ENGINEERING LETTER | 20
The New York Blower Company ● 7660 Quincy Street, Willowbrook, Illinois 60527-5530

ACCESSORIES AND CONSTRUCTION MODIFICATIONS FOR FRP FANS

INTRODUCTION

The applicability of corrosion-resistant FRP fans to a wider range of applications is enhanced through the use of accessories and construction modifications. The purpose of this Engineering Letter is to provide supplemental information concerning accessories and modifications that are unique to FRP fans.

ACCESSORIES

SHAFT SEALS are used where the standard close-clearance shaft opening is not deemed to be adequate. (Standard construction on **nyb** FRP fans have shaft openings fitted with Teflon® membranes that have shaft holes 1/32" larger than the FRP shaft sleeves.)

nyb's standard shaft seal for FRP fans utilizes a pair of Viton® lip seal elements pressed into an FRP casing. As an option, Teflon shaft seal elements can be provided for more corrosive applications. The seal assembly is secured to the fan housing with 316 stainless steel studs. The heads of the studs are encapsulated in FRP to eliminate exposure to airstream corrosives. See Figure 1.

Because the seals must ride on a smooth, heat-conductive surface, the standard construction of the shaft encapsulated in FRP is not suitable. Therefore, the seal assembly includes the substitution of a 316 stainless steel sleeve for the standard FRP sleeve. As an option, Hastelloy® C-276 sleeves are available for those cases where the corrosive environment makes stainless steel unacceptable.

The seal assembly is lubricated with "Never-Seez®," a graphite compound.

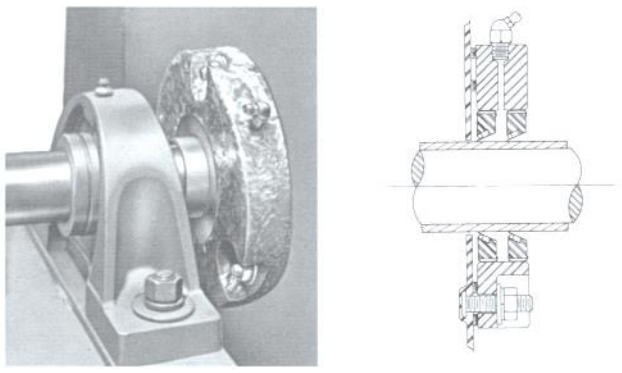

Figure 1 - Photo of FRP shaft seal mounted and diagram illustrating lubricated lip seal elements.

Seals are recommended wherever corrosive or toxic gases are being handled, or when outside air is to be kept from entering the fan and contaminating a process. It is difficult to predict the conditions that increase leakage into or out of the fan around the shaft opening. However, as a general rule, higher positive or negative pressure differentials will result in greater leakage.

OUTLET DAMPERS are designed to bolt directly to the outlet flange on FRP fans. RFE and FPB dampers are round, with one blade. FE and GFE dampers are rectangular, with parallel blades, and are available for MP fans only. See Figure 2.

Casings and blades are constructed of Derakane® 51 0A40. All damper parts are constructed of FRP except the 316 stainless steel control quadrant and hardware, and the corrosion-resistant, injection-molded bearings.

Damper casing halves are bolted together to allow for easy replacement of damper vanes and bearings. All components can be disassembled except vanes from rods.

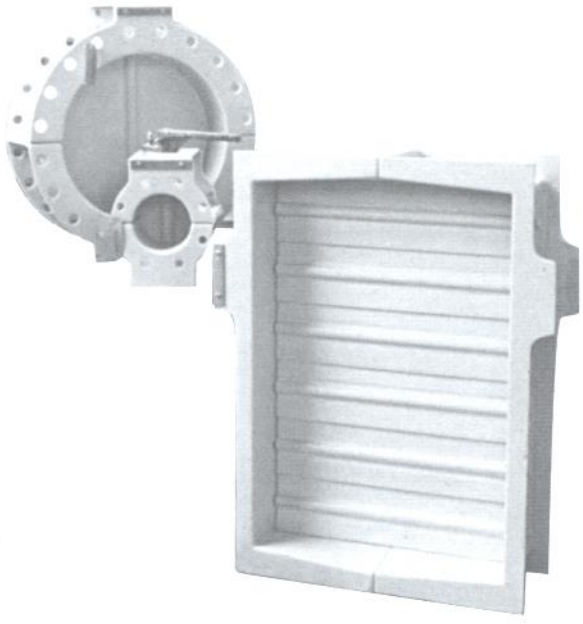

Figure 2 - Three types of FRP outlet dampers as manufactured by nyb.

