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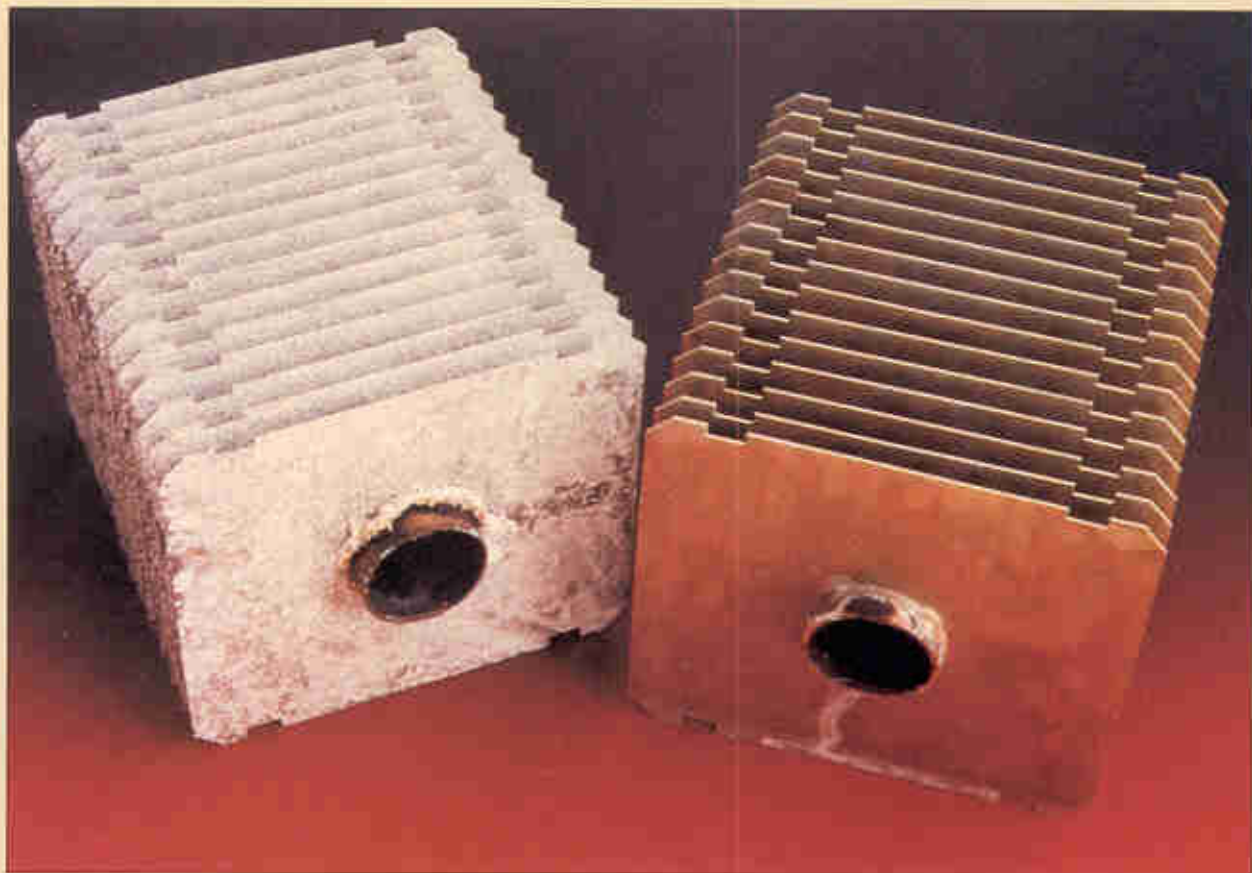
Coils vs. Corrosion

Ways to win the battle

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FIGHT OF THE CENTURY: COILS vs. CORROSION



**The winner has long been a foregone conclusion.
But now new technologies are giving coils a fighting chance.**

By Emerson Brantley
and R. Haydu

When a customer has had equipment replaced two times, three times, or more as a result of corrosion in the atmosphere, the question always asked is, "Can't you do

something to keep this from happening again?"

