), National Fire Protection Association (NFPA), American Refrigerating and Air-Conditioning Engineers (ASHRAE), and the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA). E. The Contract Documents shall take precedence where the Contract Documents exceed code, Landlord, utility, or recognized standards requirements.
1.04 PERMITS AND FEES	A. Permit, licenses, fees, inspections and arrangements required for the work under this Contract shall be obtained by the Contractor at his expense, unless otherwise indicated.
1.05 CONTRACT DRAWINGS	A. The Contractor is responsible to obtain, fully understand, and coordinate the work with the complete set of Contract Documents. Any required corrections, including all associated costs, arising from issues caused by the Contractor's failure to understand and/or coordinate the work with the complete set of Contract Documents are the Contractor's sole responsibility. B. Work under these sections is diagrammatic unless indicated otherwise and is intended to convey the scope of work and indicate the general arrangement of ductwork, piping, equipment, and materials. The Contractor shall be responsible for the work and verify spaces for the installation of these materials and equipment. Wherever a question exists as to the exact intended location of ductwork, piping, or equipment, obtain instructions from the Architect before proceeding with the work. C. Notify the Architect for resolution if a discrepancy is discovered within the Contract Documents. Failure of the Contractor to notify the Architect of any discrepancies shall result in the resolution becoming the Contractor's responsibility and subject to the Architect's review and possible rejection. Should the Architect reject a discrepancy resolution of which they were not notified, the Contractor is fully responsible to correct the installation, including all associated costs, until approval of the installation is given by the Architect.
1.06 EXISTING CONDITIONS	A. Verify existing conditions prior to beginning work. B. Any existing conditions indicated in the Contract Documents are based on information drawings provided by others and possibly limited field verification. The Contractor shall adjust for actual field conditions at no additional expense to the Owner. C. The Contractor shall visit the project site, review existing conditions against the Contract Documents, and familiarize himself with the work prior to bidding and start of the work. By signing the Contract, the Contractor acknowledges the site visit has been completed and the existing conditions are accepted. D. The Contractor shall notify the Architect of any discrepancies in writing so the appropriate modifications to the design can be made without delay to the project. The Contractor assumes full responsibility of adjusting for discrepancies of which the Architect is not informed.
1.07 SUBMITTALS	A. Shop Drawings: 1. Furnish the Architect shop drawing portfolios containing names of manufacturer and cut sheets of equipment to be used on the project. Use manufacturer's specification sheets identified by number indicated on drawings or schedules. Indicate catalog number on the cut sheets. As applicable, provide construction data, weight and dimensional data, voltage ratings, performance data, include pressure curves, fan curves and sound data as part of the shop drawing submittal. 2. Submittals are reviewed only for general compliance with the Contract Documents. Dimensions, quantities and/or details not checked during submittal review. Review of the submittals does not relieve the Contractor of the responsibility for providing all materials, equipment and accessories necessary for a complete and operational system meeting the requirements of the project and the intent of the Contract Documents. The responsibility for coordination of substituted materials and equipment lies solely with the substituting Contractor. 3. Electrical Characteristics: Verify that proper power supply is available prior to ordering equipment. Verify proper voltage, phase and current rating of power supply and inform Engineer of any deviations prior to order, connection of equipment or start-up. Responsibility for verification of proper power supply voltage and/or current rating or damage resulting from incorrect connections shall rest with this Contractor. B. Project Record Documents: Provide as specified. C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing. D. Test Reports: Provide as specified. 1.08 QUALITY ASSURANCE A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years experience. B. Installer Qualifications: Company specializing in performing the work of this section, with minimum five years experience. C. Products: 1. Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated. D. All equipment and components shall be free of all rust/corrosion or any visible damage. All items not complying with this requirement shall be replaced without any change in the Contract amount. E. Equipment performance and accessories shall be as scheduled on the Drawings and specified herein. Inclusion in both locations is not a prerequisite to inclusion in the Contract. Equipment and accessories specified in either location shall be included in the Contract. Provide all necessary accessories and connections as required for a complete, functional system, including all required components reasonably inferred to be necessary although such components may or may not be specifically indicated in the Contract Documents. F. Code or utility company requirements shall supersede any conflicting requirements of this section. 1.09 DELIVERY, STORAGE, AND HANDLING A. Rooftop Equipment: Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units. B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. C. Protect dampers and accessories from damage to operating linkages, blades and finishes. D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation. E. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately. 1.10 WARRANTY AND GUARANTEE A. Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer. B. Provide one year manufacturer warranty for pumps. C. Provide three year manufacturer warranty for solid state ignition modules. D. Provide five year manufacturers warranty for compressors, heat exchangers, condensing units, and electronic air cleaners.
