



General Specification: Polyurea Spray / Geotextile Composite Panel Manufacture

PART 1 - GENERAL

1.01 Related Documents

- A. Drawings and general provisions of the Scope of Work, including general and supplementary conditions apply to this section. This can be listed as an attachment in Appendix.

1.02 Description of Work

- A. This Section specifies the production of special composite polyurea spray elastomeric lining / geotextile panels. The primary coating material shall be a solvent free, fast-setting (< 30 minutes, as per ASTM D 1640), 100% Polyurea thick film elastomeric coating and lining system formulated to be used for applications requiring a seamless, flexible, waterproof, abrasion and impact resistant surface that may be applied on a variety of geotextile fabrics in low temperature and high humidity to produce the composite panels.
- B. Types of Polyurea Lining Systems required for the project include the following:
 - 1. Spray applied aromatic based Polyurea systems.
Including a fire retardant version
 - 2. Spray applied aliphatic based Polyurea systems.
 - 3. Brush / roller applied Polyurea systems for repair.
- C. Types of geotextile fabric required for the project include:
 - 1. non-woven / felt type with one treated / ironed side for application
 - 2. woven fabric of polyethylene, polypropylene or polyester
 - 3. spun-bonded type of polyethylene or polyester
- D. The geotextile fabric panels used must be dry and clean prior to application. Application should not be done if the surface temperature is less than 5°F (3°C) above the dew point.

1.03 References and Standards

- A. All references and standards listed shall be the latest revisions.
- B. American Society for Testing and Materials (ASTM)
ASTM D 751: Standard Test Methods for Coated Fabrics
ASTM D 1186: Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base.
ASTM D 1640: Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
ASTM D 1894: Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting.
ASTM D 2047: Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
ASTM D 2240: Standard Test Method for Rubber Property – Durometer Hardness
ASTM D 4138: Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.
ASTM D 4787: Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
ASTM D 6132: Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gauge.
ASTM D 6289: Standard Test Method for Measuring Shrinkage from Mold Dimension of Molded Thermosetting Plastic (modified for spray application)
ASTM E 337: Test Method for Measuring Humidity with a Psychrometer.
- C. Society for Protective Coatings (SSPC)
SSPC-PA 2: Measurement of Dry Coating Thickness with Magnetic Gages
SSPC-PA 9: Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages
SSPC-Guide 12: Guide for Illumination of Industrial Painting Projects
- D. Polyurea Development Association (PDA)
General Standard: Polyurea / Geotextile Elastomeric Lining Systems

- E. National Association of Corrosion Engineers (NACE)

None applicable

- F. International Concrete Repair Institute (ICRI)

None applicable

1.04 Polyurea Definition

As per the Polyurea Development Association, the following is the definition of a Polyurea system:

A **pure polyurea** coating / elastomer is derived from the reaction product of a polyisocyanate component and an amine-terminated resin blend.

1.05 Submittals

- A. Submit manufacturer's technical data, MSDS and product literature indicating that the products comply with specified requirements. If submitted material is not as specified, submit complete test results from independent lab for all tests listed.

- B. Submit 2 sample coupons (6" x 6" / 15.2 cm x 15.2 cm) of the polyurea / geotextile composite panel that are representative of the finished polyurea coating surface, texture, and color. Approved samples shall serve as basis for acceptance of the panel work for the duration of the panel production.

- C. Submit Material Manufacturer's and Equipment Manufacturer's written certification of Approved Contractor, Contractor's qualifications, and list of project references.

1.06 Quality Assurance

- A. Single Source Responsibility:
 - 1. Provide polyurea products produced by the same manufacturer, or recommended by manufacturer, for each type of Polyurea special coating / lining material specified to ensure compatibility, and proper chemical and mechanical bond.

- B. Panel Fabricator Qualifications:
 - 1. Fabricator shall have completed an established qualification program in the use of plural-component equipment and the specified Polyurea material. Provide written certification from the equipment manufacturer and material manufacturer.

- C. Equipment Requirements:
 - 1. For fast set spray systems, equipment shall be a plural component impingement spray machine capable of producing the Polyurea system suppliers published recommended processing characteristics.

- D. Substitutions:
 - 1. Manufacturers seeking approval of products other than the specified system must supply cured samples, full product information, project histories and references, technical data with specifications, MSDS and certifications regarding conformity of performance properties from an independent testing laboratory. The product being submitted for approval must meet all requirements of the performance properties noted within this specification (Appendix A).

1.07 Delivery, Storage and Handling

- A. Deliver product in the manufacturer's original, new, unopened packages and containers, clearly marked with manufacturer's identification, printed instructions, lot numbers and shelf life expiration date for each component.

