

# The performance to compete. The versatility to comply.

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



## A new non-phthalate to maximize performance

Choosing the right general-purpose plasticizer for your formulations can be a challenge. Using Eastman VersaMax™ Plus plasticizer, you can upgrade your current non-phthalate to achieve better performance and cost and meet the regulatory compliance you need—with a minimal amount of reformulating.

Eastman VersaMax Plus is a tailored, general-purpose non-phthalate solution that provides consistent and optimal efficiency and performance—and can expand your formulation window.

By providing comparable mechanical properties and improved processing parameters, VersaMax Plus has several advantages over other general-purpose plasticizers, such as DINP (diisononyl phthalate), Hexamoll® DINCH® (1,2-cyclohexane dicarboxylic acid diisononyl ester), Palatinol® DPHP (dipropylheptyl phthalate), Jayflex™ L9P (dinonyl phthalate), and even Eastman 168™ non-phthalate plasticizer (DEHT, di-2-ethylhexyl terephthalate).

For plastisol formulations, Eastman VersaMax Plus offers:

- **Faster fusion**, resulting in greater efficiency, productivity, and energy savings
- **Enhanced compatibility** in PVC formulations, especially in very soft compounds
- **High efficiency**, allowing reduced plasticizer loading or increased low-cost filler loading
- **Lower and stable plastisol viscosity**, allowing a broader formulation window as well as consistent product properties and performance, even with extended shelf life
- **Reduction or elimination of costlier copolymer** due to lower fusion temperature
- **Better clarity** in finished products as a result of lower haze
- **Non-phthalate**, meeting customer needs
- **Replacement for costly additives** such as Mesamoll®, Mesamoll® II, and Jayflex™ L9P to improve your bottom line
- **Replacement** for Palatinol® DPHP and Hexamoll® DINCH®

## Proven performance for plastisols

The industry is moving away from phthalate plasticizers, such as DINP, Palatinol® DPHP, and DEHP (di-2-ethylhexyl phthalate). With Eastman VersaMax Plus, a non-phthalate plasticizer, plastisol manufacturers now have a cost-effective choice that improves performance.

## Typical plasticizer performance data in plastisols

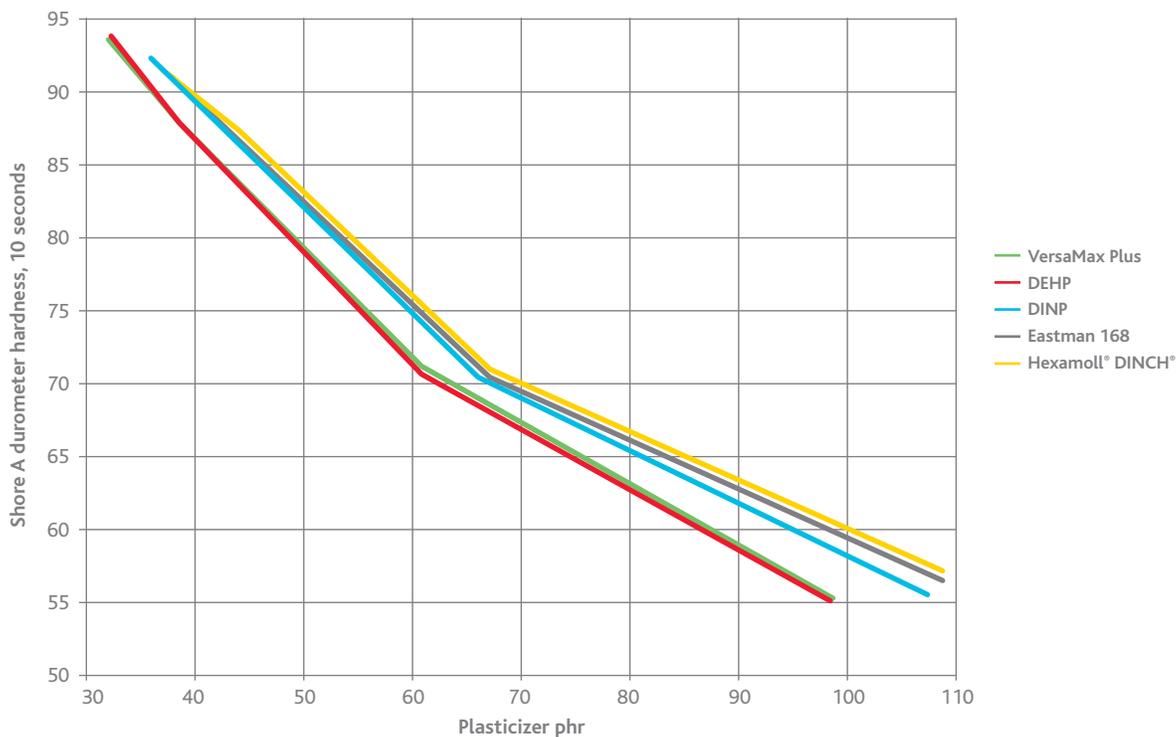
	VersaMax Plus	DEHP	Jayflex™ 77*	Mesamoll®*	Mesamoll® II*	Jayflex™ L9P*	DINP	DEHT	Palatinol® DPHP*	Hexamoll® DINCH®
Shore A hardness	70	70	70	72	72	73	73	74	77	74
Gel point, °C	72	73	71	70	71	80	79	82	85	95
Fusion peak temperature, °C	124	121	117	115	114	135	136	138	146	151

