

POLYURETHANES:**(1-16-18)****Description**

Provide polyurethanes (PU) for chemical grouting. Use polyurethanes for slab jacking, void filling, leak sealing, permeation grouting, subgrade stabilization and other applications in accordance with the contract. Use PU foams, gels and resins that are on the NCDOT APL.

Handling and Storing

Handle, store and dispose of polyurethanes per the manufacturer's instructions. Use equipment recommended by the PU Manufacturer or equipment capable of proportioning and mixing components in accordance with the PU Manufacturer's requirements. Utilize pumps and injection equipment that can maintain recommended pressures and temperatures.

Polyurethane Requirements

Use PU types in accordance with the contract. Use polyurethanes that meet the properties and characteristics listed below. Provide Type 3 material certifications in accordance with Article 106-3 of the *Standard Specifications* for polyurethanes. Do not use expired or improperly stored PU components or materials. If an expiration date is not provided by the PU Manufacturer, assume an expiration date 6 months after production.

(A) Type 1 Polyurethane

Type 1 polyurethane is a two component, high density, hydrophobic and hydro-insensitive PU foam mixed with a ratio of 1:1 by volume. When injected, the components react with each other to expand and harden forming a rigid closed cell foam. Provide PU foams that meet the following:

TYPE 1 POLYURETHANE REQUIREMENTS		
Property	Requirement	Test Method
Apparent Density (Free Rise)	3 – 4.5 pcf	ASTM D1622
Compressive Strength ¹ (Free Rise)	38 psi	ASTM D1621
Retention of Density (Hydro-Insensitivity)	80%	NYSDOT GTP-9 ²
Wet Compressive Strength ¹ (Hydro-Insensitivity)	38 psi	NYSDOT GTP-9 ²

1. Compressive strength of at least 90% of maximum strength within 30 minutes of injection.
2. New York State Department of Transportation Geotechnical Test Procedure: Hydro-Insensitivity of High Density Polyurethane Grout – Panel Test.

(B) Type 2 Polyurethane

Type 2 polyurethane is a single component, low or medium viscosity, hydrophobic PU resin mixed with an optional or required catalyst/accelerator per the PU Manufacturer's instructions to initiate or speed up reactions. When injected, the PU resin reacts with moisture in the soil or voids to expand and solidify forming a rigid or flexible, watertight closed cell foam. Provide PU rigid or flexible foams that meet the following:

TYPE 2 POLYURETHANE REQUIREMENTS		
Property	Requirement	Test Method
Viscosity ¹ (Rigid Foam)	200 centipoise	ASTM D4016 or D4878
Viscosity ¹ (Flexible Foam)	750 centipoise	
Compressive Strength ² (Without Soil)	150 psi	ASTM D1621
Compressive Strength ² (With Sand)	150 psi	ASTM D695 or D4219
Tensile Strength ³	150 psi	ASTM D3574

1. Maximum viscosity of uncured resin.
2. Compressive strength of cured rigid foam; does not apply to flexible foam.
3. Tensile strength of cured flexible foam; does not apply to rigid foam.

(C) **Type 3 Polyurethane**

Type 3 polyurethane is a single component, medium viscosity, hydrophilic PU resin mixed with optional or required water per the PU Manufacturer's instructions to initiate reactions. An optional catalyst/accelerator as recommended by the PU Manufacturer may be approved for Type 3 PU based on the application. When injected, the PU resin reacts with water to expand and produce a flexible watertight closed cell foam/impermeable gel. Provide PU foams or gels that meet the following:

TYPE 3 POLYURETHANE REQUIREMENTS		
Property	Requirement	Test Method
Viscosity ¹	750 centipoise	ASTM D4016 or D4878
Tensile Strength ²	150 psi	ASTM D3574

1. Maximum viscosity of uncured resin.
2. Tensile strength of cured foam; does not apply to gel.

Temperature Requirements

Follow the PU Manufacturer's instructions for storage and injection temperatures. Do not inject components when the air temperature measured at the location of the chemical grouting operation in the shade away from artificial heat is below 40°F.