- B. Store and ship materials in tightly covered containers in a dry, well-ventilated area at an ambient temperature of 70° - 90° F (21°-32°C), away from hazards. Drums should not be stored directly on the concrete substrate. If lower temperatures are experienced, material must be effectively reconditioned according to Polyurea system supplier / manufacturer.

- C. Before use, material must be conditioned to a standard temperature as per the Polyurea system supplier / manufacturer.

- D. Pigmented resin blend components must be properly agitated prior to use as per Polyurea system supplier's / manufacturer's recommendations.

- E. Geotextile materials / fabric must be covered and protected from the weather until ready for panel fabrication. The geotextile must remain dry prior to and during installation.
- F. When properly maintained, the industry standard for polyurea that is installed outside, is that you will have 2 mils degradation due to ozone attack / annum. For example 60 mils of product should last 30 years.

1.08 Panel Production Conditions

- A. For temperatures below 35°F (1.5°C), consult Polyurea system supplier / manufacturer.
- B. All surface preparation will depend upon the substrate involved.
- C. Provide proper safety equipment, adequate ventilation, lighting and clean, drinkable water supply. Refer to PDA Safety & Health Guidelines.
- D. Do not apply material over water or wet geotextile fabric. This will lead to disbondment / failure of the Polyurea coating / lining system.
- E. Do not apply material over frozen or ice capped geotextile fabric. This will lead to disbondment / failure of the Polyurea coating / lining system.
- F. Do not apply material over oil soaked or chemically contaminated geotextile fabric. This will lead to disbondment / failure of the Polyurea coating / lining system.

1.09 Warranty

Obviously, some form of program may be in place from the Polyurea system supplier. This information must be obtained from the Polyurea system supplier. Close communication is highly encouraged between the Polyurea system supplier, the polyurea / geotextile composite panel producer and owner.

1.10 Health and Safety

A. General:

Ventilation, electrical grounding, and care in handling paint, solvents, and equipment are important safety precautions that shall be observed. This is the sole responsibility of the composite panel fabricator.

B. Ventilation

It is essential that the vapors / overspray released during and after application of coatings be removed from all areas considered a confined space, so as not create any chance of a safety concern. During panel production operations all personnel shall wear proper respiratory and safety equipment.

C. Grounding:

Coating hoses shall be grounded to prevent accumulation of a charge of static electricity.

D. Lighting:

Explosion proof artificial lighting shall be provided for all work where and when required. Light bulbs shall be guarded to prevent breakage. Lighting fixtures and flexible cords shall comply with the requirements of NFPA 70 “National Electrical Code” for the atmosphere in which they will be used. Refer to SSPC-Guide 12.

E. Toxicity:

Solvents may be used with some of the specified coatings and are explosive at low concentrations and

are highly toxic. Because of toxicity, the maximum allowable concentration of vapor for several common solvents shall be not greater than the Immediately Dangerous to life or Health (IDLH) limits as shown in the NIOSH Registry of Toxic Chemical Substances.

E. Protective Clothing:

When handling or applying coatings, workmen shall wear gloves, eye shields and all other necessary protective clothing to assure workmen's safety.

G. Fire:

During mixing and application of coating, all spark producing material and smoking shall be prohibited in the vicinity. An appropriate type of fire extinguisher shall be kept nearby.

H. Material Safety Data Sheets (MSDS)

Fabricator shall maintain MSDS Reports on all specified coating materials on project site, accessible to employees.

PART 2 - PRODUCTS

2.01 System Performance Requirements

- A. Polyurea system must meet the definition of a polyurea system as per the Polyurea Development Association.
- B. Material Compatibility: Provide coating, repair materials, and related materials that are compatible with one another and the substrates indicated under conditions of service required as recommended by the Polyurea system supplier / manufacturer. This would include physical properties noted in Appendix A, adhesion and no adverse reaction between various systems.
- C. Polyurea lining system must meet or exceed all of the physical properties, test results, and certifications as noted in Appendix A for each specific application.

- D. All thermoset materials, polyurea included, experience linear shrinkage during set and cure. It is extremely important to understand the shrinkage value of the polyurea elastomer systems being used prior to panel preparation work.

2.02 Acceptable Manufacturer

There are a number of Polyurea system suppliers that are members of the Polyurea Development Association. Each may have specific Polyurea systems designed for certain application areas. They should be consulted for types of products for the various application areas.

2.03 Polyurea Materials

- A. Special Coating / Lining Systems:
 - 1. Spray applied aromatic based Polyurea systems.
Including a fire retardant version
 - 2. Spray applied aliphatic based Polyurea systems.
 - 3. Brush / roller applied Polyurea systems for repair work.

