

Curing systems for thermoset resins



AkzoNobel

Tomorrow's Answers Today





AkzoNobel is proud to be one of the world's leading industrial companies

In fact, we are the largest global paints and coatings company. As a major producer of specialty chemicals we supply industries worldwide with quality ingredients for life's essentials. We think about the future, but act in the present. We're passionate about introducing new ideas and developing sustainable answers for our customers.

We have operations in more than 80 countries, and employ around 55,000 people, who are committed to excellence and delivering **Tomorrow's Answers Today™**.

Our Functional Chemicals business makes organic peroxides, metal alkyls, organometallic specialties and polymer additives. We supply essential products used in the production and processing of thermoplastic resins, and thermoset and elastomeric materials.

AkzoNobel: Looking beyond horizons

We have a long history in organic peroxides, starting with dibenzoyl peroxide for the bleaching of flour in the early 1920s. Since then, we have added many new organic peroxides to our product portfolio, with the growth of plastics in everyday life.

Today, we are the number one in curing systems for thermoset resins, coatings and speciality monomers.

Our range of organic peroxides is the world's largest. We cover classes such as ketone peroxides, diacyl peroxides, peroxyesters, peroxyketals, hydroperoxides and peroxy(di) carbonates. We are home to the best known brands in the business. For example Butanox, the world's leading brand of methyl ethyl ketone peroxides. A guarantee of quality and reliability.

Butanox®

We also have a whole range of auxiliary products, such as accelerators, promoters, inhibitors and release agents, to meet your specific production requirements.

At AkzoNobel we look beyond horizons. We believe that what is good for you today is not necessarily good enough for you tomorrow. We are committed to helping you further improve your curing systems. We offer you the technological answers you need.

You and AkzoNobel: Shaping the world around us

Our expertise is your expertise

Much of our success is due to our philosophy of creating close partnerships with our customers. What do you want to achieve? From optimizing applications, improving efficiencies, resolving difficulties or even designing new curing systems, we're happy to meet with you to discuss your requirements.

From wind turbines and composite lift bridges to racing yachts and chemical storage tanks, AkzoNobel helps shape the world around us.

Sharing our thermoset experience is one of the biggest resources we offer. Whatever your particular requirements, we can develop the product to match.

A secure partner

Our manufacturing sites and distribution centers are found all over the globe, with joint ventures in Japan and China. Our global distribution network allows us to deliver the products to you anywhere in the world. That's how we ensure security of supply and easy access to quality products wherever you are.

All our sites are ISO 9001 and ISO 14001 certified to ensure the highest product quality and strict compliance with environmental regulations. We continually invest in manufacturing techniques, high quality standards, safety, innovation, active technical support and a reliable supply chain.



- Regional headquarters
- Manufacturing sites
- R&D sites

Innovation has brought us to where we are today. We are the global leader in thermoset curing systems and are determined to maintain our status. We act in the present but think about the future. We look ahead and help our customers find answers to questions that they will face tomorrow.

Tomorrow's Answers Today



Our thorough understanding and knowledge of free radical chemistry and thermoset technology is the basis for the development of innovative and sustainable products, designed with you in mind.

As a company of innovation we have a stream of new, high-value products to maintain our leadership. For instance our range of phthalate-free curing agents including Perkadox L-40 RPS, which is a phthalate-free, low viscous, sprayable BPO suspension for road marking.

Not to forget AkzoNobel's Butanox M-50. This glycol free, low water methyl ethyl ketone peroxide continues to prove to be the best possible answer to the problem of osmosis in boat building.

Innovation does not stop with our organic peroxides. Most recently, we've led the way with a new generation of thermoset accelerators.

Our Nouryact Cobalt-free accelerators offer more sustainable alternatives to traditional cobalt octoate and cobalt acetate. These products are developed as part of our continuous drive towards a Cobalt-free composites world. We strive to offer a suitable curing system for all your applications.

Safety and technical support is mainly provided from laboratories in Deventer - The Netherlands, the site of AkzoNobel's fundamental peroxide R&D, Pasadena (TX) - USA, Los Reyes - Mexico, Tianjin - China and Asa - Japan. Our researchers are based in dedicated customer-focused business teams. They perform research, product and process development and technical support in order to translate market needs into new products. They understand the needs of our customers and are committed to their success.

AkzoNobel is recognized as the global leader in organic peroxide safety. Our proven success in safely handling organic peroxides is due to our long-term commitment to developing and maintaining high safety standards. We always place safety as our top priority.

Safety: Our top priority

Sharing our experience in safety is one of the most important resources we offer. Through our safety programs we provide expert advice on the handling of our products including:

- Classroom review of safety and handling of organic peroxides
- Consultation on storage and dosing facility design
- Demonstrations on the safe use, handling and control of organic peroxides

Our Safety Research Laboratory in Deventer, The Netherlands is heavily involved in R&D, ensuring the development of safe products and processes. Studies are carried out, in order to provide a high level of safety in manufacturing, handling and transport of dangerous goods.

