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A Pictorial Guide to Corrosion-Proofing for Seaside Antenna Systems

Drastic measures are needed to protect towers and antennas within about 100 meters of salt water. Here are workable practical techniques developed from almost 20 years of experience at PJ2T.

Each morning our towers in Curacao awake drenched in a moderate coating of intensely salty slime, driven onshore by the trade winds. Only the lower 15 feet are spared. By about 3 PM, the hot sun has dried it out, but the damage has been done. As a result PJ2T's 100-foot Rohn 55 tower turned brown within a few weeks of installation in 2001. Eventually, in spite of aggressive maintenance, large holes developed in the legs, some of the braces broke under the weight of a climber, and the tower was lost. We've learned from this and now have developed good salt protection techniques. The following guidelines may not be scientifically optimal or absolute best practices, but they work for us, and they'll work for you.

Avoid Exposed Steel Tower Sections

Steel towers must be coated prior to installation. We have had excellent success with epoxy, which is sometimes called "two-component paint." It's expensive but completely worth it. Brand names vary, depending upon your locale, but all of these two-component paints come in two containers — the coating in a gallon can, and the hardener in a quart can. You mix them as instructed at somewhere between a 4:1 and 6.5:1 ratio and, once mixed, they have a maximum usable pot life of about 2 hours. This means you have to hustle!

Good surface preparation is essential prior mixing the paint. Even brand-new tower sections must be prepped because of manufacturing and shipping nicks and scratches and areas of powdery imperfections in galvanizing. As soon as your sections arrive on site, they begin to degrade. Just a couple of weeks in the salt environment results in a light corrosive coating that must be removed before applying the epoxy primer.

To prep, wear a mask and use a vibrating sander on the entire surface of a new tower section. Areas that cannot be accessed by the sander must be done by hand. This requires about three hours for a 10-foot section. The result will be a shiny and well-abraded surface (see Figure 1) that will be highly receptive to the two-component primer. Next, immediately wipe down the entire tower section with a vinegar-soaked rag. This 5% acidic solution will clean and micro-etch the surface.

Let the vinegar dry for about 15 minutes and then, *without delay*, apply the primer coat of two-component paint. Wear gloves, long sleeves, long pants, expendable shoes, and either remove or protect your glasses. Epoxy paint is very unforgiving. Use a cheap chip brush, because it can't be cleaned afterward. This paint is too thick to spray and too tacky to apply with a paint mitt. One section takes about 90 minutes to coat. Be patient, use the small brush, and coat everything except the ends of the legs that will swage inside the adjoining section. It helps to build a painting table so that the section is at waist height (see Figure 2).

Give the primed section about 24 hours to cure, but no more than that or salt will begin to accumulate. Then apply a coat

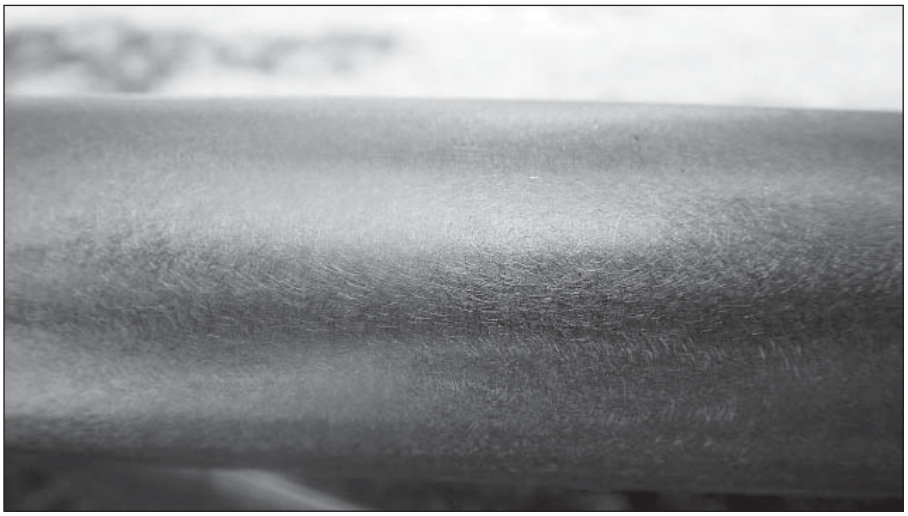

Figure 1 — A close view of a Rohn 55 tower leg after sanding, ready to receive the epoxy primer coat.

