



**BULLETIN**

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**Wind  
Tower  
Coatings**

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# Wind Tower Coatings

## INTRODUCTION

In a few short years, the rigorous corrosion performance standard ISO 12944 has been widely adopted in Europe, North America and elsewhere by the wind tower industry. However traditional multi-coat epoxy systems are under pressure as manufacturers strive to reduce costs and speed up throughput times in an increasingly competitive global market. Fast setting structural polyurethane technology is poised to meet these challenges as it has in other infrastructure markets.

It is feasible to achieve high performance standards while keeping costs at or below traditional levels. For example, replacing a three-coat system with two coats or a two-coat system with a single coat will reduce direct labor costs by 30 to 50 percent. If old technology is replaced with a coating system that cures more quickly, shop time and related expenses are reduced accordingly. Many of the traditional epoxy and urethane systems require as many as 12 or more hours cure to handle; technology is now available that will cure much more quickly, in some cases in a matter of minutes. Traditional products often require force curing in order to achieve throughput efficiencies; products that set at cold temperatures will provide energy savings.

With this in mind, Madison has developed 2 coating systems that meet the challenges of the industry and comply with the ISO standard.

## ISO 12944

The International Organization for Standardization (ISO) first published its current coating standard, ISO 12944, in 1998. Entitled *Corrosion Protection of Steel Structures by Protective Paint Systems*, this standard is intended to cover a wide variety of industries and service conditions. The standard consists of eight separate parts in which the various aspects of corrosion protection and coating systems, such as environment, design, surface preparation, various types of protective coatings, and tests, are reviewed.

For purposes of ISO 12944, atmospheric environments are classified into six corrosivity categories, as follows:

### TABLE 1: ISO 12944 CORROSIVITY CATEGORIES

Corrosivity Category	Typical Environments	
	Exterior	Interior
C1: very low	N/A	Heated buildings with clean atmospheres (e.g., offices, shops, schools, hotels)
C2: low	Atmospheres with low levels of pollution; mostly rural areas	Unheated buildings where condensation may occur (e.g., depots, sports halls)
C3: medium	Urban and industrial atmospheres, moderate sulphur dioxide pollution; coastal areas with low salinity	Production rooms with high humidity and some air pollution (e.g., food processing plants, laundries, breweries, dairies)
C4: high	Industrial areas and coastal areas with moderate salinity	Chemical plants, coastal shipyards, and boat yards
C5-I: very high industrial	Industrial areas with high humidity and aggressive atmosphere	Building or areas with almost permanent condensation and with high pollution
C5-M: very high marine	Coastal and offshore areas with high salinity	Building or areas with almost permanent condensation and with high pollution

Within each Category, two types of test regimes are defined. Under Regime 1, the focus is on the ability of the coating to withstand the anticipated environment. Under Regime 2, the coatings are exposed to harsh cyclic tests in order to determine durability. Generally speaking, within each Category, Regime 2 is more difficult to pass than Regime 1. Coatings that pass Regime 2 are deemed by ISO to have a service life rating of at least 15 years at the tested thickness. Extrapolating longer service life at higher film builds is left to the coating manufacturer to calculate.

The wind tower industry has adopted ISO 12944, with particular emphasis on Category 3 and Category 4. The interior of towers usually calls for a Category 3 coating. The exterior calls for a Category 3 or Category 4, depending on the location of the structure. For heavily industrialized areas, C5I is usually required, while for coastal and offshore structures, Category 5M is typically specified.

## **ADDING VALUE**

A number of coating products claim to be in compliance with Categories 3 and 4. A few claim to meet Category 5. Most systems are two and three coat combinations, although some Category 3 products are applied in a single coat.

Madison selected from its broad array of coatings a number of candidates that would bring additional value to the tower manufacturer and coatings applicator. The focus was on:

- Fewer coats
- Fast cure and instant cure
- Cold temperature cure
- Ease of use
- Surface tolerance

Based on a long history of introducing these application benefits in various industries, we estimate that overall savings in the range of about 10 to 30% compared to traditional products. For example, according to the Society of Protective Coatings, the labor cost of applying an industrial coating is about 50 to 55 cents per square foot. Eliminating one coat will reduce overall applied cost of the coating system by about 20%. Reducing shop time by 50% brings additional benefits. Cold temperature cure eliminates the need to heat the part or the surrounding area, further lowering costs.

## **RAISING THE PERFORMANCE BAR**

In addition to handling characteristics, Madison's research team focused on performance characteristics. The goal was not only to meet the ISO standards but to exceed them in relevant ways that will translate into extended life cycles for the coating systems.

