

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

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Thermaround, ducts and fittings by Thermaduct, LLC. Of Perrysburg,
OH. 855-809-6903

B. This section does not include:

1. Air passages rated to a specified continuous internal static pressure of
over 10" w.g. positive, 10" w.g. negative, or with test pressure rating over:
15" w.g. startup and 10" w.g. negative.

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. Isometric showing both horizontal and vertical ductwork
3. Dimensions of main duct runs from building grid lines.
4. Fittings.

5. Penetrations through partitions (walls and curbs).

C. Coordination Drawings: BIM drawings available upon request showing scope of fabricated ductwork being supplied.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Thermaround 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 1 or less.

B. Thermaround shall incorporate an InspiralR 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. Therमारound 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 THERMAROUND ROUND DUCT AND FITTINGS

A. Product:

1. Thermaround by Thermaduct, LLC. Phone: 855-809-6903

B. The round duct segments to be manufactured of two layers comprised of CFC-free closed cell rigid foam insulation. Closed cell foam is foam having greater than 90% close cell content. The inner layer will be comprised of thermoset phenolic insulation thermally bonded on both sides to a factory applied .001" (25-micron) aluminum foil facing reinforced with a fiberglass scrim. The outer layer shall have a UV stable; IR reflective .0394" (1000-micron) high impact resistant titanium infused vinyl that is factory bonded using a full lamination process. The lamination process shall permanently bond the vinyl clad to the outer surfaces of

the foam panel to provide a zero-permeability watertight 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 means to apply cladding. The inner layer of phenolic insulation shall be UL 181 listed InspiralR.

C. The thermal conductivity of the phenolic foam 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 thickness is will provide no less than R-12 and will have no thermal bridge when installed.

F. Other key attributes;

1. Maximum Temperature: Continuous rating of 185 degrees F (70 deg C) continuous air temperature inside the duct.
2. Minimum Temperature: Continuous rating of -15 degrees F (-26 deg. C)
3. Phenolic Foam Thermal Conductivity: $0.146 \text{ Btu} \times \text{in.}/\text{h} \times \text{sq. ft.} \times \text{deg F}$ at 75 deg F mean temperature.
4. Permeability: 0.00 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
5. Antimicrobial Agent: Additive for antimicrobial shall not be used but instead, raw product must pass UL bacteria growth testing.

6. Noise-Reduction Coefficient: 0.05 minimum when tested according to ASTM C 423, Mounting A.
7. Required Markings: All interior duct liner shall bear UL label and other markings required by UL 181 on each full sheet of duct panel.
8. All insulation materials shall be closed cell with a closed cell content of greater than 90%.
8. R-value:
 - a. Double Wall Thick Construction, R-12

F. Closure Materials:

1. Adhesive: Silicone (at seams only).
2. UV stable 1000-micron high impact resistant titanium infused vinyl (exterior).
 - a. Factory manufactured seams for zero perms.
 - b. Factory manufactured Thermaround flanges adhered per manufacturing guidelines.
 - 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, or Thermaduct colors selected by architect are optional).
- e. Water resistant.
- f. Mold and mildew resistant.

4. Duct Connectors.

- a. Factory manufactured powder painted galvanized steel draw bands.

G. Outdoor Cladding

- 1. Thermaround 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 draw bands are installed.

J. Reinforcement

- 1. Thermaround shall provide designed and built with adequate reinforcement to both; withstand specified air pressure forces from within the duct from blower pressure and shall be built to handle expected snow and wind load for the location where the Thermaround is being installed. Thermaduct will employ Airtruss™ reinforcement system when both specified static pressure and duct circumferences dictate the need. This is a

factory installed system and no field installation of the reinforcement system is required.

I. Weight

1. Thermaround shall provide low weight stresses on the building framing and support members. Assembled Thermaround shall have a weight of 0.86 lbs. per square foot to maximum weight of 2.7 lbs. per square foot (depending on circumference and reinforcement requirement). Hangers and tie-downs are to be detailed in the Thermaduct Contractor Installation Manual for review prior to installation but shall not exceed 8' for duct ID circumference <36" and 6' for duct girth >37" between hangers and shall be designed to carry the weight and wind and snow load applied to 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 will be according to manufacturer's written and detailed instructions by authorized fabricator.
2. Fabricated 90-degree gored elbows to require no turning vanes.
3. Fabricated duct segments in accordance with manufacturer's written details.
4. Designed and fabricated duct segments and fittings will be in accordance with observe manufacturer's guidelines.
5. Both positive and negative ductwork and fittings shall be constructed to incorporate an InspiralR UL Listed as a Class 1 air duct to meet Standards for Safety UL 181.
6. Duct shall be constructed to exceed requirements for snow and wind loads.

3.2 DUCT INSTALLATION

A. Duct segments shall be installed 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 Duct Construction Standards" 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.

1. Ensure that the chosen method is compatible with the specific ductwork system requirements per Thermaround 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 8 feet for duct sections when fabricated in 47 3/4" lengths with duct ID circumference less than 36". Larger duct sizes and short segments with duct

circumference greater than 36” are to be supported at 6 foot centers or less, in accordance with the Thermaduct Contractor Installation Manual details 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. Duct supports themselves may not be sufficient to support accessories. Accessories, such as silencers, coils, dampers, etc. may require support themselves.

3.4 FIELD QUALITY CONTROL

A. Inspection: Contractor will provide Thermaduct, LLC fully completed pre-installation and 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. Thermaround Round Ducts and Fittings:

a. Minimum Panel Thickness: 31 mm

b. Cladding: minimum 0.038 inch