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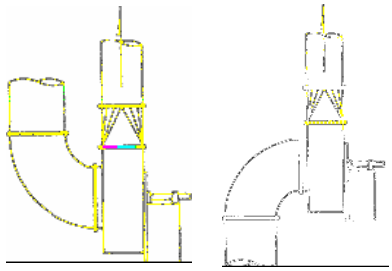
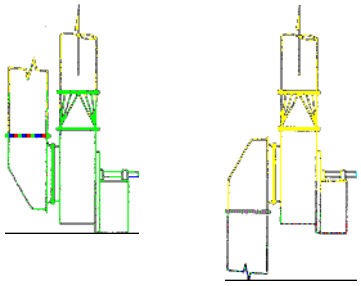
Hastelloy ® is a registered trademark of Haynes International, Inc.

Never-Seez® is a registered trademark of Bostik.
Derakane® is a registered trademark of Ashland, Inc.

INLET BOXES are used to accomplish a 90° turn at the fan inlet when space is limited. Fan applications typically involve less than ideal connections between the fan and the process. When the connections cause other than straight, uniform flow into the fan inlet, the fan suffers performance losses beyond those determined by ordinary duct-resistance calculations or pressure drop measurements. (See Engineering Letter 5 for a description of the effects of inlet connections.) Therefore, it is advantageous to use **nyb** test-rated inlet boxes to reduce flow losses, and to make those losses predictable for inclusion in system design calculations. See Figure 3.



High, unpredictable effect on fan selection and system performance.



Minimum, calculable effect on fan selection and system performance.

Figure 3 - Inlet Connections

Figure 4 - FRP Fume Exhauster with Inlet Box

Inlet Boxes are available for Fume Exhausters and General-Purpose Fume Exhausters. See Figure 4.

Construction of FRP inlet boxes is similar to that of FRP Fume Exhausters. Standard construction is with Derakane 510A40 vinyl ester resin. Inlet boxes are made in two sections bolted together with 316 stainless steel hardware.

THREADED FRP DRAIN with PVC plug, 1" npt, is bonded to the lowest point in the housing scroll.

COMPANION FLANGES are available with FPB and RFE fans for those applications where a flexible or slip connection to the fan inlet and/or outlet is required. Companion flanges are commonly used on fans furnished with vibration isolation.

INSPECTION PORTS are used for periodic maintenance checks on the wheel and the housing interior. They are available on all FRP fans, and are located on the drive side half of the housing (GFE and FE fans) or the inlet side half of the housing (FPB and RFE fans), at either the 2 o' clock or the 10 o'clock position, opposite the fan discharge.

RAISED BOLTED CLEANOUT DOORS are available on GFE and FE fans. They are located above the fan centerline at either the 2 o'clock or the 10 o'clock position, opposite the fan discharge.

OUTLET TRANSITIONS provide for a rectangular-to-round transition on the outlets of various GFE and FE fan sizes. They are available on GFE and FE Sizes 18 through 36 and 48 (MP fans only). The I.D. of the round outlet is equal to that of the fan inlet, and also to the transition length.

MODIFICATIONS

ALL-VINYL ESTER AIRSTREAM provides increased resistance to certain corrosives. Engineering Letter 18 provides data for the corrosion resistance of the standard construction and of the all-vinyl ester construction.

Standard construction uses vinyl ester resin for wheels. All other FRP parts are made of polyester resin. When an all-vinyl ester airstream is specified, parts normally made of polyester are made of vinyl ester. See Engineering Letter 19 for more details.

SURFACE VEIL is used to reinforce the surface layer of resin for added resistance to specific corrosives or to meet the specification of ASTM D4167. Veil may be applied to just the wheel, or to just the housing, or to the entire airstream. **nyb** uses a synthetic surface veil that is described in detail in Engineering Letter 21.

GRAPHITE IMPREGNATION of the final resin coat on airstream surfaces provides for static grounding. This important modification allows the fan to handle gas fumes that are not only corrosive but also potentially explosive.

FRP is inherently non-sparking and the electrical resistance of FRP may be considered infinitely high since it is essentially a non-conductive or non-metallic material. Because FRP is non-metallic, the physical contact of two FRP parts or a metallic

part with an FRP part will not produce a spark. However, FRP does have the tendency to hold a charge of static electricity. This charge can be generated by a dry gas or airstream passing over FRP. The fan can ultimately become a capacitor capable of discharging high-voltage, low-amperage sparks.

The static electricity or charge which builds up on the airstream surface of the FRP part must be eliminated in applications where the fumes are potentially explosive. This can be accomplished by making the surface electrically conductive, providing an electrical path to dissipate the relatively low-current static charge.

