

SECTION 15892 - FIBER GLASS REINFORCED PLASTIC DUCT AND DAMPERS

PART 1 – GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install fiberglass reinforced plastic (FRP) duct and all appurtenances, complete and in place, all in accordance with the requirements of the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Pipe Supports
- B. Submittal

1.03 REFERENCED SPECIFICATIONS, CODES, AND STANDARDS

- A. Codes: All codes, as referenced herein, are specified in Section entitled “Reference Standards.”

- B. Commercial Standards

- 1. ASTM D 3567 Practice for Determining Dimensions of “Fiberglass” (Glass-Fiber Reinforced-Thermosetting-Resin) Pipe and Fittings.
- 2. ASTM C 582 Standard Specification for Contact - Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion - Resistant Equipment.
- 3. AWWA M-45 American Water Works Manual of Water Supply Practices "Fiberglass Pipe Design"
- 4. ASTM D 3982 “Standard Specification for Contact Molded “Fiberglass” Duct and Hoods” or NBS PS 15-69 “Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment”
- 5. ASTM D 2992 “Standard Practice for Obtaining Hydrostatic Design Basis for Fiberglass Pipe and Fittings”
- 6. ASTM D 2310 “Standard Classification for Machine-Made “Fiberglass” Pipe

1.04 SUBMITTALS

- A. Shop Drawings

- 1. The CONTRACTOR shall submit Shop Drawings of duct and fittings in accordance with the requirements in the Sections titled “Piping, General” and “Submittals”.
- 2. Fabrication drawings shall have details on Laminate Sequence used.

B. ADDITIONAL SUBMITTAL INFORMATION

1. The CONTRACTOR shall submit a copy of this specification with check-marks by each line to show full compliance or a note with attached supporting information noting any deviation for Engineer review.
2. A letter from the resin supplier stating that the material used for this project complies with the specification and meet all corrosion requirements.
3. Design calculations performed by the manufacturer and stamped by a Professional Engineer for record purposes.
4. Duct manufacturer shall submit certified test results in accordance with ASTM 2992. Engineer will confirm that supplier has completed ASTM 2992 testing.
5. Samples shall be representative of the ductwork (construction method and material used) to be supplied on this project

PART 2 – PRODUCTS

2.01 GENERAL

- A. Manufacturer: Provide FRP duct as manufactured by one of the following w/o exception. All equipment (Duct, dampers, and fittings) shall be the product of a single manufacturer. Out-sourcing of fabrication or parts of the system will not be accepted.
 1. Belco Manufacturing
 2. Ershigs
 3. Bondstrand
 4. Fibercast
- B. Service conditions:
 1. All equipment shall be designed for a minimum working pressure of ___" WC Positive and ___" WC Negative pressure. Buried duct shall be designed per AWWA M-45 Standards and be rated for H-20 Loading. The minimum wall thickness for all FRP duct shall conform to the following:
 - a. Wall thickness for internal positive pressure should be determined by ASTM 2310 using duct manufacturers Certified ASTM 2992 HDB test results. A full copy of the HDB testing should be submitted with the wall thickness calculations.

b.

Duct Inside Diameter (inches)	Minimum Wall Thickness (inches)
3 - 16	0.1875
18 - 24	0.220
30 - 36	0.250

2. The fiberglass reinforced plastic (FRP) ductwork shall be designed and fabricated for odor control service to carry warm, moisture-laden air with hydrogen sulfide, mercaptans and other organic and inorganic compounds typically associated with wastewater treatment.

3. Resin:

a. Resin shall be premium corrosion resistant and fire retardant brominated vinyl ester. Resin shall not contain pigments, dyes, colorants or fillers. Product should have a class 1 flame spread rating (25 or less).

b. Thixotropic agents may be added to control resin viscosity per resin manufacturer's recommendation.

c. Acceptable resins shall be:

- 1) AOC Vipel K022
- 2) Ashland Chemical Hetron FR992
- 3) Interplastics CoRezyn 8442.
- 4) Or approved equal.