- B. Acceptable Polyurea Spray Elastomer System
VF 380 (PV 380) from VersaFlex, Incorporated® / PolyVers, International®

2.04 Geotextile

Only special geotextiles which have been tested and approved by the Polyurea System supplier are recommended. These geotextiles may be pre-treated on one side (ironed) to facilitate uniform coverage of the Polyurea elastomer lining system. These geotextile fabrics may include non-woven polyester,

woven polyester, and / or spun bond polyester fabrics. Use of Polyethylene or polypropylene based geotextile fabrics should be reviewed as little to no adhesion will occur between the fabric and the polyurea elastomeric lining system, only penetration through.

Selection of a geotextile fabric for the composite panel system depends on the type and condition of the substrate placed, and on the end use of the system. For polyurea / geotextile elastomeric composite panel systems or environmental covers, the following may be used as a general guide:

<u>Service Conditions</u>	<u>Geotextile Fabric / Weight</u>
Light duty service	2 – 4 oz / sq. yd.
Standard Duty (most pond liners and secondary containment)	4 – 8 oz / sq. yd.
Heavy Duty	8 – 9 oz / sq. yd.

PART 3 - POLYUREA / GEOTEXTILE COMPOSITE PANEL PRODUCTION

3.01 Manufacturing of Panels

- A. All surfaces shall be dry and cleaned of any foreign objects that may damage or inhibit uniform and consistent coverage the liner system.

- B. The geotextile rolls shall remain covered and protected from weather until ready for installation. Only geotextile panels for each day's spraying shall be spread. Do not place or roll onto wet substrates at any time. Plastic sheets may be used under the geotextile if this condition occurs.
- C. The geotextile panels shall be flat in place on the surface area. Uniform wrinkling of the geomembrane is considered normal and acceptable. However, excessive wrinkles must be avoided.
- D. Spray the polyurea elastomeric lining system with uniform multiple passes over the dry geotextile surface. Multiple pass application shall be in a criss-cross pattern when done manually to insure uniformity in coverage. Robotic application cannot be done in a criss-cross pattern.
- E. Apply polyurea system at an average 60 mils (1.5 mm). Heavy weight, non-woven geotextile may require a higher applied film thickness to achieve proper and complete coverage. Apply a stipple / texture finish following base build-up of polyurea.
- F. Leave approximately 6 inches (15 cm) on each edge of the geotextile fabric uncoated for proper seaming of the panels in the field.
- G. Footwear should be of the rubber sole type for walking on the liner system during installation without pulling up "hairs" of the geotextile fabric.
- H. After complete spraying of the geotextile panels, allow them to sit for a period of 30 min to 1 hour for inspection. After inspection, completed composite panels may set for a period of 4 hours or more prior to being rolled up for transport / delivery.

3.02 Composite Panel Quality Control

- A. Completed composite panels should be visually inspected for voids and defects. Repair prior to packaging completed panels.
- B. Adhesion Testing (if required): Per Polyurea system supplier's recommendations following ASTM D 751.
- C. Applied Thickness Testing: ASTM D 751, D 1186, D 4138, or D 6132. Thickness also may be verified by logging the volume of material sprayed through the automatic counter located on the special spray equipment.
- D. Shore Hardness Testing: monitor Shore Hardness (D 2240) of the applied polyurea to insure proper mix and set.
- F. Complete daily log detailing all job conditions. Assign a batch number to each panel corresponding to application conditions, stroke count, material lot numbers, etc.
- G. Rubbersource Inc. will take 5 thickness readings for each panel and record them in the Quality Log. All rolls will be numbered and have the Lot # of the raw material recorded as well

APPENDIX “A”

Polyurea / Geotextile Composite Panel Physical Testing

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>UNITS</u>
Tensile Elongation	ASTM D 638, Type IV	175 %
Tensile Strength	ASTM D 638, Type IV	1370 psi
Durometer Hardness	ASTM D 2240	80 – 85 Shore A 35 – 37 Shore D
Moisture Vapor Transmission	ASTM E 96, wet cup	< 0.02 perms
Tear Strength	ASTM D 624, Die C	445 pli
Trouser Tear	ASTM D 624	95 pli
Bursting Strength	ASTM D 751	410 ft-lbs 170 psi

Puncture Resistance	ASTM D 751	65 ft-lbs 25 psi
Coefficient of Linear Thermal Expansion	ASTM C 531	2 – 6 in./in./°C.
Cure Shrinkage	ASTM D 6289	< 0.5 %
Mandrel Bend Conical bend (Applied to geotextile fabric)	ASTM D 522	Pass
Mandrel Bend 1/4" mandrel, 25° C 1/4" mandrel, -20° C (Free film - 35 - 50 mils)	ASTM D 522	Pass Pass