Some of the usual responses are:

"I can put some paint or something on it, but nothing will stop the problem."

"They really don't have anything that'll help."

"Don't worry, the warranty

will cover it for the first year."

"Well, it's usually cheaper just to replace the coil."

"If you coat it, you may save the coil, but you'll lose your efficiency."

Unfortunately, while some of these responses may have been true in the past, they are rarely accurate today. The reasons

these and similar attitudes continue is simple: Lack of good, solid information and a general resistance to change. As in most areas some things take getting used to. If we start with the basics of the corrosion problem, we'll build a good foundation of understanding that we can relate to customers with positive results.

Literally dozens of studies have been sanctioned to determine the viability of post pro-

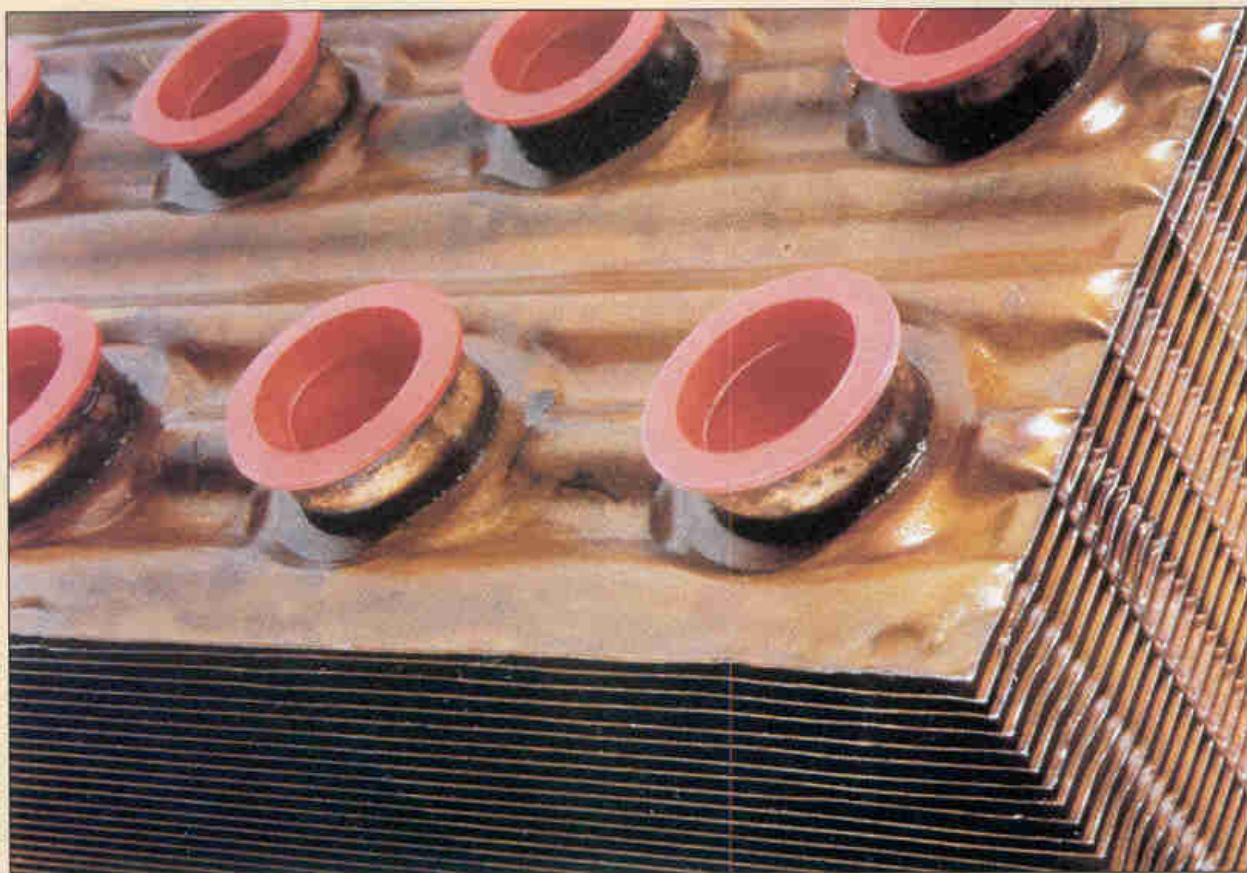
cessing (no paint, sealer, or caulk).