PART 2 PRODUCTS	
2.01 SUBSTITUTIONS	A. The manufacturers listed are listed to set minimum standards for quality, design, and functionality. The products of other manufacturers may be substituted, at the Contractor's option, during shop drawing review unless indicated otherwise. The products of other manufacturers shall meet or exceed all requirements of the Contract Documents. The Contractor accepts all responsibility for costs and coordination issues arising out of the substitution of materials or equipment, and the coordination of such substitutions with all other contractors and subcontractors. B. The Contractor may use any of the following ductwork, piping or insulation materials at his option, provided the selected material meets with the approval of

all State, local authorities and any utility company requirements. Verification of compliance of the selected material is the sole responsibility of the installing Contractor.	
PART 3 EXECUTION	
3.01 COORDINATION OF WORK	A. Examine the Contract Documents as a whole for the work of other trades. Coordinate all work accordingly. B. Promptly report to the Architect any delay or difficulties encountered in the installation of the work, which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others. Failure to so report shall constitute an acceptance of the work of other trades as being fit and proper for the execution of this work. C. Plan, lay out, and coordinate the work with all trades well enough in advance so coordination of the work with interference to work that has not been completed and work that is in progress. Inform all trades of openings required for the work and provide all special frames, sleeves, and anchor bolts required. The HVAC system layout may be altered to suit the conditions with engineer approval, prior to the installation of any work and without additional cost to the Owner. Conflicts arising from lack of coordination shall be this Contractor's responsibility. D. Perform all work in conformity with the Contract Documents and afford other trades reasonable opportunity for the execution of their work. Properly connect and coordinate this work with the work of other trades at such time and in such a manner as not to delay or interfere with their work. E. All roofing penetrations shall be flashed and weather sealed by the roofing manufacturer's authorized roofing contractor at this Contractor's expense. This Contractor shall contract with the factory authorized roofing contractor for the Code, Mechanical Code, Plumbing Code, Energy Code, and all other applicable codes, amendments, and ordinances. The use of an unauthorized roofing contractor may result in removal and replacement of the penetration systems at this Contractor's expense. F. All temperature control wiring, thermostat wiring, damper interlock wiring, control panel interlock wiring and miscellaneous low voltage wiring associated with the equipment furnished or installed under this contract shall be furnished and installed by the mechanical contractor or his sub-contractor. All wiring installed under this contract shall be in full compliance with the National Electrical Code, all State and local codes and requirements of the Electrical Specifications for this Contract project.
3.02 EXAMINATION	A. Verify field measurements are as indicated on the Drawings. B. Verify all equipment locations prior to rough-in. Maintain adequate equipment service clearance per manufacturer and code. C. Verify routing of all ductwork, piping and field prior to fabrication or installation. Verify adequate clearance with structure, light fixtures, and ceiling heights. D. Verify that proper fuel and power supply is available for connection.
3.03 INTERFACE WITH OTHER PRODUCTS	A. Install all ductwork, pipe, equipment, and accessories to preserve fire resistance rating of partitions and other elements using materials and methods specified.
3.04 FIELD QUALITY CONTROL	A. Provide tests as necessary to establish the adequacy, quality, safety, completed status, and suitable operation of each system. Tests shall be conducted under the supervision of the Architect.
3.05 CLEANING AND REPAIR	A. Clean fire suppression parts to remove harmful materials. B. Clean exposed surfaces of all ductwork pipe, equipment, and accessories of all dirt, dust, debris, and other deleterious materials. Follow the manufacturer's recommendations for cleaning as applicable. C. Repair or replace damaged ductwork, pipe, equipment, and accessories, as directed by and to the Architect, where marking or disfigurement has occurred. All pipe, equipment, and accessories shall be new.
