



Holtac™
Lead-free for PVC

2015

Holtac™ micronized polyols for Ca/Zn stabilizer systems

- ▶ Enabling lead-free PVC without compromising performance
- ▶ Micronized size gives smooth processing and high quality PVC
- ▶ High performance, high purity solid polyols
- ▶ From a trusted supplier able to offer guide formulations
- ▶ Facilitating the phase-out of lead by 2015 in Europe

Lead-free for PVC

Holtac™ is Perstorp's polyol offer for lead-free PVC. It is a cutting-edge environmentally friendly building block for Ca/Zn stabilizers that helps achieve the desired processing properties and heat resistance required by a top performing PVC stabilizer. When PVC compounds are processed, high temperatures affect the color of the compound through degradation and cause yellowing. Heat stabilizers counteract the degradation and yellowing of PVC compounds. With Holtac™ as a co-stabilizer you have a precise polyol that secures high performance PVC processing, while at the same time being a sustainable choice replacing harmful lead-based alternatives.

Delivering reliability

When choosing Perstorp's Holtac™ you profit from the unique service and high quality that comes from a partnership with the world leader in polyalcohols. Founded in Sweden, the Perstorp name has become synonymous with high Swedish standards. Perstorp has the largest polyalcohol production capacity in the world and with own production sites we can guarantee safety and quality for the whole chain, from sensitive raw materials, through production and milling, to bagging and distribution. Holtac™ production is carried out in Germany where the polyol is formulated and milled to a precise micronized size to meet the high quality demands of the market.

The Holtac™ portfolio

The Holtac™ portfolio contains a range of different polyols with varying melting points and hydroxyl numbers. This allows customization of the polyol for your specific PVC processing need. It is also possible to mix several Holtac™ products to achieve a unique performance.

In the future, Perstorp will have the capability to produce a renewable Holtac™. Based on renewable raw materials with renewably powered production, this innovation would require no change in processing or formulation. Renewable Holtac™ would have all the advantages of Holtac™ while giving an added competitive value though its minimized environmental impact.



Members of The European Stabilizer Producers Association (ESPA) have made a voluntary commitment to phase out lead entirely by 2015. Being concerned about the potential toxic risks related to lead stabilizers, the rest of the world is following. Holtac™ for Ca/Zn stabilizer systems provides a sustainable alternative facilitating the phase-out of lead without compromising performance.



Our Holtac™ products:

Holtac™ M

- ▶ Melting point at 262 °C
- ▶ Good dynamic heat stability
- ▶ Low water absorption

Holtac™ D

- ▶ Melting point at 222 °C
- ▶ Excellent dynamic heat stability
- ▶ Low water absorption
- ▶ Low risk for plate-out

Holtac™ T

- ▶ Melting point at 248 °C
- ▶ Good dynamic heat stability
- ▶ Low water absorption

Holtac™ DT

- ▶ Low melting point at 111 °C
- ▶ Excellent early color and clarity
- ▶ Low water absorption
- ▶ Good processing and low risk of plate-out

Holtac™ Poly

- ▶ Melting point below approx. 170 °C
- ▶ Good processing and low risk of plate-out
- ▶ Good heat stability
- ▶ Low impact on early color
- ▶ Within polymer compliance



Ca/Zn stabilizers have already proven their performance in various PVC applications. For example, in PVC window profiles these stabilizers show an outstanding weathering stability.

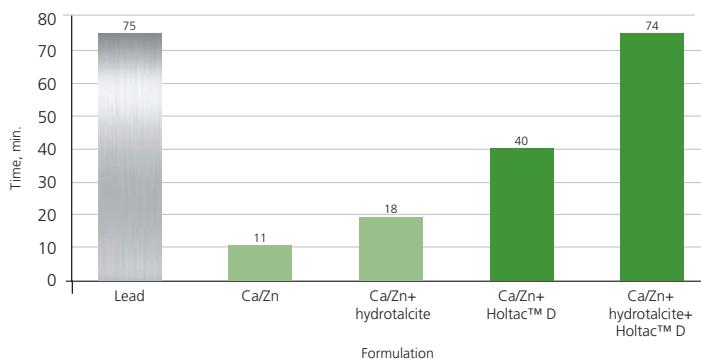
No compromise on performance or the environment

For Ca/Zn stabilizer systems

The Perstorp polyol offer for lead-free PVC provides an unbeatable combination of high product and environmental performance. Choosing Holtac™ as a co-stabilizer in Ca/Zn systems has many advantages. In dynamic heat stability tests comparing the performance of lead to Ca/Zn systems, equal performance can be reached. When designing Ca/Zn systems, adding a hydrotalcite gives a synergistic effect with Holtac™. When choosing a Holtac™ product, there are a range of different product characteristics to choose between. For example, Holtac™ DT is excellent at improving color, while Holtac™ D shows outstanding dynamic heat stability.