\*This data is a correlation between two data sets containing VersaMax Plus and DEHT.

The use of VersaMax Plus leads to lower gelation and fusion temperatures than DINP, Jayflex™ L9P, Hexamoll® DINCH®, and Palatinol® DPHP and mirrors the gelation and fusion temperatures of DEHP. VersaMax Plus has similar gelation and fusion temperatures to Mesamoll® and Jayflex™ 77. Due to these lower temperatures, less heat and total energy are needed during production.

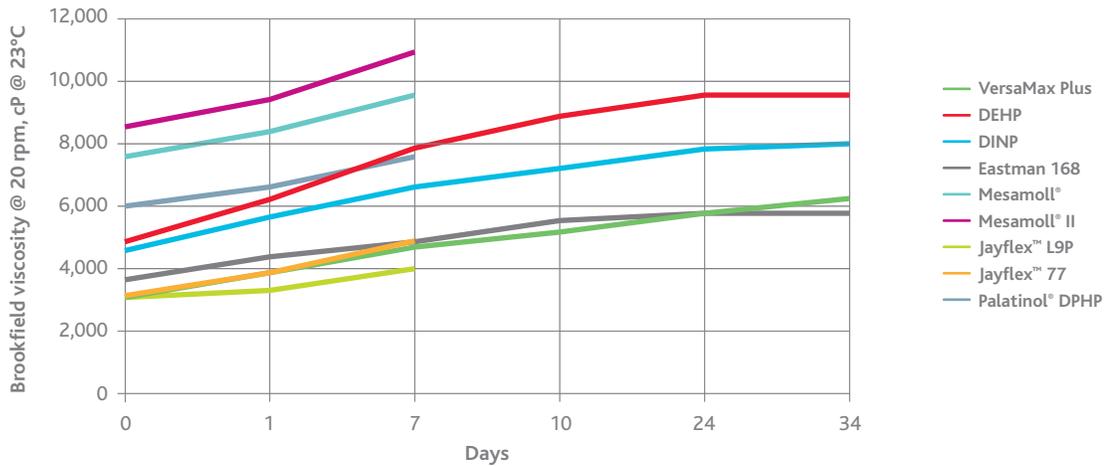
Component	PHR
K74 dispersion resin	100
Plasticizer	60
ESO (epoxidized soybean oil)	3
Heat stabilizer	3

## Higher efficiency



VersaMax Plus exhibits better efficiency than DINP, Hexamoll® DINCH®, and even Eastman 168 and mirrors the efficiency of DEHP. With higher efficiency, less plasticizer is needed during production to achieve the same Shore A hardness. Based on formulations in the preceding table, we would expect that VersaMax Plus would also have better efficiency than Mesamoll®, Jayflex™ L9P, and Palatinol® DPHP.