3.06 PROJECT CLOSEOUT	A. Project Record Documents: At project closeout, provide one printed copy and one electronic copy of project record drawings to the Owner. Information contained on project record drawings shall include, as a minimum: 1. Actual locations of all equipment, ductwork, air inlets/outlets, accessories, etc. 2. Actual routing of ductwork with sizes and elevations. 3. Actual locations of control devices including valves and volume dampers. B. Operation and Maintenance Data: At project closeout, submit to the Architect two copies of descriptive literature, maintenance and operation data for all hvac equipment, control systems, accessories, and materials used. Include maintenance procedures, intervals and parts list of each item installed under this contract. Include all manufacturer's guarantees and warranties. C. Maintenance Materials: At project closeout, furnish to the Owner the following: 1. On replacement contract of replacement parts for all hvac equipment. 2. The maintenance contract for the hvac system, if applicable. D. Test Reports: At project closeout, submit to the Architect two copies of the following: 1. Testing, Adjusting and Balancing Report
END OF SECTION	
SECTION 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT	
PART 1 GENERAL	
1.01 SECTION INCLUDES	A. Vibration isolators. B. Seismic restraints. C. Equipment: 1. Fans, axial and centrifugal 2. Packaged roof top equipment
1.02 SUBMITTALS	A. Product Data: Provide schedule of vibration isolator type with location and load on each.
PART 2 PRODUCTS	
2.01 MANUFACTURERS	A. Isolation Technology, Inc.; Kinetics Noise Control, Inc.; Mason Industries.
2.02 VIBRATION ISOLATORS	A. Restrained Open Spring Isolators: 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code spring capacity. 2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromated plated hardware. 3. Sound Pads: 1/2 inch minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators. 4. Restraint: Provide heavy mounting frame and limit stops. 5. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs. B. Spring Hanger: 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity. 2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators or rubber hanger with threaded insert. 3. Mounting: Single layer. 4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs. C. Neoprene Pad Isolators: 1. Rubber or neoprene waffle pads. a. Hardness: 30 durometer. b. Thickness: Minimum 1/2 inch. c. Maximum Loading: 50 psi. d. Rib Height: Maximum 0.7 times width. D. Configuration: Single layer. E. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert. F. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
2.03 SEISMIC RESTRAINTS	A. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements. B. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap. C. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection. D. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.
PART 3 EXECUTION	
3.01 INSTALLATION	A. Install in accordance with manufacturer's instructions. B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions. C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal. D. Support piping connections to equipment mounted on isolators using isolators or resilient hangers to nearest flexible pipe connector. E. Provide flexible connections on all piping and ductwork connections to equipment. Refer to other sections of this Specification for the acceptable types of flexible connectors to be used. F. Selection of type, thickness and deflection of vibration isolation shall be by the vibration control manufacturer based on the specific equipment type and size, as scheduled on the Drawings and indicated below.
3.02 SCHEDULES	A. Equipment Isolation Schedule: (Minimum deflection as sized by the isolation equipment manufacturer). 1. Fans, axial and centrifugal. a. Small fans up to 22" diameter wheel: 1) Rubber Mount or Hanger

2. Packaged roof top equipment. a. Above grade roof structures: 1) Base: Roof Curb. 2) Isolation: Full perimeter Neoprene Pad between curb and units. Provide restrained spring vibration isolation curbs when indicated on the Drawings.	
END OF SECTION	
SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC	
PART 1 GENERAL	
1.01 SECTION INCLUDES	A. Testing, adjusting, and balancing of air systems. 1. Air handling units; Packaged heating and/or cooling equipment; Fans. (Exhaust and supply); Coils; Terminal equipment; Air inlets and outlets. (Diffusers, grilles, louvers, etc.) 2. Measurement of final operating condition of HVAC systems. Independent agency requirements.
1.02 SUBMITTALS	A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract. Provide TAB Agency qualifications. B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance. 1. Submit to the Construction Manager within two weeks after completion of testing, adjusting, and balancing. 2. Provide reports in bound manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat and equipment locations. 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration. 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111. 5. Include the following on the title page of each report: a. Name, address and telephone number of Testing, Adjusting, and Balancing Agency. b. Project: Name; location; Engineer; Contractor; Report date.