Figure 2 — This painting table at PJ2T makes section painting fairly easy.

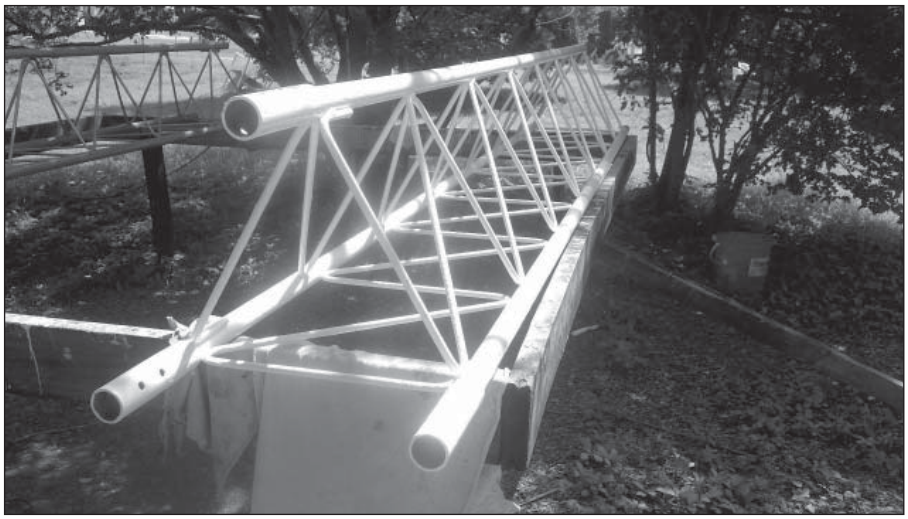

Figure 3 — A Rohn 55 section with a white coat of epoxy. One more finish coat (gray) will follow.

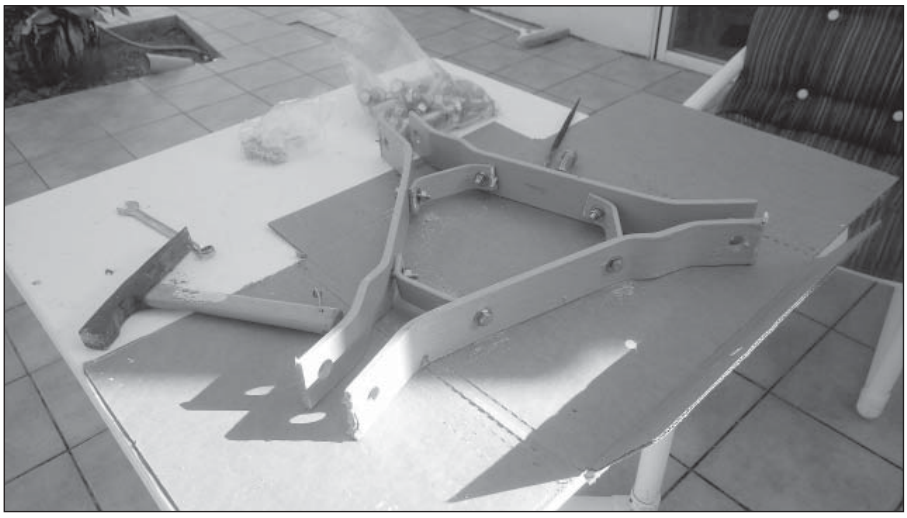

Figure 4 — A Rohn guy bracket with three coats of epoxy coating.