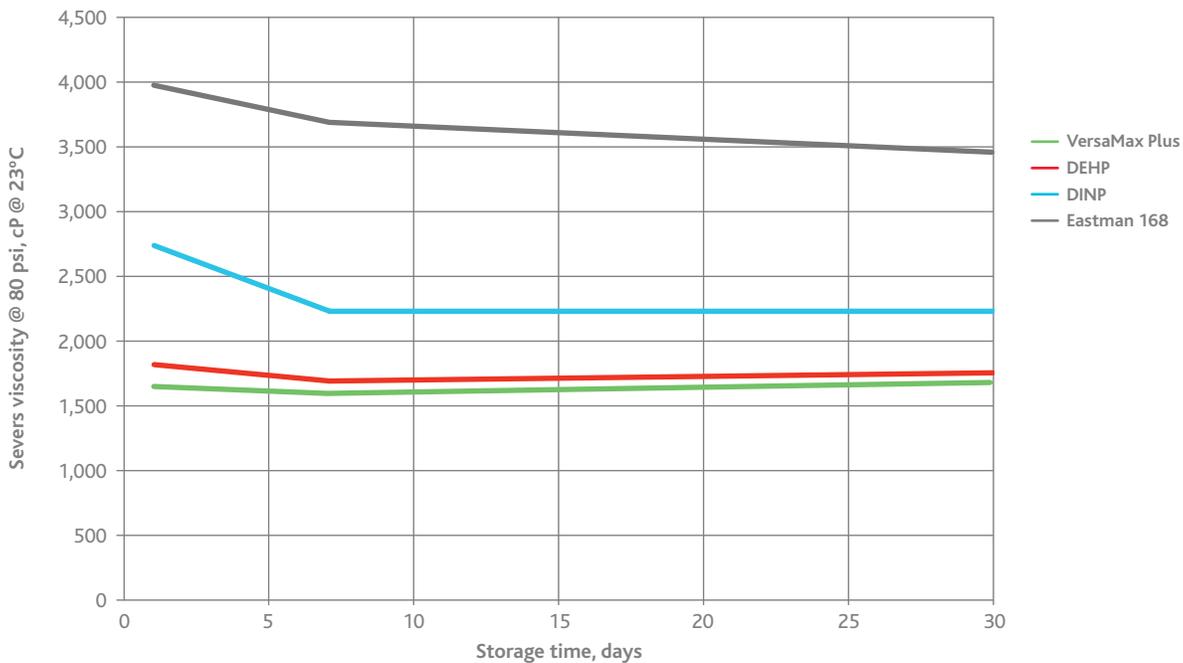
## Brookfield viscosity\*



\*60 phr plasticizer and 3 phr ESO after storage time in days

Using a Brookfield viscometer, we observed that VersaMax Plus has low viscosities similar to Eastman 168, Jayflex™ L9P, and Jayflex™ 77. The low viscosities obtained with VersaMax Plus may allow the formulator to extend shelf life, broaden the formulation window, and reduce the need for viscosity modifiers.