4. Reinforcement:

a. Surfacing veil shall be C glass veil with a silane finish and a styrene soluble binder.

b. Chopped strand mat shall be Type E glass minimum 1-1/2 ounces per square foot with silane finish and styrene soluble binder.

c. Continuous roving for chopper gun spray up shall be Type E glass.

d. Woven roving shall be Type E glass minimum 24 ounces per square yard with a five by four weave.

e. Continuous roving for filament winding shall be Type E glass with a silane finish.

C. Construction:

1. All FRP ductwork shall be of filament wound construction for sizes >10" diameter and hand lay-up or filament wound construction for 10" and smaller. Cast pipe with no reinforced internal corrosion barrier or press molded fittings will not be accepted.
2. Maximum allowable deflection for any size ductwork shall be ½ inch between supports and for any size of duct under worse case operating conditions.
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 the diameter.
5. Length of all flanged duct sections shall not vary more than ± 1/2 inch at 70 F.
6. All un-flanged duct shall be square on the ends in relation to the center axis within ± 1/8 inch up to and including 24-inch diameter and within ± 3/16 inch for all diameters greater than 24-inch.
7. Laminates:
 - a. All ductwork shall have a resin-rich inner surface, an interior corrosion barrier, an interior structural layer and an exterior corrosion layer and UV resistant coating.
 - b. Inner surface: Nominal 10 mils thick composed of a single ply of the C glass surfacing veil embedded in a resin-rich surface. Resin content shall be 90%.
 - c. Interior layer: Nominal 90 mils thick composed of at least two layers of chopped strand mat or equivalent chopped strand. Resin content shall be 75%.
 - d. Structural layer: Type E glass to meet minimum wall thickness as specified. The total wall thickness includes the inner surface.
 - 1) Contact molded structural layer shall include alternate layers of chopped strand mat and woven roving.
 - 2) Filament wound structural layer shall be preceded by a layer of chopped strand mat or spray chop. The structural layer shall consist of a minimum of two complete cross hatched layers of continuous filaments applied in a helix angle of 55 to 65 degrees for above-ground ductwork and 75 deg. for any buried ductwork.
 - e. Exterior corrosion layer: Single A or C Veil shall be applied to all duct exterior
 - f. Exterior UV resistant coating: Factory applied paraffinated gel coat with UV inhibitors. Color shall be determined by the ENGINEER.

8. Fittings:
 - a. All fittings shall be hand lay-up construction fabricated from the same resin and have the same strength as hand lay-up FRP ductwork.
 - b. The internal diameter of all fittings shall be equal to the adjacent duct.
 - c. The tolerance on angles of all fittings shall be ± 1 degree up to and including 24 inch diameter and $\pm 1/2$ degree for 30 inch diameter and above.
9. Elbows:
 - a. The centerline radius of all elbows shall be 1-1/2 times the diameter.
 - b. Elbows 24-inch diameter and smaller shall be smooth radius. Elbows 30-inch and larger shall be mitered. Provide a minimum of two mitered joints (3-piece) for all elbows above 45 Deg.
10. Flanges:
 - a. Provide flanged connections to flexible connectors, expansion joints, vessels, demisters, fans, silencers and other locations as shown on the drawings.
 - b. Flanges shall be hand lay-up construction. Dimensions shall be in accordance with ASTM D 3982, Table 1, and the Duct Dimension Schedule.
 - c. Flanges shall be drilled in accordance with ASTM D 3982, Table 1. Backs of flange face shall be flat so that washer seats fully on bolt face and flange backing.
 - d. Flange tolerances shall be in ASTM D 3982, Section 8, Tolerances.
 - e. Gaskets shall be EPDM, full face and minimum 1/8 inch thickness.
 - f. All bolts, nuts and washers shall be Type 316 stainless steel.
11. Joints:
 - a. Provide all butt and strap joints in accordance with ASTM D 3982, Table 2, and manufacturer's drawings.
 - b. Field weld kits shall be supplied by the duct manufacturer. All necessary fiberglass and reinforcing material shall be supplied pre-cut and individually packaged for each joint. Bulk Glass rolls will not be acceptable.
 - c. All resin, catalyst and putty shall be supplied in quantities to complete all field joints plus 20% extra for waste.

2.02 EXPANSION JOINTS

- A. Provide expansion joints where shown on the Drawings.
- B. Expansion joints shall be manufactured by Mercer Rubber, RM-Holz, The Metraflex Company, or equal.
- C. Expansion joints shall be flanged where connecting ductwork to equipment; otherwise, slip-type will be acceptable.

