EASTMAN

# **Efficiency** to the **Max**

*Improve performance with minimum reformulation using a cost-effective, hassle-free, general-purpose non-phthalate plasticizer for dry-blend compounding.*

Eastman **VERSAMAX**™ Plus
plasticizer

# Maximum performance. Minimum hassle.

Using Eastman VersaMax™ Plus plasticizer, you can upgrade your current non-phthalate to achieve better performance and cost while meeting the regulatory compliance you need—with a minimal amount of reformulating.

Eastman VersaMax Plus is a tailored, general-purpose non-phthalate solution that provides better efficiency and improved dry times and can expand your formulation window.

For dry-blend compounders, VersaMax Plus offers:

- **Improved dry times,** demonstrating significant improvement in dry time when compared to Hexamoll® DINCH® (1,2-cyclohexane dicarboxylic acid diisononyl ester), DINP (diisononyl phthalate), Palatinol® DPHP (dipropylheptyl phthalate), and even Eastman 168™ non-phthalate plasticizer (DEHT, di-2-ethylhexyl terephthalate).
- **Greater productivity** on the factory floor thanks to improved dry time, saving not just time but costs as well.
- **Higher efficiency,** requiring reduced plasticizer loading or allowing the use of more low-cost filler
- **Enhanced plasticizer compatibility** in PVC formulations, allowing more robust formulations, especially very soft compounds
- **Lower melt viscosity,** enabling a broader processing window
- **Faster fusion,** also resulting in greater efficiency and productivity
- **Lower processing temperature,** yielding energy savings and faster line speeds
- **Better clarity in finished products** due to lower haze
- **Non-phthalate,** meeting customer needs
- **Replacement** for Palatinol® DPHP, L9P, DINP, and Hexamoll® DINCH®

# Versatile applications. Enhanced compatibility.

The industry is moving away from phthalate plasticizers, such as DINP, Palatinol® DPHP, Jayflex™ L9P, and DEHP (di-2-ethylhexyl phthalate). But that doesn't mean formulators have to settle for longer dry times, higher costs, or other performance factors. With VersaMax Plus, a non-phthalate plasticizer, dry-blend compounders now have a cost-effective choice that improves performance.

## Typical plasticizer performance data in dry blends

| | VersaMax Plus | DEHP | Eastman 168 | DINP | Hexamoll® DINCH® | Palatinol® DPHP |
|---|---|---|---|---|---|---|
| **Dry time, min** | 2.4 | 2.7 | 3.5 | 3.7 | 4.1 | 4.1 |
| **Durometer A hardness** | 70 | 70 | 73 | 73 | 74 | No data* |
| **Tensile @ break (MPa)** | 15.5 | 14.1 | 14.7 | 14.4 | 14.0 | No data* |

**No data was available at the time this study was conducted.*

When testing production rates in the lab with a Brabender® rheometer, significant reductions in dry times were observed for VersaMax Plus compared to DINP and other non-phthalate plasticizers. Dry times of compounds with VersaMax Plus were similar to DEHP.

