
7

Polyurea Resin

Learning Outcomes:

- Know components and characteristics of Polyurea Resin
- Understand the application methods

Polyurea Resin

Polyurea marking material is a durable, two component pavement marking. Polyurea materials cure by reacting amine terminated resins with an isocyanate component which forms a urea linkage. Polyurea materials can cure to a hard film within one to two minutes and continue to fully cure after application therefore; formulations are adjusted for reaction (cure) times for the desired performance properties.

Components

Pigments

Polyurea pavement markings use pigments similar to all other pavement marking materials. Pigments are ground into the resin portion to achieve the desired color, contrast ratio and durability.

Mixing

Polyurea pavement markings must be completely mixed using two parts Component A (amine) to one part of Component B (isocyanate) when applied. It is very important this ratio is consistent throughout the application. Each component is stored in separate pressurized tanks on the application equipment and is heated to the correct temperatures in accordance with the manufacturer's recommendations. Proportioning pumps draw the material in a 2:1 ratio to an airless static mixing tube or impingement mixing gun and sprayed applied to the road surface.

Reflective Beads and/or Optics

Reflective beads or optics are uniformly applied to the entire width of the marking by a bead gun located immediately behind the polyurea spray gun. A double drop method is typically used for applying large and small glass beads or a combination of glass beads with other optic materials.

Prior to the application of polyurea markings, the contractor and the inspector must verify the specifications or contract documents to ensure the application meets requirements.

Beads are uniformly applied across the entire width of the marking by a bead gun located immediately behind the epoxy spray gun. A double drop method is typically used for the application of the beads. Large and small beads are typically applied at a rate of 11 to 13 lbs/gal for each bead size for a total of 25 lbs/gal.

Characteristics of Polyurea

Polyurea marking material is classified as a 100 percent solids material, meaning the evaporation of solvents or water does not take place. With no evaporation process during cure, the two components react with each other to form a dry cured marking. Polyurea is typically applied at a 20 +/- 1 mil wet film thickness and will yield a 20 mil dry film thickness after curing.

Advantages

- Good Abrasion resistance
- Can be applied in a wide range of temperatures
- Makes a mechanical bond with road surfaces
- Fast cure times are achieved
- More tolerant to moisture than other markings

Disadvantages

- Mix proportions are critical
- Incomplete mixing will increase porosity and result in poor adhesion

Method of Application

Polyurea is applied using a specially designed truck that is capable of applying two parts of the Part A component by volume to one part of Part B component by volume. Separate tanks containing Parts A and B materials are under pressure to assist the proportioning pumps in drawing the correct ratio of materials through the plumbing system for heating, mixing and spraying. Glass beads and/or optics are also stored in separate tanks under pressure. Prior to application, all equipment, spray guns and bead guns shall be calibrated to ensure the specified amounts of material components as well as glass beads and/or optics are supplied at the correct ratios for the specified application.

It is very important to verify the manufacturer's installation instructions for material pressures required, for material components, for glass beads and/or optics applied as well as truck speed prior to and during the application of polyurea markings.

Shelf Life

Polyurea materials have a shelf life of 24 months in their original unopened containers. Shipping documents and containers shall have identification numbers or batch dates for confirmation of when products were manufactured. Materials shall be stored in accordance with the manufacturer's instructions. It is very important to verify the manufacturer's requirements for shelf life and storage conditions have been met prior to loading operations.

Temperature

Polyurea markings can be applied in a wide range of ambient temperatures. However, the marking contractor and the inspector must verify not only ambient conditions, but also the material and surface temperatures. With pigmented resinous materials and cold temperatures, the viscosity will increase (become thicker) and in warm or hot conditions the materials will have a decreased (or thinner) viscosity. All temperature requirements shall be in accordance with the manufacturers Product Data Sheet (PDS). Polyurea marking material can be applied at an ambient temperature of 35°F.

It is very important to verify the manufacturer's requirements for material, surface and ambient conditions are in accordance with the manufacturers Product Data Sheet (PDS) prior to and through out the application of polyurea markings.

Pavement Surface Considerations

Road surfaces shall be free of curing compounds, oil, grease, salt, dirt, debris, moisture and other debris that may reduce the adhesion or durability of the applied marking. Polyurea markings may be applied directly after hot mix asphalt (HMA) paving operations providing the mat has cooled sufficiently to hold the marking equipment without deforming the road surface.

It is very important for the contractor and inspector to verify surface conditions in accordance with the manufacturers Product Data Sheet (PDS) prior to and through out the application of polyurea markings.

