## SUBMITTAL FOR:

# PS 15-69 INDUSTRIAL DUCT

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## NBS PS 15-69 SPECIFICATIONS FOR FRP DUCTWORK
## Standard for Lab Exhaust or Waste Water Treatment

Part 2 - **PRODUCTS**

2.01 **GENERAL**

A. Fiberglass Reinforced Plastic Duct as manufactured by Spunstrand® Inc., or pre-approved equal, and shall be used to convey and distribute air, backwash water, tank drainage and miscellaneous services as shown on the drawings.

2.02 **MATERIALS**

A. FRP DUCT:

1. Type: Filament wound rated at design pressures indicated in the drawings. Minimum wall thickness shall be .125 2" through 22",.187 24" thru 36", .250 42" thru 60". Rectangular ductwork thickness shall be determined bu substituting the long side dimension for the round equivalent diameter thickness, and 1/16 inch greater.
2. Grade: Type 1, Grade 2 RTRP, Class E per ASTM D2310.
3. All duct shall be designed for not less than 20" water column pressure and 12" water column vacuum.
4. A minimum structural safety factor of 5 to 1 shall be used in the design of ducting.
5. Maximum deflection of rectangular duct under deadload and operating conditions shall not exceed 1% of the width of the longest side.
6. The Type A resin used shall be Hetron 992SB, AOC KO22, or Corezyn Corve8440, depending on availability, and selected to meet the exposures and temperatures of the air to be exhausted. (See resin application page.) Fillers other than those added for flame retardance when required, shall **not** be allowed, and should not exceed 5% by weight. Flame spread rating shall be 25 or less per ASTM E-84.
7. Corrosion Liner: Inner surface shall contain one ply of 20 mil thick minimum surface veil saturated with vinylester resin consisting of approximately 90% resin and 10% glass content by weight. The surface veil shall be overlapped a minimum of 1".
8. Structural layer shall be filament wound of Type A premium grade vinylester resin and glass as required for the specific working pressure, bedding conditions, and design conditions.
9. Exterior of pipe shall contain sufficient resin to ensure a relatively smooth surface free from exposed glass fibers or sharp projections and shall contain an ultra violet inhibiting agent.

10. Standard lengths shall be in accordance with the manufacturers published product data sheets. Wall thickness of the duct furnished shall not at any point be less than 87.5% of the nominal wall thickness specified when measured in accordance with ASTM D-3567 Standard Method of Determining Dimensions of Reinforced Thermosetting Resin Pipe and Fittings.
11. Duct stiffness: The duct shall have sufficient strength to exhibit, without structural damage, a minimum rated stiffness in accordance with ASTM D-2412 for the pipe laying conditions as noted for the design conditions.
12. Duct manufactured with a composite structural wall containing sand, alumina or other granular fillers is **not** acceptable.

## 2.03 ACCESSORIES

A. FITTINGS:
1. Construction shall be similar to that for the ducting.
2. Bends shall be formed over a removable mold up thru 30"∅ and fabricated from straight duct for all larger sizes with the following miter segments:
    a. Bends up to 30° - 1 miter / 2 gore
    b. 31° to 60° - 2 miter / 3 gore
    c. 61° to 90° bend - 4 miter / 5 gore
3. Corrosion resistance and working pressure equal to that of connecting duct.

B. DUCT JOINTS:
Same Material as the duct and shall meet or exceed the hoop tensile strength and axial strength requirements of the duct.
1. Joints
    a. Duct joints shall be butt and wrap.
    b. Fittings shall be plain end for butt and wrap.
    c. Adhesive material for field joints shall be suitable for minimum 250° F continuous service.
2. Flanges
    a. Flanges shall be hand lay-up per NBS PS 15-69 and furnished undrilled.
    b. Flange gasket shall be suitable for 250° F continuous service and constructed of neoprene rubber or approved equal. Gaskets will be supplied by others.

C. SUPPORT AND HANGERS:
1. FRP Ductwork shall be supported at intervals no greater than 10-foot centers. Supports and Hangers shall transmit all ductwork load into the building structural frame through a system of intermediate beams and struts as necessary to accommodate requirements of these specifications. Supports will be by others.

D. DAMPERS:
1. FRP dampers shall be fabricated with the same materials as the duct. No resin variations will be acceptable. Blade shall be FRP 2 piece molded including blade stiffeners per schedule on drawing. Damper blade shall be offset 5° in closed position to form a normal stop on wall of duct. Axle to be pultruded FRP made with same resin and continuous strand roving. Bearings to be Teflon. O-rings shall be Viton. No metal parts or cut edges in airstream will be allowed.
2. Volume dampers to be manually operated Spunstrand® Inc. single blade, plain end by plain end volume dampers.
3. Balancing dampers to be Spunstrand® Inc. BA series, or Swarwout model 912 with blade shop, axle shaft seals and locking hand quadrant.
4. Isolation dampers to be Spunstrand® Inc. ZL Series (Zero Leak), Ershigs type "B", or Swartwout model 914 with blade seals, axle shaft seals, and gear operator. Flanges included on all isolation dampers and on balancing dampers when shown on drawings. Either damper submitted shall have AMCA certified leakage rates os shall be individually water tested and certified leak free. No other shop-fabricated dampers shall be allowed. See separate specifications for Zero Leak Dampers and cut-sheets.
5. Rectangular Dampers:
    a. Rectangular multi-blade volume dampers to be single blade manual dampers manufactured by Spunstrand® Inc.
    b. Rectangular multi-blade dampers shall be Swartwout 426AF with airfoil blade seals, rated with certified AMCA leakage rates and shall not exceed 20 cfm per sq / ft.

