

# IN•TOUCH

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## Latex Foam Rubber and Flexible Polyurethane Foam: Different Technologies With Comfort Goals

Today, nearly every chair and mattress sold in the United States contains flexible foam cushioning. While flexible polyurethane foam (FPF) holds the dominant position in upholstered furniture, latex foam rubber fulfills a niche role in certain furniture products. In sleep products such as mattresses and pillows, both materials play important roles.

While both FPF and latex foam rubber advance comfort, support and durability, they are chemically distinct, require different production processes and feature different performance attributes.

The purpose of this issue of IN•TOUCH is to help manufacturers and consumers of furniture and bedding understand these distinctions, and to evaluate competing commercial claims about these materials.

*Latex Foam Rubber Is NOT Flexible Polyurethane Foam*

Latex is NOT flexible polyurethane foam. Over the years, there has been a tendency use the terms “foam rubber” and “polyurethane foam” interchangeably. This is not accurate.

### Natural Latex Foam Rubber

Latex foam rubber in home furnishings applications can be natural rubber, synthetic rubber, or a blend of the two.

In its natural form, latex is a milky white liquid tapped from the trunks of rubber trees (*hevea brasiliensis*) and then concentrated in a 60/40 water/rubber mixture to create a thick suspension.

In manufacturing natural latex foam rubber, the latex suspension is whipped to a froth and poured into carousel molds, onto a conveyor, or into sheets (for sponge rubber carpet cushion). It is sometimes additionally frothed using CO<sub>2</sub> gas, chilled to below freezing, and then



heated to the point of vulcanization (about 240° F). During vulcanization, molecular crosslinks are formed, giving the resulting foam rubber the ability to recover its shape after compression.

Traditionally, vulcanization is accomplished by heating the frothed latex suspension while exposing it to elemental sulfur, one or more organic accelerators, a metal oxide (zinc oxide) and an organic acid (stearic acid).

## Synthetic Latex Foam Rubber

Synthetic latex foam rubber can be the product of natural rubber suspension combined with man-made chemistry. Synthetic latex foam rubber can also be made using a totally synthetic process such as used to produce styrene-butadiene rubber (SBR) and polymerized chloroprene, known as neoprene, introduced by DuPont in 1932.

Today's synthetic foam rubber can provide many of the physical performance characteristics of natural foam rubber, with more attractive economics and more precise performance attributes. Changes in chemical formulation or processing can yield different densities and firmnesses, for example.

## The Production Of Latex Foam Rubber

There are two different mechanical processing technologies used today.

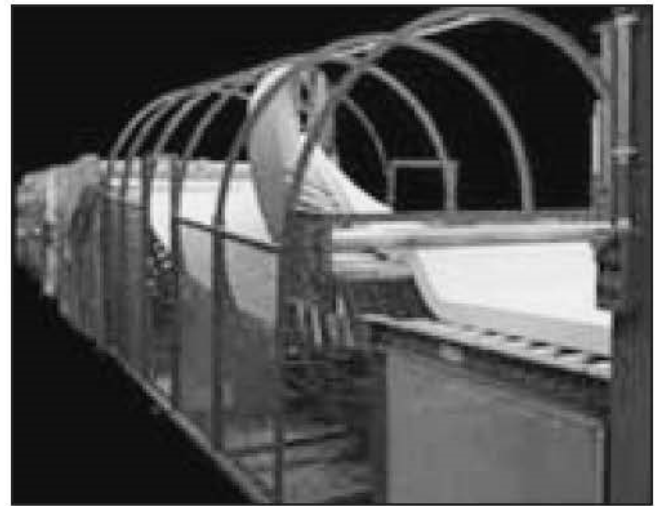
The **Dunlop Method** and the **Talalay Mechanical Process** account for most latex foam rubber used in home furnishings products.