Synergistic effect when hydrotalcite is added to Holtac™

- Ca/Zn + hydrotalcite + Holtac™ D 74 minutes
(47 minutes if additive)



Dynamic heat stability for lead vs Ca/Zn with hydrotalcite, Holtac™ D and hydrotalcite + Holtac™ D

The lead-free choice

When choosing Holtac™ you also make a lead-free choice for the benefit of the environment. Being concerned about the potential toxic risks related to lead stabilizers, a voluntary commitment was initiated in the EU to move away from lead. Members of The European Stabilizer Producers Association (ESPA) decided to replace 50% of lead stabilizers with alternatives by 2010 and to phase out lead entirely by 2015. This agreement is having a critical impact in Europe and beyond, driving the rest of the world to also change to lead-free stabilizers. With increased concerns about working and living environments as well as awareness of lead's impact on health, it is clear that lead-free is the future.

Also, Holtac™ is fully in line with the European regulation covering the Registration, Evaluation and Authorization of Chemicals (REACH). This means that Perstorp has successfully pre-registered Holtac™ to ensure compliance with the new regulation.

Sustainability at Perstorp

Sustainability is an important topic in the PVC industry as well as for Perstorp. Through continuous and focused innovation for the environment, health and safety of our products, Perstorp has built a reputation in the industry of being at the forefront of sustainability. We can never afford to endanger the environment and believe in balancing environmental sensibility, customer demands and economic realities to achieve winning formulas. All of Perstorp's production plants maintain the highest standard and fulfill rigorous environmental criteria. Our quality Sustainability Reports have set new standards both in our industry and outside. So if sustainability is a part of your business, Perstorp is your natural partner.

We welcome your questions.
More detailed information and specifications of each product are available on www.perstorp.com or through your Perstorp sales representative.

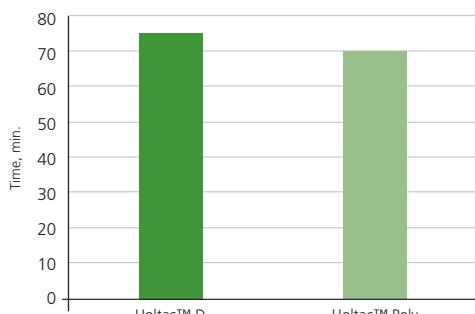
New innovation to meet growing demand

New Holtac™ Poly

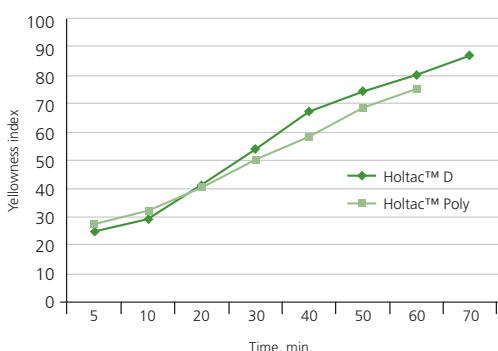
The new Holtac™ Poly has been developed as a complementary product to Holtac™ D and is the result of innovative Perstorp technology based on a mixture of polymers. It is designed to support the growing demand for Ca/Zn co-stabilizers as lead is phased out.

Holtac™ Poly has very similar technical properties compared to Holtac™ D. Heat stability and yellowing index for the two products are within the same range. The advantage with Holtac™ Poly is the ability to meet high capacity needs.

Holtac™ Poly is more than a product. It is an innovative technology developed by Perstorp offering possibilities to further modify the polymer to match specific needs and applications. Holtac™ Poly is a starting point for formulating new solutions together with our customers, while still being within the polymer compliance of REACH and TSCA. All in all, it is a new winning formula from Perstorp developed to suit your business.



