

SECTION 15081 – DUCT INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Section, apply to this Section.

1.2 WORK INCLUDED

- A. Furnish and install all duct insulation, vapor barriers, jackets, finishes, adhesives, cements and accessories to make a complete and insulated system of all ductwork, fittings, joints, offsets and accessories specified herein.
- B. All insulation system materials shall conform to the maximum flame spread/smoke developed ratings specified herein.
- C. All kitchen hood exhaust ductwork and accessories shall be insulated with a rated fireproof insulation system with zero clearance allowed. The system shall extend continuously from the hood connections to the fan intake connection.

1.3 RELATED SECTIONS

- A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

- A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.
- B. Material standards shall be as specified or detailed hereinafter and as follows:
 - 1. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Steel and Plate.
 - 2. ASTM B 209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and plate (Metric).

3. ASTM C 518 – Standard Test method for Steady-State Heat Flux Measurements and Thermal Insulating and Finishing Cement.
4. ASTM C 553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
5. ASTM C 612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
6. ASTM C 921 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
7. ASTM C 1071 – Standard Specification for Thermal and Acoustical Insulation (Glass, Fiber, Duct Lining Material).
8. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
10. ASTM E 162 – Standard Test Method for Surface flammability of Materials Using a Radiant Heat Energy Source.
11. ASTM G 21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
12. NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.
13. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.
14. SMACNA (DCS) – HVAC Duct Construction Standards – Metal and Flexible.
15. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.
16. ANSI/ASHRAE 90.1 - Energy Conservation in New Building Design.

1.5 SUBMITTALS

- A. See Section 15050 and General conditions for additional requirements.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.6 QUALITY ASSURANCE

- A. All insulation materials, finishes, coatings, cements, tapes, jackets and other insulation accessories shall have minimum composite or individual fire hazard ratings as well as thickness and "C" values conforming to State Building Codes which control building construction materials that may be used on this project. Where specification requirements exceed the Code requirements, the specification shall govern.

- B. Insulation for the various duct systems and associated equipment shall be composed of materials which are non-combustible and/or provide a fire resistive system of insulation which complies with the applicable Code having jurisdiction. Generally, it is required that fire hazard ratings shall not exceed the following, except as noted:
 - 1. Flame Spread Rating: 25 (No Exceptions)
 - 2. Smoke Developed Rating: 50
- C. All fire hazard ratings shall be as determined by NFPA 255 "Method of Test of Surface Burning Characteristics of Building Materials", ASTM E84 or UL 723.
- D. All insulation materials herein specified shall be used subject to the manufacturer's temperature limitations and their compatibility with other materials.
- E. Installation of all insulation work shall be executed by a qualified Insulation Contractor who is thoroughly experienced in this particular type of work and who has adequate facilities and equipment for installation of all insulation work herein specified and who is familiar with the requirements of the Code enforcing Authorities as to fire hazard rating.
- F. The finished installation shall present a neat and workmanlike appearance with all jackets smooth, with all vapor barriers sealed and intact.
- G. Where insulation is specified for ductwork, insulate similarly all collars, dampers, edges, joints, etc. connected to system subject to heat loss or gain. Do not cover damper actuators or other maintenance points on equipment unless identified on the insulation with removable access panels or covers.

1.7 REGULATORY REQUIREMENTS

- A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E 84, NFPA 255, or UL 723.
- B. Kitchen hood exhaust ducts shall be insulated with a insulation system complying with NFPA 96.

1.8 DELIVERY, STORAGE AND PROTECTION

- A. Accept materials on site, labeled with manufacturer's identification, product density and thickness.
- B. All materials shall be stored in a dry area free from moisture and debris.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of each product.

- B. Maintain temperature before, during and after installation for minimum of 24 hours.

1.10 DUCTWORK INSULATION SCHEDULE

PART 2 – PRODUCTS

2.1 MANUFACTURERS ACCEPTABLE FOR PRODUCT TYPES INDICATED CONTINGENT UPON PRODUCTS' COMPLIANCE WITH THE SPECIFICATIONS

A. Insulation:

1. Manville Corporation.
2. Owens-Corning Fiberglass Corporation.
3. Certainteed Corporation.
4. Knauf
5. 3M Company

B. Mastics and adhesives:

1. Childers Products Company.
2. H. B. Fuller Company, Foster Products Division.
3. 3M Company Adhesives, Coatings and Sealers.
4. Ruston Plant.
5. Chicago-Mastic
6. Insul-Coustic
7. St. Clair Rubber
8. Vimasco
9. Baldwin-Ehret-Hill

C. PVC fitting covers:

1. Manville, Corporation.
2. Ceel-Co.
3. Certainteed, Corp.
4. Cell Co. Plastics

2.2 FACED FLEXIBLE FIBER GLASS INSULATION

- A. Faced flexible fiber glass duct insulation shall be equal and equivalent to Owens-Corning Fiberglas Faced Duct Wrap, Series ED 100, FRK-25 having an approximate density of 1.0 lb./cu.ft. and an approximate thermal conductivity of 0.30 at 75° F.