The Dunlop Method was developed in 1929. It is generally used to produce latex foam rubber that's made from natural latex; in fact, to meet the requirement of some natural latex manufacturing certifications, this is the only method that can be used. The liquid latex is whipped into a froth and poured into a mold. The mold is filled to the top. The latex is then vulcanized by baking, removed from the mold, washed, and heated again to remove moisture. Because of the inconsistencies in the natural rubber mixture, the bottom of the cushion is typically denser and firmer than the top, because heavier particles in the mix settle during the process.

There is also a lesser known, next generation Dunlop process known as Perpetua™, a Continuous Pour Method. While it traces its roots back to 1929, this newer, advanced technology relies on a continuously moving line vs. pouring into a static, standard mold. The latex particles are kept in constant motion to prevent settling, creating consistent density and feel throughout the latex cushion. This technology aims for efficiency. The latex is whipped into a froth using air at the beginning of the process with no need to later introduce blowing agents. The consistent cell structure is inherent in the continuous pour process, achieved without the use of additional steps, such as freezing.

The Talalay Mechanical Process is a newer form of latex production commercialized in the 1940s. Again, the liquid latex is frothed and poured into the mold, but the mold is only partially filled. A vacuum is created to disperse the latex throughout the mold. The mold is then frozen at -20F. This keeps the latex mixture distributed throughout the mold for the vulcanization process. After vulcanization, the cushion is removed from the mold.

The Talalay process produces latex that is more consistent than the Dunlop method. It is also less dense. However, it is almost impossible for the latex cushions made this way to be 100% natural latex—chemical additives and fillers are typically required.



Production of latex foam rubber using the Dunlop Method



Filing a Talalay Mold With Latex Suspension

## How Does Latex Foam Rubber Cushioning Perform In Home Furnishings?

Both FPF and latex can provide high levels of comfort, support and durability in home furnishings cushioning (mattresses, pillows, and upholstery) and carpet cushion applications. Latex tends to be more costly, so is used in select products, as well as in combination with FPF.

Using ASTM testing standards, comparisons between latex foam rubber and various grades of FPF can be made. Because it is typically denser than FPF, latex foam rubber often achieves somewhat higher measurements in support factor and fatigue resistance. However, FPF may surpass latex foam rubber in properties such as IFD recovery. Also, the higher density means latex mattresses are heavier, and may be difficult to move.

Because of their contrasting and complementary attributes, it is not uncommon to see mattress constructions that contain both FPF and latex foam rubber to create specific mattress feels. The growing popularity of viscoelastic or “memory” FPF foam has added another variable to the picture.

Consider a hypothetical involving a premium-priced mattress. Latex tends to be very supportive and springy, whereas memory foam will conform to the body of the sleeper. A mattress might contain a thin layer of latex foam rubber on top for a springy “hand” and to maintain the tautness of the mattress ticking, while a layer of memory foam directly below allows the sleeper to “sink” into the mattress. Below that could be a thicker layer of either FPF or latex foam rubber for support and durability.

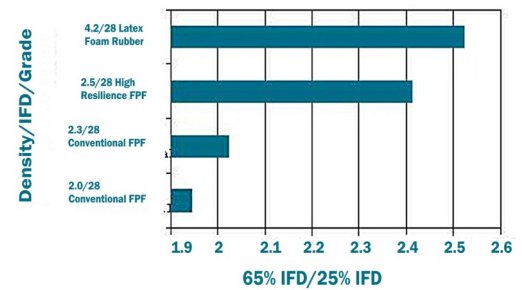
## Recycling Of Latex Foam Rubber and FPF

Both latex foam rubber and flexible polyurethane foam have positive environmental stories to tell and both materials have found acceptance among consumers concerned about the environmental impact of the products they buy.