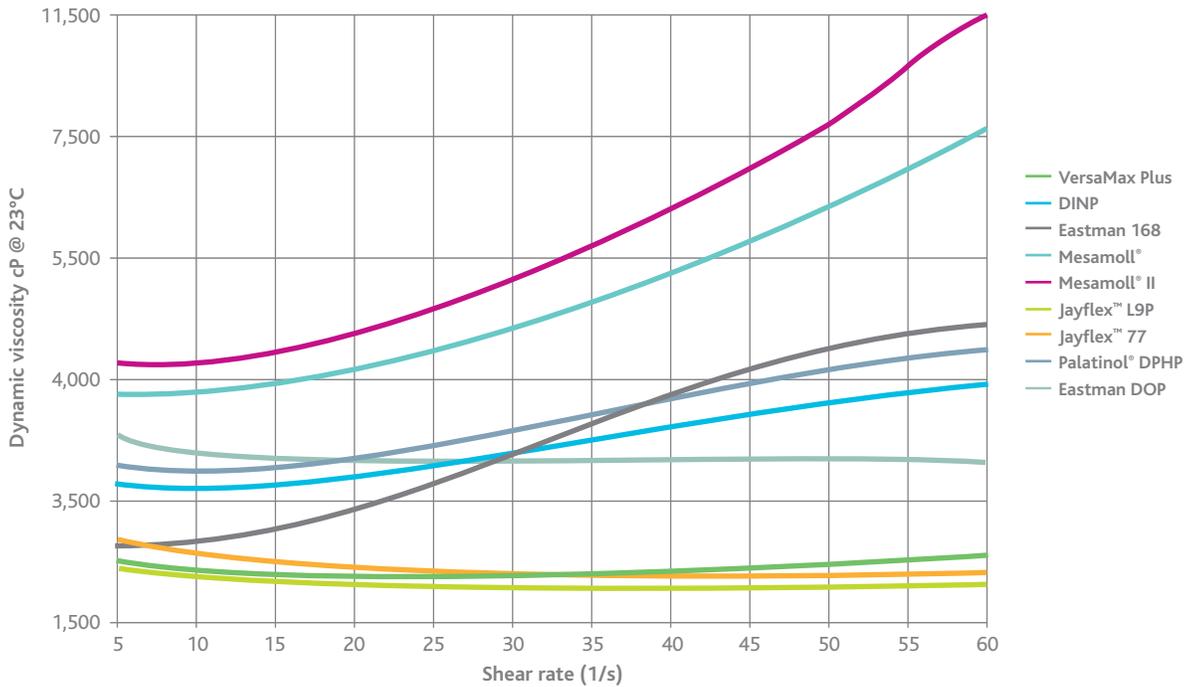
## Severs viscosity\* (Orifice = 0.1484 cm diameter × 5.0 cm)



\*60 phr plasticizer and 3 phr ESO after storage time in days

Plastisols made with VersaMax Plus have similar Severs viscosities to DEHP and DINP—making it easier for a formulator to match viscosities when switching from phthalate to non-phthalate alternatives.

## Dynamic viscosity\*



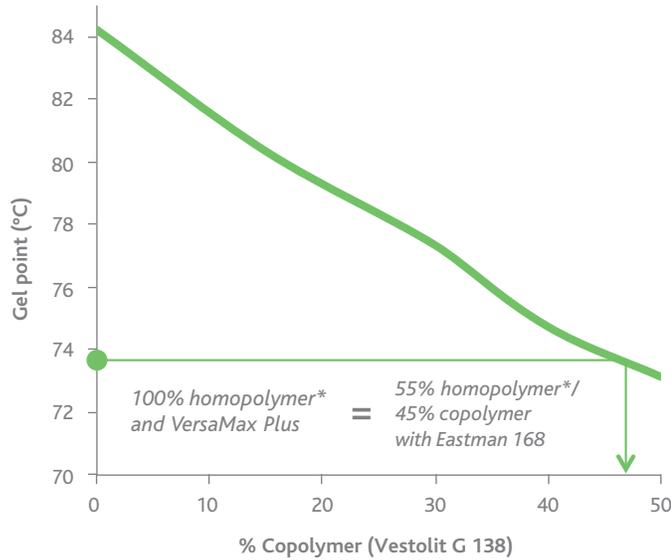
\*60 phr plasticizer and 3 phr ESO after 7 days of storage

Dynamic viscosity was measured on each plastisol after 7 days at room temperature using a parallel-plate rheometer. Plastisols made with VersaMax Plus, Jayflex™ L9P, and Jayflex™ 77 have the lowest viscosity under increased shear and, along with Eastman DOP plasticizer, are the most Newtonian of the formulations studied. The plastisols made from Mesamoll® and Mesamoll® II have the highest viscosities and, along with Palatinol® DPHP, DIMP, and Eastman 168, shear thicken.