Dynamic heat stability for Holtac™ D and Holtac™ Poly are within the same range



Yellowness index for Holtac™ D and Holtac™ Poly are within the same range

{lead-free}



Enabling smooth processing

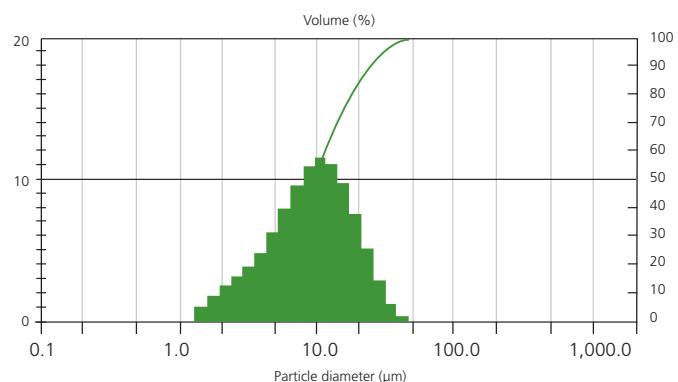
Pure product quality

The high and consistent quality of Holtac™ is ideal in strengthening your competitive advantage. All Holtac™ polyols are manufactured to a high purity level which guarantees a consistent melting point and predictable heat stability. The polyols are precision milled to a micronized size of 40 µm (250 µm for Holtac™ DT and Holtac™ Poly) and have a narrow particle size distribution enabling high and consistent performance. Our quality control procedures ensure that at least 99% (98% for Holtac™ DT and Holtac™ Poly) are below the stated particle size values. With Holtac™ you can expect smooth and stable PVC processing with no lumps. You save time, costs and lower your scrap rates.

Offering guide formulations

Our ambition is to be your reliable and trusted business partner. To ease transition from lead to using Holtac™ polyols, Perstorp is able to offer guide formulations for both rigid and plasticized PVC stabilized by Ca/Zn. Whether it is about finding basic recipes for possible stabilizer packages or times for dynamic heat stability, Perstorp Technical Teams will be happy to supply you with the right information. Reliable solutions mean low risk and extra profit in your production.

Perstorp has a well equipped PVC-laboratory ready to co-develop and customize new solutions to address special challenges. The laboratory is on standby for any technical issues or just as a technical partner to help you succeed.



Particle size distribution of Holtac™ M, Holtac™ D and Holtac™ T
Typically 99% of particles are below 40 µm

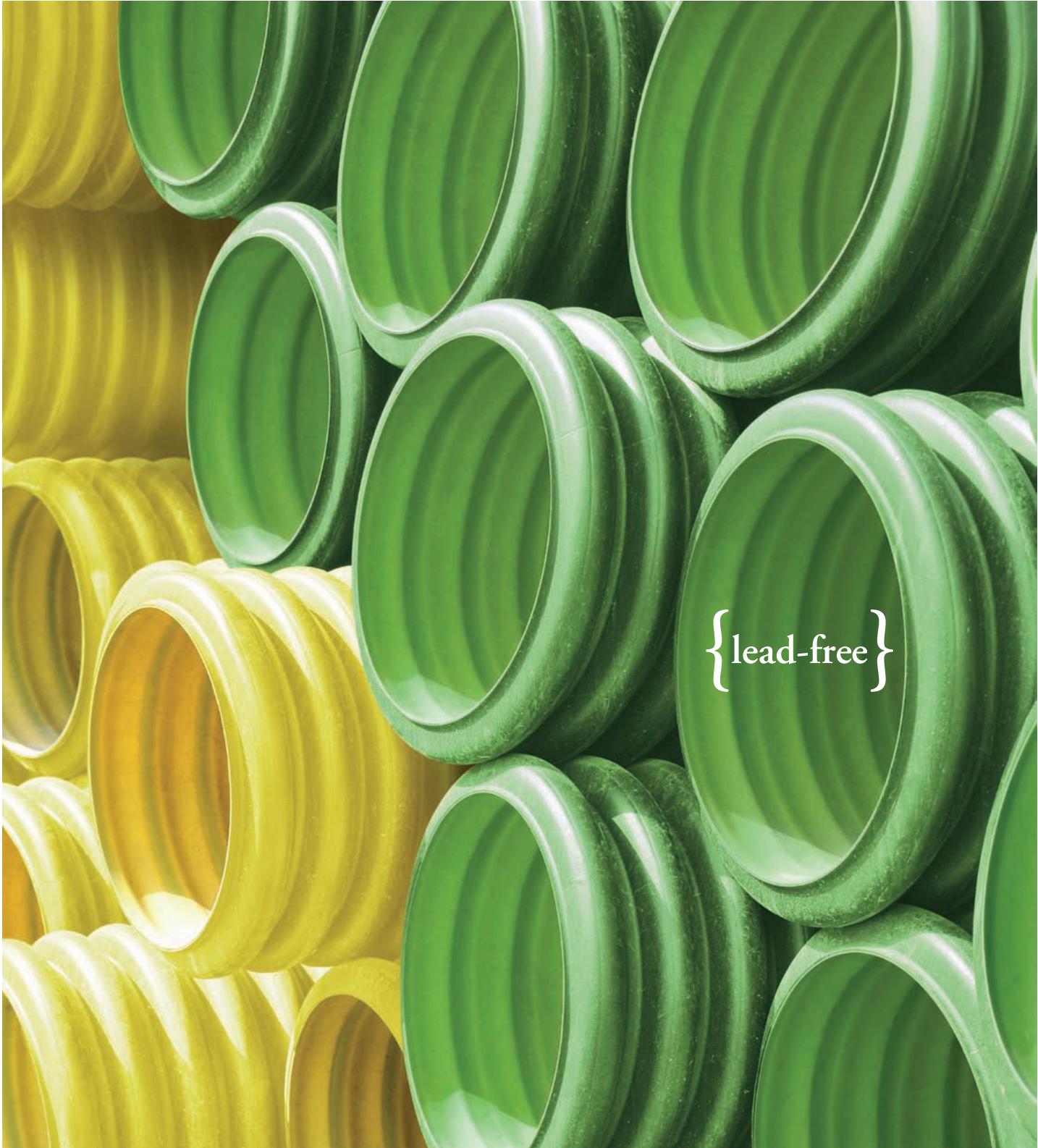
	Stability Time, min	10	20	30	40	50	60	70	80	90	100
Holtac™ D	79										
Holtac™ Poly	74										
Holtac™ T	67										
Holtac™ M	64										
Holtac™ DT	34										

