

Heavy Movable Structures, Inc.

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**“Coating Systems for Marine and
Immersion Applications”**

by

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Coating Systems for Marine and Immersion Applications

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ABSTRACT

Since being introduced into the North American coatings market in the 1950s, polyurethanes have penetrated every major end use market including transportation, heavy duty maintenance, architectural and product finishing. Because of the increased demand for higher solids (lower VOC) coatings, polyurethane coatings use is growing rapidly. Very low in VOC composition, the coatings provide excellent weathering and appearance to the finished surface. Their high performance, long-lasting qualities are also an important attribute. When compared with other coatings, polyurethane systems rank among the lowest in life cycle costs. Polyurethane coatings also provide chemical and abrasion resistance, low-temperature curing, surface tolerant application and good recoatability. Of added significance, polyurethane coatings are available to meet VOC emission limits of zero to 2.8 lbs./gal. The performance of these systems, coupled with their economic benefits, productivity advantages and low VOC levels, have prompted growing acceptance of polyurethane coatings among specifiers and end users.

Heavy Movable Marine Structures

Moisture-cured polyurethane coatings were developed during the late 1930s for application in the North Sea oil fields. Their use continues to grow in the marine environment, especially for applications in wet areas such as machinery, piling and zones where painting can occur only between low and high tides.

This paper will document performance and applications where a surface tolerant coating is required for adhesion to visibly damp substrates such as those encountered in heavy movable structures. Comparisons to epoxy mastics and inorganic zinc are shown.

Moisture-cured urethane coatings are nothing new to the Marine Coating Market. These coatings have been used to impart timely corrosion and abrasion resistance soon after the application. Specially formulated, high solids, high build moisture-cure urethane formulations have been developed which eliminate bubbling and blistering problems at high film thickness (up to 20 mils wet) and at very high humidities. Outstanding features

include low temperature cure properties and rapid handling time that give moisture-cured urethanes an edge over conventional systems. High build formulations allow for user friendly, high performance coating applications, along with fast cure and low VOC (below 2.8 lbs./gal.).

These products are classified as Type II urethanes under the ASTM D-16 specification. They are single package coatings that cure by the reaction of polyurethane resin and atmospheric moisture.

The principle advantages of the moisture curing polyurethane are its single package and ability to be applied by brush, roller, trowel, squeegee or spray without great demands on the applicator and generally coatings can be applied independent of dew point or weather.

The paint films are typified by the same general property profiles that characterize all polyurethanes; i.e., great hardness without brittleness, toughness combined with excellent elongation and excellent resistance to acids, alkalis, sulfates, solvents and other strong chemicals. Aliphatic based materials are available for exterior application. The more flexible polyurethanes make ideal coatings for flexible substrate such as rubber, canvas, flexible plastics and textile fabrics of all kinds. They will retain good adhesion over substrate having high coefficients of thermal expansion where epoxies, vinyl esters and similar coatings will often fail.

Innovation

A newly developed high solids, high build moisture-cure urethane eliminates bubbling problems at even 100% relative humidity. These products are designed to be applied to poorly prepared steel at 10 to 15 mils dry without bubbling or sagging. This new generation of high build product will cure with specially formulated additive which will offer the following benefits (the specially formulated additive must be added just prior to applications).

The Feature and Benefits of Moisture Cure Urethane

- **High Performance**
Long service life comparable to other high performance coatings
- **More Tolerant to Job Site Conditions**
Moisture, low temperature and reactivity with moisture on and within the substrate
- **Chemically cures with moisture**
- **Low Temperature Cure**
Extends painting season
- **Easy Application**

Brush, roll and spray
Can be applied over aged alkyds and epoxies

- Excellent Chemical Resistance
Tolerates marine environments
- Meets VOC Restrictions
Below 2.8 VOC
- Lower Temperature Cure
Can be cured at 20°F
Independent of weather, temperature or dew point
- High Build Capability
Can be applied up to 25 wet without bubbling or blistering
- Fast Dry
Can be handled after four hours
- Fast Water Immersion
Can be immersed into sea or fresh water four hours after application

Conclusion

High build moisture cure urethane formulations allow for user friendly, high performance coating applications, along with fast cure and low VOC (below 2.8 lbs./gal.). In most cases the coatings can be applied independent of weather (temperature, humidity, dew point). In addition, the coating remains elastic and resistant to UV radiation and provides long term durability.

Comparison Between Single Coat of
High Build Moisture Cure Urethane vs. High Build Epoxy Mastic

	High Build Epoxy Mastic	High Build Low VOC M.C.U.
VOC	Below 2.8 lbs./gal.	Below 2.8 lbs./gal.
Volume Solids	72%	63%
NCO Content		
Film Thickness	4.0 – 8.0 Mils (100 – 200 Microns)	6 – 12 Mils (150 – 300 Micron) DFT
Air Dry @ 75°F		
Tack Free	1½ Hours	15 – 25 Minutes
Handle	6 – 8 Hours	2 Hours
Hard	12 Hours	4 – 6 Hours
Application Temp. & R. Humidity	Below 60°F Longer Cure Time	20°F or (100% Humidity)
Water Resistance Immersion after Application	Not Recommended	4 Hours at 75°F
Potlife	7 Hours	6 Hours

Figure 1