—It is not passive in its environment. (That is, the corrosive atmosphere it is within is literally pulled in across its surface.)

—The coil is most often of bi-metallic construction consisting of copper tubes and aluminum fins. (The coil can be tri-metallic, when including the header, commonly made of galvanized steel.)

contaminated air) bridges the two metals, and an electrical current is generated, creating an ion flow in which the aluminum sacrifices itself to the copper. Even standard industrial coatings are largely ineffective for controlling or preventing this type of corrosion.

Generally speaking, other common surface corruptions such as general surface oxidation, scaling, and fouling from atmospheric pollutants, are



duction coatings on hvacr units. While all of the various components of a unit benefit from such protection, none receive as much value added as do the heat transfer coils themselves. In fact, the component of an hvacr unit most immediately affected by corrosion is the fin-tube coil.

There are a number of reasons for this:

—The fins are made of wafer-thin metal.

—The entire coil is usually

This use of differing metals creates the opportunity for bi-metallic, or galvanic corrosion to attack the coil (where the tube interfaces with the fin) and U-bends (where the copper tube comes in contact with galvanized casing or stiffener). The electrochemical galvanic action occurs between the more active (anodic) aluminum and the more passive (cathodic) copper. A galvanic cell develops when an electrolytic solution (created by warm, humid,

easier to guard against: simply seal the surface from the atmospheric contaminants and moisture. Unfortunately, the basics of refrigeration work against the technician. The coil is subjected to wide temperature swings which result in extensive metal contraction and expansion. It is not uncommon for this to result in cracking of surface coatings, as well as the bi-metallic interfaces (such as where the fin and tube contact one another)

where the differing expansion/contraction characteristics of the two metals only aggravate this problem.

Once the protective surface is compromised, moisture and contaminants gain a new foothold to do their dirty work. Paints and coatings which will withstand this continuous flexing in other industrial environments (or such environmental hardships such as sunlight, direct chemical splashes, and periodic cleanings) are often not products readily adapted to use on fin-tube coils. Often, their densities and other characteristics—acceptable in many other applications—result in bridging of the fins, restricting airflow. The general industry trend toward increased fins per inch in the pursuit of higher SEERs, has increased the frequency of this problem.

Obviously, the coils need some specialized protective surface, one which can resist the corrosive attack, seal out galvanic corrosion, withstand expansion and contraction of the surface, and the other environmental realities. But what about heat transfer?

The positive attributes of protective coatings have often been downplayed or "sold against," using fears of heat transfer losses as an argument. Working for a coating company, I'm often asked about the effect of our coating processes on heat transfer coefficients. In independent, industry-standard capacity tests, our products have been confirmed as having no effect on heat transfer coefficients or EER.

The real enemy to unit capacity or EER, then, is the proven efficiency "thief", corrosion itself. Numerous studies have proven that surface oxidation and fin loss increase operating costs well over 200% in as little as two years of exposure, even in a "mild" corrosive environment. The properly protected coil maintains almost all of its original efficiency. The net effect is that the protected or coated coil has over 55% greater efficiency than

the uncoated coil in the first two years. In fact, the unprotected coils showed measurable efficiency losses in only 28 days.

Corrosion increases energy costs. Protecting the coil increases the net lifetime efficiency of the same coil.

DIP- APPLICATION

There are two basic methods for offering your customer this protection: In-house dip application of coils, and field-applied application.

One study advises and "strongly recommends shop-applied coatings and shop assembly of coated items over field-applied coatings or field retrofit."