Dynamic heat stability including yellowness indication for all Holtac™ products in a basic Ca/Zn stabilizer system



Basic guide formulation for a Ca/Zn stabilizer system

Norvinyl S 5745	100 phr
Kane Ace PA210	1,5 phr
Loxiol G15	1,5 phr
Edenol D81 (ESO)	3,0 phr
Rhodiastab 50	0,1 phr
Hydrotalcite	0,2 phr
Calcium Stearate	0,3 phr
Zinc Stearate TG	0,6 phr
Holtac™	0,2 phr



{lead-free}

Product data summary

Holtac™	Product	Appearance	Reactive group	OH-value (mg KOH/g)	Melting point (°C)
Holtac™ M		Powder (<40 µm)	4 hydroxyl	1,645	262 °C
Holtac™ D		Powder (<40 µm)	6 hydroxyl	1,325	222 °C
Holtac™ T		Powder (<40 µm)	4 hydroxyl	1,645	248 °C
Holtac™ DT		Powder (<250 µm)	4 hydroxyl	895	111 °C
Holtac™ Poly		Powder (<250 µm)	polymer	940	170 °C



Your Winning Formula

The Perstorp Group, a trusted world leader in specialty chemicals, places focused innovation at your fingertips. Our culture of performance builds on over 125 years of experience and represents a complete chain of solutions in organic chemistry, process technology and application development.

Matched to your business needs, our versatile intermediates enhance the quality, performance and profitability of your products and processes. This is how we enable you to meet market demands for safer, lighter, more durable and environmentally sound end-products – for the aerospace, marine, coatings, chemicals, plastics, engineering, and construction industries, as well as automotive, agricultural, food, packaging, textile, paper and electronics applications.

Our chemistry is backed by reliable business practices and a global commitment to responsiveness and flexibility. Consistent high quality, capacity and delivery security are ensured through strategic production plants in Asia, Europe and North America, as well as sales offices in all major markets. Likewise, we combine product and application assistance with the very best in technical support.

As we look to the future, we strive for the development of smarter and safer products and sustainable processes that reduce environmental impact and create real value in new chemical applications. This principle of proactive innovation and responsibility applies not only to our own business, but also to our work with yours. In fulfilling it, we partner with you to create a winning formula that benefits your business – as well as the people it serves.

Discover your winning formula at www.perstorp.com