SPECIFICATIONS

CONTACT MOLDED
FIBERGLASS DUCTING

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CONTACT MOLDED FIBERGLASS DUCTING SPECIFICATION

1.0 SCOPE

The following is a specification for contact molded glass fiber reinforced process ducting and fittings as developed and adhered to by HEE Environmental Engineering. This specification conforms to the National Bureau of Standard's Voluntary Product Standard PS 15-69 and covers construction, workmanship, test, procedure and auxiliaries for products intended for use in aggressive chemical environments. The product standard is based on existing technology, accepted industry practice and our experience of fabrication by the tape wound method and the contact molded method.

2.0 CONSTRUCTION

2.1 MATERIALS

2.1.1 Resin – The resin shall be VINYLESTER such as Reichold DION FR ® 9300or equal and shall achieve a Class 1 flame spread of 25 or less per ASTM E-84 tunnel test by using one and a half to three percent (1 1/12 – 3%) Antimony Trioxide.

2.1.2 Fillers – The above shall not contain any filler except as required for viscosity control.

2.1.3 Reinforcing Material – The reinforcing material shall be a commercial grade of glass fiber having a suitable bond between glass reinforcement and resin such as manufactured by Owens-Corning or John-Manville.

2.2 PRODUCT

2.2.1 Laminate – The laminate shall consist of an inner surface, a first interior layer, a second interior layer, an exterior layer and an exterior gel coat. The corrosion liner shall consist of the inner surface and the first interior layer.

2.2.2 Inner Surface – The inner surface shall be free of cracks and crazing with a smooth finish, resin rich to avoid exposure of glass fibers. Some waviness is permissible as long as the surface is smooth and free of pits. A "C" –glass veil or NEXUS® synthetic surfacing veil shall be used on the inner surface to provide a resin rich surface of 90 percent (90%) resin and ten percent (10%) glass. Synthetic surfacing veil shall be used for duct exposed to hydrogen fluoride.

2.2.3 First Interior Layer – The first interior layer shall consist of three (3) ounce glass mat, impregnated with resin to a ratio of two-thirds resin to one-third glass fiber.

2.2.4 Second Interior Layer – The second interior layer shall consist of three (3) once glass mat impregnated with resin to a ratio of two-thirds resin to one-third glass fiber. Successive layers shall be a applied to achieve the desired material thickness per Table I.

2.2.5 Exterior Layer – The exterior layer shall consist of a "C" –glass veil or NEXUS® synthetic surfacing veil impregnated with resin.

2.2.6 Exterior Gel Coat – The exterior Gel coat shall be commercially available material, consisting of polyester resin, a pigment color, and an ultra-violet light inhibitor.

2.3 FINISH

2.3.1 Cut Edge – All cut edges shall be coated with resin so that no glass fibers are exposed.

2.3.2 Joints – Finished joints shall be built up in successive layers and be as strong as the pieces being joined and as crevice free as commercially practical. The width of the first layer shall be two (2) inches minimum and each layer shall increase in width uniformly until the desired thickness is achieved.

2.3.3 Appearance – The finished laminate shall be as free as commercially practical from visual defects such as foreign inclusions, dry spots, air bubbles, pin holes and delamination.

2.4 METHOD

2.4.1 Tape Wound Method – Round Ducting with an inside diameter of 38 inches and smaller shall be manufactured by the tape winding method utilizing a rotating mandrel of the required duct size.

2.4.2 Chop Strand Method – All other duct size and fittings round, square or rectangular shall be manufactured by the chop strand method.

3.0 DUCT SIZE AND TOLERANCE

3.1 ROUND DUCTING

The size of round ducting shall be determined by the inside diameter in inches. The standard size shall be 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36, 42, 48, 54, and 60 inches. Unless otherwise specified, the tolerance, including out-of- roundness, shall be ± 1/8 inch for ducting up to and including 12 inches and ± 1/4 inches or ± 1 percent (1%) whichever is greater, for ducting exceeding 12 inches.

3.2 RECTANGULER DUCTING

The size of rectangular ducting shall be determined by the inside dimensions. There are no standard sizes for rectangular ducting. Unless otherwise specified, the tolerance on ordered sizes shall be ±1/4 inches for dimensions up to 18 inches and ± one percent (1%) on dimensions greater than 18 inches.

3.3 WALL THICKNESS

The minimum nominal wall thickness of round ducting shall be in accordance with Table I. For rectangular ducting, the minimum nominal wall thickness shall be as specified to Table I substituting the longer side for the diameter.