2.03 BUTTERFLY DAMPERS

A. Round Fiberglass Reinforced Plastic Dampers

- 12. All round FRP dampers shall be the butterfly type. FRP fabrication shall meet the corrosion requirements specified in this Section for FRP duct work.
- 13. Leakage shall not exceed 3 cfm/sq. ft at 10" W.C. and 5.25 cfm/sq. ft at 30" W.C. for Isolation. Unless otherwise specified on the drawings, all dampers are assumed to be Isolation.
- 14. 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: Type 316 stainless steel for all dampers.
 - c. Bearings and bushings: Teflon.
 - d. Pins and all hardware: Type 316 stainless steel.
 - e. Shaft seals: EPDM.
 - f. Provide all round isolation dampers with a blade stop consisting of FRP angles with full circumference EPDM seals.
 - g. All dampers shall have flanged ends. Contractor to provide connecting bolts, nuts and washers.
 - h. All dampers 24" or larger shall be provided with Gear Operators with a epoxy coating. Dampers below 24" shall be supplied with hand quadrant actuators fabricated of Type 316 stainless steel with a 5-stage locking quadrant Indicator. All 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 system is balanced so handle can not vibrate loose. Drawing may indicate motorized actuators; if so that shall take precedence. Any dampers over 6' AFF shall be furnished with Chain wheel gear operators.
 - i. FRP dampers shall be manufactured by Swartwout, Division of Phillips Industries, Belco Manufacturing, or Ershigs without exception.

- j. All Isolation dampers provided shall bear the AMCA seal. Dampers are to have been tested in an AMCA laboratory for performance (pressure drop) and leakage.
- k. Dampers may be tested after installation to confirm compliance.

2.08 DUCT HANGERS AND SUPPORTS

- A. All duct supports, interior and exterior, shall meet the requirements of the Section titled "Pipe Supports", except that hangers and supports for fiberglass duct shall be located at maximum spans as shown in ASTM D 3982, Table 1.
- B. Duct supports located on the exterior of the building shall be designed to include the weight of the duct and to withstand all applicable combinations of wind and seismic loading in accordance with the _____ Building Code. Exterior supports shall be located as shown on the Drawings and shall be of the "saddle type" support as per the standard detail shown on the Drawings. The locations of duct supports shown on the Drawings are approximate, and the CONTRACTOR shall be required to confirm the support requirements and locations.
- C. The Contractor shall note that not all duct support locations are shown on the Drawings, and the Contractor shall follow the Specifications herein in locating additional supports as required. The Contractor shall be responsible for the design of additional supports and for the overall stability of the entire support system. Support and hanger details and a detailed layout showing the location of all duct supports and hangers shall be submitted in the shop drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. General: All FRP pipes 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. Exposed pipes shall afford maximum headroom and access to equipment, and where necessary, all piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points. All installations shall be acceptable to the ENGINEER. CONTRACTOR shall obtain training by the pipe manufacturer's field representative in the correct installation and support of all FRP piping.
- B. Supports and Anchors: All ducting shall be firmly supported with fabricated or commercial hangers or supports in accordance with the requirements in the Section titled "Pipe Supports". Where necessary to avoid stress on equipment or structural members, the pipes shall be anchored or harnessed. Expansion joints and guides shall compensate for duct expansion due to temperature differences.

3.02 PIPE PREPARATION

- 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 PIPE 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 pipe 24" Diameter and above an interior corrosion wrap is required. The joint should be of equal strength as the pipe. A butt and wrap sequence and thickness chart should be shown on the fabrication drawings. The laminate sequence for each size duct should be supported by a separate section in the design calculations.
- B. Supports and Anchors: All piping shall be firmly supported with fabricated or commercial hangers or supports in accordance with the requirements in the Section titled "Pipe Supports". Where necessary to avoid stress on equipment or structural members, the pipes shall be anchored or harnessed. Expansion joints and guides shall compensate for pipe 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 pipe, fittings, and coating. Damage shall be repaired to the satisfaction of the ENGINEER.
- B. Field Testing: Prior to enclosure or buying, all piping 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.
 - 1. 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 testing procedures.
 - 2. 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 -