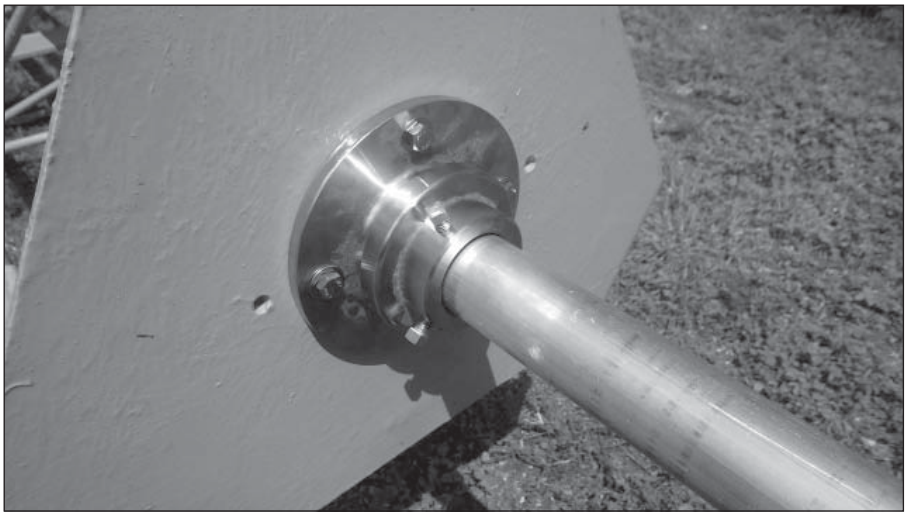

Figure 5 — A stainless-steel thrust bearing and aluminum mast at a tower top plate.

of finish epoxy paint using the same techniques as for the primer. I prefer white for this first finish coat, because the color contrast makes it easy to see what where you've been (see Figure 3). Twenty-four hours later, put on a second coat of epoxy of a different color. Now the tower sections are ready for assembly, and this quality industrial coating will greatly retard the formation of rust.

Steel Fixtures and Accessories Cannot be Exposed

Guy brackets, the tower top and bottom plates, steel deadends, rotator shelves, equalizer plates, side-mount brackets — *anything steel* must also be coated. Figure 4 shows a Rohn guy bracket that has been painstakingly prepped and then coated as described.

Where possible, avoid steel accessories. We used custom-manufactured stainless steel thrust bearings and very thick-wall aluminum mast material (see Figure 5). A steel mast and thrust bearing will fuse together after a few years, will no longer rotate, and cannot be removed. DX Engineering carries stainless-steel accessory shelves that fit a variety of tower sizes (see Figure 6).

Use Stainless Hardware Everywhere

Use stainless steel wherever possible (see Figure 7). We set aside all of the Rohn-supplied nuts and bolts in favor of equivalent sizes of stainless. Don't put even one piece of steel hardware in your installation when a stainless equivalent is available. With some patient shopping on the Internet you'll be able to find stainless nuts, bolts, washers, cable clamps, U-bolts, and even cable thimbles.

Guy Wire Advice

Steel guy wire will fail quickly, so use Phillystran. We have had Phillystran guys in the air for 18 years at PJ2T that look as good as the day they were installed. The Phillystran grips are, unfortunately, steel, so it's necessary to coat them with multiple coats of epoxy *after* they've been applied to the Phillystran (see Figure 8). After painting, pot the entire grip in duct-seal putty and then tape, as shown progressively in the photo. One-pound bricks of Gardner-Bender duct seal are available in the electrical section at The Home Depot. You can purchase stainless-steel cable thimbles online; always use these!

It's good practice to terminate Phillystran guys with steel guy cable about 10 feet from the ground to protect against vandals and brush fires. The Phillystran-to-steel cable junction is a challenge to rustproof, however. Coat the deadends on both sides of the insulator with epoxy. Then carefully

pot the entire assembly of two deadends and an insulator in duct-seal putty, assuring that there are zero air gaps inside (see Figure 9). Then, wrap the entire assembly in two layers of electrical tape, finishing with a coat of varnish. Scotch 33 tape is preferred, because it conforms better than Scotch 88 to irregular surfaces. Finally, multi-coat the steel guy wire itself with epoxy paint and wrap it in two layers of electrical tape, capping that with varnish. This is labor intensive but will provide protection for the ages (see Figure 10).

At the ground end of the guy wire, use similar potting techniques to protect deadend junctions and turnbuckles (see Figure 11). The principle is simple: If the salty air can't touch the steel, the steel won't rust.

No Tape on the Tower

Don't tape feed lines to the tower legs or diagonal braces. Over a period of years, the tape traps salty moisture against the exterior surface of the leg. At PJ2T the absolute worst rust damage anywhere on the towers was under these tape wraps, with holes in the legs and about 50% of the circumference of the leg tubing dissolved by rust. It's obvious in every case that this corrosion proceeded from the taped outside surface inward and not from inside the legs. A far better way to attach feed lines is to route them up the braces, not the legs, and attach them with a twist wrap of insulated #12 solid electrical wire (see Figure 12). The wire will never corrode, and this minimizes the creation of spaces where moisture will be held and eventually corrode the steel.

