PRODUCT APPLICATION

A technical bulletin for engineers, contractors and students in the air movement and control industry

Straight Talk on Protective and Aesthetic Coatings for Commercial/Industrial Fans

Commercial and industrial fan equipment has many uses in a variety of industries. Some of these industries require coatings for the fans. These coatings provide two main functions—protection and aesthetics. Certain circumstances may require both protective and aesthetic coatings. Coatings protect the metal products from excessive heat, chemicals, UV rays (color fade), water, oxygen, and other contaminants that can destroy the metal.

While the need for coatings is clear, confusion exists regarding use of coatings for applications, types of coatings available, and what typical tests and testing processes reveal about these coatings.

Protective Coatings

Protective coatings provide corrosion control. These coatings offer long-term protection under a broad range of corrosive conditions, from atmospheric exposure to the most demanding chemical processing conditions. Protective coatings can be powder or a liquid coating and have little or no structural strength yet protects other materials to preserve strength and integrity. The National Association of Corrosion Engineers (NACE) reports that corrosion has a global impact of $2.5 trillion every year. Metal corrosion also presents challenges to productivity and safety.

Decorative Coatings

Projects where the exterior appearance is important often use a powder or liquid coating. A decorative coating often incorporates some characteristics of protection—usually from UV rays to prevent the color from fading, and in some cases corrosion. However, this type of coating emphasizes aesthetics.

Metals Used in the Manufacture of Fans

Commercial and industrial fan manufacturers use four main metals in their products. These metals are:

- Steel
- Aluminum
- Zinc-coated steel
- Stainless steel

Each metal mentioned corrodes at different rates, assuming all other conditions are equal. Zinc-coated steel corrodes the fastest. However, zinc coatings intentionally corrode quickly, creating a film protection to help the steel last longer. Aluminum and steel corrode at a slightly slower pace, while stainless steel is the most resistant to corrosion. By comparison, a metal such as gold corrodes very slowly.

Other factors affecting the corrosion rate include oxidizing agents, the electric conductivity of an electrolyte, temperature, and concentration.

The Effect of Microclimates on Metals

A microclimate is a region where natural and man-made influences affect the integrity of metals. Geography, contaminants such as industrial air pollutants, high-temperature exhaust, and particulates are some of the major factors contributing to a microclimate.

For example, a factory along the coast of Florida or one in Central Wisconsin could be considered two different microclimates. These examples of microclimates factor in geographic features. The location in Florida is influenced heavily by the ocean that produces high levels of sodium chloride (salt) in the air along with high humidity. The Central Wisconsin factory does not have challenges from salt air to affect metals.

Now suppose that there are three factories, including the two mentioned above. The third factory is located in Houston, Texas, where industrial pollution combines with salt air from the Gulf of Mexico. Each received a fan to exhaust air from the facility. Both the Florida factory and the factory in Wisconsin use the fan to exhaust clean air. The factory in Houston exhausts a hot, moist chemical-infused air. Which fan will experience corrosion the fastest?

The factory in Houston because of its exposure to industrial pollution combined with the humid salt air and a moist, chemical-infused airstream from the fan creates a highly corrosive environment. The factory in Florida is next. The fan at the Wisconsin factory should corrode the slowest. Why? The Wisconsin factory does not receive the level of UV exposure and exhausts clean air that does not contribute to accelerated corrosion.

Other Corrosion-Causing Factors

HVAC equipment operate under a variety of conditions unrelated to microclimate conditions. Corrosion occurs from a variety of other sources including metal filings left on surfaces, dirt and dust, moisture, the content of exhausted air, and high temperatures. These sources represent common corrosion-producing factors.

Metal integrity becomes compromised when the surface is damaged. Surface elements including metal filings, dust or dirt that combine with moisture create an environment for rust to start.

Anecdotal information suggests that the concentration of a chemical or chemicals in the airstream will have little effect on the coating. The reason for this is the design of certain HVAC equipment allows for safe diluting of the chemical fume. However, if the airstream is wet and contains chemicals, the possibility of accelerated corrosion is a concern.

Corrosion of metal cannot be prevented; however, it is possible to slow it and minimize its effect on HVAC equipment. Protective coatings can slow corrosion.

Coatings

A coating is a barrier that slows the effects of corrosion; however, some incorrectly assume coatings seal the metal from corrosive agents. **No coating will prevent corrosion indefinitely.**

Several types of coatings exist for protecting metals. These include anodizing, galvanizing, electroplating, liquid paints, and powder coating. Powder coating and liquid paints are the most common coatings used on HVAC equipment, with powder coating gaining favor over liquids. Powder coating offers more benefits over liquid paints, although liquid paints have an advantage in certain circumstances. Regardless of the type of coating, a well-applied, thicker coat always provides better protection. The following are common coatings used with HVAC equipment.