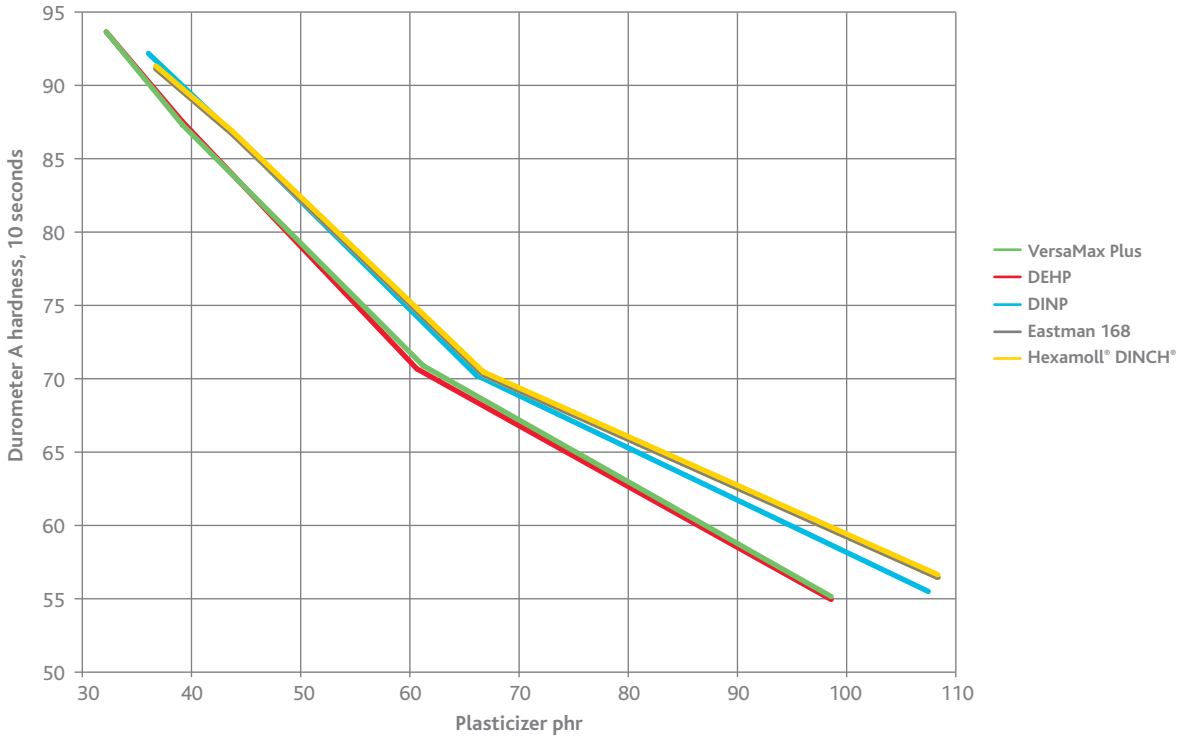
| Component | PHR |
|---|---|
| K70 suspension resin | 100 |
| Plasticizer | 70 |
| Clay | 18 |
| ESO (epoxidized soybean oil) | 5 |

## Reduced dry time

| Compound | Hardness | Filler PHR | Dry time | | Reduced dry time |
|---|---|---|---|---|---|
| | | | Eastman 168 | VersaMax Plus | |
| A | 55A | 90 | 5–6 hr | 90 min | **2.7–4× reduction** with VersaMax Plus |
| B | 65A | 0 | 2.5–3 hr | 55 min | |
| C | 65A | 71 | 3–3.5 hr | 55–60 min | |

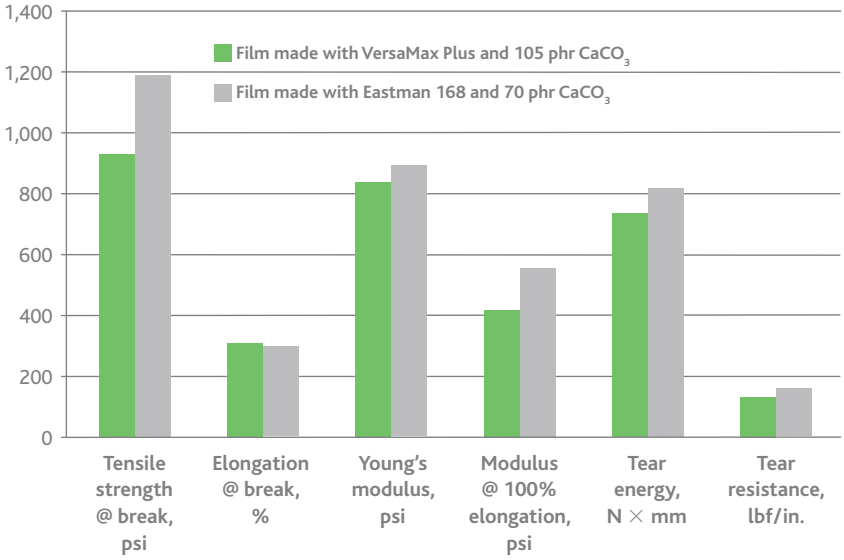
In 2000-lb production runs with a ribbon blender, a 2.7–4× reduction in dry time was observed with VersaMax Plus.

## Plasticizer efficiency




VersaMax Plus demonstrates efficiency similar to DEHP across a variety of durometer A hardness levels while outperforming DINP, Hexamoll® DINCH®, and even Eastman 168. We would expect that VersaMax Plus would also have much better efficiency than Palatinol® DPHP based on our findings in plastisols and findings in other reference books.