Antennas

Be certain that no steel or zinc hardware is anywhere on the antennas. If you can't find stainless hardware, pot it in duct seal and tape over (see Figure 13). Be particularly careful not to use zinc or galvanized U-bolts on booms. Over time, dissimilar metal corrosion will result in a broken boom — guaranteed.

Tape over all plastic parts. Most seaside locations are also very sunny, and prolonged exposure to UV will destroy plastic parts. Even black "UV resistant" tie wraps will fail in bright sunlight, so put a tape wrap over every tie wrap.

Not all aluminum is corrosion resistant. Many of the soft aluminum parts in our Ringo Ranger disintegrated over time. After the rebuild, the trusted technique of potting in duct seal and taping has preserved that antenna perfectly (see Figure 14).

All of these corrosion-proofing techniques are labor-intensive and expensive, but well worth it. Done properly, a seaside tower and antenna installation can last for decades. Absent these techniques, you'll

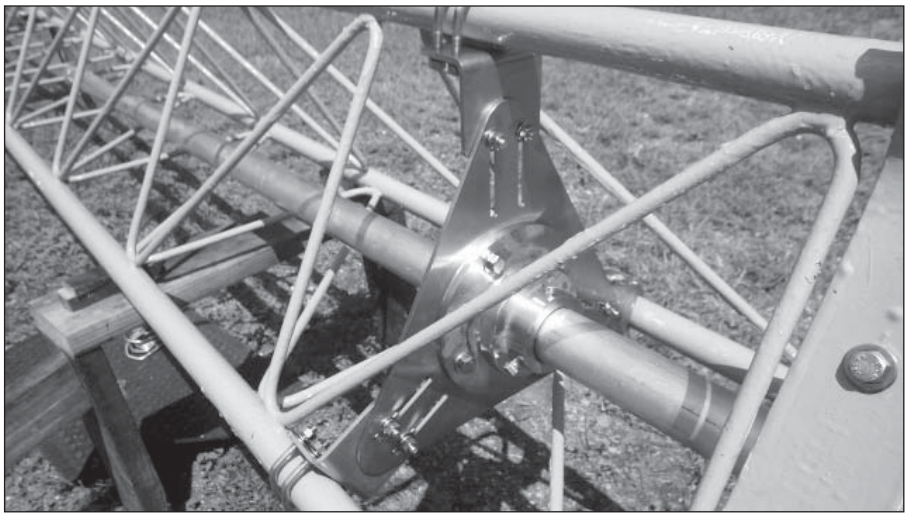

Figure 6 — A stainless-steel accessory plate from DX Engineering supports a PJ2T stainless thrust bearing.

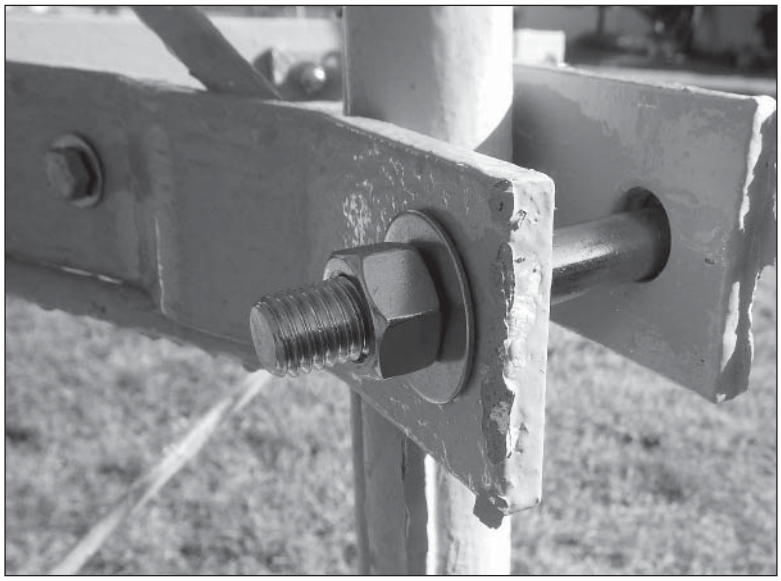

Figure 7 — Stainless hardware at a guy attachment point.

