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The following are the broad design "steps" that would need to be undertaken in designing and specifying a successful duct installation - regardless of the materials of construction.

1: Determine the specific chemical service environment(s) (i.e. identifying all chemicals that will be conveyed in the fume stream, the concentration of those chemicals, and the operating temperatures).

2: Select the appropriate FRP composite resin system, based on the information gathered in #1. Consult with Industrial Fiberglass and/or the resin manufacturers for corrosion tables and recommendations, by resin type.

3: Select the appropriate FRP laminate construction - again, based on the specific chemical service environments developed in #1. Consult with Industrial Fiberglass on the type and thickness of the corrosion liner that will provide the optimum service life, and the lowest cost of ownership.

4: Determine if fire retardancy is an important consideration for your client. If so, specify the ASTM E-84 flame spread and smoke generation values that are appropriate for your project.

5: Determine capacity (CFM) of ducting required for each pickup location. Make preliminary duct size selections. Use NBS PS-15-69 (Table #2), or SMACNA standard duct sizes, whenever possible.

6: Determine the maximum velocity that will be seen by the duct system. From the velocity data, after consulting with the MSDS sheets for the chemical service environments identified in #1, determine if static charge buildups are of concern for the concentrations of chemicals for which the duct is being designed.

7: If static charge buildup and potentially explosive service conditions can occur, then select the best type of conductive inner liner for your application; along with the techniques and methods to be employed for grounding the liner.

8: Determine if the duct will be operating under pressure (outlet side of the fan); or vacuum (inlet side of the fan). Based on the nameplate ratings of the fan selected, establish the ratings in inches of water column for the duct design. If an internal vacuum will exist, it is almost always the controlling design criteria for the wall thickness of the duct (assuming proper support spacings).

9: Select the type (shape) of the duct to be used for this project (i.e. round, oval, or rectangular). As a rule of thumb: Oval duct will cost about 1.25 times the cost of round duct for equal airflow capacity. Rectangular duct will cost about 1.5 times the cost of round duct, again for equal airflow capacity.

10: Select the type of field duct joints that are to be provided. Bell and spigot socket joints will often provide the lowest installed cost. Other alternates include: Plain end duct and fittings with field butt overlay welds, flanged joints, bell and spigot gasketed joints, and mechanical couplings.

11: If temperatures inside the duct (or on the outside) will vary or cycle - design the duct for thermal expansion. We can help with a finite element analysis.

12: Determine the locations, spacing, and types of duct supports that will be installed. Many times the type and spacing of the duct supports may determine the duct wall thickness required. One consulting engineer has even said, in his literature, that 95% of all FRP composite pipe and duct failures are because of improperly designed supports and installation. Our sister company, Pipe Supports, Inc., can help with the design and type of supports.

13: Determine the need for fume dampers. Are these dampers to be for shut-off, volume control, or balancing the system. Again, round dampers are less costly than rectangular dampers. Also determine how those dampers will be supported, to include the forces from opening and closing.

14: Determine where flexible and expansion joints will be installed. They should be used at all fixed equipment locations and all rotating equipment (fans, etc.). Determine the type of ends for these expansion joints (sleeve or flanged). Also check for the amount of flexing and expansion that these devices must accommodate.

15: Prepare preliminary duct routing, and elevation and plan view AutoCad drawings. Have a qualified FRP duct manufacturer review those drawings for cost savings input, and possible problem areas that should be addressed. Industrial Fiberglass would welcome the opportunity to provide you this support.

16: Prepare detailed and complete project specifications to insure that your client receives their best buy per year of service life. We can provide you guide specifications that can easily be adapted to your specific project.

17: Have an FRP duct manufacturer provide you budget pricing on the final duct design for review with the client. Again, this is a service that we would be glad to provide. If the budget pricing is over "target", we can work with you to find ways to bring the project in on target.

18: Prequalify at least one FRP composite duct supplier, naming them as a reference in the specifications - to help insure the client obtains the long term quality that is expected. Naturally we would hope to be included.

19: Review quotations received to insure that all bidders are quoting to the same level of standards and specifications. An alternate would be to select the preferred vendor and negotiate a contract. (Because of the criticality of their projects, major chemical companies; such as Dow Chemical, DuPont, and Shell often use this Engineering and Manufacturing Service Contract (EMSC) approach.)

20: To help you compile all the information necessary to successfully design and specify an FRP composite ducting system we have prepared a Duct Survey Form for your review with your client. A copy of that survey form is available upon request.

21: We can also provide (upon request) basic information on the different "Series" of FRP composite duct available; two bulletins on different types of duct fittings that are available, and a table of our resource personnel.

22: As further support, we can provide a complete qualification binder and catalog. Included in this binder will be copies of the resin companies' corrosion tables, additional background information on designing FRP composite duct, a CD of the SMACNA FRP Composite Duct Design Manual, and CDs from Reichhold, Dow, and Ashland - all containing a compilation of technical articles on designing and specifying FRP composite pipe and duct.

23: We also invite you to visit our web site, www.ifs-frp.com, for additional background information on us, our experience, and resources.