HOW TO PREPARE A RIGID POLYURETHANE FOAM HAND MIX

Chapter 1 – Introduction

Honeywell

PURPOSE

This guide provides useful information about the step-by-step method to prepare a rigid polyurethane foam hand mix. It is intended as a guidance document and should not be considered all inclusive. In addition to these guidelines, you must also follow your company's guidelines and safety practices and procedures. This document is not intended to supersede those requirements. Besides these guidelines, it is also essential for the preparation of the rigid polyurethane foam hand mix, to become familiar with the Safety Data Sheets (SDSs) for all formulation ingredients.

HONEYWELL LIQUID BLOWING AGENTS

Honeywell offers two liquid foam blowing agents, Solstice® Liquid Blowing Agent (LBA) and Enovate® 245fa, that can be used for the isocyanate and polyol blend mixing process demonstrated in this guide. Solstice LBA is our latest advancement in foam blowing agent technology. It is based on hydrofluoro-olefin (HFO) technology and has a global warming potential (GWP) of 1, which is 99.9% lower than hydrofluorocarbon (HFC) blowing agents. It is a nonflammable, non-ozone-depleting replacement for HFCs, HCFCs, hydrocarbons, and other blowing agents. It does not require major equipment adjustments during conversion. Many systems suppliers are switching to Solstice LBA for its improved foam performance and to stay ahead of changing environmental regulations.

Enovate 245fa, based on HFC-based technology, is a proven replacement for HCFC-141b and other hydrofluorocarbon and nonfluorocarbon blowing agents in rigid polyurethane foam. Its excellent thermal insulating characteristics, physical properties, and materials compatibility make it an ideal blowing agent for rigid polyurethane foams.

Both blowing agents are used in a wide range of applications including but not limited to:

- Spray foam insulation
- Insulated panels / boardstock
- Appliance insulation
- More

PREPARATION OF HAND MIX FOAM

In the upcoming chapters, we will provide guidance on safety and equipment required, as well as illustrate a step-by-step method to prepare a rigid polyurethane foam hand mix.

Chapter 2: Getting Started | Safety and Equipment Check
Chapter 3: The Hand Mix Process | Step-by-Step Guide
Chapter 4: Advanced Technology | Dedicated Service

HOW TO PREPARE A RIGID POLYURETHANE FOAM HAND MIX

Chapter 2
Getting Started - Safety and Equipment Check

GETTING STARTED

Safety and Equipment Check

This chapter will help you get ready to prepare a rigid polyurethane foam hand mix using Honeywell Solstice® Liquid Blowing Agent (LBA) or Enovate® 245fa. It is intended as guidance only and should not be considered all inclusive. In addition to these guidelines, you must follow your company's guidelines and safety practices and procedures. This document is not intended to supersede those requirements. Before getting started, it is important to review the Safety Data Sheets (SDSs) for the materials that you will be mixing.

SAFETY CHECK

It is essential to wear the proper personal protective equipment (PPE). PPE includes but is not limited to:

- Safety glasses with side shields
- Solvent-resistant gloves
- Long pants
- Long-sleeve shirt/lab coat
- Safety shoes

The hand mix foam must be prepared in a hood with proper ventilation

EQUIPMENT CHECK

Before the hand mix process can begin, you should inspect all equipment. Ensure that you have all supplies needed, that they are in proper working condition, and meet materials compatibility requirements.

SUPPLIES YOU WILL NEED

Polyol premix.
Store the polyol premix at a temperature below the blowing agent's boiling point.

Prepare the polyol premix and store it at a temperature below the boiling point of the blowing agent. For the purposes of this guide, we stored the polyol premix at 50°F (10°C) ± 1°F. Solstice LBA is the blowing agent used in our polyol premix.

Isocyanate
Suggest storing at 70°F (21.1°C) ± 1°F.

For the purposes of this guide, the isocyanate is kept at a room temperature of 70°F (21.1°C) ± 1°F.

Polyol thermometer

The use of a polyol thermometer ensures that the polyol premix is at the proper temperature prior to mixing.

Agitator

For agitation, use a Conn ITT Dispersion Blade Type R or equivalent at 3000 rpm to ensure a thorough mixing of the components. The diameter of the agitator in this guide is 2 inches. Agitator size can vary and is dependent on the size of the pour.

