SPECIAL SPECIFICATION

SECTION 15081S

DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Thermal and acoustical insulation applied externally or internally to ductwork and air handling devices; including:

1. Duct insulation.

2. Insulation jackets.

3. Duct liner.

1.02 RELATED SECTIONS

A. Section 09900S - Painting.

B. Section 15075S - Mechanical Identification.

C. Section 158**9**1S - Duct**work**

1.03 REFERENCES

A. ASTM C 553 - Mineral Fiber Blanket and Felt Insulation.

B. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E 84 - Surface Burning Characteristics of Building Materials.

D. C 534 Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tube Form.

1.04 SUBMITTALS

A. Include product description, list of materials, and thickness for each service and location.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in duct insulation application with three years minimum experience.

B. Materials: UL listed; flame spread/fuel contributed/smoke developed rating of 25/25/50 in accordance with ASTM E 84.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Certainteed Corporation.

B. Knauf Fiber Glass.

C. Manville Corporation.

D. Owens-Corning Fiberglass Corporation.

2.02 MATERIALS

A. Type A: Flexible glass fiber **duct wrap**; ASTM C 553; commercial grade; 'k' value of 0.2**2** at 75 degrees F; **3/4** pound per cubic foot minimum density; 0.002-inch foil scrim kraft facing for air ducts. **The vapor barrier shall be legibly printed by the manufacturer to show flame spread smoke developed, nominal thickness and type of insulation.**

B. Type B: Rigid glass fiber **duct board**; ASTM C 612, Class 1; 'k' value of 0.2**2** at 75 degrees F; 0.002-inch foil scrim kraft facing for air ducts. **The vapor barrier shall be legibly printed by the manufacturer to show flame spread smoke developed, nominal thickness and type of insulation.**

C. Type C: Ductliner, flexible glass fiber; ASTM C 553; '**C**' value of 0.2**5** at 75 degrees F **for 1" thick and "C" value of 0.13 at 75°F for 2" thick**; 1-1/2 pounds per cubic foot minimum density; coated air side for maximum 4,000 feet per minute air velocity.

D. Type E: Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.

2. **Ultraviolet-Protective Coating: As recommended by insulation manufacturer.**

3. **Standard PVC: PVC covers manufactured from 20-mils thick, high-impact, ultraviolet-resistant PVC.**

4. **Adhesive: As recommended by insulation material manufacturer.**

E. **Type D: Fiberglass Flexible Duct shall be installed in sizes and locations where indicated on drawings. The flexible duct shall have: maximum interior air temperature of 2000F, maximum static pressure 10", maximum negative air pressure ½" a C value of .23 BTU/hr./ft.2/F. or engineer approved equal.**

F. Adhesives: Waterproof vapor barrier type, Childers CP-82.

G. Finish: Vapor barrier finish coating, Childers CP-33.

H. Jacket: Presized glass cloth, minimum 7.8 ounces per square yard.

I. Lagging Adhesive: Fire resistive to ASTM E 84, Childers CP-82.

J. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

K. Lagging: 2 inch high density fiberglass, 6 pounds per cubic foot, covered with a 0.016 acoustically treated stucco embossed with 1-1/4 pounds per square foot aluminum cladding, Childers Muffl-Jac.

L. Joint Tape: Glass fiber cloth, open mesh.

M. Tie Wire: Annealed steel, 16 gage.

2.03 FIELD-APPLIED JACKETS

A. **Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes, or factor cut and rolled. Comply with ASTM B 209, 3003 alloy, H-14 temper.**

1. **Finish and Thickness: Stucco-embossed finish, 0.016 inch thick.**

2. **Moisture Barrier: 1-mil thick, heat-bonded polyethylene and kraft paper.**

3. **Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.**

B. **PVC Jacket: White, 25/50 rated per ASTM E 84, UV resistant, minimum thickness 0.20" for insulation O.D. up to 18" and 0.030" for insulation O.D. above 18"**

2.04 ACCESSORIES AND ATTACHMENTS

A. Bands: Aluminum; 0.007 inch thick 3/4 inch wide.

B. Bands: Stainless Steel, ASTM A666, Type 304, 0.020 inch thick.

C. Manufactured Thermal Hanger Shields: Thermal inserts shall be 360 degree calcium silicate extending 1 inch past the metal shield and with all service jacket. Sized to fit the pipe diameter and match the outside diameter of the adjoining pipe insulation. Metal shield shall be galvanized steel 180 degree for clevises and roller type hangers and 360 degree for clamp type hangers and supports. Shield and insert length and gauge shall be manufactures standard for the intended application.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install exterior materials after duct has been tested and approved.

