SECTION 230713 - DUCT INSULATION

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Outdoor, exposed supply and return, with mineral-fiber board insulation, foam insulation board, and a field-applied, self-adhesive weather barrier outdoor jacket.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 230719 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and field-applied jackets.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sheet Form Insulation Materials: 12 inches (300 mm) square.
2. Sheet Jacket Materials: 12 inches (300 mm) square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Ductwork Mockups:

    a. One 10-foot (3-m) section each of rectangular and round straight duct.
    b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
    c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
    d. One rectangular and round transition fitting.
    e. Four support hangers for round and rectangular ductwork.
    f. Each type of damper and specialty.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Outdoor, Field-Applied Jacket Installation", and "Outdoor, Field-Applied Jacket Schedule" articles for application of insulating materials.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.
f. <**Insert manufacturer's name**>.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.
f. <**Insert manufacturer's name**>.

H. Foam Insulation Board: Closed Cell, Isocyanurate, Extruded Polystyrene, Phenolic, Expanded Polystyrene. Minimum density 1.6 lb/cu. ft. (25.6 kg/cu. m); minimum compressive strength, 20-psi (137.9-kPa); either faced or unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Chemical Company (The).
b. Owens Corning.
c. <**Insert manufacturer's name**>.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

1. Adhesives shall have a VOC content of [**50**] <**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.
e. <**Insert manufacturer's name**>.

2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 SELF-ADHESIVE, FIELD-APPLIED, OUTDOOR JACKETS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Polyguard Products, Inc.; Alumaguard, Alumaguard All-Weather, Alumaguard Lite, or comparable product by one of the following:

1. 3M.
2. MFM Building Products Corp.

B. General Requirements for Self-Adhesive Outdoor Jacket: Laminated vapor barrier and waterproofing membrane with perm rating of 0.00 perm (0.00 metric perm), when tested according to ASTM E 96/E 96M, for installation over either fiberglass or foam board insulation located above ground outdoors; consists of a foil polymer laminated film with a coating of rubberized bituminous compound or acrylic adhesive that allows membrane to self-adhere to the substrate.

C. Alumaguard: Composite membrane consisting of a multi-ply embossed UV resistant aluminum foil/polymer laminate to which is applied a layer of rubberized asphalt.

1. Alumaguard Membrane Thickness: 56-mils (1.42-mm).
2. Alumaguard Cool Wrap Membrane Thickness: 59-mils (1.50-mm).

a. Solar Reflectance, CRRC Initial Rating: 0.86.
b. Solar Reflectance, CRRC 3-Year Rating: 0.77.
c. Thermal Emittance, CRRC Initial Rating: 0.82.
d. Thermal Emittance, CRRC 3-Year Rating: 0.86.

D. Alumaguard Lite: Multi-ply aluminum foil/polymer composite film coated with a low-temperature acrylic adhesive.

1. Smooth Silver Thickness: 7-mils (0.18-mm).
2. Stucco Embossed Silver Thickness: 9-mils (0.23-mm).
3. White Matte Cool Wrap Finish Thickness: 9-mils (0.23-mm).

a. Solar Reflectance, CRRC Initial Rating: 0.86.
b. Solar Reflectance, CRRC 3-Year Rating: 0.77.
c. Thermal Emittance, CRRC Initial Rating: 0.82.
d. Thermal Emittance, CRRC 3-Year Rating: 0.86.

4. Alumaguard Lite White Thickness: 9-mils (0.23-mm).

E. Alumaguard All-Weather: Hybrid product combining the UV-resistant aluminum foil/polymer laminate and rubberized asphalt used in the Alumaguard product, with a metalized film coated with low temperature acrylic adhesive.

1. Alumaguard All-Weather Membrane Thickness: 35-mil (0.89-mm).
2. Alumaguard All-Weather with Cool Wrap Coating Thickness: 38-mils (0.96-mm).

a. Solar Reflectance, CRRC Initial Rating: 0.86.
b. Solar Reflectance, CRRC 3-Year Rating: 0.77.
c. Thermal Emittance, CRRC Initial Rating: 0.82.
d. Thermal Emittance, CRRC 3-Year Rating: 0.86.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

A. The contractor shall verify and obtain the latest installation instructions from the manufacturer prior to any work being done.

