# GENERAL

## SECTION INCLUDES

### Ductwork insulation.

### Duct liner.

### Insulation jackets.

## REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

### References.

### Submittals.

### LEED Submittals:

### [Note to A/E: Edit to suit any LEED certification requirements]

### Delivery, Storage, and Handling.

### Quality assurance.

#### Materials: ASTM E84 Flame spread/smoke developed rating of 25/50 or less.

### Qualifications.

#### Applicator: Company specializing in performing the work of this section with minimum three years’ experience.

### Environmental requirements.

#### Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

#### Maintain temperature during and after installation as recommended by the manufacturer.

"Product Data for Credit IEQ 4.1" Subparagraph below applies to LEED-NC, LEED-CI, and LEED-CS; coordinate with requirements for adhesives and sealants.

"Laboratory Test Reports for Credit IEQ 4" Subparagraph below applies to LEED for Schools.

# PRODUCTS

## GLASS FIBER, FLEXIBLE

### Insulation: ASTM C553; flexible, noncombustible blanket.

#### 'K' value: ASTM C518, 0.30 at 75 degrees F.

#### Maximum service temperature: 250 degrees F.

#### Maximum moisture absorption: less than 3 percent by volume.

#### Density: 1.5 lb./cu ft.

### Vapor Barrier Jacket

#### Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.

#### Moisture vapor transmission: ASTM E96; 0.02 perm maximum.

#### Secure with pressure sensitive tape.

### Vapor Barrier Tape

#### Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

### Tie Wire: Annealed steel, 16 gage (1.5 mm).

## GLASS FIBER, RIGID

### Insulation: ASTM C612; rigid, noncombustible blanket.

#### 'K' value: ASTM C518, 0.23 at 75 degrees F.

#### Maximum service temperature: 250 degrees F.

#### Maximum moisture absorption: less than 3 percent by volume.

#### Density (concealed locations): 3.0 lb./cu ft.

#### Density (exposed locations): 6.0 lb./cu ft.

### Vapor Barrier Jacket

#### Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.

#### Moisture vapor transmission: ASTM E96; 0.02 perm.

#### Secure with pressure sensitive tape.

### Vapor Barrier Tape

#### Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

## CELLULAR FOAM

### Insulation: ASTM C534; flexible, cellular elastomeric, sheet.

#### 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F.

#### Minimum Service Temperature: ‑40 degrees F.

#### Maximum Service Temperature: 220 degrees F.

#### Maximum Moisture Absorption: ASTM D209; 0.2 percent by volume.

#### Moisture Vapor Transmission: ASTM E96; 0.08 perm-inches.

#### Maximum Flame Spread: ASTM E84; 25.

#### Maximum Smoke Developed: ASTM E84; 50.

#### Connection: Waterproof vapor barrier adhesive.

### Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

## DUCT LINER

* + - * 1. Acceptable Manufacturers:

#### Armacell AP CoilFlex

#### Nomaco Fiber-free

* + - * 1. Flexible Polyimide Foam Duct Liner: Preformed, polyimide foam coated with acrylic polymer, sheet materials complying with NFPA 90A or NFPA 90B.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

To exceed the minimum requirements set by ASTM C 1071, verify that a particular manufacturer's product can meet the requirements, retain the "Basis-of-Design Product" Subparagraph below, and insert the manufacturer's name and product designation.

Available thicknesses for flexible elastomeric duct liner are 3/8, 1/2, 3/4, and 1 inch (10, 13, 19, and 25 mm). Indicate thickness on Drawings or in the "Duct Schedule" Article.

Surface-burning characteristics in first subparagraph below are available in limited thicknesses. Verify maximum thickness with manufacturers.

Indoor Air Quality Characteristics: Fiber-free and formaldehyde-free.

Odor Characteristics: No objectionable odors when tested using ASTM C1304

Mold Growth Characteristics: Meets requirements of UL181

Fungi Resistance Characteristics: Meets requirements of ASTM G21

Bacterial Resistance Characteristics: Meets requirements of ASTM G22

Antibacterial Coating: EPA-registered for use in air duct insulation

Erosion Resistance Characteristics: Does not break away, flake off, or show evidence of delamination at velocities of 5,000 ft./min, tested at ASTM C1071

'K' value: ASTM C518, 0.30 at 75 degrees F.

Maximum service temperature: 250 degrees F.

Maximum moisture absorption: less than 2.0 percent by volume.

Maximum Flame Spread: ASTM E84; 25.

Maximum Smoke Developed: ASTM E84; 50.

Density: 0.8 lb./cu ft.

Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

Retain first subparagraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit EQ 4.1.

For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Sound Absorption at 1” thickness: ASTM C423 and ASTM E795

##### 125 Hz: 0.11

##### 250 Hz: 0.30

##### 500 Hz: 0.73

##### 1 kHz: 1.02

##### 2 kHz: 0.73

##### 4 kHz: 0.66

##### NRC: 0.70

### Cellular Foam Duct Liner: ASTM C534; flexible, cellular elastomeric, sheet.

#### 'K' ('ksi') Value: ASTM C177 or C518; 0.28 at 75 degrees F.

#### Minimum Service Temperature: ‑297 degrees F.

#### Maximum Service Temperature: 180 degrees F.

#### Maximum Moisture Absorption: ASTM D209; 0.2 percent by volume.

#### Moisture Vapor Transmission: ASTM E96; 0.08 perm-inches.

#### Maximum Flame Spread: ASTM E84; 25.

#### Maximum Smoke Developed: ASTM E84; 50.

#### Connection: Waterproof vapor barrier adhesive.

#### AP Armaflex FS Self-Adhering Sheet Insulation or equivalent.

Retain subparagraph below if required for LEED for Schools.