B. Clean surfaces for adhesives.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Provide insulation on exterior of all round duct.

C. Insulation (Types A and B) Application for exterior of duct in Interior of Building:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. **The duct wrap shall be applied over clear dry sheet metal duct work that has been sealed air-tight at all seams and joints. Duct wrap shall be installed to allow maximum fullness at corners (avoid excessive compression).** Install without sag on underside of ductwork. Use 4 inch wide strips of adhesive on 8 inch centers or mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3. Insulate standing seams and stiffeners which protrude through the insulation with 1-1/2 inch thick, unfaced, flexible blanket insulation. Cover with glass cloth and coat with vapor barrier finish coating.

4. On circumferential joints, the 2-inch flange on the facing shall be secured with 9/16-inch outward clinch steel staples on 2-inch centers, and taped with a minimum 3 inch wide strip of **fold vapor barrier tape.**

5. Cover seams, joints, pin penetrations and other breaks finish coating reinforced with glass cloth.

6. **Outdoor Duct Insulation:**
   Insulate all heating, ventilating and air conditioning sheet metal ductwork, outdoors, exposed to the weather, with 2" thick 6 lb. Density 705 ASJ Board or approved equal.

   Application:
   Insulation shall be cut and fit tightly between standing seams. Insulation boards shall be applied using mechanical fasteners, such as weld pins or stick clips. Fasteners shall be located not less than 3" from each edge or corner of the board. Pin or clip spacing along the duct should be no greater than 12" on centers. Additional pins or clips may be required to hold the insulation tightly against the surface where cross breaking is used for stiffening. Weld pin lengths must be selected to insure tight fit but avoid "oil canning" effect.

   Finish:
   Air Conditioning, heating and ventilating ducts. Cover all joints and fastener penetration with 3" wide pressure sensitive All Service Jacket (ASJ) tape. Rub tape hard with a nylon sealing tool. Over the entire surface apply a 20 x 20 weave glass reinforcing cloth embedded between two 1/8" thick wet coats of Breather mastic, i.e., B. Foster Seal Fast 6 PM 35-00-4500.

D. Liner (Type C) Application:

1. **All portions of duct designated to receive duct liner shall be completely covered with Duct Liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps.**

2. **The black coated surface of the Duct Liner shall face the air stream.**

3. **The Duct Liner shall be adhered to the sheet metal with 100% coverage of adhesive and all exposed leading edges and all transverse joints coated with adhesive. Adhesive shall conform to Adhesive and Sealant Council Standards for Adhesive for Duct Liner, ASC-A-7001C-1972.**

4. **The Duct Liner shall be additionally secured with mechanical fasteners (Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association), which shall compress the duct liner sufficiently to hold it firmly in place.**

5. **Duct Liner shall be cut to a assure overlapped and compressed longitudinal corner joints.**

6. **For velocities to 2,000 feet per minute, fasteners shall start within 3" of the upstream transverse edges of the Aeroflex Duct Liner and 3" from the longitudinal joints and shall be spaced at a maximum of 12" o.c. around the perimeter of the duct, except that they may be maximum of 12" from corner break. Elsewhere they shall be a maximum of 18" o.c. except that they shall be placed not more than 6" from a longitudinal joint of the liner nor 12" from a corner break.**

7. **For velocities from 2,001 to 4000 feet per minute, fasteners shall start within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and shall be spaced at a maximum of 6" o.c. around the perimeter of the duct, except that they may be a maximum of 6" from a corner break. Elsewhere they shall be a maximum of 16" o.c. , except that they shall be placed not more than 6" from a longitudinal joint of the liner nor 12" from a corner break. In addition to the adhesive edge coating of transverse joints, any longitudinal joints shall be similarly coated with adhesive.**

8. **For velocities from 4,000 to 6,000 feet per minute. Same as 2,001 to 4,000 a FPM except that metal nosing shall be installed to secure the Aeroflex Duct Liner at all upstream transverse edges.**

E. Noise Control and Sound Traps **(Type C)**:

1. For noise control and sound traps, use lagging. Secure insulation with 100 percent coverage of lagging adhesive, pins and clips not more than 18 inches on center.