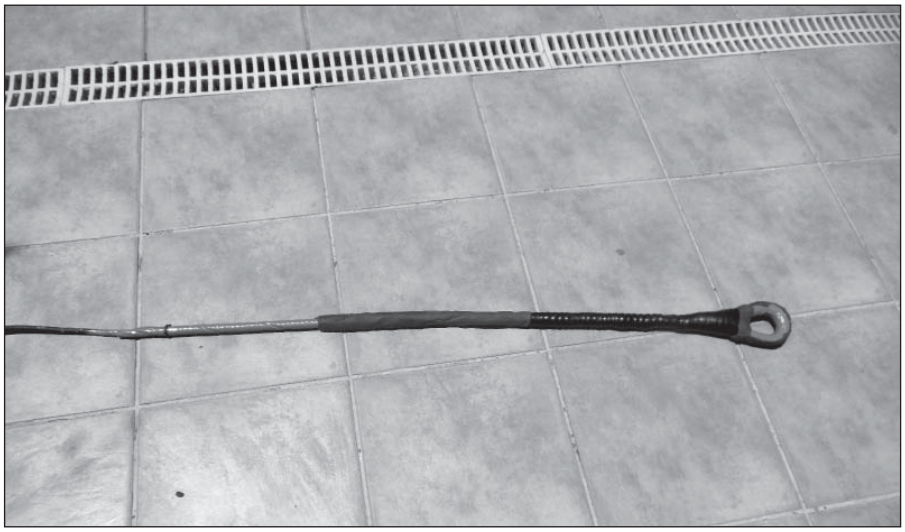

Figure 8 — A Phillystran big grip and stainless thimble after blue epoxy coating and showing progressive potting and taping, left to right.

be replacing things and experiencing failures within months.

The Five Commandments

1. Avoid steel wherever possible in favor of stainless and aluminum.

2. Where steel must be used, as in tower sections, carefully coat it with epoxy paint.

3. Epoxy-coat exposed steel parts such as deadends and turnbuckle bodies, then pot and tape them.

4. Protect all exposed plastic parts with electrical tape.

5. Never wrap steel tower parts with electrical tape — *anywhere*, *ever*!

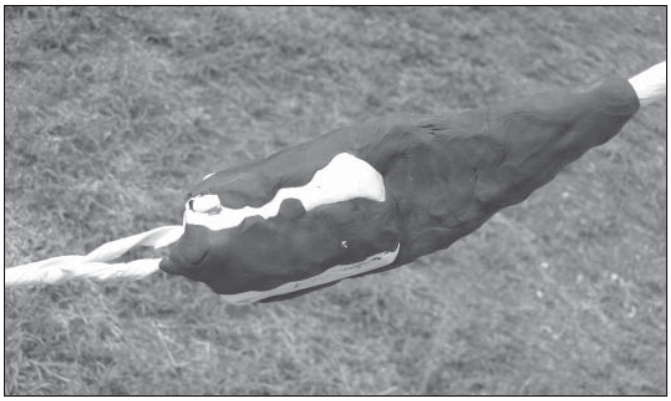

Figure 9 — A Phillystran-to-steel cable junction in the process of being potted with duct seal putty.

Figure 12 — Proper attachment of cables to towers in salty environments using #12 solid copper wire.

Figure 10 — A Phillystran guy wire, above at the right, connected to a steel EHS cable below, with the insulator and deadends fully potted and protected.

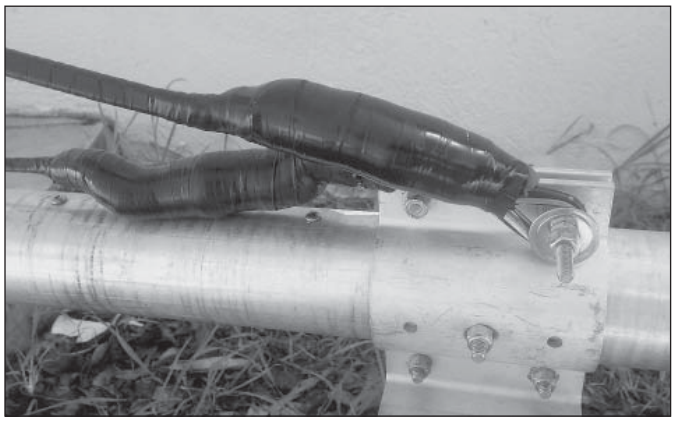

Figure 13 — Non-stainless saddle clamps protected by potting in duct seal and tape.

Figure 11 — Fully protected guy wire terminations.

Figure 14 — The mast-base junction and matching assembly of a Ringo Ranger 2-meter vertical, properly potted and taped.