**Sample Specification from Monoxivent Corrosion Composites**

**SECTION 15800 – FIBERGLASS REINFORCED PLASTIC DUCTWORK**

**PART 1 – GENERAL**

* 1. **Reference:**

## 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. **Work Included:**

## FRP – Fiberglass Reinforced Plastic ductwork and appurtenances, complete and in place, in accordance with the requirements of the Drawings.

## All ductwork in the Chemical Room and connecting the Hydrochloric Acid Scrubber Unit shall be FRP.

* 1. **Standards:**
1. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
	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. **Submittals:**
2. Submit shop fabrication drawings and installation drawings of the ventilation system in accordance with Section **01300 – Submittals.**

**PART 2 – PRODUCTS**

**2.01 General:**

1. Manufacturer:
	1. Provide FRP duct as manufactured by one of the following without exception:
		1. Monoxivent
		2. Yankee Plastics
		3. Or equal
2. Service Conditions:
	1. Ductwork shall be designed for exhausting **Hydrochloric Acid fumes at ambient conditions.** The minimum wall thickness for above grade FRP ductwork shall conform to the following:
	2. Minimum Wall thickness will be in accordance with NPS 15-69, Table 2.
	3. 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).
		1. Surfacing veil shall be C glass veil with a silane finish and a soluble binder.
		2. Chopped strand mat shall be type ECR glass minimum 1.5 oz/sq ft (458 g/sq m) with silane finish and styrene soluble binder.
		3. Continuous roving for chopper gun spray up shall be type E glass.
		4. Woven roving shall be type E glass minimum 24 oz/sq yd (814 g/sq m)
		5. Continuous roving for filament winding shall be type E glass with silane finish.
	4. Minimum Hanger Spacing will be in accordance with ASTM D 3982, Table 1.
	5. Construction:
		1. FRP shall be of filament wound construction with an ASTM C – 582 interior corrosion barrier. Cast duct with no reinforced internal corrosion barrier or press molded fittings will not be accepted.
		2. FRP exterior shall be Monoxivent 824 modified acrylic resin that complies with NFPA 90 for a Class 1 duct material having a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL according to ASTM E 84.
		3. The use of liners to achieve the indicated smoke and flame spread development will not be accepted.
		4. FRP duct shall be factory assembled to the greatest possible extent, with a minimum number of field joints.
		5. Maximum allowable deflection for any size ductwork shall be 12 mm (0.47”) between supports and for any size of duct under worst case operating conditions.
		6. FRP ductwork shall be designed using a safety factor of 10 to 1 for pressure and 5 to 1 for vacuum without exception.
		7. Out of roundness of duct shall be limited to 1% of diameter.
		8. Length of flanged duct sections shall not vary more than 12 mm (0.47”) at 21 degrees C.
		9. Un-flanged duct sections shall be square on the ends in relation to the center axis within 3 mm (0.118”) up to and including 600 mm (24”) diameter and within 4.76 mm (0.187”) for all diameters greater than 600 mm.
	6. Laminates:
		1. Interior resin shall be a premium grade of fire retardant vinyl ester with a flame spread rating of less than 25, I.D. “Class 1” of ASTM E84 “Standard Method of Test for Surface Burning Characteristics of Building Material”. Resin shall be AOC’s #K022, Ashland’s #FR992 or Reichhold #9300.
		2. Exterior resin shall be Monoxivent 824 modified acrylic resin that complies with UL 181 for Class 1 duct.
		3. Ductwork shall have a resin rich inner surface, an interior layer, a structural layer and a resin rich exterior surface.
		4. Inner surface: Nominal 10 mils thick composed of a single ply of the “C “glass surfacing veil, having a resin content of 90%.
		5. Interior layer: Nominal 90 mils thick composed of at least two layers of 1-1/2’’ chopped strand mat. Resin content shall be 75%.
		6. Structural layer: Filament wound type E glass to meet minimum wall thickness as specified. The total wall thickness includes the inner surface.
		7. Exterior layer: Single “C” veil shall be applied to duct exterior without exception.
		8. Exterior coating: Factory applied corrosion resistant gel coat. Dark gray shall be used as the standard color.
3. Fittings:
	1. Fittings shall be hand lay-up construction fabricated from the same resin and have the same strength as the FRP duct.
	2. The internal diameter of fittings shall be equal to the adjacent duct.
	3. The centerline radius of all elbows shall be 1.5 times the diameter.
	4. Elbows 24" (610mm) diameter and smaller shall be smooth radius. Elbows larger than 24" (610mm) diameter shall be mitered.
	5. Elbows 45 degrees or less shall be at least two (2) miter/three (3) gore. Elbows greater than 45 degrees shall be at least four (4) miter/five (5) gore.
4. Flanges:
	1. Provide flanged connections as required to flexible connectors, expansion joints, vessels, demisters, fans, silencers and other locations as shown.
	2. Flanges shall be hand lay-up construction. Dimensions shall be in accordance with PS 15-69 – Table 2 and the duct dimension schedule.
	3. Flange faces shall be perpendicular to the axis of the duct within 0.5 degree.
	4. Flange faces shall be flat to within 0.0313" (0.8mm) up to and including 18" (457mm) diameter and within 0.0625" (1.6mm) for 20" (508mm) diameter and larger.
	5. Gaskets shall be **EPDM/Neoprene**, full face and minimum 0.125" (3.2mm) thickness.
	6. Bolts, nuts and washers shall be Type 316 stainless steel.
5. Joints:
	1. Provide butt and wrap joints in accordance with ASTM D 3982.
	2. Field weld materials shall be supplied by the duct manufacturer. Complete written and online video instructions shall be provided along with Material Safety Data Sheets.
	3. Resin, catalyst and fiberglass materials shall be supplied in bulk for the total number of joints plus 20% extra.