Storage temperatures

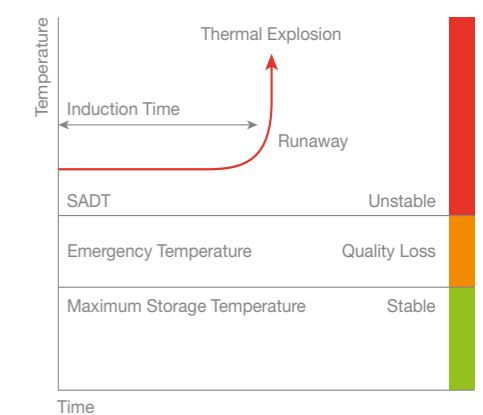
The T_s max. given in the product list on pages 8-13 is the recommended maximum storage temperature at which the product is stable and quality loss will be minimal.

A minimum storage temperature (T_s min.) is given if phase separation, crystallization or solidification of the product is known to occur below the temperature indicated. We recommend that you store the product above the T_s min. indicated for quality and in some cases safety reasons.

SADT: Self-Accelerating Decomposition Temperature

The SADT is the lowest temperature at which self-accelerating decomposition may occur with a substance in the packaging as used in transport. Transportation temperatures are derived from the SADT according to the recommendations by the United Nations Committee of Experts on the Transport of Dangerous Goods.

Survey of thermal stability



UN Numbers

All products accepted for transport are assigned to generic entry numbers according to classification principles as described in the recommendations by the United Nations Committee of Experts on the Transport of Dangerous Goods. An explanation of all relevant UN numbers is given in the table.

Table 1. Classification of organic peroxides

UN No.	Classification	AkzoNobel hazard rating	Maximum container size
3103	type C; liquid	High	50 kg
3113	type C; liquid, temperature controlled	High	50 kg
3114	type C; solid, temperature controlled	High	50 kg
3105	type D; liquid	Medium	50 kg
3106	type D; solid	Medium	50 kg
3107	type E; liquid	Low	400 kg
3108	type E; solid	Low	400 kg
3109	type F; liquid	Very low	IBC's / Tanks
3119	type F; liquid, temperature controlled	Very low	IBC's / Tanks
none	Non-dangerous good	No	Unrestricted

Packaging



We offer a variety of packaging options for both liquid and solid organic peroxides. The maximum package size for each organic peroxide is regulated by the United Nations, based on the hazard classification of the peroxide as shown in table 1 on page 5.

Liquid organic peroxides

Liquid peroxides from AkzoNobel are available in packages shown in table 2.

We also understand the need to innovate our packaging. For instance our Nourytainer[®]. Developed by AkzoNobel it is recognized as the world's benchmark in liquid organic peroxide handling. And we're continually looking for new ways to optimize safe transport, handling and storage of organic peroxides.

Solid organic peroxides

Standard packages for our solid and paste-form peroxides are shown in table 3.

For the availability of our products in non-standard packages, please consult your AkzoNobel account manager.

Table 2. Standard packages for liquid peroxides

Package	Volume	Net Weight	Comments
Bottle	0.5 - 1 liter	0.5 - 1 kg	packaged as 12 or 28 polyethylene bottles per non-returnable carton
HDPE can	20 - 30 liter	15 - 30 kg	single component, polyethylene container (Nourytainer [®])

Table 3. Standard packages for solid and paste-form peroxides

Package	Net Weight	Comments
Tube	5 - 150 g	for Perkadox paste products
Sachet	25 - 100 g	for Perkadox paste products
Bag	25 - 5000 g	for Perkadox CH-50 formulations
Pail	15 - 20 kg	for Perkadox paste products
Pastebox	15 - 25 kg	for Perkadox paste products
Carton	varies with product	polyethylene bags inside non-returnable cardboard box



The Perfect Match

Nouryact® Cobalt-free and low-Cobalt accelerators

Butanox® and Perkadox® phthalate-free curing agents

At AkzoNobel, sustainability is at the heart of everything we do. We're now leading the way with a new range of Cobalt-free and low-Cobalt accelerators for the curing of thermoset resins. These products offer more sustainable alternatives to traditional cobalt octoate and cobalt acetate. The Nouryact product portfolio perfectly matches the eco profile of our phthalate-free curing agents. As a company of innovation we see oceans of opportunities that benefit our customers and the world around us.