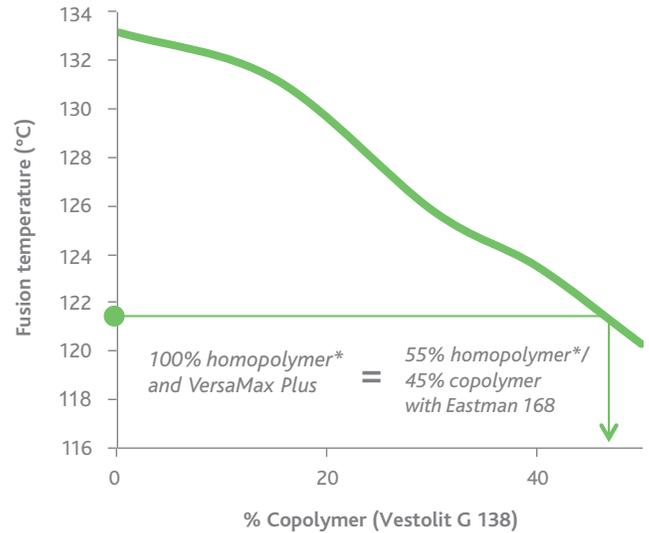


Reduce or eliminate copolymer usage to reduce cost and/or improve processing.

### Gel point with Eastman 168 as a function of % copolymer



### Fusion temperature with Eastman 168 as a function of % copolymer



Lower fusion temperatures can allow faster processing, and they can broaden your formulation window to enable applications that typically cannot withstand processing at higher temperatures.

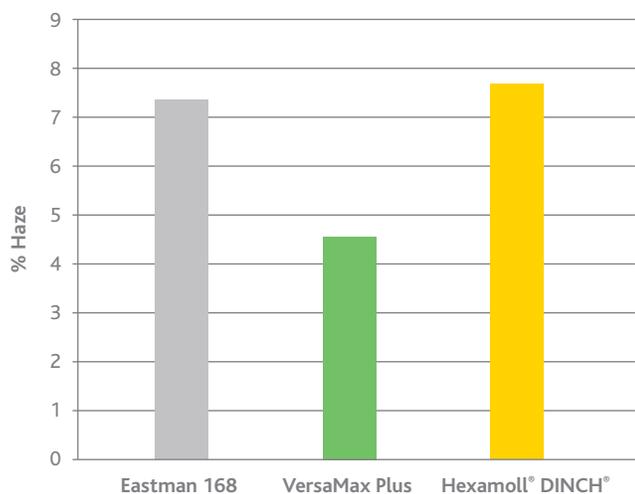
Some formulators use acrylic copolymers to achieve lower fusion temperatures in their process. The preceding plots show increasing copolymer leads to lower gel points and fusion temperatures.

When using VersaMax Plus with 100% homopolymer, you achieve a gel point of 74°C and a fusion temperature of 122°C. To achieve this gel point and fusion temperature using Eastman 168, you need to use 45% acrylic copolymer.



## Lower haze

### Haze measurements\*



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

In this study, films were made at 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 provide the guidance you need when selecting VersaMax Plus plasticizer.

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To sample Eastman VersaMax Plus™ plasticizer, contact your Eastman representative or visit [www.EastmanPlastizers.com/VersaMaxPlus](http://www.EastmanPlastizers.com/VersaMaxPlus).



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