- B. Insulation shall be tightly wrapped on the duct work with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. All joints shall be sealed with approved adhesive. Adhere insulation to ducts with 4 inch wide strips of an approved bonding adhesive, at 18 inches on center. Additionally, secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins or stickclips at no more than 18 inches on center. Alternative means of securing insulation to ducts will be permitted, subject to the manufacturer's recommendations and the Architect's written approval.
- C. Insulation shall be butted with facing overlapping all joints at least 2 inches and sealed with approved fire retardant vapor barrier adhesive. All breaks, punctures and pin penetration in facing, shall be sealed with vapor barrier tape per the manufacturer's published installation instructions.

2.3 RIGID FIBERGLASS BOARD INSULATION

- A. Rigid fiberglass board insulation shall be equal to Owens-Corning Fiberglas 25 with ASJ having an approximate density of 4.2 lbs./cu.ft. and an approximate thermal conductivity of 0.25 at 75°F.
- B. The insulation shall be applied by use of weld pins or stick clips. Such fasteners shall be spaced 3 inches from each corner of the board with intermediate pins spaced no more than 12 inches on center. Pin caps shall be covered with a round vapor seal patch that matches the jacket on the ASJ board.
- C. Ducts, plenums and equipment having sharp bend shall have the insulation scored as required to conform to the curved surfaces to provide a neat and workmanlike appearance when finished.
- D. All insulation edges and joints shall be sealed with a fire retardant vapor barrier adhesive, reinforced with a vapor barrier tape similar to that of the board facing. Tape shall be 3 to 5 inches wide as recommended by the particular manufacturer.
- E. The above specified insulation will be used in all areas, and it is intended that the finish present a neat and uniform appearance as to color and workmanship.

2.4 KITCHEN HOOD EXHAUST DUCT INSULATION SYSTEM

- A. The entire kitchen hood exhaust duct shall be insulated with 3M Fire Barrier Duct Wrap 15A Commercial Kitchen Grease Duct Fire Protection System or equivalent UL rated system.
- B. The system shall consist of a 2 hour UL rated assembly for zero (0) clearance to adjacent building materials. It shall include a hanging and support system with rated cleanout doors as required by NFPA 96.

- C. The kitchen hood duct enclosure system shall be installed in multiple layers in accordance with manufacturer's instructions to provide a UL listed 2 hour assembly. The encapsulation system shall be a non-combustible, inorganic fire-proofing wrap. The 3M Fire Barrier Duct Wrap shall have a thermal conductivity of 2.27 at 1800°F and be rated for continuous service at 1800°F.

2.5 INSULATION FACING

- A. Code ASJ: All service jacket composed of high intensity white chemically treated Kraft paper reinforced with fiberglass yarn and mesh and laminated to aluminum foil with a fire retardant adhesive. Longitudinal laps and butt strips shall be a minimum of 3 inches.
- B. Code FSKL: 0.35 mil aluminum foil reinforced with fiberglass yarn reinforcing scrim and laminated to chemically treated fire resistive Kraft paper having a minimum 35 pound per inch width tensile strength when tested in accordance with ASTM D 828. Water vapor permeability 0.04 perms. Longitudinal laps and butt strips shall be a minimum of 3 inches.

2.6 ADHESIVES

- A. Code ADH-1: Fibrous adhesive, non-flammable, quick setting adhesive for calcium silicate. Similar to Childers CP-97, 98.
- B. Code ADH-2: Fast-drying vinyl base coating and lagging adhesive. Similar to Childers CP-50A HV2.
- C. Code ADH-3: Fast-drying neoprene base adhesive for lap joints of foil-faced facing applied over pipe insulation. Similar to Childers CP-82.
- D. Code ADH-4: Adhesive for use in adhering fiberglass board or blanket insulation to pipe and equipment. 3M Company Insulation Adhesive No. 35 or 38 non-flammable adhesive.

