SECTION 233113 - METAL DUCTS Updated 6/2019

This Section may be edited and revised by inserting or deleting text to meet requirements specific to your project. The Document is provided in a modified format.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Single wall rectangular ducts and fittings.

Double wall rectangular ducts and fittings.

Single wall round [**and flat oval**] ducts and fittings.

Double wall round [**and flat oval**] ducts and fittings.

Sheet metal materials.

Duct liner.

Sealants and gaskets.

Hangers and supports.

Seismic restraint devices.

* + - * 1. Related Sections:

Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

Section 233116 "Nonmetal Ducts" for fiberglass ducts, thermoset fiber reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.

Section 233119 "HVAC Casings" for factory and field fabricated casings for mechanical equipment.

Section 233300 "Air Duct Accessories" for dampers, sound control devices, duct mounting access doors and panels, turning vanes, and flexible ducts.

* + - 1. REFERENCE STANDARDS
				1. ASTM International (ASTM).
				2. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).
				3. North American Insulation Manufacturers Association (NAIMA).
				4. National Fire Protection Association (NFPA).
				5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
				6. Underwriters Laboratories (UL).
				7. Underwriters Laboratories Environment (UL Environment).
				8. UL 2824 – GREENGUARD Certification Program Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers.
				9. ASHRAE 189.1 – “Standard for the Design of High-Performance Green Buildings; Except
				Low-Rise Residential Buildings”.
				10. California Department of Public Health - "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers". Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.
			2. DEFINITIONS
				1. Thermal Conductivity (K value): Heat flow property of a homogeneous material; the lower the “k” the better the insulating value. Expressed in units of Btu-inch/hour per square foot per degree F.
				2. Underwriters Laboratories Environment (UL Environment): independent, third-party green claims validation, product assessment and certification.

1. Environmental Claim Validation (ECV): Independent third-party review to single attribute environmental claims.

 a. Formaldehyde Free: Independent third-party validation of claim that a product does not contain formaldehyde (or formaldehyde precursors) using a combination of auditing raw material input and testing of chemical emission from the product.
 b. Recycled Content:

 1. Pre-Consumer - materials used or created from one manufacturing process which are collected as scrap and placed back into another manufacturing process rather than being placed in a landfill or incinerated.
 2. Post-Consumer - materials such as bottled glass collected at curbside or other collection sites after consumer use.

2. GREENGUARD Certification: Health based emission testing criteria for chemicals; requiring total VOC emission levels for products.

3. GREENGUARD Gold: Emission testing criteria for chemicals requiring lower total VOC emission limit levels for products acceptable for use in environments such as schools and healthcare facilities. Complies with California’s Department of Public Health (CDPH) “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers”; Version 1.1 (2010), also known as California Section 01350 .

4. Environmental Product Declaration (EPD): Independently verified and registered document providing information about the life-cycle impact of products

* + - * 1. Health Product Declaration (HPD): Product disclosure document containing an inventory of the contents of a product for its end use and the associated health hazards.
				2. EPA: Environmental Protection Agency.
				3. WHO: World Health Organization.
				4. NIA – National Insulation Association - Thermal Insulation Certified Inspector Program: a recommended certified mechanical insulation inspector program that utilizes inspectors who maintain current certification by NIA to inspect and verify the materials used are, and the total insulation system has been, installed correctly in accordance with the Specifications; throughout the project.
				5. LEED: Leadership in Energy and Environmental Design, a voluntary rating system for high performance green buildings developed by the US Green Building Council (USGBC).
				6. Sustainable Minds (SM) Transparency Catalog: Designed as an educational marketing platform to provide access to products with environmental and material disclosures that qualify for Collaborative for High Performance Schools, LEED v4, Green Globes, the Well Building Standard and the Living Building Challenge ­– from all manufacturers, all program operators and all material disclosure rating systems.
				7. EUCEB: The European Certification Board for Mineral Wool Products, a voluntary certification of the conformity to meet the bio-solubility criteria of mineral wool fibers.
				8. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants: used in the manufacture of some insulation facings.
				9. UL Classified: Underwriters Laboratory product label of fire resistance testing that includes
				on-going evaluation of the product to assure it continues to meet the Fire Hazard Classification (FHC) 25 Flame Spread; 50 Smoke Developed rating; unlike other FHC testing which is a
				one-time only test.
			1. PERFORMANCE REQUIREMENTS
				1. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
				2. Structural Performance: Duct hangers and supports shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
				3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
			2. ACTION SUBMITTALS
				1. Product Data: For each type of the following products:

Liners and adhesives.