STATIC GROUNDING - FRP fans can be effectively grounded for the removal and control of static electricity by incorporating graphite in the airstream layer of resin. See Figure 5.

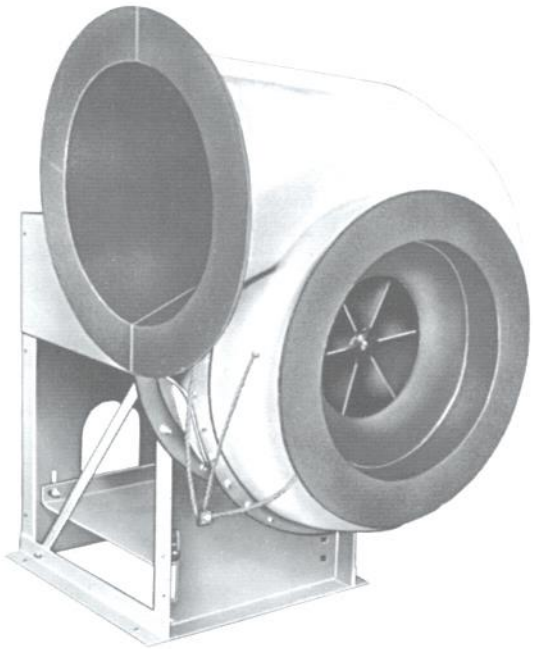


Figure 5 – FRP Radial Fume Exhauster with graphite impregnation and copper grounding straps.

The proper application of the graphite-resin coat is critical if static grounding is to be achieved. Airstream and related surfaces are coated with a mixture of graphite flakes and resin to form a smooth, continuous graphite surface. FPB, RFE, and non-rotatable GFE and FE fans are furnished with contacts which are imbedded in the graphite layer to accommodate grounding straps made of twisted, bare copper wire. The straps are attached to the fan base on FPB and RFE fans and to inlet side angles on the large Fume Exhausters. Rotatable GFE and FE fans do not require grounding straps. These fans are completely grounded to the pedestal through the mounting studs on the housing. This design effectively grounds the airstream to the steel base of the fan. However, **it is essential that the customer ground the fan base at the installation.**

GROUNDING FEATURES - Surface resistivity of not more than 1 megohm from any point on the airstream to ground is generally considered adequate. **nyb**'s process of static grounding by graphite impregnation provides surface resistivity well below the 1-megohm figure.

Tests of **nyb** FRP fans equipped for static grounding indicate that there is sufficient conductivity through the bearings to eliminate the need for supplemental brush-type contacts to ground the wheel and shaft assembly for most applications. However, the burden of determining whether this is the case for a particular installation and lubrication system rests with the customer.

Static grounding by graphite impregnation does not interfere with the corrosion-resistant properties of the fan. Graphite is extremely corrosion resistant. However, the addition of the graphite makes the surface softer than normal and prevents the normal checking of the surface for Barcol-hardness readings.

FRP fans are often the best alternative for those applications which require the handling of explosive, as well as corrosive gas fumes. However, care must be taken to realize that there can be no guarantees against possible sparking or ignition in such airstreams. All aspects of the application, the system components, and even the potential for sparks resulting from "tramp" or "foreign" elements in the airstream must be considered to ensure the safety of the installation.

FLANGE-DRILLING PATTERNS for round inlet and round outlet flanges are in accordance with the National Bureau of Standards Voluntary Product Standard PS 15-69. This drilling pattern was developed by members of the FRP industry for FRP ductwork and specifies bolt hole diameters appropriate for bolting FRP ducts to FRP fans.

nyb FRP fans that have both round inlets and round outlets are also available with flanges drilled to ANSI 150. Because ANSI 150 is intended for bolting together heavy metal pipe, it uses bolts that are unnecessarily large for FRP. Although **nyb** charges the same for drilling to PS 15-69 or ANSI 150, the cost to the user can be substantially different. Flanges are usually fastened together with corrosion-resistant alloy bolts, nuts, and washers. The cost difference between the sizes required for PS 15-69 and ANSI 150 can be significant. For example, a 12" inside-diameter PS 15-69 flange would have 7/16" diameter holes for twelve 3/8" bolts. An ANSI 150 flange would have 1" diameter holes for 7/8" bolts. The difference in cost can be $50 or more per flange for 316 stainless steel hardware and much more for higher-alloy hardware.

Since PS 15-69 and ANSI 150 drilling patterns only pertain to round flanges, they do not apply to FE and GFE outlet flanges. Therefore, **nyb** has developed a standard for drilling rectangular outlet flanges which provides holes drilled on 4" centers, straddling the flange centerlines.