3.1 OUTDOOR, FIELD-APPLIED JACKET INSTALLATION

A. Seal ducts in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible - Second Edition (1995) Seal Class A (or latest version of SMACNA) prior to installation of insulation and the outdoor, field-applied jacket. Leaking ducts can cause the jacket to balloon since the jacket system will be air tight.

B. Install outdoor, field-applied jacket on ductwork insulation pitched to shed water and prevent water ponding on top of the duct.

C. Fiberglass, urethane, or phenolic foam insulations must have a factory applied FSK facing. Extruded or expanded polystyrene may be faced or unfaced. Contractor is responsible for testing adhesion to any substrate; there are products that have manufacturing release agents (Densglas gold) which will not allow adhesion.

D. Substrate surfaces must be clean, dry, and free of oil films.

E. Select outdoor, field-applied jacket materials in accordance with manufacturer's instructions for coverage on the underside of the ductwork, to avoid pins.

F. Not all outdoor, field-applied jacket materials require pins. See manufacturer's instructions.

G. Hot and cold air duct installation for proper maintenance of vapor barrier and physical integrity:

1. Board insulation is mechanically installed on properly sealed duct according to the specifications using insulation fasteners (mini-cup weld pins or perf. based pins and washers).
2. Washers are covered with a 4-inch (101.6-mm) square piece of smooth foil tape prior to jacketing the ductwork to prevent the puncture of the outer membrane by the fasteners.
3. Insulation on the top of the ductwork is installed to allow for the water to shed from the top of the duct and to prevent water from ponding on the top of the duct.

H. Follow one of the options below for the installation of the outdoor, field-applied jacket depending on the jacket product and the duct sizes:

a. One Piece Installation.
b. Two Piece Installation.
c. Three Piece Installation.
d. Four Piece Installation.

I. Select the correct outdoor, field-applied jacket when installing in temperatures below 50 deg F (10 deg C).

J. Protect outdoor, field-applied jackets from damaging chemicals. Solvation will occur to the rubberized bitumen when exposed to petroleum or coal tar based compounds. Contact the manufacturer immediately for more information if there is doubt, before any chemical interaction.

K. Allow each piece of the outdoor, field-applied jacket to stretch by using a 6-inch (152.4-mm) lap over the circumferential lap, and a 4-inch (101.6-mm) wide butt lap or overlap over the joint, and then roll with a roller. Position longitudinal laps at a water shed position.

L. Do not pre-apply the outdoor, field-applied jacket to fabricated insulation unless metal banding is used. Outdoor, field-applied jackets are not mechanical fastening systems and will not hold the insulation on the duct.

M. On hot systems insure that the surface temperature after insulation installation does not exceed the manufacturer's upper temperature use limitations. Heat transfer through single layer joint seams could result in the softening or melting of the rubberized asphalt compound.

N. Lay out duct tees and branches using standard sheet metal two-piece methods, modified to allow for overlap seals. Add 1-1/2 inches (38.1-mm) to 2-inches (50.8-mm) to the throat of the bottom half of the fitting. Add 1-1/2 inches (38.1-mm) to the heel of the top half of the fitting. The bottom piece is installed first, and then the top piece lapped over the bottom piece to permit water shedding over the lap. Tees and fittings can be fabricated using standard layout procedures, adding 1-1/2 inches (38.1-mm) to 2-inches (50.8-mm) for the required laps. Fittings can also be gored. Oversize each gore piece to allow for a lap onto the preceding piece. The two-piece method makes a better looking fitting, however, as with metal work, larger fittings must be gored due to material constraints and ease of application. Standard metal fitting covers can also be used with the outdoor, field-applied jacket products. Insure that the fittings are vapor sealed.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent inspecting agency to perform field inspections and prepare inspection reports.

B. Perform the field tests and inspections and prepare test reports:

1. Inspect the jackets on the exterior ductwork, piping, and equipment.

C. All jacketing applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

D. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

E. Obtain written confirmation from jacket manufacturer that completed installation meets manufacturer’s installation requirements.

3.3 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

1. Outdoor, Field-Applied Jacket Schedule: [**Alumaguard or Alumaguard Cool Wrap,**] [**Alumaguard All-Weather or Alumaguard All-Weather Cool Wrap,**] [**and**] [**Alumaguard Lite Smooth or Embossed or Alumaguard Lite Cool Wrap or White**].

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