Dip-processing involves complete immersion of the coil requiring as many as 18 individual steps, resulting in 100% penetration of the fins, 100% coverage of the surfaces, and even distribution of the coatings on the coil. Bronz-Glow's in-house dip-process resists the entire pH scale of corrosives (1.0 - 14.0) and its 400% flexibility solves the galvanic problem as well as the problems caused by surface oxidation.

To have a unit dip-processed, the contractor can specify that on the equipment order through the distributor or oem and have the coil or unit drop-shipped direct to a dip-processing facility. After processing, the unit is return-shipped to the contractor, the job site, or the factory. Touch-up repair kits are available to handle any damage to the protective surface done in shipping or installation.

FIELD APPLICATION

While dip-processing is preferable, it may not always be practical. Often the unit may already be installed, or the small size of a coil could make in-house processing unfeasible.

Aerosol kits are designed so that the technician can field-apply a protective coating on smaller units such as window units, through-wall units, small

central units, and refrigeration coils. (Such a coating is not currently recommended for use on food contact surfaces such as icemaker evaporator coils.)

These four-step kits consist of a surface degreaser/cleaner, a bonder/primer, finish coat, and an inert dresscoat/sealer.

Field application can be done by the contractor on new units, or those which are used, but still in good overall condition. Said one Jacksonville, FL, contractor, "When an application is being performed on a new unit on the job site, we usually do it during the system check-out, system charging, or 'start up' phase of the installation."

On all coils being coated, whether new or already in use, a clean surface is absolutely necessary. The solvent/cleaner dries quickly, and removes most greases and oils as it evaporates.

On used or dirty coils, take the time to perform an alkaline cleaning of the coils, followed by a water rinse. Immediately after this, acid spray the coils, followed by a second water rinse. Your objective here is to get "bright metal" wherever possible for the best possible adhesion and protection. You might want to consider a mild, mineral acid-based cleaner for this purpose. It's easier to work with and easier on the coil. It is formulated so that it doesn't react with the aluminum fin at all, so no metal loss is incurred.

Oil-free air can be used for speed drying of the coil. While the fan can also be used, there is greater likelihood of having environmental contaminants again deposited on the cleaned coil. For this reason, we don't recommend this as an alternative, and you should carefully consider the operating environment before attempting to dry the coils in this way.

The primer/bonder should be sprayed in the direction of the fins, using light passing strokes, "fogging" the coil. For the best possible coverage, spray from both sides of the coil.

The coating should be

allowed to dry to touch between steps, but this usually occurs by the time each step is completed. When the primer/bonder is dry to touch, several light coats of the finish coat should be applied. This is more effective than one heavy coat, and quicker. Unlike a paint or "coating," the thickness of the protector has very little to do with the degree of protection you receive. The main objective when spraying is to get good penetration of the fin-tube coil, and good, even coverage on all coil surfaces.

After the finish coat is dry, apply the dresscoat sealer.

The total actual application time is rarely more than 30 to 40 minutes, including cabinet disassembly where required. We recommend a final cure time of about two hours, before starting the unit. You don't have to wait for the coating to cure. Just advise the customer to start the

unit after a certain time.

After a unit has been processed, the unit is resistant to the corrosives in the environment, as well as normal dings, nicks, and scratches. Whenever the coating surface is damaged to the point of penetration of the surface to the metal beneath, field touch-up can be done. Special kits are available which allow you to perform this on site. The procedures are similar to those with the aerosol kits. In the case of a touch-up, the existing coating surface will soften slightly, and "receive" the new (touch-up) coating into itself—forming a new unbroken surface when cured.

While often the need for future "touch ups" is not considered when selecting a coating, this can be a vital element. Many industrial coatings, like thermo-set phenolics and epox-

ies, are difficult or even impossible to adequately repair. In cases where repairs are made, often the result is a "patch" with an edge where corrosion can again gain a foothold.

Husky brand aerosol kits make field application of a protective coating possible on all sorts of small hvacr equipment. When the unit is too big to allow adequate penetration in the field, have the unit dip-processed in-house.

The customer can expect extended life out of equipment even in a corrosive operating environment when these procedures are implemented.

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