1.03 WARRANTY	A. The Balancing Contractor shall be prepared to return to the site at no additional cost to re-adjust air quantities as required to provide uniform temperatures, eliminate drafts and objectionable noises during the first year of occupancy, including one full heating and one full cooling season, after the acceptance of the final balancing report.
PART 2 PRODUCTS – NOT USED	
PART 3 EXECUTION	
3.01 GENERAL REQUIREMENTS	A. Perform total system balance in accordance with one of the following: 1. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems. 2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems. 3. SMACNA HVAC Systems Testing, Adjusting, and Balancing. B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project. C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction. D. TAB Agency Qualifications: 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section with a minimum of five years experience. 2. Certified by one of the following: a. ASHRAE Associated Air Balance Council; upon completion submit AABC National Performance Guaranty. b. NEBB, National Environmental Balancing Bureau. c. TABS, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute. 3. The TAB Agency must be a completely independent, third party balancing contractor with no financial, common owners or other ties to the installing contractors. E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
3.02 ADJUSTMENT TOLERANCES	A. Air Handling Systems; Air Outlets and Inlets; Hydronic Systems: Adjust to within plus or minus 0.15 percent of design. B. Mark on the Drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
3.03 RECORDING AND ADJUSTING	A. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops. B. Measure air quantities at air inlets and outlets. C. Adjust distribution system to balance uniform space temperatures free from objectionable drafts and noise. D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters. Do not use diffuser, grille or register integral dampers for balancing adjustments unless the plans do not indicate duct mounted devices. F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required at no additional expense to the Owner. Vary branch air quantities by damper regulation. G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters. H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions in all operating modes as indicated in the sequence of control. I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage. J. Where modulating dampers are provided, take measurements and balance at extreme conditions and at all intermediate operating conditions specified in the sequence of control. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
3.04 AIR SYSTEM PROCEDURE	A. Adjust air handling and distribution systems to provide required or design cross return, and exhaust air quantities. B. Make air quantity measurements in ducts by Pitot tube traverse of entire supply sectional area of duct. C. Measure air quantities at air inlets and outlets. D. Adjust distribution system to balance uniform space temperatures free from objectionable drafts and noise. E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters. Do not use diffuser, grille or register integral dampers for balancing adjustments unless the plans do not indicate duct mounted devices. F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required at no additional expense to the Owner. Vary branch air quantities by damper regulation. G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters. H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions in all operating modes as indicated in the sequence of control. I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage. J. Where modulating dampers are provided, take measurements and balance at extreme conditions and at all intermediate operating conditions specified in the sequence of control. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
3.05 SCOPE	A. Equipment Requiring Testing, Adjusting, and Balancing (if present on the project): 1. HVAC Pumps; Boilers; All Air Handling Equipment; All Packaged Heating and/or Cooling Equipment; All Coils; All Heat Exchangers; Terminal Heat Transfer Units; Air Terminal Units; Air Inlets and Outlets
3.06 MINIMUM DATA TO BE REPORTED	A. Report (as applicable to the project): 1. Summary Comments: a. Design versus final performance b. Notable characteristics of system c. Summary of outdoor and exhaust flows to indicate amount of building pressurization d. Nomenclature used throughout report and test conditions. B. Electric Motors and drives: 1. Manufacturer; Model/Frame; HP/BHP; Phase, voltage, amperage; nameplate, actual, no load; RPM; Service factor; Sheave Make/Size/Bore. 2. V-Belt Drives: Identification/location; Required driven RPM; Driven sheave, diameter and RPM; Belt, size and quantity. C. Cooling and Heating Coils: 1. Identification/number; Manufacturer 2. Air flow, design and actual 3. Air pressure drop, design and actual 4. Entering and leaving air DB and WB temperature, design and actual 5. Water flow, design and actual (if applicable) 6. Water pressure drop, design and actual (if applicable) 7. Entering and leaving water temperature, design and actual (if applicable) D. Air Moving Equipment: 1. Manufacturer; Model number; Serial number; Arrangement/Class/Discharge 2. Air flow, specified and actual 3. Inlet; Discharge; Total static pressure (total external), specified and actual E. Air Distributing: 1. Air terminal number 2. Room number/location 3. Fire ratings 4. Terminal size 5. Area factor 6. Design velocity 7. Design air flow 8. Test (final) velocity 9. Test (final) air flow 10. Percent of design air flow
END OF SECTION	
SECTION 230713 – DUCT INSULATION	
PART 1 GENERAL	
1.01 SECTION INCLUDES	

A. Duct insulation. B. Built up liner. C. Insulation jackets. D. Supply, return or exhaust ducts in ceiling spaces. E. Supply, return or exhaust ducts in interior unconditioned areas. F. Supply, return or exhaust ducts in exposed locations.	