3.4 FITTINGS

Tolerance on angles shall be ± 1 degree through 24 inches, ± 7/8 degree for 30 inches, ± 3/4 degree for 36 inches, ± 5/8 degree for 42 inches and ± 1/2 degree for 48 inches and above. Wall thickness of the fittings shall be at least that of the ducting of equivalent size.

3.4.1 Elbows – Standard elbows shall have a centerline radius of one and one-half times the duct diameter.
3.4.2 Lateral – Standard lateral shall be 45 degrees.
3.4.3 Eccentric or Concentric Reducers – Lengths of standard reducers, unless otherwise specified, shall be five times the difference in diameters. Minimum wall thickness shall be that required for the larger diameter duct as shown in Table I.

3.5 STRAIGHT CONNECTIONS

3.5.1 Butt Joints – Strength of the butt joint shall be at least equal to that of the duct and shall be made in accordance with 2.3.2. Total minimum width of the joint shall be 3 inches foe 1/8 inch thickness, 4 inches for 3/16 inch thickness and 6 inches for ¼ inch thickness.

3.6 FLANGES

3.6.1 Flange Dimensions – Dimensions shall confirm with table I. Flanges thickness and width for rectangular duct shall correspond to those for round ducts having the same diameter as the longer side of the rectangular dusts.
3.6.2 Flange Attachment – Duct wall at the hub of the flange shall be at least 1-1/2 times the normal thickness of the duct and taper to normal thickness over a distance of the flange width.
3.6.3 Face of Flange – Face of Flange shall have no projections or depressions and shall be perpendicular to the centerline of the duct. A camber of 1/8 inch with respect to the centerline, measured at the O.D. of the flange shall be allowable.
3.6.4 Drilling – Standard flanges shall be supplied un-drilled unless drilling is specified by the customer
3.6.5 Flange Bolting – The bolt holes shall straddle the centerline unless otherwise specified. The number of the bolt holes and size shall be specified in Table I. Rectangular flange width and bolt spacing shall be the same as that for the diameter corresponding to the longer side.

4.0 RECOMMENDED INSTALLATION PRACTICE

4.1 DUCT HANGER AND SPACING

Hangers shall be band type hangers contacting 180 degrees of the duct surface. The maximum duct hanger spacing shall be as specified in accordance with Table I

4.2 UNDERGROUND INSTALLATION

Fiberglass duct as manufactured by HEE Environmental Engineering is not recommended for underground installation.

4.3 BOLT, NUTS, WASHER

Bolts, Nuts and Washers shall be furnished by the customer unless otherwise specified, Metal washers shall be used under all nuts and bolt heads. All nuts, bolts and washers shall be of a material suitable for the exterior environment.

4.4 GASKETS

Gaskets shall be furnished by the customer unless otherwise specified. Gasketing materials shall be at least 1/8 inches in thickness with a chemical resistance suitable for the environment. Gaskets should have a Shore A or Shore A2 hardness of 40-70.

4.5 RECOMMEMDED PRACTICES FOR JOINING

4.5.1 Preparation of Duct Surface – The surface of the duct should be sanded or ground to a rough finish approximately 6 inches back from the joint.

4.5.2 Mixing of Bonding Material – Vinylester resin is mixed with catalyst (MEKP) just prior to temperature and humidity conditions.

4.5.3 Glass Fiber Matt – The glass fiber matt should be pre-cut to the appropriate widths necessary to obtain the thickness desired.

5.0 INSPECTION AND TEST PROCEDURES

5.1 INSPECTION AND TESTING

5.1.1 Specimens – Tests shall be made on specimens cut from waste areas when possible; otherwise, the specimens shall be cut from flat laminated prepared in the same construction and by the same techniques as the process equipment. In all cases, the average value of the indicated number of specimens shall be used to determine conformance with detailed requirement.

5.1.2 Conditioning – The test specimens shall be conditioned in accordance with Procedure A of ASTM Designation D618-96, Standard Practices for Conditioning Plastics for Testing.

5.2 TEST

5.2.1 Glass Content- The glass content shall be determined in accordance with ASTM Designation D2484-94, Standard Test Method for Ignition Loss of Cured Reinforced Resins, except the specimens tested shall be approximately 1 square inch in area and low temperature pre-ignition prior to placement in ignition furnace is recommended. The average for five specimens shall be considered to be the glass content.