**2.02 Expansion Joints:**

1. Provide expansion joints where shown on the Drawings.
2. Type: W-design configuration with integral flanges suitable for service with FRP duct under the conditions specified.
	1. Material: **EPDM**
	2. Backing rings: 0.394" (10mm) thick, 2" (51mm) wide, type 316 stainless steel where flanged expansion joints or flex connectors are noted.
	3. Extensions: 3" (76mm)
	4. Compression: 2.5" (64mm)
	5. Lateral offset: 2.5" (64mm)
	6. Thickness: 0.250"(6.4mm) minimum
	7. Bolts, nuts and washers: Type 316 stainless steel.
3. Expansion joints shall be flanged where connecting ductwork to equipment, otherwise slip-type will be acceptable. Acceptable manufacturer: Mercer Rubber or equal.

**2.03 Butterfly Dampers:**

1. Round FRP dampers:
	1. Round FRP dampers shall be the butterfly type. FRP fabrication shall meet the corrosion requirements specified in this section for FRP ductwork.
		1. Fabrication:
			1. Frame and blade: premium vinyl ester. Blade shall fully encapsulate shaft. Blades that bolt to a single side of the shaft will not be accepted.
			2. Shaft: Pultruded vinyl ester
			3. Bearings: EPDM/Neoprene
			4. Pins and hardware: Type 316 stainless steel.
			5. Shaft seals: EPDM/Neoprene
			6. Isolation dampers will have full circumference EPDM/Neoprene seals.
			7. Dampers shall have flanged ends or plain ends. Provide Type 316 stainless steel bolts, nuts and washers for flanged connections (By Others).
			8. Balancing/Volume dampers shall have a fully adjustable slot with an extra hole drilled in the handle for contractor to “drill –and-pin in-place” once the system is balanced so handle cannot vibrate loose.

**PART 3 – EXECUTION**

**3.01 Installation:**

1. FRP ducts shall be installed in a neat and workmanlike manner, properly aligned and cut from measurements taken at the site to avoid interferences with structural members, architectural features, openings and equipment.
2. Supports and anchors: All ducting shall be firmly supported with fabricated or commercial hangers or supports in accordance with SMACNA requirements. Where necessary to avoid stress on equipment or structural members, the ducts shall be anchored or harnessed. Expansion joints and guides as shown on drawings shall compensate for expansion due to temperature differences.
3. Support duct risers in accordance with ASHRAE and SMACNA as indicated.

**3.02 Duct Preparations:**

1. Prior to installation, each duct length and all fittings shall be carefully inspected, flushed clean of any debris or dust, and straightened, if not true. All duct and fittings shall be equally cleaned before assembly.

**3.03 Duct Joints:**

1. Butt and Wrap Joints: Prior to joining, ends shall be ground smooth. All dust and debris must be fully removed. Ends shall be resin-coated to prevent corrosion; in duct of 24" (610mm) diameter and above an interior corrosion wrap is required. The joint should be of equal strength as the duct wall. A butt and wrap sequence and thickness chart should be shown on the fabrication drawings and supplied with the Material Safety Data Sheets.
2. Supports and Anchors: All ducting shall be firmly supported with fabricated or commercial hangers or supports in accordance with SMACNA. Where necessary to avoid stress on equipment or structural members, the ducts shall be anchored or harnessed. Expansion joints and guides shall compensate for duct expansion due to temperature differences.

**3.04 Inspection and Field Testing:**

1. Inspection: All finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interference and damage to duct, fittings and gel coat. Damage 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 15800**