2.7 CAULKING COMPONENTS

- A. Code CC-1: For use with foam glass and/or joint sealant applications. Flexible elastomeric vapor barrier sealant. Similar to Childers CP-76.

2.8 MASTICS

- A. Code MAS-1: Vapor barrier mastic made with an elastomeric resin. For indoor use. Similar to Childers CP-30.
- B. Code MAS-2: A non-water vapor barrier asphaltic emulsion coating, breathing type, for above ground installations. Similar to Childers CP-10.

- C. Code MAS-3: Vapor barrier mastic made with an elastomeric resin. For outdoor use.

2.9 TIE WIRE

- A. Tie wire for securing insulation in place shall be type 304 stainless steel annealed steel wire of gauge and proper spacing as recommended by the insulation manufacturer. Wire shall be drawn up tightly enough to become embedded in the insulation and the ends of the loop twisted, bent over, and pressed into the insulation so as to leave no ends protruding.

2.10 BANDING

- A. 3/8 inch x 0.02 inch type 304 stainless steel for pipe insulation.
- B. 3/4 inch x 0.02 inch type 304 stainless steel for additional insulation jackets.

2.11 WIRE MESH

- A. Wire mesh shall be one inch by No. 20 BGW hexagonal mesh galvanized.
- B. Expanded metal: Expanded metal shall be 1/2 inch Hi-Rib metal lath of copper bearing steel.

2.12 TAPE

- A. Lead foil tape, where specified, shall be 3M Company Lead Foil Tape No. 422, 4 mil thick, acrylic adhesive, 2 inch wide.
- B. Vinyl plastic tape, silver gray, flame resistant, vapor barrier sealant tape on rigid and flexible insulation material for warm or cold air ducts. Similar to 3M Company Duct Sealing Tape No. 474.
- C. Aluminum foil tape, dead soft aluminum foil, point seal on stick pin, metal patching, moisture barrier, heat reflecting and general sealing on aluminum facing foil. Similar to 3M Company Aluminum Foil Tape No. 425.

2.13 STAPLES

- A. Staples shall be 304 or 316 stainless steel clad outward clinching insulation staples.

2.14 INSULATING CEMENT

- A. Insulating cement shall be a mineral-fiber (wool) ASTM C 195 base material having essentially the same insulating characteristics as the adjacent insulation. Similar to PABCO

High Temperature Insulating Cement. Insulating cement shall be applied in layers to a maximum thickness of 1/2 inch. Each layer shall be allowed to dry thoroughly before subsequent layers are applied.

2.15 FINISHING CEMENT

- A. Finishing cement ASTM C 449 shall be diatomaceous silica thermal insulating materials with a suitable proportion of heat resistant binder, hydraulic setting insulating cement capable of withstanding maximum temperature of 700 degrees Fahrenheit. When mixed with water it shall be a plastic mix suitable for trowel applications and shall present a hard, smooth and durable surface after drying. Similar to PABCO No. 127.
- B. Combination insulating and finishing cement:
 - 1. Similar to Ryder One Coat or equal.
- C. Welding studs:
 - 1. Welding studs shall be capacitor type split pin or TCP tipped insulation pins with speed clips. Similar to Nelson Stud Welding Spec. 28.
- D. Corner angles on insulation of ducts, plenums and equipment in finished areas shall be formed of 28 gauge, 1 inch by 1 inch aluminum adhered to heavy Kraft paper having 2 inch by 2 inch by 2 inch wings to protect external corners under glass cloth jackets.
 - 1. Corner beads shall be 26 gauge galvanized steel with 2 ½ inch wings (exposed ducts on roof).

PART 3 – EXECUTION

3.1 INSTALLATION OF INSULATION

- A. All insulation shall be applied by experienced insulating contractors in accordance with best Trade practice.
- B. Test, inspect and clean all surfaces of ductwork to be insulated before applying insulation.
- C. Take all possible precautions to protect work of other Trades. Provide protective covering as required to accomplish this end. This Trade shall be responsible for returning all equipment and material to its original new condition and appearance where damage occurs due to his neglect.
- D. All ductwork shall have been tested and approved prior to installation of insulation.

