

SECTION 23 XXXX NON-FIBROUS, CLOSED CELL, OUTDOOR DUCTWORK

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Therma duct, ducts and fittings by Therma duct, LLC. 855-809-6903

B. This section does not include:

1. Air passages rated over a continuous internal static pressure of 10" w.g. positive, 10" negative, or with test pressure rating over: 10" w.g. startup and 10" w.g. negative (as documented on product labeling).

1.2 SUBMITTALS

A. Product data: For each type of product indicated.

B. Shop drawings: Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work including.

1. Duct layout indicating sizes and pressure classes.
2. Elevation of top of ducts.
3. Dimensions of main duct runs from building grid lines.
4. Fittings.
5. Penetrations through fire-rated and other partitions.

C. Coordination Drawings: Plans, drawn to scale, showing coordination general construction, building components, and other building services.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Thermaduct can be installed by competent field mechanics who demonstrate competence in the HVAC industry and that have completed Thermaduct, LLC's online training course available at training.thermaduct.com. Installation practices must adhere to Thermaduct's Contractor Installation Manual that is current at the time of product installation.

1.4 SPECIFICATION COMPLIANCE

A. Duct Leakage Class, follow SMACNA Leakage Class 3 or less.

B. Thermaduct shall incorporate a Kingspan KoolDuct fortified inner liner compliant to UL (C-UL) 181 Standard for Safety Listed, Class 1 system, with included testing and passing the following:

1. Test for Surface Burning Characteristics
2. Flame Penetration Test
3. Burning Test
4. Mold Growth and Humidity Test
5. Low Temperature Test and High Temperature Test
6. Puncture Test
7. Static Load Test
8. Impact Test
9. Pressure Test and Collapse (negative pressure) Test
10. High Temperature and Humidity for 90 days
11. Cone Calorimeter

12. ASTM E2257 Standard Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies
13. ASTM E 84 tested, Tunnel Test, Does not exceed 25 flame spread, 50 smoke developed.
14. DW144, Class B
15. NRTL product approval, (Subpart S of 29 CFR Part 1910, OSHA)
16. ASTM C 423 noise reduction
17. ASTM E 96/E 96M Procedure A for permeability
18. ASTM C 1071 for erosion
19. ASTM C 518: 2004, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
20. UL 723, Test for Surface Burning Characteristics of Building Materials
21. NFPA Compliance:
 - a. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
 - b. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
 - c. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials"

B. Thermaduct outer shell shall be a UV stable 1000 micron high impact resistant titanium infused vinyl with included testing as following;

1. UL-94 Flammability V-0
2. ASTM D-638 Tensile Strength of 6250 psi
3. ASTM D-790 Flexible Strength of 11,000 psi
4. ASTM D-4226 Drop Impact Resistance
5. ASTM D-4216 Cell Classification

1.5 PRODUCT DELIVERY AND STORAGE

- A. Prevent objectionable aesthetic damage to the outer surface of duct segments during transport and storage.
- B. Store duct segments under cover and protect from excessive moisture prior to installation.

PART 2 – PRODUCTS

2.1 THERMADUCT RECTANGULAR DUCT AND FITTINGS

A. Product:

1. Thermaduct by Thermaduct, LLC. 855-809-6903

B. The panel shall be manufactured of CFC-free Kingspan Kooltherm closed cell rigid thermoset resin thermally bonded on both sides to a factory applied .001" (25 micron) aluminum foil facing reinforced with a fiberglass scrim. An added UV stable, IR reflective 1000-micron high impact resistant titanium infused vinyl is factory bonded using a full lamination process. The lamination process shall permanently bond the vinyl clad to the outer surfaces of the phenolic foam panel to provide a zero-permeability water tight barrier and to form a structurally insulated panel (SIP) in which to form duct segments. Processes that do not employ a full lamination process are not acceptable. Self-applied adhesives such as tapes, caulks or cladding that incorporate pressure sensitive or spray adhesives are not acceptable.