1.02 FIELD CONDITIONS	A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements. B. Maintain temperature during and after installation for minimum period of 24 hours.
PART 2 PRODUCTS	
2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION	A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, UL 255, or UL 723. B. Manufacturer: Knaflex Fiber Glass; Johns Manville Corporation; Owens Corning Corp.; CertainTeed Corporation.
2.02 GLASS FIBER, FLEXIBLE	A. Insulation: ASTM C 553; flexible, noncombustible blanket. 1. "K" value: 0.31 at 75 degrees F, when tested in accordance with ASTM C 518. 2. Maximum Service Temperature: 450 degrees F. 3. Maximum Water Vapor Sorption: 5.0 percent by weight. B. Vapor Barrier Jacket: 1. Kraft paper with glass fiber yarn and bonded to aluminumized film. 2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 90M. 3. Secure with pressure sensitive tape. C. Vapor Barrier Tape: 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminumized film, with pressure sensitive rubber based adhesive. D. Outdoor Vapor Barrier Mastic: 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color. 2. Tie Wire: Annealed steel, 16 gage.
2.03 DUCT LINER	A. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21. 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F. 2. Service Temperature: Up to 250 degrees F. 3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum. 4. Minimum Thickness: a. 1/2 inch Thickness: 0.30. b. 1 inch Thickness: 0.45. c. 1-1/2 inches Thickness: 0.60. d. 2 inch Thickness: 0.70. B. Adhesive: Waterproof, fire-retardant type. C. Liner Fastener: Galvanized steel, self-adhesive pad or impact applied with integral, or press-on head.
PART 3 EXECUTION	
3.01 INSTALLATION	A. Install in accordance with manufacturer's instructions and NAIMA National Insulation Standards. B. Insulated ducts conveying air below ambient temperature: 1. Provide insulation with vapor barrier jackets. 2. Finish with tape and vapor barrier jacket. C. Insulated ducts conveying air above ambient temperature: 1. Provide with or without standard vapor barrier jacket. 2. Insulate fittings and flanges. Where service access is required, bevel and seal ends of insulation. D. External Duct Insulation Application: 1. Seal duct joints with vapor barrier adhesive or tape to match jacket. 2. Secure insulation without vapor barrier with staples, tacks, or wires. 3. Seal ducts with sealant. Seal and lock memory stops. 4. Seal linear penetrations with adhesive. 5. Duct dimensions indicated are net inside dimensions required for air flow. Increasing duct size to allow necessary insulation thickness. E. Duct and Plenum Liner Application: 1. Adhere insulation with adhesive for 90 percent coverage. 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards – Metal and Flexible for spacing. 3. Seal duct joints with adhesive. Seal and lock memory stops. 4. Seal linear surface penetrations with adhesive. 5. Duct dimensions indicated are net inside dimensions required for air flow. Increasing duct size to allow necessary insulation thickness.