- E. All ductwork and plenum or surfaces, where subject to condensation on the outside, shall be insulated including vapor seal finish.
- F. All surfaces to be insulated shall be clean, dry and free from dirt and scale when insulation is being applied. Insulation shall be dry at the time of installation and before and during the process of finished application.
- G. Butt ends will not be allowed. However, where required and approved by Architect, jacket material shall be pasted over exposed ends and banded to give a neat and finished appearance. Exposed fiberglass material will not be permitted.
- H. Surfaces of insulation shall be smooth, even and true to line with jackets drawn tight and smoothly secured. Scrap pieces of insulation shall not be used where a full length section will fit.
- I. The methods of application of insulation, finishes, adhesives, cements, accessories are generally specified under the material headings of these specifications. Where not specifically detailed, it is intended that they are equal or exceed the manufacturer's published recommendations, existing at time of bid openings, subject to the approval of the Architect.
- J. Butt covering neatly to walls, floors, ceiling. Apply band at end and position so band covers gap between surface and insulation where exposed.
- K. All kitchen hood exhaust duct insulation shall have no gaps, voids or interferences. Provide supports 4'-0" o.c. for horizontal installation and 10'-0" o.c. for vertical installation. The system shall be continuous and installed in accordance with specific manufacturer's instructions and NFPA 96. The entire system shall be 2 hour UL rated. All joints shall be sealed using 3M Fire Barrier 1000 N/S, 1003 S/L or 2000+ Silicone Sealant.
- L. Fastenings: Provide where required to securely hold insulation. Apply adhesive and weld pins and/or stick clips on exposed risers to prevent slipping and turning of insulation. .
- M. Thickness of insulation shall not be compromised due to piping interferences, improper installation or any other reason.
- N. All duct traverse holes and piping testing ports shall be fitted with removable, re-usable insulation for access for future testing. Each test point shall be tagged with a 2" diameter round fluorescent orange marker, centered on the duct or piping to identify the test point.

3.2 DUCTWORK EXPOSED TO WEATHER

- A. When duct installation, sealing and testing is completed by the Mechanical Contractor, the Insulation Contractor shall cover all ducts exposed to weather with 2 inch thick fiber glass rigid board insulation with vapor barrier for rectangular ductwork and 1 inch thick molded fiber glass insulation with vapor barrier for round ductwork. Insulation shall be installed in one piece and where applicable shall have mitered corners to fit tightly over the sheet metal.

When insulation application is completed, the entire installation shall be covered with EPDM roofing material with the joints overlapping minimum of 6 inches. All joints shall be staggered and shall be covered with mastic to ensure a weatherproof system.

1. EPDM roofing shall be 60-mil. Ductwork to be tested to assure 0% leakage prior to installing EPDM material
2. Ductwork shall be 100% watertight.

PART 4 – SCHEDULES

4.1 DUCTWORK INSULATION SCHEDULE:

Service	Type Insulation and Thickness (Inches)	Facing	Additional Jacket
All Outside Air Intake Ducts & Plenums; Supply Air Ductwork/Return Air Ductwork within Mechanical Rooms Located within 8'-0" above Finished Floor or Catwalks(Exposed)	Rigid Fiber Glass Board Insulation 2"	FSKL	
Supply Air Ductwork/Return Air Ductwork within Mechanical Rooms located more than 8'-0" above Finished Floor or Catwalks (Exposed)	Flexible Fiber Glass w/Vapor Barrier 1-1/2"	FSKL	
All Supply Air Ductwork (Concealed)	Flexible Fiber Glass w/Vapor Barrier 1 1/2"	FSKL	
All Kitchen Hood Exhaust Ductwork	3M Fire Barrier Duct Wrap 15A System		
Louver Blank-off Panels	Rigid Fiberglass Board Insulation 3"	FSLK	
All Relief & Exhaust Ducts within 15'-0" of the outside; Relief & Exhaust Plenums	Rigid Fiberglass Board Insulation 2"	FSLK	
Outdoor Ductwork exposed-to-weather supply, exhaust, return and other	Rigid Fiber Glass Board Insulation 2 times the scheduled requirement for interior ductwork	FSLK	EPDM roofing
Others not scheduled with system temperatures below 60°F or above 90°F	Flexible Fiberglass w/Vapor Barrier 1"	FSKL	

A. HVAC Insulation Schedule Notes

1. Provide vapor barrier on all ductwork insulation.
2. Ductwork exposed to weather shall be insulated with external insulation using double the thicknesses scheduled hereinbefore, up to 24 inches beyond the point where ducts (supply and return) enter the building. Provide weatherproof jacket as hereinafter specified.
3. The kitchen hood exhaust air ductwork shall be insulated with a NFPA approved insulation system installed in accordance with specific manufacturer's instructions.

END OF SECTION