C. The thermal conductivity shall be no greater than $0.146 \text{ BTU} \cdot \text{in}/\text{Hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$ ($.018 \text{ W}/\text{m} \cdot ^\circ\text{C}$), the thermal conductivity shall be no greater than $0.146 \text{ BTU} \cdot \text{in}/\text{Hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$ ($.018 \text{ W}/\text{m} \cdot ^\circ\text{C}$)

D. The density of the Kooltherm foam shall not be less than 3.5 pcf (56 Kg/m³) with a minimum compressive strength of 28 psi (.2 MPa).

E. The standard panel is (31 mm) thickness panel with R-8.1 (1.5 RSI) shall be utilized unless indicated otherwise on the print.

1. Maximum Temperature: Continuous rating of 185 degrees F (70 deg C) inside ducts or ambient temperature surrounding ducts.
2. Maximum Thermal Conductivity: 0.146 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. Permeability: 0.00 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
4. Antimicrobial Agent: Additive for antimicrobial shall not be used but instead, raw product must pass UL bacteria growth testing.
5. Noise-Reduction Coefficient: 0.05 minimum when tested according to ASTM C 423, Mounting A.
6. Required Markings: All interior duct liner shall bear UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for internal closure materials.
7. All insulation materials shall be closed cell with a closed cell content of >90%.
8. R-value:
 - a. 1 3/16 inch (31 mm) Thick Panel: 8.1 R
 - b. 1 3/4 (45 mm) Thick Panel: 12 R
 - c. 2 3/8" Double wall (62 mm) Thick Panel: 16.2 R
 - d. 3" Double wall (76 mm) Thick Panel: 20.1 R
 - e. 3.5" Double wall (100 mm) Thick Panel 24 R

9. Pressure Class design must be specified prior to fabrication.

Thermaduct can provide ductwork constructed to the following pressure classes:

a. 2" w.g.

b. 4" w.g.

c. 6" w.g.

d. 8" w.g.

e. 10" w.g.

F. Closure Materials:

1. V-Groove Adhesive: Silicone (interior only).

2. UV stable 1000 micron high impact resistant titanium infused vinyl (exterior).

a. Factory manufactured seamless corners for zero perms.

b. Cohesive bonded over-lap at corner seam covers for zero perms.

c. Water resistant titanium infused welded vinyl seams.

d. Mold and mildew resistant.

3. Polymeric Sealing System:

a. Structural Membrane: Aluminum scrim with woven glass fiber with UV stable vinyl clad applied

b. Minimum Seam Cover Width: 2 7/8" inches (75 mm)

c. Sealant: Low VOC.

d. Color: White (colors, matched by architect optional).

e. Water resistant.

f. Mold and mildew resistant.

4. Duct Connectors.

a. Factory manufactured galvanized 4-bolt flange.

G. Outdoor Cladding

1. Thermaduct outdoor Installations: Duct segments shall incorporate UV stable 1000 micron high impact resistant titanium infused vinyl which is introduced during the manufacturing process.

H. Flange coverings

a. Flanges are field sealed airtight before flange covers are installed. Flange covering consists of the following:

1. Foam tape insulation with molded 39 mil covers.
2. Air gap (heating only application) with molded 39 mil covers.

J. Reinforcement

1. Thermaduct shall provide designed and built with adequate reinforcement to both; withstand air pressure forces from within the duct from blower pressure and shall be built to handle expected snow load for the location where the Thermaduct is being installed. Thermaduct will employ Airtruss™ reinforcement system when both specified static pressure and duct sizes dictate the need. This is a factory installed system and no field installation of the reinforcement system is required.

I. Weight

1. Thermaduct shall provide low weight stresses on the building framing and support members. Assembled Thermaduct shall have a weight of 0.86 lbs. per square foot to maximum weight of 2.7 lbs. per square foot (depending on R-value and reinforcement requirement). Hangers and tie-downs are to be detailed in the Thermaduct Contractor Installation Manual for review prior to installation but not exceeding 13' for duct girth <84" and 8' for duct girth >85" between hangers and designed to carry the weight and wind load of the ductwork.