## EXTERIOR DUCT INSULATION

### Laminated Cellular Foam; closed cell foam insulation with metal covering.

#### 'K' ('ksi') Value: ASTM C177 or C518; 0.25 at 75 degrees F.

#### Minimum Service Temperature: ‑297 degrees F.

#### Maximum Service Temperature: 180 degrees F.

#### Maximum Moisture Absorption: ASTM D209; 0.2 percent by volume.

#### Moisture Vapor Transmission: ASTM E96; 0.05 perm-inches.

#### Connection: Waterproof vapor barrier adhesive.

#### Armaflex Armatuff Sheet Insulation or equivalent.

### Polyisocyanurate Foam Sheathing: ASTM C1289; Foil-faced uniform closed-cell board. Johns Manville AP Foil-Faced or equivalent.

#### ‘R’ Value: 9.0 at 1-1/2” board thickness.

#### Minimum Service Temperature: ‑100 degrees F.

#### Maximum Service Temperature: 250 degrees F.

#### Moisture Vapor Transmission: ASTM E96; 0.03 perm-inches.

#### Connection: Waterproof vapor barrier adhesive.

#### Field applied jacketing: MFM FlexClad 400 or equivalent; 40 mil thickness.

##### Aluminum jacket with high-density cross-linked polymer film.

##### Aggressive Asphalt adhesive.

# EXECUTION

## EXAMINATION

### Verify that ductwork has been tested before applying insulation materials.

### Verify that surfaces are clean, foreign material removed, and dry.

## INSTALLATION

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

### Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

### Continue insulation through walls, sleeves, hangers, and other duct penetrations.

### Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

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

### Secure insulation without vapor barrier with staples, tape, or wires.

### Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.

### 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.

### Do not overtighten and/or compress flexible glass fiber duct insulation.

### At duct access doors or other openings, insulation shall be properly framed and finished.

### Duct Liner Application:

#### Install in accordance with SMACNA HVAC Duct Construction Standard and all manufacturer recommendations.

#### Adhere insulation with adhesive for 100 percent coverage.

#### Secure insulation with mechanical liner fasteners if recommended by manufacturer. Refer to SMACNA Standards for spacing.

#### Seal and smooth joints.

#### Seal liner surface penetrations with adhesive.

#### Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

### Exterior Insulation Application:

#### Laminated closed cell foam:

##### Install in accordance with manufacturer’s recommendation.

##### Utilize product compliant adhesives or pre-applied pressure sensitive adhesives.

##### Cover seams with product compliant seal tape.

#### Polyisocyanurate:

##### Install in accordance with manufacturer’s recommendation.

##### Use product compliant adhesive for board installation

##### Taper insulation on top of ductwork to allow positive drainage.

##### Field-apply jacketing using pressure-sensitive adhesive and hand roller.

##### Install jacketing continuous across bottom of ductwork extending minimum 6” up each side of duct. Pin duct bottoms over 36” in width.

## GLASS FIBER DUCTWORK INSULATION SCHEDULE

## [Note to A/E: Edit Duct Insulation Schedule as necessary to suit project requirements]

| **Ductwork Application:** | **Type:** | **Thickness:** | **Vapor Barrier Required (Y/N):** |
| --- | --- | --- | --- |
| Exposed rectangular outside air duct in mechanical rooms and chases | Rigid | 2” | Y |
| Exposed rectangular supply air duct in mechanical rooms and chases | Rigid | 2” | Y |
| Exposed round supply air duct in mechanical rooms | Flexible | 2” | Y |
| Exposed rectangular and round return air duct in mechanical rooms | None required unless shown on plans |
| Exposed rectangular and round exhaust air duct upstream of heat recovery system in mechanical rooms | None required unless shown on plans |
| Exposed rectangular and round exhaust/relief air duct downstream of heat recovery system in mechanical rooms | Rigid | 2” | Y |
| Exposed rectangular and round return air duct or exhaust air duct in other areas | None required unless shown on plans |
| Exposed rectangular and round supply air duct upstream of terminal units | Flexible | 2” | Y |
| Exposed rectangular supply air duct downstream of terminal units | Flexible | 2” | Y |
| Exposed round supply air duct downstream of terminal units | Flexible | 2” | Y |
| Concealed rectangular and round supply air duct upstream of terminal units | Flexible | 2” | Y |
| Concealed rectangular supply air duct downstream of terminal units | Flexible | 2” | Y |
| Concealed round supply air duct downstream of terminal units | Flexible | 2” | Y |
| Concealed return air duct upstream of terminal units | Liner | 1” | Y |
| Concealed exhaust air duct  | None required unless shown on plans |
| Return air grille boots/transfer ducts (where indicated on drawings) | Liner | 1” | N |
| Exterior Ductwork | Exterior | 2” | Y |

Schedule Notes:

### All ductwork in mechanical rooms shall be insulated as though it were “Exposed”.

### Any exterior ductwork requiring insulation from the categories above shall be insulated as “Exterior.”

END OF SECTION 23 07 13