3.02 SCHEDULES	A. The Contractor may use any of the following insulating materials, at his option, provided the selected material meets with the approval of all State, local authorities and utility company requirements. Verification of compliance of the selected material is the sole responsibility of the Contractor. B. Acceptable Product: 3M Fire Barrier Duct Wrap; fire resistant inorganic blanket encapsulated with scrim-reinforced foil facing. C. Fasteners: Non-combustible; use one or both of the following to attach fireproofing to ducts: 1. Bonding: Steel or stainless steel, 1/2 inch wide, minimum, and 0.015 inch thick, minimum; with steel banding clips. 2. Insulation Pins: Copper-coated steel implement pins, minimum 12 gage, for welded attachment, with galvanized steel self-locking washers, 1-1/2 inch square or diameter; or equivalent sized cup-head pins. 3. Access: 1/2 inch diameter hole saw, 1/2 inch diameter, and wing nuts as specified in manufacturer's instructions. D. Tape: Aluminum foil tape for sealing exposed fiber edges and repairing tears in fireproofing. E. Fireproofing: Material tested in conjunction with fireproofing, in accordance with ASTM E 814, to achieve fire rated penetration seal at duct penetrations through fire rated assemblies. F. Sealants: Same or greater than rating of penetrated assembly. 1. Fire Rating: Same or greater than rating of penetrated assembly. 2. Acceptable Product: 3M Fire Barrier 1000 N/S, 1003 S/L, and 2000+ Silicone Sealants, as required by tested assembly.
END OF SECTION	
SECTION 230713.13 – GREASE DUCT FIREPROOFING	
PART 1 GENERAL	
1.01 SECTION INCLUDES	A. Fire resistant duct wrap for kitchen hood exhaust ventilation ducts (grease ducts). B. Fireproofing at duct penetrations through fire rated walls and floors.
1.02 SUBMITTALS	A. Product Data: Manufacturer's data sheets on each product to be used. B. Certification: Evidence that the proposed fireproofing and fireproofing are acceptable to the authorities having jurisdiction.
PART 2 PRODUCTS	
2.01 MANUFACTURERS	A. Acceptable Manufacturer: 3M Fire Protection Products, Inc.; Unifrax FireWrap; Morgan Thermal Ceramics.
2.02 MATERIALS	A. Grease Duct Fireproofing: Material applied directly to metal ducts and achieving two-hour fire rated separation when tested in accordance with UL 2221 or ASTM E2336 by independent testing agency. 1. Surface Burning Characteristics: Flame spread index of 0 and smoke developed index of 0, when tested in accordance with ASTM E 84, both blanket and foil. 2. Combustibility: Non-combustible, when tested in accordance with ASTM E 136. 3. Flexibility: Capable of being formed around corners and shapes by hand. 4. Surface: Foil or other damage resistant surface; fiber not exposed after installation. 5. Accommodation For Duct Access Doors and Panels: Capable of being installed to achieve fire rating without impeding access. 6. Acceptable Product: 3M Fire Barrier Duct Wrap; fire resistant inorganic blanket encapsulated with scrim-reinforced foil facing. B. Fasteners: Non-combustible; use one or both of the following to attach fireproofing to ducts: 1. Bonding: Steel or stainless steel, 1/2 inch wide, minimum, and 0.015 inch thick, minimum; with steel banding clips. 2. Insulation Pins: Copper-coated steel implement pins, minimum 12 gage, for welded attachment, with galvanized steel self-locking washers, 1-1/2 inch square or diameter; or equivalent sized cup-head pins. 3. Access: 1/2 inch diameter hole saw, 1/2 inch diameter, and wing nuts as specified in manufacturer's instructions. D. Tape: Aluminum foil tape for sealing exposed fiber edges and repairing tears in fireproofing. E. Fireproofing: Material tested in conjunction with fireproofing, in accordance with ASTM E 814, to achieve fire rated penetration seal at duct penetrations through fire rated assemblies. F. Sealants: Same or greater than rating of penetrated assembly. 1. Fire Rating: Same or greater than rating of penetrated assembly. 2. Acceptable Product: 3M Fire Barrier 1000 N/S, 1003 S/L, and 2000+ Silicone Sealants, as required by tested assembly.
PART 3 EXECUTION	
3.01 EXAMINATION	A. Do not begin installation until substrates have been properly prepared. B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.
3.02 PREPARATION	A. Clean surfaces thoroughly prior to installation. B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
3.03 INSTALLATION	A. Install in strict accordance with manufacturer's instructions and as indicated on



ARCHITECT	
CONSULTANT	
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PROJECT	
TENANT IMPROVEMENT FOR	
1966 WEST AVE L LANCASTER, CA	
DATE	ISSUED FOR
9-24-18	BUILDING DEPT SUBMITTAL
6-28-19	
NO.	REVISIONS
▲	
▲	
▲	
▲	
MECHANICAL	
FILE NAME:	2366A2-0
SHEET	
M-301	