



**Sample Specification from Monoxivent Corrosion Composites**  
**SECTION 15800 – FIBERGLASS REINFORCED PLASTIC DUCTWORK**

**PART 1 – GENERAL**

**1.01 Reference:**

- A. 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 Work Included:**

- A. FRP – Fiberglass Reinforced Plastic ductwork and appurtenances, complete and in place, in accordance with the requirements of the Drawings.
- B. All ductwork in the Chemical Room and connecting the Hydrochloric Acid Scrubber Unit shall be FRP.

**1.03 Standards:**

- A. ASTM C 582 – Standard specification for contact – molded reinforced thermosetting plastic laminates for corrosion resistant equipment.
- B. ASTM D 3982 – Standard specification for contact-molded fiberglass ducts and hoods.
- C. ASTM D 2996 – Standard specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Pipe.

**1.04 Submittals:**

- A. Submit shop fabrication drawings and installation drawings of the ventilation system in accordance with Section 01300 – Submittals.

## **PART 2 – PRODUCTS**

### **2.01 General:**

- A. Manufacturer: Provide FRP duct as manufactured by one of the following without exception:
  - 1. Monoxivent
  - 2. Ershigs
  - 3. Yankee Plastics
  
- B. 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:
    - a) Wall thickness an minimum hanger spacing will be in accordance with ASTM D3982, Table 1
  
    - b) Duct with inside diameter of 80-400 mm (4"-16") diameter shall have a wall thickness of 4.76mm (0.125"); duct with inside diameter of 450 mm-600mm (16"-24") diameter shall have a wall thickness of 6.35 mm (0.250").
  
  - 2. The FRP ductwork shall be designed and fabricated to carry air which is laden with chlorine gas.
  
- C. Reinforcement:
  - 1. Surfacing veil shall be C glass veil with a silane finish and a soluble binder.
  
  - 2. Chopped strand mat shall be type E glass minimum 460 gr/sq. m (1.5 oz./sq. ft.) 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 570 gr/sq. m (24 oz. /sq. yd.)
5. Continuous roving for filament winding shall be type E glass with silane finish.

D. Construction:

1. FRP shall be of filament wound construction with an ASTM C – 582 corrosion barrier. Cast duct with no reinforced internal corrosion barrier or press molded fittings will not be accepted.
2. FRP duct shall be factory assembled to the greatest possible extent, with a minimum number of field joints.
3. 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.
4. FRP ductwork shall be designed using a safety factor of 10 to 1 for pressure and 5 to 1 for vacuum without exception.
5. Out of roundness of duct shall be limited to 1% of diameter.
6. Length of flanged duct sections shall not vary more than 12 mm (0.47”) at 21 degrees C.
7. 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.
8. (When Required) Double-Wall Insulated Duct: Inner and outer duct complying with requirements for “Round Duct” description above. Polyurethane foam or isocyanurate 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 7). Insulation is to be factory installed during the filament wound process to maximize quality control.

E. Laminates:

1. 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 Riechhold #9300.

2. Ductwork shall have a resin rich inner surface, an interior layer, a structural layer and an exterior layer with UV resistant coating.
3. Inner surface: Nominal 10 mils thick composed of a single ply of the "C" glass surfacing veil, having a resin content of 90%.
4. Interior layer: Nominal 90 mils thick composed of at least two layers of 1-1/2" chopped strand mat. Resin content shall be 75%.
5. Structural layer: Filament wound type E glass to meet minimum wall thickness as specified. The total wall thickness includes the inner surface.
6. Exterior corrosion layer: Single "C" veil shall be applied to duct exterior without exception.
7. Exterior UV resistant coating: Factory applied corrosion resistant gel coat with UV inhibitors. Light gray or white shall be used as the standard colors of choice.

F. 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 of all elbows shall be 1.5 times the diameter.
4. Elbows 600 mm (24") and smaller shall be smooth radius. Elbows 750 mm and larger shall be mitered. Provide a minimum of three (3) mitered joints (s-piece) for elbows above 45 degrees.

G. 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 ASTM D 3982- Table 1 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 0.8 mm (0.03") up to and including 450 mm (18") diameter and within 1.6 mm (0.06") for 500 mm (20") diameter and larger.
5. Gaskets shall be EPDM, full face and minimum 3.175 mm (0.125") thickness.
6. Bolts, nuts and washers shall be Type 316 stainless steel.

H. 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 15% extra.

**2.02 Expansion Joints:**

- A. Provide expansion joints where shown on the Drawings.
- B. Type: W-design configuration with integral flanges suitable for service with FRP duct under the conditions specified.
- C. Material: EPDM
- D. Backing rings: 10 mm (0.39") thick, 50 mm (2") wide, type 316 stainless steel where flanged expansion joints or flex connectors are noted.
- E. Extensions: 80 mm (3")
- F. Compression: 65 mm (2.5")
- G. Lateral offset: 65 mm (2.5")
- H. Thickness: 6 mm (0.25") minimum
- I. Bolts, nuts and washers: Type 316 stainless steel.
- J. 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:

### A. 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.
2. Leakage shall not exceed 15.17 lps/sq m at 2.5 kPa (3 cfm/sq ft. at 10" w.g.) for balancing and 26.8 lps/sq m at 7.14 kPa (5.3 cfm/sq ft. at 30" w.g.) for isolation. Unless otherwise specified on the drawings, dampers are assumed to be balancing.
3. Fabrication:
  - a) 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.
  - b) Shaft: premium vinyl ester for manually actuated dampers below 750 mm diameter (30") diameter and Type 316 stainless steel for dampers 750 mm and larger.
  - c) Bearings: Teflon
  - d) Pins and hardware: Type 316 stainless steel.
  - e) Shaft seals: EPDM
  - f) Provide balancing dampers with a blade stop consisting of FRP angles. Isolation dampers will have full circumference EPDM seals.
  - g) Dampers shall have flanged ends or plain ends. Provide Type 316 stainless steel bolts, nuts and washers for flanged connections.
  - h) Balancing 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. Any dampers over 1800 mm (70") AFF shall be furnished with chain wheel gear operators.
  - i) Isolation dampers provided shall be tested in accordance with AMCA 500 D. Test reports for each size shall be provided prior to shipping.

## **PART 3 - EXECUTION**

### **3.01 Installation:**

- A. 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.
- B. 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.
- C. Support duct risers in accordance with ASHRAE and SMACNA as indicated.
- D.

### **3.02 Duct Preparations:**

- A. 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:**

- A. 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 600 mm (24") 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.
- B. 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:**

- A. 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.
- B. 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.
- C. 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.

D. 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