**Sample Specifications for Monoxivent Vehicle Exhaust**

**SECTION 15800 – FIBERGLASS REINFORCED PLASTIC DUCTWORK (FRP)**

**PART 1 - GENERAL**

**1.01 Summary:**

## This Section of the Contract Specifications shall be read in conjunction with Section 15000 – General Mechanical Clauses, which shall apply to and govern the work of this section.

**1.02 Standards:**

1. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
	1. American Society for Testing Materials (ASTM):
		1. ASTM D 2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
		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. E 84 Standard Test Method for Surface Burning Characteristic of Building Materials
2. NBS PS 15-69 Standard specification for Custom Contact-Molded Reinforced - Polyester Chemical - Resistant Process Equipment.
3. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
4. Thermoset FRP Duct Construction Manual Rev. 2 (2016)
	1. International Mechanical Code (IMC) 2012
		1. IMC 510.8 Duct Construction for Non-Combustible Hazardous Fume Exhaust systems

**1.03 Submittals**

1. Product Data:
	1. Resin
	2. Glass
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 ASTM E-84 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

 2010 National Building Code of Canadaᴿ (NBC)

1. Coordination Drawings: Plans drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
2. Duct installation in congested spaces, indicating coordination with general construction, building components and other building services. Indicated proposed changes to duct layout.
3. Structural members to which duct will be attached.
4. 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.
5. Verification that the duct system can be buried to a maximum depth below Base Flood Elevation (BFE) of six feet (6').

**PART 2 -PRODUCTS**

**2.01 Thermoset FRP Ducts and Fittings**

1. Resin:
	1. Thermoset FRP Resin: Duct and fittings shall be made with a fire retardant resin that is corrosion resistant to carbon monoxide gas and engine exhaust at 900 dg F. Duct shall have a flame spread of less than 25 and a smoke spread of less than 50 for a class 1duct system per ASTME-84 throughout the laminate.
2. 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.
3. Construction:
	* 1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels, according to SMACNA’s “Thermoset FRP Duct Construction Manual” Chapter 7, “Requirements”.
		2. All underground ductwork shall be approved and listed for vehicle exhaust applications per IMC 510.8.
		3. FRP ductwork shall be design safety factor of 10 to 1 for pressure and 5 to 1 for vacuum
		4. Out of roundness of duct shall be limited to ±1/4”
		5. Round Duct: Filament wound minimum Thickness:
			1. The minimum wall thickness for above grade FRP ductwork shall conform to the following operating pressure:
			2. **INSERT BURIAL DEPTH HERE**
			3. **INSERT OPERATING PRESSURE HERE**
4. Lamination:
	1. All ductwork shall have any interior and exterior “C” veil liner 10 mil thick.
	2. Structural layer shall be fabricated toward Winding or Hand lay-up Standard.
	3. Exterior:
		1. Below ground to have a “C” veil layer.
5. 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.
6. Elbows:
	1. Elbows Centerline radius shall be 1-1/2 times the diameter.
	2. Fabricate 45-degree elbows with a minimum of two (2) segments and 90-degree round elbows with a minimum of three (3) segments.
7. Joints:
	1. **Field Joints to be Butt & Wrap type for wet lay-up method.**
	2. **Field Joints to be SMACNA recommended Dry-Fit joint method per SMACNA Thermoset FRP Construction Manual Rev. 2 (2016)**
	3. Field joint kits sent out in bulk form with an extra 20% material for waste
	4. Field joint resin to be the same as duct
8. **INSERT SPECIAL REQUIREMENTS HERE**

**PART 3 - EXECUTION**

**3.01 Duct Installation**

1. General
	1. Store Resin, glass reinforcing and curing 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. 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 result in a fracture of the inner lining and may affect the service life of the duct.
	4. Support large sub-assemblies during unloading and transportation to prevent excessive deflection and over stressing.
	5. Follow manufactures Field Jointing instructions for bonding ductwork together.
2. Burial
	1. Burial depth of duct shall be **INSERT BURIAL DEPTH HERE**
	2. Ductwork Trench shall be dug so that it will be 1.5 times wider than then diameter of the duct.
	3. Fill bottom of trench with a minimum of 6” of back fill (sand or pea gravel) compacted to 80%-90%.
	4. Grade Trench with a 1% pitch back to the largest diameter duct.
	5. Backfill in 6” lift increments compacting 80%-90%.
	6. A minimum of 4” of backfill overtop the duct system is required.

**END OF SECTION 15800**