**Sample Specification from Monoxivent UnderDuct**

**SECTION 233116 – FIBERGLASS REINFORCED PLASTIC DUCTWORK (FRP)**

**PART 1 - GENERAL**

**1.01 Summary:**

1. This section of the Contract Specifications shall be read in conjunction with Section 15000 – General Mechanical Clauses, which governs the work of this section.

Related Sections:

* 1. **Section XXXXX** “Testing, Adjusting and Balancing for HVAC” for testing, adjusting and balancing requirements for nonmetal ducts.
	2. **Section XXXXX** “Metal Ducts” for single and double wall, rectangular and round ducts.
	3. **Section XXXXX** “Air Design Accessories” for dampers, duct-mounting access doors and panels, turning vanes and flexible ducts.

**1.02 References:**

1. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
	1. C 518 - Standard Test Method for Steady-State Thermal Transmission

Transmission Properties by Means of the Heat Flow Meter Apparatus

* 1. ASTM C 582 – Standard specification for contact – molded reinforced thermosetting plastic laminates for corrosion resistant equipment
	2. ASTM D 3982 – Standard specification for contact-molded fiberglass ducts and hoods.
	3. ASTM D 2996 – Standard specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Pipe
	4. NPS 15-69 - Standards specification for Custom Contact-Molded Reinforced - Polyester Chemical - Resistant Process Equipment.
	5. SMACNA Thermoset FRP Duct Construction Manual
	6. ASTM E 84 - Test for low flame
	7. UL 723 - Test for Surface Burning Characteristics of Building Materials
	8. UL 181 - Mold Growth and Humidity Test
	9. ICC-ES (International Code Council Evaluation Service):
		1. LC 1014 PMG-Listing Criteria for Underground Plastic Ducts
		2. EG290-Evaluation Guideline for Underground Plastic Air Ducts

**1.03 Submittals**

1. Submit electronic layout and shop fabrication drawings in accordance with **Section 01300 – Submittals**.
2. Provide a description of manufacturing materials and process.
3. Submit burial instructions and field joining procedures.
4. Verification that the resin to be supplied has been tested by an ASTM E84 Nationally Recognized Testing Laboratory to comply with UL 181 Class 1 standards of low smoke and low flame. Certification shall be current within ten (10) years of project start date.
5. Verification that the duct system is ICC approved and complies with the following Building Codes:

2012 and 2009 International Mechanical Codeᴿ (IMC)

2012 and 2009 International Residential Codeᴿ (IRC)

2012 and 2009 Uniform Mechanical Codeᴿ (UMC)\*

2010 and 2007 California Mechanical Codeᴿ (CMC)

\*Uniform Mechanical Code is a copyrighted publication of the International Association of Plumbing and Mechanical Officials

1. Submit design calculations signed and sealed by a professional engineer and fabrication procedures for record purposes only. Also submit a letter certifying that the laminates fabricated with the proposed resin system will give satisfactory performance under the specified service conditions and stating the service conditions for which certification is provided and indicating compliance with specified pressure and vacuum design criteria.
2. Verification that the duct product provided complies with UL 181 Mold Growth and Humidity testing and that this testing was performed by a UL accredited laboratory.

