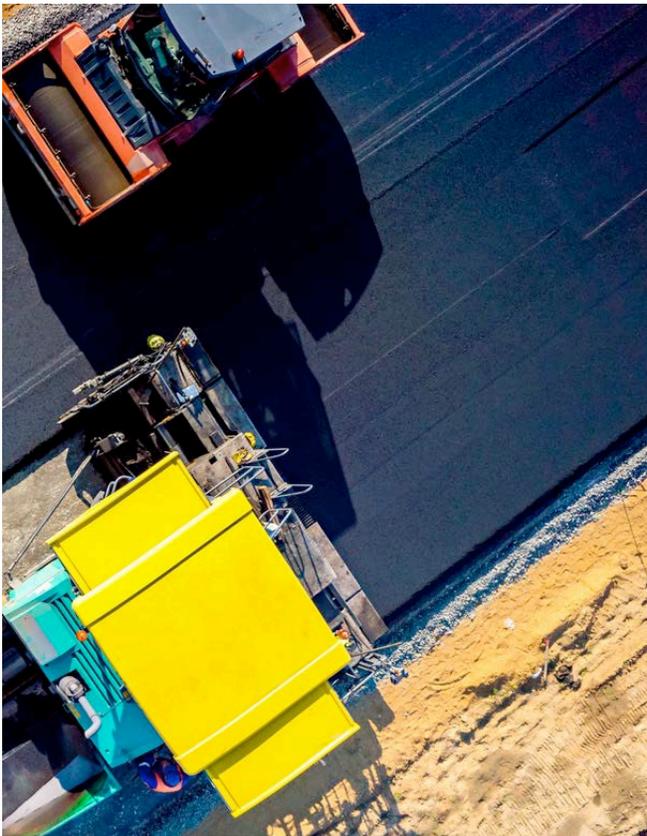




PGXpand®: A Unique Polymer

Guidelines for Blending the Polymer into Bitumen



INTRODUCTION

PGXpand® is a uniquely engineered innovative polymer designed to enhance high temperature performance of bitumen without impacting low temperature properties. It lowers viscosity, improves workability, and supports higher filler loads. PGXpand® is highly dosage efficient, storage stable and easily mixes into bitumen using low shear mixers and short mixing times. This document provides suggested guidelines for the blending of PGXpand® into bitumen.

PGXpand® BLENDING GUIDELINES

The addition of PGXpand® into bitumen is an endothermic process, thus, the mixture needs to be heated during the entire blending process to maintain the desired temperature. At suggested blending temperatures, PGXpand® melts easily into the bitumen, resulting in liquid-on-liquid mixing. The table below highlights the recommended guidelines for key blending parameters.

KEY PARAMETERS	GUIDELINES	COMMENTS
Blending Temperature	150 to 163 °C (300 to 325 °F)	Maintain temperature during the entire blending process
Mixing Equipment	Low Shear Mixer	A high shear mixer will not degrade PGXpand
Blending Speed	As required to maintain a small, minimal vortex	Up to 1000 RPM
Blending Time	1 to 3 hours	Recirculation helps ensure a homogenous end product. The optimum blending time depends on tank size & mixing efficiency.
Mixing Paddle Speed & Temperature	Above 163 C (325 F) Any Reasonable Speed	Neither paddle type or speed has any significant influence on the blending process.
Viscosity	-	When PGXpand is added to Bitumen, the viscosity typically drops by about 5 to 15 %.

Manufacturing Plant Blending Guidelines:

- If combining with elastomeric polymers, PGXpand may be added before, during or after the other polymers. However, incorporating PGXpand BEFORE other elastomers reduces the blend viscosity, which would likely aid in the compatibilization of the elastomers into the bitumen.
- PGXpand is non-abrasive to any components of the shear mixer.
- PGXpand does not impact the slip resistance in the shear mixer.

Laboratory Blending Guidelines:

Step 1: Pre-heat the Bitumen

- Pre-heat about 1000 g of the binder in a container to 145 °C (300 °F) in an oven for 30 minutes.

Step 2: Initial Set Up and Pre-Stirring

- Place the pre-heated container of binder on the hot plate and place a thermocouple in the binder such that the tip is about 1/3 of the way down and near the edge of the container.
- Set the temperature to 163 °C (325 °F) and wait for the temperature to stabilize.
- Next, lower the dispersing element into the binder such that it is 2.5 cm (1 inch) above the bottom of the container.
- Turn the motor on, set the speed to 600 rpm, and wait for the temperature to stabilize.

Step 3: Addition of Polymer and Blending

- Once the binder temperature reaches 163 °C (325 °F), slowly add the PGXpand to the binder.
- Blend the polymer and the binder for 60 minutes.
- Maintain the binder at a temperature between 150 to 163 °C (300 to 325 °F) throughout the blending process.
- At the end of 60 minutes, transfer the blended bitumen into a container and store for future testing.

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