Epoxies

Epoxy finishes are a frequent selection because of its mechanical and chemical resistance properties. The epoxy finish is for use on applications requiring inherent toughness, corrosion resistance, flexibility, and adhesion. An epoxy finish offers excellent moisture resistance. However, epoxies are not recommended for use outside. The UV rays break down the epoxy finish, causing it to fade and chalk, affecting the aesthetic and protective qualities of the finish exposing it to corrosion.

High Temperature

This coating offers high-performance heat resistance. The coating offers a tough, hard weather and heat resistant finish. The high temperature coating withstands continuous temperatures up to 500° F (260° C) while providing good mechanical and chemical resistance.

Two-Coat Systems

The two-coat system includes a base coat of epoxy powder and a topcoat of a super durable polyester TGIC. The thicker combination of this topcoat over the epoxy base coat results in a system providing superior corrosion resistance along with a tough, uniform finish to protect against the most extreme conditions indoors and outside.

Super Durables

Super durable coatings specifically are formulated to offer improved performance in abrasion, impact, UV, and chemical resistance. It is a high-quality coating because of its UV and color fade resistance.

Coating Process

No coating will perform as expected without a thorough cleaning of the base material (metal) first. Proper cleaning promotes appearance, adhesion, and corrosion protection. Manufacturers often use a multistep wash process to achieve the performance required. This washing varies by manufacturer. This example includes the following:

1. Remove all dirt and oils on the surface of the metal, removing surface contaminants and prepares the metal for the next step.
2. Application of a “conversion coating.” This conversion coating forms a microthin crystalline layer that promotes adhesion and resists corrosion creep under the paint surface.
3. The final step is an application of a sealer that assists in paint adhesion and corrosion-resistance.

Chemicals

Current testing to determine how well a coating withstands a chemical does not offer an accurate representation of how the coating on the fan performs in the field, since the testing applies a concentrated amount of a chemical to the coating and does not consider other factors. However, it does provide a general indication of its performance to chemicals.

Many situations where concern for chemicals occurs often have more than one chemical being exhausted from the fan. Situations like this make it difficult to determine the effect on a coating. Most charts do not provide factual data for the effects of multiple chemicals. A better method to determine if a coating performs well against chemicals, is asking the manufacturer and providing detailed information on the application.

Testing for Coatings

Industries use several tests to determine whether a coating meets the requirements needed to protect equipment. ASTM standards such as D1654, D714 and D610 accurately measure the results for criteria such as quality or grade. Another part of these tests allows manufacturers to choose a single scribe, “X” scribe or no scribe the panel depending on how they prefer to rate their coating. This option changes the outcome of the results.

The HVAC industry, however, still uses the ASTM B117 salt spray test as its main testing for coatings. Many industries have moved on to other tests. The B117 Salt Spray Performance test is an ASTM standard describing parameters for proper setup of a salt spray chamber for accelerated corrosion testing. This standard is the most widely recognized corrosion standard dating back to 1939.

B117 is an easy test to apply. It is fast and inexpensive to perform. The test is helpful and comparative when testing different coating formulations. The test also is helpful for manufacturers to benchmark process performance.

Unfortunately, the standard does not address the quality of the outcome. B117 only verifies how a product is tested and how long it was tested, letting people read into the results—often incorrectly. The B117 Salt Spray Performance test is comparative not correlative. Predicting how well a coating performs in the field is difficult using this test by itself since it does not factor in microclimates, application, or weather conditions.

Performance standards are beneficial tools if all parties understand the standard and its use. The most important consideration is having a good understanding of the application and applying the proper coating.

Tips to Prolong the Life of Coatings

A coating can provide the end user years of protection and beauty. Some additional preventative maintenance will extend the integrity of the coating.

- Wipe down flat surfaces that may collect chips or shavings resulting from installation.
- Check for areas of corrosion annually and repair with a touch-up kit. Nicks and scratches from the installation, maintenance or wind abrasion may allow corrosion to start. Touching up these spots will stop further damage.
- Wipe down the fan's exterior annually with a mild detergent and rinse.

Conclusion

Coatings used on HVAC equipment provide protection against corrosion, add to the aesthetics, or a combination of both. The best way to determine which coating best fits the use is consulting with a manufacturer or its representatives. The following set of questions serve as a guide to help select the best coating for the application:

1. Is this an outdoor application?

   NOTE: Epoxies alone are not recommended for outdoor applications as UV will break them down causing premature failure of the protective qualities of the paint. A protective topcoat over the epoxy can be added in most applications.

2. Is the jobsite less than 10 miles from a body of salt water (coastal areas)?
3. Will the airstream contain abrasive materials such as silica or others?
4. Will the airstream contain moisture?
5. What temperature will the airstream see?
6. Are there chemicals in the airstream?

   a. If yes, what type of chemical will it be exposed to?

   b. Include a SDS safety data sheet.

   c. Estimate the concentration in the airstream… low, medium, high.

7. How often will the fan operate?

GREENHECK
Building Value in Air.

P.O. Box 410 • Schofield, WI 54476
Phone: 715.359.6171 • greenheck.com