Sealants and gaskets.

Seismic restraint devices.

* + - * 1. EPD or HPD Submittals: Third Party Validated
				2. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.
3. Laboratory Certificates or Validations: For adhesives, indicating compliance with
 requirements for low-emitting materials.
4. Laboratory Certificates or Validations: For insulation, indicating compliance with
 requirements for low-emitting materials.

* + - * 1. LEED v 4 Submittals:

Product Data for Credit Energy and Atmosphere (EA) – Minimum Energy Performance, Optimize Energy Performance.

Product Data for Credit Materials and Resources (MR) – Building Product Disclosure & Optimization – EPD, Building Product Disclosure & Optimization – Source of Raw Materials, Building Product Disclosure & Optimization – Material Ingredients.

Product Data for Credit Indoor Environmental Quality (EQ) – Minimum Indoor Quality Performance, Minimum Acoustic Performance, Low Emitting Materials.

* + - * 1. Shop Drawings:

Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

Factory and shop-fabricated ducts and fittings.

Duct layout indicating sizes, configuration, liner material, and static pressure classes.

Elevation of top of ducts.

Dimensions of main duct runs from building grid lines.

Fittings.

Reinforcement and spacing.

Seam and joint construction.

Penetrations through fire rated and other partitions.

Equipment installation based on equipment being used on Project.

Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

Hangers and supports, including methods for duct and building attachment [**seismic restraints**] and vibration isolation.

<**Insert lists of areas or systems requiring Shop Drawings>.**

* + - * 1. Delegated Design Submittal:

Sheet metal thicknesses.

Joint and seam construction and sealing.

Reinforcement details and spacing.

Materials, fabrication, assembly, and spacing of hangers and supports.

Design Calculations: Calculations [**including analysis data signed and sealed by the qualified professional engineer responsible for their preparation**] for selecting hangers and supports [**and seismic restraints**].

* + - 1. INFORMATIONAL SUBMITTALS
				1. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

Suspended ceiling components.

Structural members to which duct will be attached.

Size and location of initial access modules for acoustical tile.

Penetrations of smoke barriers and fire rated construction.

Items penetrating finished ceiling including the following:

Lighting fixtures.

Air outlets and inlets.

Speakers.

Sprinklers.

Access panels.

Perimeter moldings.

<**Insert item**>.

* + - * 1. Welding certificates.
				2. Field quality control reports.
			1. QUALITY ASSURANCE
				1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up".
				2. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation".
				3. Manson Insulation recommends the use of the NIA – National Insulation Association, Thermal Insulation Certified Inspector Program (as defined in 1.4 F – above).
				4. Bio-Based Binder: a plant based sustainable chemistry bond that holds the fiberglass product together; replacing the phenol/formaldehyde (PF) binder traditionally used in fiberglass products.
				5. Surface Burning Characteristics: For insulation and related materials, UL/ULC Classified per UL 723 or meeting ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.

Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

* + - * 1. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds
				**[if** **available]**. Products shall be Certified UL GREENGUARD Gold.
				2. Biosoluble Fiber: Certified by European Certification Board for Mineral Wool Products (EUCEB).
				3. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.
				4. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants; whenever available.
				5. Any duct insulation products that have become wet before, during or after installation SHALL BE REMOVED AND REPLACED.
				6. Mockups:

Before installing duct systems, build mockups to comply with the Architect’s requirements, using materials indicated for the completed Work:

Approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1. PRODUCTS
	* + 1. DOUBLE WALL RECTANGULAR DUCTS AND FITTINGS
				1. Manufacturers: Subject to compliance with requirements
				2. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
				3. Interstitial Insulation: Fiberglass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

Maximum Thermal Conductivity: [**0.27 Btu x in. /h x sq. ft. x deg. F (0.039 W/m x C)**] <**Insert conductivity**> at 75 deg. F (24 deg. C) mean temperature.

Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

Product shall have a factory-applied antimicrobial agent.

Cover insulation with polyester film complying with UL 181, Class 1.

* + - 1. DOUBLE WALL ROUND [**AND FLAT OVAL**] DUCTS AND FITTINGS
				1. Manufacturers: Subject to compliance with requirements.
				2. Flat Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
				3. Interstitial Insulation: Fiberglass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

Maximum Thermal Conductivity: [**0.27 Btu x in. /h x sq. ft. x deg. F (0.039 W/m x C)**] <**Insert conductivity**> at 75 deg. F (24 deg. C) mean temperature.

Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

Product shall have a factory-applied antimicrobial agent.

Cover insulation with polyester film complying with UL 181, Class 1.

* + - 1. DUCT LINER
				1. Fiberglass Duct Liner: Glass fibers bonded with a bio-based, formaldehyde free thermosetting resin and a tightly bonded mat on the airstream side. UL/ULC Classified per UL 723. Comply with ASTM C 1071 Type I and Type II, ASTM G 22, NFPA 90A, and NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." Tested and verified microbial resistant in accordance with UL 2824 for Type I; does not support the growth of mold, fungi, or bacteria per ASTM C 1338.

Basis-of-Design Product: Subject to compliance with requirements, provide Manson Insulation; Akousti-Liner or Akousti-Liner R.

a. Type I, Flexible: [**0.24 Btu x in. /h x sq. ft. x deg. F (0.039 W/m x C)**] <**Insert conductivity**> at 75 deg. F (24 deg. C) mean temperature.

b. Type II, Rigid: [**0.23 Btu x in. /h x sq. ft. x deg. F (0.033 W/m x C)**] <**Insert conductivity**> at 75 deg. F (24 deg. C) mean temperature.

Duct Liners meet ASTM C 1338 by applying and EPA registered antimicrobial agent to aid in the prevention of fungal and bacterial growth. The addition of a coating as suggested above MAY affect the FHC Classification of the product.

[**Solvent**] [**Water**] Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

For indoor applications, adhesive shall have a VOC content of 80 g/L or less.

Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

* + - * 1. Insulation Pins and Washers:

Cupped Head, Capacitor Discharge Weld Pins: Copper or zinc coated steel pin, length to suit depth of insulation indicated with integral 1-1/2 inch (38 mm) galvanized carbon steel washer.

Insulation Retaining Washers: Self-locking washers sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

* + - * 1. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

Apply one layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

Butt transverse joints without gaps, and coat joint with adhesive.

Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted edge overlapping.

Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally. Assure that the mechanical fasteners DO NOT compress the insulation more than 1/8 inch (3 mm) and are installed perpendicular to the duct surface.

Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

Fan discharges.

Intervals of lined duct preceding unlined duct.

Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

Secure insulation between perforated sheet metal inner duct; of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

Terminate inner ducts with buildouts attached to fire damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional. When used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

1. EXECUTION
	* + 1. DUCT SCHEDULE
				1. Liner:

Supply Air Ducts: [Fiberglass**, Type I**], [**1 inch (25 mm)**]
[**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] <**Insert thickness**> thick.

Return Air Ducts: [Fiberglass**, Type I**], [**1 inch (25 mm)**]
[**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] <**Insert thickness**> thick.

Exhaust Air Ducts: [Fiberglass**, Type I**], [**1 inch (25 mm)**]
<**Insert thickness**> thick.

Supply Fan Plenums: [Fiberglass**, Type II**], [**1 inch (25 mm)**]
[**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] <**Insert thickness**> thick.

Return and Exhaust Fan Plenums: [Fiberglass**, Type II**], [**2 inches (51 mm)**] <**Insert thickness**> thick.

Transfer Ducts: [Fiberglass**, Type I**], [**1 inch (25 mm)**]
[**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] <**Insert thickness**> thick.

* + - * 1. Double Wall Duct Interstitial Insulation:

Supply Air Ducts: [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**]
<**Insert thickness**> thick.

Return Air Ducts: [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**]
<**Insert thickness**> thick.

Exhaust Air Ducts: [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] <**Insert thickness**> thick.

END OF SECTION 233113