2. Secure bottom of duct insulation using alternate single and double clips. The first pin will secure the insulation and the second clip will be used to secure the cladding. Isolate the exterior clip from the cladding by using two 1/8-inch closed cell neoprene (Armaflex) washers on either side of the cladding. Predrill holes in cladding and avoid contact with pin during installation.

3. For round duct, secure insulation with 100 percent coverage of lagging adhesive. Secure cladding with 3/4-inch, 0.020-inch stainless steel bands on 12 inch centers.

4. For joints and overlaps, fold cladding to form a double thickness hem 2 inches minimum. Seal with a non-shrink, non-hardening sealing compound.

F. Walk-in Plenum Application: Adhere insulation on interior surface of plenum with adhesive for 100 percent coverage. Secure insulation with mechanical fasteners. Seal and smooth joints. Do not use nail-type fasteners.

G. Continue insulation with vapor barrier through penetrations.

3.03 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Follow manufacturer's written instructions for applying insulation to straight pipes, tubes, and fittings.

1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.04 FIELD-APPLIED JACKET APPLICATION

A. Exterior: Apply aluminum jacketing to all external piping that is insulated. Cover all fittings, valves, and specialties with aluminum jacketing.

B. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Secure jacket with aluminum bands or sheet metal screws on 12 inches centers and at end joints. On piping exposed to the weather, overlap longitudinal seams arranged to shed water and seal end joints with weatherproof mastic.

C. Apply PVC jacketing where indicated, with 2-inch overlap at longitudinal seams and and at fitting covers, the maximum the cover allows. Seal longitudinal seams by joining with PVC welding solvent. Seal circumferential ends with 1/1/2" PVC tape.

3.05 SCHEDULE

A. Provide insulation or liner for duct in accordance with the following schedule:

ALL BUILDINGS EXCEPT MICROFAB		
Duct	Type	Insulation **or Liner** Thickness
Combustion Air Duct	A or B	1"
Exhaust Ducts **in Mechanical Rooms or** within 10 feet of Exterior Openings and Exhaust Ducts Exposed to Outdoor Air	A or B	1"
Outside Air Intake Ducts	C	2"
Plenums	A or B	1"
Ventilation Equipment Casings	A or B	2"
Concealed Round, Rectangular, Supply or Return Duct**s**	A or B	**1**"
Exposed Round Supply, Exhaust or Return Duct	C	1"

ALL BUILDINGS EXCEPT MICROFAB		
Duct	Type	Insulation **or Liner** Thickness
Rectangular **or round S**upply, Exhaust or **r**eturn **ducts in Mechanical Rooms and** within **3**0 feet of the Mechanical Room or Air Handler	C	2"
Return Air Boots	C	1”
Supply ductwork downstream of VAV boxes.	**C**	**1”**

B. Provide insulation or liner for duct for the MicroFab only in accordance with the following schedule:

MICROFAB		
Duct	**Type**	**Insulation Thickness**
Recirculation Units RAH 1-30	**N/A**	**N/A**
Make-up Air Units MAH 1-3 Supply	**N/A**	**N/A**
Make-up Air Unit MAH 4		
Supply Outside Bldg.	**B**	**1 ½"**
Supply Inside Bldg.	**N/A**	**N/A**
Make-up Air Unit MAH 5		
Supply Air Outside Bldg.	**B**	**1½"**
Supply Air Inside Bldg.	**A or B**	**1-½"**
Return Air Outside Bldg.	**B**	**1½"**
Return Air Inside Bldg.	**N/A**	**N/A**
Supply Air Inside Building above Certified Areas	**E**	**½"**
Air Handling Units AHU 1, 3, 4, 5		
Supply Air	**A or B**	**1½"**
Return Air	**A or B**	**1½"**
Air MicroFab Outside Air Intakes	**B**	**1½"**

END OF SECTION