Cake Box and Wooden Frame

When ready, the mixed foam will be poured into a "cake box" to expand. A cake box is made of uncoated cardboard and its size depends on the testing to be done and size of the pour. The cake box is placed inside a custom-made wooden frame to provide rigidity during polyurethane foam expansion. The wooden frame is equipped with a hinge that opens to ease removal.

Tongue Depressors

Tongue depressors are used to test the reactivity properties of the hand mix foam.

Timer

A timer ensures that pouring and mixing are performed for the correct duration.

HOW TO PREPARE A RIGID POLYURETHANE FOAM HAND MIX

Chapter 3
The Hand Mix Process | Step-by-Step Guide

THE HAND MIX PROCESS

Step 1 - Add Blowing Agent to the Prepared Polyol Premix

Prepare the polyol premix by weighing out the necessary components into a polyol blend container and mixing thoroughly after each chemical is added.
Add the components in the following order:

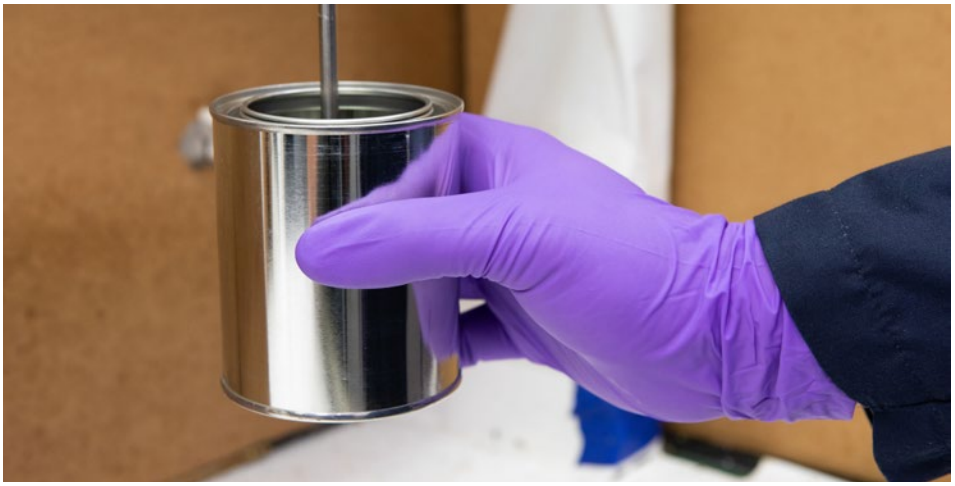
1. Polyol
2. Surfactant
3. Flame retardant (if applicable)
4. Catalyst
5. Other non-volatile ingredients
6. Water

Be sure to account for any material that may adhere to the agitator during the mixing process. This can be done by placing the agitator in the container and making it part of the tare weight. Place the tared container with the agitator inside on a scale, add the ingredient, and move the container with the agitator to the motor. Attach the agitator to the motor using the chuck, and blend. Then remove the agitator from the chuck and move the container with the agitator in it to the scale. Weigh the material, and repeat this process for other ingredients.

After blending is complete, place the polyol blend in the refrigerator and chill to 50°F ± 1°F, or your preferred processing temperature. For the purposes of this guide, we processed at 50°F (10°C).

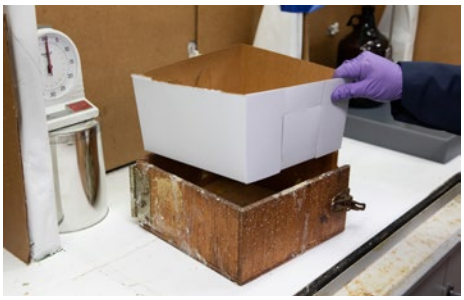
Once the polyol blend has reached 50°F ± 1°F, or your preferred processing temperature, remove it from the refrigerator. Tare the container (with agitator) and add the appropriate amount of blowing agent depending on your formulation.

Then blend the polyol premix. Start the agitation slowly to eliminate splatter. After mixing is complete, re-weigh the polyol blend. If the final weight is within 1% of the specified amount of blowing agent, cover the polyol blend and return it to the refrigerator to bring the temperature back to 50°F ± 1°F, or your preferred processing temperature before preparing the foam. If the weight is too low, add additional blowing agent and mix the polyol blend again. If the weight is too high, mix the polyol blend longer to evaporate off some of the blowing agent and then re-weigh it.



Step 2 - Stage the Materials and Equipment in the Hood

Next, stage the equipment and materials in the hood for foam making.