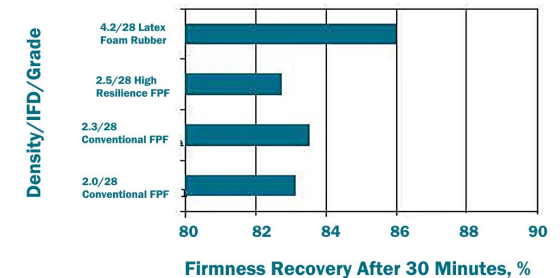
Like FPF, latex foam rubber collected as manufacturing scrap or recovered from post consumer use can be chopped and utilized when mixed with polyurethane scrap, as bonded carpet cushion. Latex foam rubber generally has a relatively high density and is soft, thus can only be used in limited proportions in the production of bonded carpet cushion.

Recycling now provides a market for virtually 100% of all post-industrial scrap generated during FPF production and finished product fabrication, as well as a large share of the post-consumer scrap sourced from recycled carpet cushion, mattresses, upholstered furniture, among other sources. More than one billion pounds of scrap foam are recycled annually in North America, making this one of the largest recycling success stories in the world.

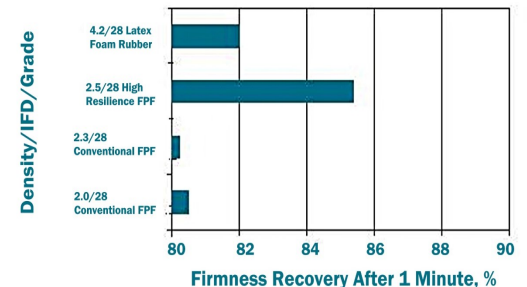
### Support Factor



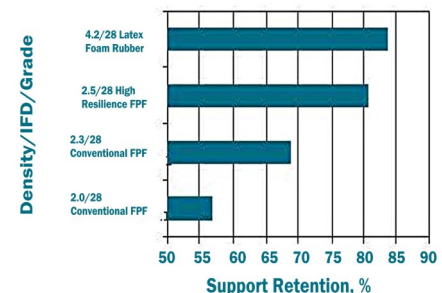
### Static Fatigue Resistance



### 25% IFD Recovery



### Dynamic Fatigue By Roller Shear



Charts source: Polyurethanes World Congress, September 1991, Nice, France

## Misleading Marketing Claims

Some sellers of latex foam sleep products tout it as more “natural” or “organic” to suggest it is a healthier option for consumers. In fact, the terms “natural” and “organic” are not the same thing when it comes to latex foam rubber.

The manufacturing of latex foams requires sulfur in order to vulcanize (crosslink) the latex rubber as well as accelerators (typically zinc oxide) and surfactants or soaps (typically potassium oleate) and other chemicals that may remain in the final latex foam. These chemicals typically represent 3 to 5% by weight of a latex foam mattress, so responsible manufacturers do not make the claim that their mattresses are “100% pure latex.”

The [Global Organic Latex Standard](#) (GOLS) requires that a product must contain more than 95% of certified organic raw latex material. The GOLS standard features permissible limits for harmful substances, emission test requirements and polymer and filler percentages. Rubber plantations as well as processing units up to the final retailer are certified according to the standard.

Some claims of “natural” latex may involve materials that have more additives than what can be used to qualify as “organic.” The additives required for the Talalay production process typically exceed the limitations.

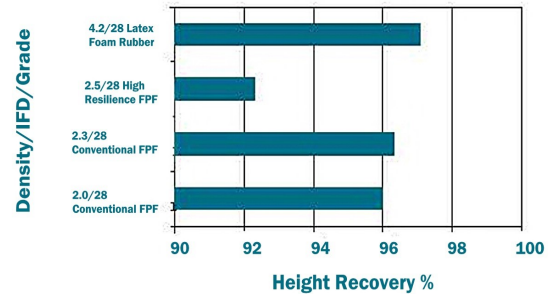
At the commercial scale and consumer price points required of most furnishings and bedding products, relying solely on naturally-occurring latex and not using some synthetic latex formulations would be prohibitively expensive.