Cure Time

There are several stages of cure when considering paint and coatings. The typical field measurement for drying or curing of pavement markings is called "No-Track-Time." Polyurea markings will typically reach a no-track condition in approximately two minutes where other manufacturers may formulate their products to reach a no-track condition in seven to ten minutes. This time may vary depending upon air, surface and material temperatures.

It is very important for the contractor and inspector to verify no-track-times achieved given the temperatures encountered. No-track-time shall be in accordance with the manufacturers Product Data Sheet (PDS) prior to and through out the application of polyurea markings.

Quality Control of Application and Documentation

All verified information from Manufacturer’s Product Data Sheets (PDS), material documentation, work completed and quality control measurements taken shall be reported to the Department using an approved Pavement Marking Daily Log and Quality Control Report, Form C-85. Polyurea, binder and glass beads are approved as a system per VDOT’s Approved List of materials.

Polyurea Spray Application Troubleshooting			
Conventional Application			
Problem	Cause	Effect	Remedy
Heavy centers	<ul style="list-style-type: none"> - Material tank pressure too - Inadequate fluid delivery - Fluid or gun tip clogged - Material too cold 	<ul style="list-style-type: none"> - Tracking - Erratic wear patterns - "Railroad Tracks" initially 	<ul style="list-style-type: none"> -Verify delivery pressure - Decrease tip size - Clean fluid line and gun tip -Verify material temp.
Light centers	<ul style="list-style-type: none"> - Inadequate fluid delivery - Fluid or gun tip clogged - Material too cold 	<ul style="list-style-type: none"> - Erratic wear patterns - Poor durability - No durability 	<ul style="list-style-type: none"> Verify delivery pressure -Increase tip size -Clean fluid line and gun tip -Verify material temp.
Surging patterns	<ul style="list-style-type: none"> - Pulsating material delivery - Proportioning pump or compressor malfunction 	<ul style="list-style-type: none"> - Erratic application - Non conformance to Spec. 	<ul style="list-style-type: none"> -Verify consistent delivery pressure -Check for supply line for leaks -Clean supply line and gun tip
Uneven millage across width	<ul style="list-style-type: none"> - Gun not aligned - Worn gun tip - Clogged gun tip 	<ul style="list-style-type: none"> - Erratic wear pattern - Poor durability - Non conformance to Spec. 	<ul style="list-style-type: none"> -Verify gun alignment -Clean gun tip -Replace gun tip
Line too wide	<ul style="list-style-type: none"> - Gun too high - Gun tip fan pattern too wide 	<ul style="list-style-type: none"> - Non conformance to Spec. 	<ul style="list-style-type: none"> -Lower gun -Verify gun tip orifice
Applied line too thin	<ul style="list-style-type: none"> - Incorrect tip size - Appl. speed too fast - Change in delivery pressure - Material too hot 	<ul style="list-style-type: none"> - Poor Durability -Non conformance to Spec. 	<ul style="list-style-type: none"> Change gun tip -Decrease appl. speed -Verify delivery pressure -Verify material temp.
Applied line too thick	<ul style="list-style-type: none"> - Incorrect gun tip - Appl. speed too slow - Change in delivery pressure - Material too cold 	<ul style="list-style-type: none"> -Longer cure times -Over embedment of glass and/or optics 	<ul style="list-style-type: none"> - Verify gun tip orifice -Increase appl. speed -Verify delivery pressure -Verify material temp.
Line not curing	<ul style="list-style-type: none"> -Insufficient proportion of hardener to resin - Air, surface or material too cold 	<ul style="list-style-type: none"> -Extended time in lane -Markings being tracked -Eradicate and replace 	<ul style="list-style-type: none"> Verify delivery pressure of both components -Verify air, surface and ambient conditions

Chapter 7 Knowledge Check

1. What is one advantage for using Polyurea pavement marking material?
 - a) Good abrasion resistance.
 - b) Is mixed with water to apply to road surface.
 - c) Is applied using a latex paint equipment.
 - d) Mix proportions are not critical.

2. Polyurea pavement marking material is normally applied at the following thickness:
 - a) 10 mils
 - b) 20 mils
 - c) 50 mils
 - d) 120 mils

3. Polyurea pavement marking material cure time is less than one minute.
 - a) True
 - b) False

4. What is the sheet called where manufacturer's product information is found for polyurea application requirements?
 - a) Manufacturer's Sheet Products (MSP)
 - b) Performance Product Sheet (PPS)
 - c) Product Data Sheet (PDS)
 - d) Data Product Materials (DPM)

5. Polyurea is typically applied at a 20 mil wet film thickness and will yield a 20 mil dry film thickness after curing.
 - a) True
 - b) False

References

See Appendix A for the following:

VDOT ROAD & BRIDGE SPECIFICATION BOOK

To be added.

Page intentionally left blank
