TECHNICAL BULLETIN

100% Solids Polyurethane versus Fusion Bonded Epoxy

The following report a written summary of physical properties and application parameters that compares Madison's 100% solids polyurethane coatings and Fusion Bond Epoxy as per ANSI/AWWA C213-91.

Performance

Material Properties	100% Solids Rigid Polyurethane	Fusion Bond Epoxy	Results Indicator
Impact Resistance (ASTM G-14)	100 in/lbs	100 in/lbs	Higher is better
Shear Adhesion	3000 psi	3000 psi	Higher is better
Hot Water Resistance (212 °F, 160 °C)	Pass	Pass	Pass or fail
Flexibility (size of mandrel to pass)	**1.0 inch**	**6.25 inches**	**Lower is better**
Abrasion Resistance (ASTM D4060)	**80 mg**	**300 mg**	**Lower is better**
Surface Resistivity (ohms per cm^2)	1.0×10^{14}	1.1×10^{15}	Lower is better
Dielectric Strength (volts per mil)	200	1000	Higher is better

Madison Chemical's 100% solids, rigid polyurethanes are very tough and durable protective barriers and are equal to, or better than Fusion Bond Epoxy when compared based on most performance parameters.

In water and waste water pipeline applications the toughness of the protective barrier is very important. In cases where the pipe may be manufactured and coated at one site and shipped to the distant installation site, the coating must be able to survive the pre-installation handling. A coating's impact resistance and flexbility are good indicators for this purpose. While the Fusion Bond Epoxy and the Polyurethane are equal on impact resistance, the polyurethane is much better suited for surviving the movement and flexing of the pipe without being damaged.

In water systems, a coating's ability to survive the high velocity and resulting abrasion is very important. Polyurethanes are very tough and abrasive resistant materials. If a system is designed with anticipated high velocities, the coating with the highest abrasion resistance should be considered.

Application

Activity	100% Solids Rigid Polyurethane	Fusion Bond Epoxy	Results Indicator
Surface Preparation	SSPC SP10	SSPC SP10	Same
Surface Profile	1.5 - 4.0 mils	1.5 - 4.0 mils	Same
Coating Thickness	15 mils	15 mils	Same
Preheating	**Not Required**	**425°F - 475°F**	**FBE must have preheat**

One of the benefits of Madison Chemical's 100% solids rigid polyurethane system is its ability to be applied at almost any temperature. Application temperatures can range from -40°F to 150°F. Due to the exothermic reaction of the polyurethane coating, the ambient and substrate temperatures are not factors in the curing and performance of the coating. Fusion Bond Epoxy tends to be sensitive to substrate temperature fluctuations and can therefore be impacted in terms of performance.

Repairs

Activity	100% Solids Rigid Polyurethane	Fusion Bond Epoxy	Results Indicator
Surface Preparation	Surface grinder, file, or sander	Surface grinder, file, or sander	Same
Repair Material	**Liquid Polyurethane**	**Liquid Epoxy**	**Epoxy is different from primary system**
Repair Material Application Temp.	**>32°F**	**>55°F**	**Epoxy is limited by cold weather**

While repairs of the polyurethane and epoxy system may appear to be similar, it is important to keep in mind that the repair material for Fusion Bond Epoxy is a liquid epoxy that is different in composition and performance from the primary Fusion Bond Epoxy system.

Field Joints

Activity	100% Solids Rigid Polyurethane	Fusion Bond Epoxy	Results Indicator
Surface Preparation	SSPC SP10	SSPC SP10	Same
Material	**Liquid Polyurethane**	**Liguid Epoxy**	**Epoxy is different from primary system**
Material Application Temperature	**>32°F**	**>55°F**	**Epoxy is limited by cold weather**

As with repairs, the coating of the field joints of a Fusion Bond Epoxy system uses a different material from the primary coating system. Liquid epoxy systems tend to have lower tensile adhesion results and are not as abrasion resistant as the Fusion Bond Epoxy system.

Flanges and Couplings

Activity	100% Solids Rigid Polyurethane	Fusion Bond Epoxy	Results Indicator
Surface Preparation	SSPC SP10	SSPC SP10	Same
Material	**Liquid Polyurethane**	**Liquid Epoxy**	**Epoxy is different from primary system**
Preheating	**425°F - 475°F**	**Not required**	**FBE must have preheat**
Post Cure Heating	**Not Required**	**Required**	**FBE must have post cure heating**

The use of Madison Chemical's 100% solids, rigid polyurethane coating on the pipe system ensures that the protective coating is applied after the unit has been fabricated. Therefore the Polyurethane coating is a monolithic, uniform, consistent coating that will protect the structure for many years. The Fusion Bond Epoxy system will require cutting the coated pipe to allow for fabrication, and will therefore result in multiple systems of different performance capabilities being used to protect the final fabricated unit.

AWWA Standard

We certify that Madison's 100% solids polyurethane coating meets and exceeds ANSI/AWWA C-222 standard for steel water pipe and fittings.

Underwriters Laboratories

UL is one of America's largest standard setting organizations. Madison Chemical has held a number of listings for over 20 years for our materials associated with the coatings for underground storage tanks. Each of the Standards involves over one year of testing in addition to random audits of our facilities. Madison Chemical 100% solids, rigid polyurethane coatings meet the strict standards for underground corrosion protection UL 1746.