There are a number of ways to increase the performance of a coating. The systems submitted by Madison for third party testing all incorporated at least one of the following performance-enhancing technologies:

- *CM or Ceramic Modification:* by incorporating NanoShield, a proprietary compound which consists of microscopic nano-spheres of real ceramic, it is possible to increase the abrasion resistance of a coating significantly. In polyurethanes, the increase is typically in the 30% range. In epoxies, which have lower inherent resistance to abrasion, the improvement is more dramatic, often in the range of 100%.
- *Adhesion Promoter:* In 2007, Madison's pipe coating division developed an adhesion promoter that increases adhesion significantly, especially where the surface preparation is not ideal. Thus the adhesion results over a commercial blast will approach the values normally expected over a near-white or white metal blast. This technology is now offered in most Madison products across all market sectors.
- *Automotive grade pigments:* industrial pigments tend to fade or discolor noticeably in as few as two or three years and their ability to screen UV rays is limited. Automotive grade pigments perform much better in this regard.
- *Ultra Violet Stabilizers:* For its acrylic polyurethane topcoats, Madison uses the same UV stabilizers used in automotive clear coats and in aerospace coatings. The loading of UV stabilizers is at the top end of the range recommended by the suppliers of these additives.

As mentioned earlier, ISO provides estimates for the life of coating systems that meet the various categories, from five to fifteen years. By using the above performance enhancers, Madison strives to provide products that will endure for the design life of the structure itself. Achieving longer service life is often as simple as increasing the thickness of the coating. This is an extremely economical option since the surface preparation costs are the same and there are typically savings resulting from the efficiencies discussed earlier.

In the tables that appear below, two systems were tested at thicker film builds that were necessary to pass ISO 12944 in order to provide the option of design life spans of 20 to 25 years and beyond.



**TABLE 2: SYSTEMS THAT PASS C3**

<b>SYSTEM</b>	<b>TYPE OF PRODUCT</b>	<b>PRODUCT NAME<sup>(1)</sup></b>	<b>APPLIED THICKNESS</b>	<b>INTENDED APPLICATION</b>	<b>DESIGN LIFE</b>
1	Mix-and-Apply, One Coat	AlumiZinc 'S'	8 mils minimum	Interior	>15 years <sup>(2)</sup>
	Mix-and-Apply, Two-Coat	AlumiZinc 'S' & AcrylaThane	13 mils minimum (8+5)	Exterior	>15 years <sup>(3)</sup>
2	Instant setting plural component, one coat	CorroCote Plus	18 mils min	Interior	>25 years <sup>(3)</sup>
	As above with UV stable topcoat	CorroCote Plus & AcrylaThane	23 mils minimum (18+ 5)	Exterior	>25 years <sup>(3)</sup>

**TABLE 3: SYSTEMS THAT PASS C4 and C5-I**

<b>TYPE OF PRODUCT</b>	<b>PRODUCT NAME</b>	<b>APPLIED THICKNESS</b>	<b>INTENDED APPLICATION</b>	<b>DESIGN LIFE</b>
Mix-and-Apply, One Coat	AlumiZinc 'S'	8 mils minimum	Exterior or interior;	>15 years <sup>(2)</sup>
Mix-and-Apply Two-Coat	AlumiZinc 'S' & AcrylaThane	13 mils minimum (8+5)	Exterior	>15 years <sup>(2)</sup>
Instant setting plural component, one coat	CorroCote Plus	25 mils min	Interior	>25 years <sup>(2)</sup>
As above with UV stable topcoat	CorroCote Plus & AcrylaThane	30 mils minimum (25+5)	Exterior	>25 years <sup>(3)</sup>

**TABLE 5: PRODUCT DESCRIPTIONS**

<b>PRODUCT NAME</b>	<b>DESCRIPTION</b>
AlumiZinc 'S'	Next Generation Zinc Rich Primer; user friendly, paint-like, Mix-and-Apply format. Can be applied at 8 to 10 dry mils on one multi-pass coat. Will self cure at any ambient temp.
AcrylaThane	A family of Mix-and-Apply marine grade polyurethane resins systems, cross-linked with acrylics, heavily loaded with Ultra Violet stabilizers. Formulas contain NanoShield ceramic nano-spheres for unsurpassed abrasion and impact resistance. Will self cure at any ambient temperature
CorroCote Plus	Plural component, instant-setting, solvent free polyurethane; unlimited build in one, multi-pass coat; rated non-hazardous by U.S. D.O.T.; apply direct to metal (no primer required); Will self cure at any ambient temperature.

**FOOTNOTES:**

- (1) For description of specific products, see Table 5
- (2) Based on ISO criteria
- (3) Madison estimate based on extra mils over and above amount of coating required to exceed ISO requirements

Also note that the trade names AlumiZinc, AcrylaThane, CorroCote and NanoShield are trade marks, registered or otherwise, of Madison Chemical Industries Inc.



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