## VersaMax Plus allows higher filler loading for cost reduction



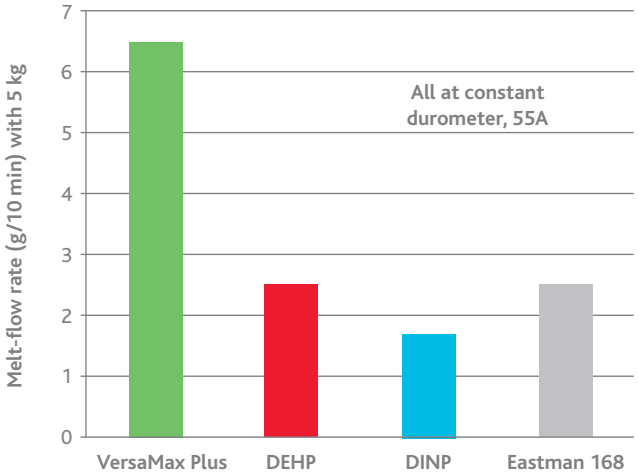

*Films tested in the plot above were formulated using 104 phr of plasticizer, and the filler loading was adjusted to make a film having a 60A Durometer hardness.*

Due to its higher efficiency, a VersaMax Plus formulation can use 50% more filler while still achieving the same hardness and similar mechanical properties.

| Component | Formulation made with VersaMax Plus | Formulation made with Eastman 168 |
|---|---|---|
| K70 suspension resin | 100 | 100 |
| Calcium carbonate (325 mesh) | 105 | 70 |
| ESO (epoxidized soybean oil) | 3 | 3 |
| Ba/Zn heat stabilizer | 3 | 3 |
| Plasticizer | 104 | 104 |

## Lower melt viscosity

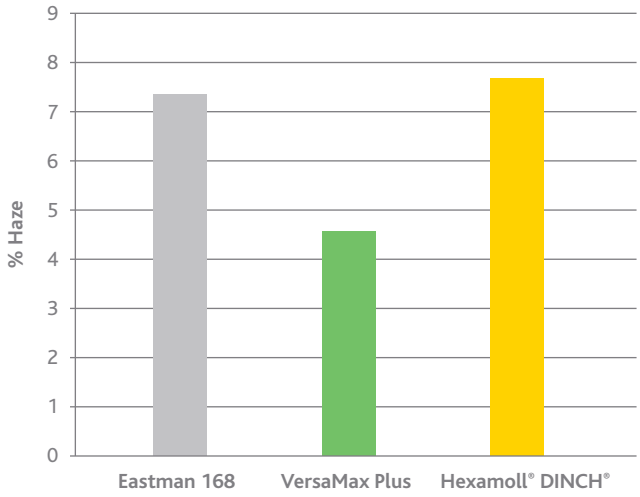
*Melt-flow rate at 175°C using 5 kg*




Using a plastometer, the melt-flow rates of compounds with different plasticizers were measured. The higher the melt-flow rate, the lower the melt viscosity of the compound. VersaMax Plus demonstrates the lowest melt viscosity.

## Lower haze

*Haze measurements**




**Measured on 75-mil films formulated to 70 durometer A hardness*

In this study, films were made at a 70 durometer A hardness from formulations containing several general-purpose plasticizers. These films were tested on a BYK Haze-Gard Plus instrument, and the % haze of each film was measured. The results suggest that VersaMax Plus films have 40% less haze than films made from Eastman 168 or Hexamoll® DINCH®.

# Reliable supplier and industry partner

Eastman has the world's broadest portfolio of non-phthalate plasticizers. Your business, however, needs more than reliable plasticizers—it needs a reliable plasticizer manufacturer.

For more than 50 years, Eastman has proven to be a dependable and trusted plasticizer supplier to the world. With manufacturing capabilities around the globe, including sites in North America, Latin America, Europe, and Asia, we deliver the plasticizers that make products better . . . and safer.

With a knowledgeable technical support staff, a reliable and global supply, and a strong commitment to product development, Eastman remains poised to meet your long-term needs amidst a shifting regulatory landscape and to provide the guidance you need when selecting VersaMax Plus plasticizer.

To sample Eastman VersaMax™ Plus plasticizer, contact your Eastman representative or visit www.EastmanPlastizers.com/VersaMaxPlus.

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The results of insight™

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