PART 3 – EXECUTION

3.1 Shop Fabrication

A. Certification:

1. Ducts shall be detailed and fully factory manufactured by an authorized Thermaduct, LLC facility system. All fabrication labor will be certified "yellow label" building trade professionals, compliant to SMWIA and SMACNA labor guidelines (work preservation observed).

B. Fabrication:

1. Fabricated joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to manufacturer's written and detailed instructions.
2. Fabricated 90-degree mitered elbows to include turning vanes.

3. Fabricated duct segments in accordance with manufacturer's written details.

4. Duct Fittings shall include 6 inches of connecting material, as measured, from last bend line to the end of the duct. Connections on machine manufactured duct may be 4 inches.

5. Fabricated duct segments utilizing v-groove method of fabrication.

Factory welded or cohesively bonded seams will apply to fully manufactured ductwork and fittings. Internal seams will be supplied with an unbroken layer of low VOC silicone or bonding (for paint shop applications). Each duct segment will be factory supplied with either aluminum grip pro-file or pre-insulated duct connectors in accordance with manufacturer's detailed submittal guide. Applied duct reinforcement to protect against side deformation from both positive and negative pressure per manufacturer's design guide based on specified ductwork size and system pressure.

6. Designed and fabricated duct segments and fittings will be in accordance with "SMACNA Phenolic Duct Construction Standards" latest edition.

7. Both positive and negative ductwork and fittings shall be constructed to incorporate a UL Listed as a Class 1 air duct to Standard for Safety UL 181 liner with an exterior clad for permanent protection against water intrusion.

8. Duct shall be constructed to exceed requirements for snow and wind loads.

3.2 DUCT INSTALLATION

A. Duct segments shall be installed per the Thermaduct Contractor Installation Manual by competent HVAC installers.

B. Install ducts and fittings to comply with manufacturer's installation instructions as follows:

1. Install ducts with fewest possible joints.
2. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
3. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
4. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
5. Use prescribed duct support spacing as described in this specification and manufacturer's recommendations.

C. Air Leakage: Duct air leakage rates to be in compliance with "SMACNA HVAC Air Duct Leakage Test Manual" latest version per applicable leakage class based on pressure.

3.3 HANGER AND SUPPORT INSTALLATION

A. Contractor to ensure that the ductwork system is properly and adequately supported per the Thermaduct Contractor Installation Manual.

1. Ensure that the chosen method is compatible with the specific ductwork system requirements per Thermaduct installation detail drawings. Pre-installation should be provided prior to work commencement by installing contractor for approval.
2. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Supports on straight runs of ductwork shall be positioned at centers not exceeding 13 feet (3.96 m) for duct sections when fabricated in 13 foot (3.96 m) lengths with duct girth less than 84". Larger duct sizes and short segments with duct girth greater than 84" are to be supported at 8 foot centers or less, in accordance with the Thermaduct Contractor's Installation Manual provided prior to work commencement.

C. Ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, parallel under turning vanes and all duct accessories such as dampers, etc.

D. The load of such accessories to the ductwork shall be neutralized by the accessory support.

3.4 FIELD QUALITY CONTROL

A. Inspection: Contractor will provide Thermaduct, LLC fully completed post installation forms with jobsite photos to review e-mailed to warranty@thermaduct.com.

1. Remove and replace duct system where initial post installation submission indicate that it does not comply with specified requirements.
- B. Perform additional testing and inspecting, at the Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.5 DUCT SCHEDULE

A. Outdoor Ducts and Fittings:

1. Thermaduct Rectangular Ducts and Fittings:
 - a. Minimum Panel Thickness: 31 mm
 - b. Cladding: minimum 0.038 inch