The potential for misleading consumers through such “green” claims led the U.S. Federal Trade Commission to issue guidance about the improper use of “natural” and “organic” designations. Firms making misleading claims can be subject to lawsuits and to enforcement actions by the FTC.

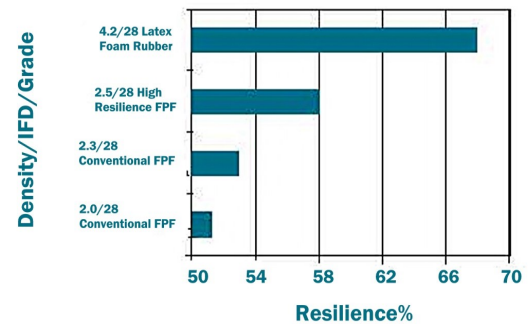
The real question for consumers concerned about healthy sleep products is whether the product they purchase contains harmful chemicals at a level apt to cause adverse health effects. Consumers concerned about chemical exposure should consider FPF certified by the [CertiPUR-US®](#) program. Certification means the foam was made without lead, mercury, formaldehyde, and without PBDEs, TDCPP or TCEP flame retardants. CertiPUR-US® foam also emit low levels of volatile organic compounds (VOC’s).

Likewise, consumers concerned about chemical content of latex products should look for the [GreenGuard](#) label on latex foam rubber mattresses, pillows, or other products. The GreenGuard label is also a certification of low emissions.

### Dry Compression Set



### Surface Liveliness



In addition, consumers should consider latex that is Standard 100 by OEKO-TEX® certified, meaning that the latex has been tested for harmful substances and is safe for human use. Product Class 1 is particularly significant because the testing is the most rigorous, with products being certified safe for infants and babies.

## About Latex Allergies

Some consumers express concern about allergic reactions attributed to exposure to natural latex products. Natural proteins from the rubber tree have been cited by health professionals as the primary cause of allergic reactions.

According to companies involved in the production of latex foam products for cushioning applications, the majority of allergic responses to latex occur with people in the medical industry who wear natural latex gloves as protection over a long period of time.

Some companies advise that if an individual is known to have allergies to plant antigens, they should avoid contact with natural latex based products. Synthetic latex does not contain natural proteins and so synthetic rubber products provide options for individuals having concerns about exposure to natural latex.

## Summary

The following summarizes latex foam rubber technology and performance capabilities:

- Latex foam rubber in home furnishings applications can be natural rubber, synthetic rubber, or a blend of the two.
- Latex foam rubber derives its physical performance properties from the vulcanization process that creates long molecular chains with strong crosslinked bonds.
- Because of its typically higher density, the performance of latex foam rubber may be higher than flexible polyurethane foam in some measurements. However, the high density adds costs and latex foam rubber is usually used in premium product applications and in combination with FPF. The higher density also means latex foam mattresses can be heavy and difficult to move.
- Because the characteristics of latex foam rubber and FPF products may differ, they may be used for different applications (for example, viscoelastic or “memory” FPF may provide more surface softness or body contouring than latex foam rubber. In some cases, manufacturers may combine both latex foam and FPF in a product construction.
- Both latex foam rubber and FPF can be certified by third parties for low emissions of certain chemicals.
- As is the case with FPF, natural and synthetic foam rubber scrap is recyclable and can be used in limited amounts in the production of bonded carpet cushion.
- Although it would be unusual for an individual sensitive to natural latex to come into direct physical contact with the core material of a foam rubber cushion, synthetic latex provides an option.

This bulletin is intended to serve as a reference regarding the general properties and uses of polyurethane foam and has been developed as a service for the Polyurethane Foam Association’s (PFA) members and their customers. The information contained in this bulletin is offered in good faith, developed from sources deemed to be reliable, and believed to be accurate when prepared, but is offered without warranty, express or implied, as to merchantability, fitness for a particular purpose, or any other matter.

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