First, place the cake box with the top removed into the wooden cake box frame.

Next, place the tongue depressors next to the cake box for reactivity testing.

Stage the timer in the hood so it is ready when you prepare the isocyanate using the wet-tare method.

Step 3 - Prepare Isocyanate Needed for Your Formulation

Prepare the appropriate amount of isocyanate needed for your formulation. This step is done immediately before making the foam because isocyanate can react with water in the air.

Follow the wet-tare method of weighing isocyanate to ensure that you add the proper amount of isocyanate to the polyol pre-mix. Complete this step with the isocyanate at room temperature, which should be measured and recorded. Label two disposable lab containers isocyanate 1 and isocyanate 2. Add the appropriate amount of isocyanate per your formulation to container 1, plus an additional 30 grams. This additional 30 grams is added to account for the isocyanate that remains in the container when you pour it out over the course of 3 seconds.

Start the timer. Pour the Isocyanate from container 1 to container 2 for 3 seconds using a timer to track the time. Stop the timer. Place container 1 on the scale and tare the scale to zero.

Repeat the 3 second pour from container 1 to container 2. If the amount poured from container 1 to container 2 on the repeated pour is the target amount, plus or minus 1%, you have demonstrated that the correct amount can be poured. Refill container 1 to the specified amount for your formulation and proceed to the next step. Isocyanate container 1 is ready to be staged in the hood. Pour from container 2 into container 1 until you obtain the amount specified by weight in your formulation.

Now you should reset the timer to the 40 second mark so it is ready for the foam making process.

Step 4 - Check Temperature of the Polyol Premix

Check the temperature of the polyol premix to ensure that it is at your required processing temperature, as differences in temperature can affect the resulting foam. For this guide, the temperature target is 50°F or 10°C. The polyol premix is then staged in the hood next to the isocyanate.

Step 5 - Making the Foam

Next, you will move on to the foam making process. First, start the agitator. When you are ready, start the timer. When it reaches 56 seconds, pour the isocyanate into the polyol vessel for 3 seconds. When the timer reaches 60 seconds, bring the polyol vessel up to the agitator. Agitate the isocyanate-polyol combination for the length of time required to ensure a thorough mix. This time will depend on the reaction speed of the formulation and can typically range from 3 to 10 seconds. For the purposes of this guide, we mixed for 5 seconds. Stop the agitator and pour the mixture into the cake box container.

Step 6 - Reactivity Testing

Next, we can test the reactivity of the foam mixture.

Record Cream Time

First, record what is known as the Cream Time. When the color of the foam mixture lightens from brown to a cream color, record the time on the timer to indicate the Cream Time. Cream Time will vary depending on the type of formulation and the catalysts used. In some fast-reacting foam, the Cream Time may be instantaneous.