E. SILENCERS:
1. Fiberglass Reinforced Plastic Silencers shall be manufactured by Spunstrand® Inc. and David P. Wilson **FiberSonic Model FS-00-00-00,** or pre-approved equal. Silencer shall be tested for insertion loss, self-noise, and pressure drop in an independent NVLAP accredited laboratory in full accordance with ASTM E477. Testing shall be completed and data available for review 72 hours prior to bid date. Test data for insertion losses to meet or exceed the acoustical data published in the specification tables.
2. Silencers above ground to installed per manufacturer's recommendations.
3. Silencers installed below ground should either be accessible inside a watertight concrete vault, or fitted with a schedule 80 PVC drain at the lowest point for piping back to plenum. Water entering the duct by any means will find a low point in the silencer, and must have a provision for draining.
4. See Fibersonic Silencer™ Construction Specification for details.

## 2.04 QUALITY ASSURANCE

A. Manufacturer shall provide the following information with the pre-approval package:
1. (2) sample cutouts demonstrating 100 to 110 mils clear liner with no antimony and filament wound structural laminate. Samples to be a minimum of 8"∅ cut out and a 12"∅ piece of duct at least 12" long complying with RTP-1 visual level II.
2. Company filament winding history and at least (2) FRP duct job names with similar type construction, including contact names and phone numbers.
3. (2) copies of the fabricators ISO 9000 based Quality Control Manual, or equal.
4. A letter from an outside testing agency confirming RTP-1 visual level II quality and the quantity and the size of the specimens examined.
5. Certified testing data from an outside testing agency confirming the resin and

glass contents of the liner and structural layers separately.

6. Copies of burial calculations for at least 3 sizes of duct between 18" and 48"∅.
7. Any fabricator unable to provide this information and samples to the engineer 48 hours prior to bid will not be considered.

B. All FRP ductwork shall be fabricated and installed by qualified, experienced mechanics, who have a minimum of 5 years experience with the lay-up, fabrication and joining of this type of material.

C. FACTORY INSPECTION:
   1. Owner shall be given access to the FRP ductwork and all quality control records during fabrication and upon completion for the purpose of verifying compliance to the Contract Documents.
   2. The owner shall maintain the right to tour the FRP duct manufacturer's plant anytime that fabrication is in process prior to final shipment. The owner and engineer may exercise the option, without any advance notice, to tour the plant and inspect all stages of fabrication to ensure that quality control is being maintained.
   3. Inspection by owner does not relieve any responsibility of the fabricator to meet the requirements of this specification.
   4. Final Inspection: The engineer and owner may carry out a final inspection of the equipment prior to shipment. Fabricator shall give the owner a minimum of 5 days advance notice of scheduled ductwork shipment. Prior to final inspection by owner, the ductwork shall be cleaned of all foreign material and shall be in a position that allows easy access and viewing.

D. ACCEPTANCE:
   1. Lack of compliance with any aspect of the specifications and drawings will be grounds for rejection of the equipment.
   2. Repair of rejected equipment: Repair procedures must be approved by the owner prior to implementation. No more than 5% of the surface area of each FRP duct component may be repaired.

E. The fabricator's inspector (Quality Control Manager) will provide the owner with a complete Quality Control report for the job. The report will be available within 15 days after the final parts are shipped. The fabricator will have available after each shipment the completed QC sheets for review upon request at any time.

## 2.05 SUBMITTALS

A. Provide the following information in addition to the standard submittal requirements with the Bid:
   1. The fabricator shall submit for approval all reference standards, fabrication drawings and any engineering details of the duct design prior to beginning fabrication.
      a. The submittal should include all information utilized by the fabricator which describes specifically how their FRP duct and fittings are manufactured. This should be in the form of shop drawings, standards, specifications, other shop instructions and QC records. This should include, but not be limited to:

1. Resin type
    2. Types and amounts of filler
    3. Corrosion liner description
    4. Reinforcement types for hand lay-up or chopped laminates

b. For filament-wound laminates:
    1. Helix angle
    2. Glass content range
    3. Strand yield
    4. Strands per inch in the winding band
    5. Ply thickness
    6. Amount of chop or unidirectional roving interspersed with winding, if any, and location within laminate

c. For all fabricated parts
    1. Construction type
    2. Laminate thickness
    3. Ply sequences
    4. Glass content range

d. For all secondary overlays (both interior and exterior):
    1. Laminate thickness
    2. Ply sequences and widths

e. Construction details for all other special configurations and fabricated parts.

2. FRP round duct cutout a minimum of 8" diameter and of the quality of workmanship and glass / resin being quoted. These will be retained for quality comparison on materials shipped to jobsite.
3. Recommended procedure for the protection and handling of materials prior to installation.
4. ISO 9000 based Quality Control Manual detailing shop QC inspection procedures, documentation and samples of all shop QC forms utilized in the process.