5.2.2 Tensile Strength – Tensile strength shall be determined in accordance with ASTM Designation D638-96, Standard Method for Tensile Properties of Plastics, except that specimens shall be that actual thickness of the fabricated article and the width of the reduced section shall be 1 inch. Other dimensions of specimens shall be as designed by ASTM Standard for Type 1 specimens for material over 1/2 inch to 1 inch, inclusive. Specimens shall not be machined on the surface. Tensile strength shall be the average of five specimens tested at 0.20 to 0.25 inch/minutes speed.

5.2.3 Flexural Strength – Flexural strength shall be determined in accordance with procedure A and Table I of ASTM Designation D790-96a, Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulation Materials, except that the specimens

shall be the actual thickness of the fabricated item and the width shall be 1 inch. Other dimensions of the specimens shall be as designated by the ASTM Standard. Specimens shall not be machined on the surface. Tests shall be made with resin rich side in compression, using five specimens.

5.2.4 Flexural Modulus – The tangent modules of elasticity in flexure shall be determined by ASTM Method D790-96a. Refer to section 5.2.3

5.2.5 Hardness – The hardness shall be determined in accordance with ASTM Designation D2583-95, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser. Calibration of the Barcol instrument shall be verified by comparing with blank specimens having known readings of 85 to 87 and 2 to 46. Ten readings on the clean, resin rich surface shall be made. After eliminating the two higher and two lower readings, the average of the remainder shall be the reported hardness reading.

TABLE I. REINFORCED VINYLESTER ROUND DUCT DIMENSIONS
(Dimensions are in inches unless noted otherwise)

I.D Inches	Wall Thickness (Min) Inches	Allowable Vacuum (Inches of Water) (1,2)	Allowable Pressure (Inches of Water)	Flange Diameter (O.D.)	Flange Thickness	Bolt Circle Diameter	Bolt Hole Diameter	Number Of Bolt Holes	Allowable Spacing Support (Feet) (3,4)
2	0.125	405	705	6-3/8	1/4	5	7/16	4	8
3	0.125	405	500	7-3/8	1/4	6	7/16	4	8-1/2
4	0.125	210	410	8-3/8	1/4	7	7/16	4	9
6	0.125	64	350	10-3/8	1/4	9	7/16	8	10
8	0.125	30	180	12-3/8	1/4	11	7/16	8	10
10	0.125	16	340	14-3/8	3/8	13	7/16	12	10
12	0.125	9	280	16-3/8	3/8	15	7/16	12	9-1/2
14	0.125	7	220	18-3/8	3/8	17	7/16	12	9
16	0.125	6	290	20-3/8	1/2	19	7/16	16	8-1/2
18	0.125	5	240	22-3/8	1/2	21	7/16	16	8
20	0.125	5	190	24-3/8	1/2	23	7/16	20	7-1/2
24	0.187	9	140	28-2/8	1/2	27	7/16	20	10
30	0.187	7	100	34-3/8	1/2	33	7/16	28	9
36	0.187	5	70	40-3/8	1/2	39	7/16	32	8
42	0.250	10	120	46-3/8	5/8	45	7/16	36	11
48	0.250	9	100	54-3/8	5/8	52	9/16	44	10
54	0.250	7	80	60-3/8	5/8	58	9/16	44	9-1/2
60	0.250	6	60	66-3/8	5/8	64	9/16	52	9

(1) A 5 to 1 design factor of safety based on the data in Table II. Also based on 10 foot lengths between stiffener rings for vacuum service.
(2) These ratings are suitable for use up to 180 degrees Fahrenheit (82.2 degrees centigrade) in pressure services and ambient atmospheric temperatures on vacuum services. For ratings at higher temperatures, consult the manufacturer.
(3) Based on 1/4 inch span deflection on air conveying system at 180 degrees Fahrenheit maximum.
(4) Based on duct systems not subjected to more severe services conditions such as additional weight caused by liquid or solids build-up in the duct system, effects of wind loading on outdoor installations, or possible failure of intermediate dust hangers.

Property at 73.4 degrees F. (23 C.)	Thickness (inches)			
	1/8 to 3/16	1/4	5/16	3/8 and up
Ultimate Tensile Strength (Minimum)	9,000	12,000	13,500	15,000
Flexural Strength (minimum)	16,000	19,000	20,000	22,000
Tangent Modulus of Elasticity in Flexure (minimum)	700,000	800,000	900,000	1,000,000

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