**PART 2 - PRODUCTS**

**2.01 Thermoset FRP Ducts and Fittings**

1. Manufacturer: Provide FRP duct as manufactured by one of the following:
	1. UnderDuct by Monoxivent
	2. Or equal
2. Conditions:
	1. Ductwork shall be designed for underground HVAC exhaust and supply.
	2. Top of duct must be a minimum of 4’’ under the bottom of slab. When the top of duct is deeper than 48’’ from bottom of slab the duct wall thickness shall be confirmed by calculation.
	3. Duct shall be corrosion resistant in all soil conditions.
	4. The FRP ductwork shall be designed for plus 10’’, minus 5’’ water column.
	5. Duct shall be designed for an operating temperature range of 45o F to 175 o F while maintaining class 1 duct material properties per NFPA.
	6. All round duct systems shall be designed for direct burial without the need for concrete encasement.
3. Resin:
	1. Thermoset FRP Resin: Manufacture duct with Monoxivent 824 modified acrylic resin that complies with ASTM E84, Class 1, maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL.
	2. The use of liners to achieve the indicated smoke and flame spread development will not be accepted.
4. **Insulation:**
	1. **Double-Wall Insulated Duct: Inner and outer duct complying with requirements for “Round Duct” description. Closed Cell Polyurethane Foam insulation with maximum thermal conductivity of 0.14 BTU x in. / h x sq. ft. x deg F at 75 deg. F mean temperature (R-Value of 6).**
5. Reinforcement:
	1. Surfacing Veil shall be “C” glass veil with a silane finish and a styrene soluble binder.
	2. Chopped Strand Mat shall be Type E Glass with a minimum 1-1/2 ounce per square foot with silane finish and styrene soluble binder.
	3. Woven Roving shall be Type E glass minimum 24 ounces per square yard.
	4. Continuous Roving for a filament binding shall be Type E glass with a silane finish.
6. Construction:
	1. FRP shall be of filament wound construction with a smooth resin rich interior layer and a ‘C’ veil resin rich exterior.
	2. FRP duct shall be factory assembled to the greatest possible extent, with a minimum number of field joints.
	3. FRP ductwork shall be designed using a safety factor of 10 to 1 for pressure and 5 to 1 for vacuum without exception.
	4. Out of roundness of duct shall be limited to 1% of diameter.
	5. Length of duct sections shall not vary more than 0.50" (12.7mm) at 70 degrees F (21 degrees C).
	6. Duct sections shall be square on the ends in relation to the center axis within 0.125" (3.2mm) up to and including 24" (610mm) diameter and within 0.1875" (4.8mm) for all diameters greater than 24" (610mm).
	7. Round Duct: Filament wound minimum Thickness:
		1. Minimum Wall thickness will be in accordance with NPS 15-69, Table 2.
		2. Duct with inside diameter of 20" (508mm) or less shall have a wall thickness of 0.125" (3.2mm); duct with inside diameter of 22" - 36" (559mm - 914mm) shall have a wall thickness of 0.1875" (4.8mm); duct with inside diameter of 38" (965mm) or greater shall have a wall thickness of 0.25" (6.4mm).
7. Lamination:
	1. All ductwork shall have an exterior “C” veil linear 10 mil thick.
	2. Structural layer shall be fabricated toward Winding or Hand lay-up STD.
8. Exterior:
	1. Below ground to have a “C” veil layer.
	2. Above ground to have a “C” veil layer and White or Light Gray paraffinated gel coat with UV inhibitors
9. Fittings:
	1. All fittings shall be made out of the same resin and having the same strength as the FRP ductwork
	2. The internal diameter of all fittings shall be equal to the adjacent duct
	3. The tolerance on angles of all fittings shall be ± 1o up to and including 24” diameter and ± ½o for 30” diameter and above.
	4. Elbows Centerline radius shall be 1-1/2 times the diameter.
10. Elbows 45 degrees or less shall be at least one (1) miter/two (2) gore. Elbows greater than 45 degrees shall be at least two (2) miter/three (3) gore.
11. Drains:
	1. When required, formed drain pockets with a minimum of NPS 1” threaded pipe connections
12. Joints:
	1. Field Joints to be Butt & Wrap type for wet lay-up method.
	2. Field joint kits sent out with an extra 20% material

**PART 3 - EXECUTION**

**3.01 Duct Installation**

1. General
	1. Store Resin, glass reinforcing and during agent in a cool, dry area to maximize shelf life.
	2. Upon arrival at the installation site, the customer shall examine the duct for any damage that may have occurred in transit.
	3. Follow ASTM D 3982 Table 1 for recommended hanger spacing.
	4. Use flexible connections to isolate ductwork form vibration caused by air-moving equipment (By Others).
	5. Unload the duct system with care and store in a location where it will be free of damage. Impact of a tool or other heavy object may results in a fracture of the inner lining and may affect the service life.
	6. Support large sub-assemblies during unloading and transportation to prevent excessive deflection and over stressing.
	7. Use full-face gaskets to eliminate any cantilever effect caused from bolting.
	8. Tighten bolts on flange connection s following torque values given in Table1 per ASTM D 3982.
	9. Follow manufacturer's Field Jointing instructions for bonding ductwork together.
2. Burial
	1. Grade Trench so it will be 1.5 times wider than then diameter of the duct.
	2. Fill bottom of trench with a minimum of 6” of back fill (sand or pea gravel).
	3. Slope Trench with a 1/8" per foot pitch back to the start of the system.
	4. Backfill in 6” lift increments compacting 80-90%.
	5. A minimum of 4” of backfill overtop the duct system is required.
	6. Follow manufacturer's burial procedures.

**3.02 Field Connections**

1. Butt and Wrap Joints: Prior to joining, ends shall be ground smooth. All dust and debris must be fully removed. The joint shall be of equal strength to the duct sections being joined. A butt and wrap sequence and thickness chart shall be provided with written instructions as well as Material Safety Data Sheets.
2. **For L-3 joints follow field instructions provided.**
3. Double wall insulated duct joints shall include a fiberglass alignment sleeve in the foam layer with a standard butt and wrap overlay.

**3.03 Field Quality Control**

1. Inspection: All finished installations shall be carefully inspected for properly made joints and damage to duct and fittings. Damage found shall be repaired to the satisfaction of the Engineer.
2. Field Testing: Prior to enclosure or buying, all ducting systems shall be pressure tested at 1-1/2 times the maximum working pressure. The contractor shall furnish all test equipment, labor, materials and devices at no extra cost to the owner.
3. Leakage may be determined by loss of pressure, soap solution, chemical indicator or other positive and accurate method. All fixtures, devices or other accessories which are to be connected to the lines and which would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines plugged or capped as required during the test procedures.
4. Leaks shall be repaired to the satisfaction of the Engineer and the system shall be re-tested until no leaks are found.

**END OF SECTION 233116**