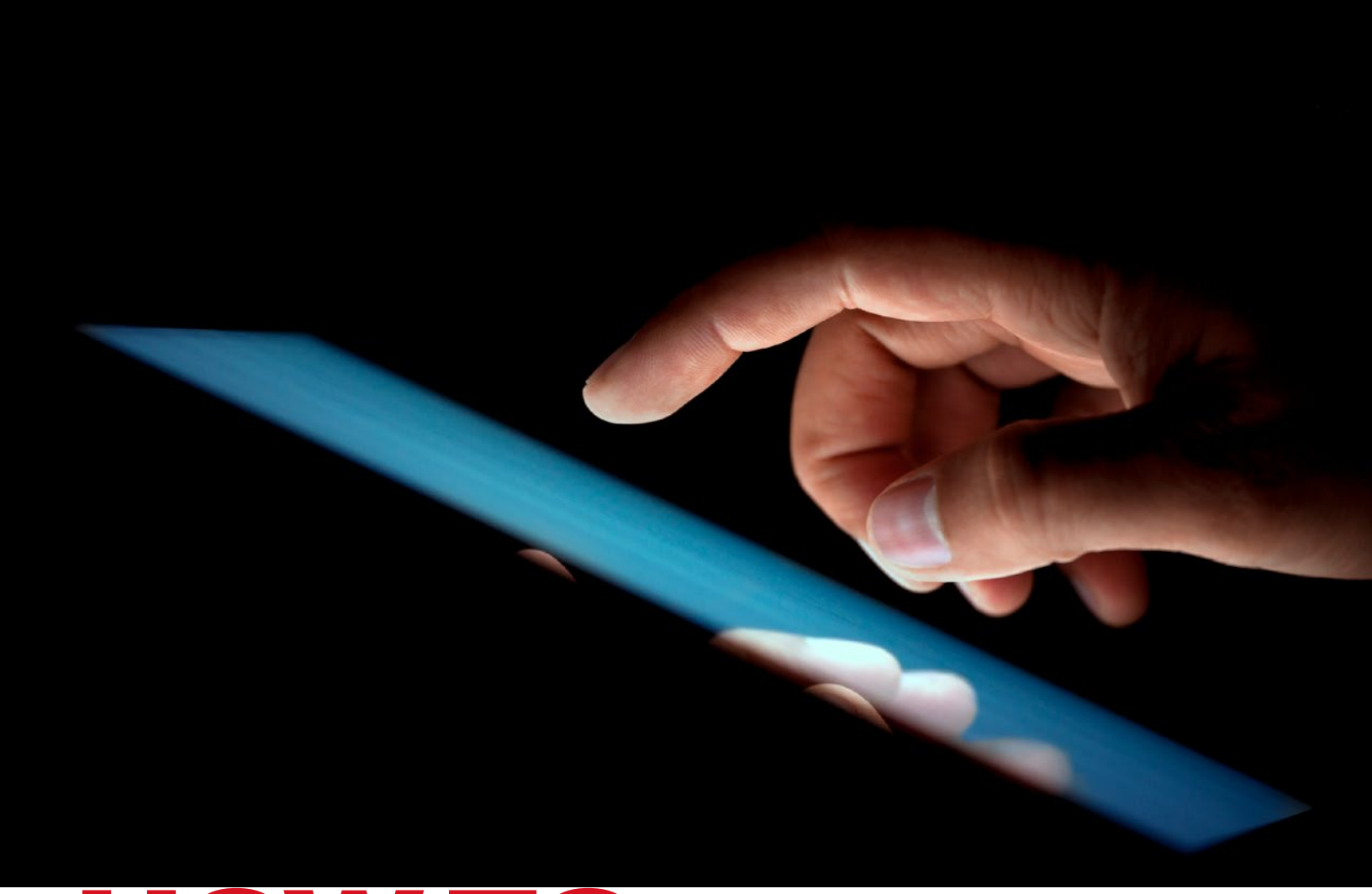
Record Gel Time

Next, you can determine the Gel Time. Cut into the foam one inch with a clean tongue depressor and raise it right away. If there is a string of reacting foam that follows the stick, record the time on the timer as the Gel Time. If not, cut into the foam in a new location, using a new, clean tongue depressor for each cut, until this is observed. The formation of strings of reacting foam indicates the Gel Time of the foam mixture.

Record Tack-Free Time

Now, you can test for the Tack-Free Time. For this test, the flat side of a clean tongue depressor is tapped lightly on top of the foam surface. The absence of foam sticking to the clean flat surface of the tongue depressor indicates the Tack-Free Time of the foam.

This concludes the foam preparation process and reactivity testing. It is suggested that the foam be conditioned at room temperature for at least 12 hours before it is cut for physical property testing.



HOW TO PREPARE A RIGID POLYURETHANE FOAM HAND MIX

Chapter 4
Advanced Technology | Dedicated Service

Our foam blowing agents are used in spray foam insulation for commercial and residential buildings, insulated nsulated panels/boardstock, appliance insulation, and many other applications worldwide.

Solstice® LBA and Enovate® 245fa offer system houses and polyurethane foam formulators a cost-effective means of achieving proven performance in closed-cell foam. Solstice LBA offers the additional advantage of being environmentally preferred due to its ultra-low GWP. It has been evaluated in a variety of foam systems and applications including but not limited to rigid foam applications such as refrigerators, freezers, spray foam, panels, and insulation for LNG shipping and storage. It's also used in flexible foam applications such as integral skin, molded, and slabstock foam.

Honeywell's commitment to the blowing agent/foam industry is not limited to supplying products. We also provide world-class customer service. Our technical team can assist with recommendations on foam formulations, including the selection of foam blowing agents, surfactants, catalysts, and other raw materials.

Call Us Today

If you have questions about the guidance provided in this brochure or would like to know more about the benefits of Honeywell blowing agents, **Contact Us** or visit **https://www.fluorineproducts-honeywell.com/blowingagents**.

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