Butanox®



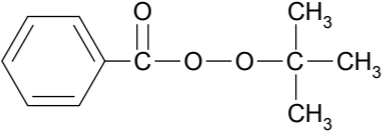
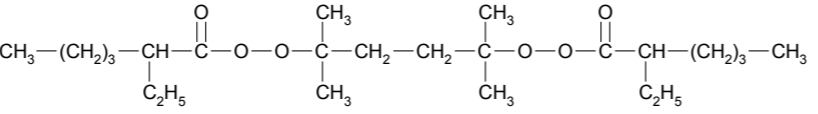
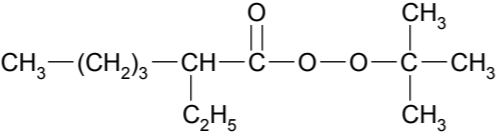
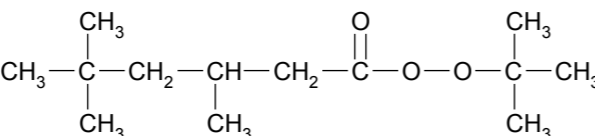
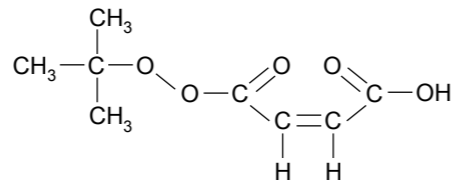
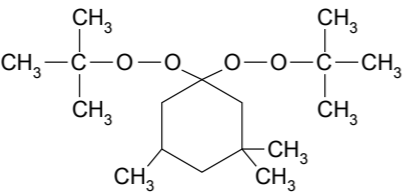
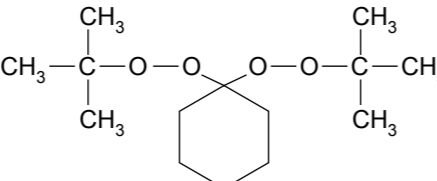
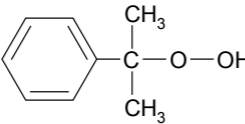
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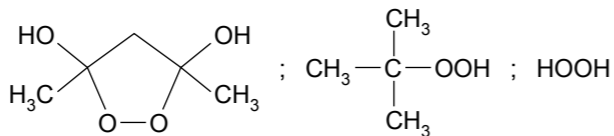
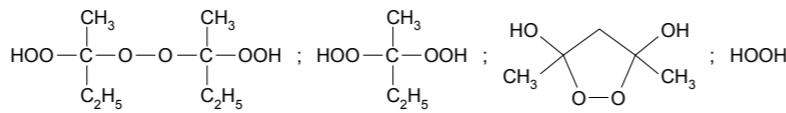
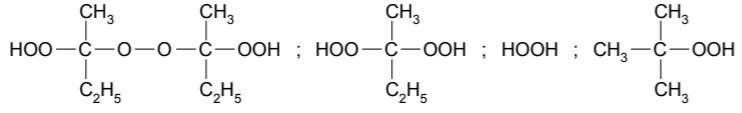
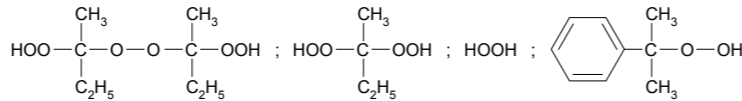
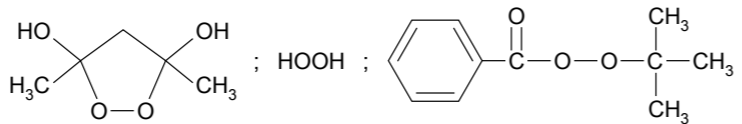
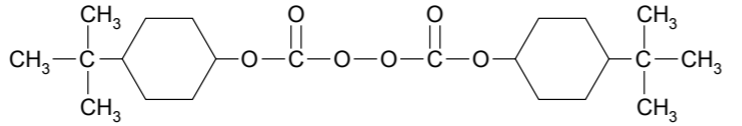
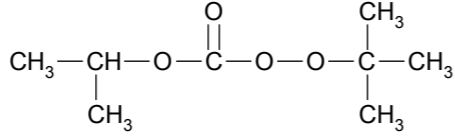
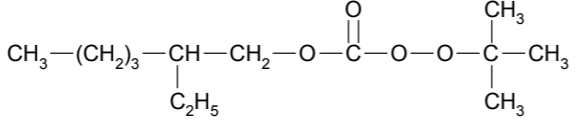
Our Curing Agents

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	STORAGE TEMPERATURES		SADT (°C)	UN No.	FEATURES
					T _g max. (°C)	T _g min. (°C)			
Ketone peroxides									
Methyl ethyl ketone peroxide [1338-23-4]									
BUTANOX 28		8.9		solution in phthalate	25		60	3105	very high reactivity
BUTANOX HBO-50		9.9		solution in phthalate	25		60	3105	high reactivity
BUTANOX LA-IN		8.7		solution in phthalate mixture	25		60	3105	low reactivity
BUTANOX LPT-IN		8.5		solution in phthalate	25		60	3105	very low reactivity
BUTANOX M-50		8.9		solution in phthalate	25		60	3105	standard, medium reactivity
BUTANOX M-50VR		8.9		solution in phthalate	25		60	3105	vanishing red version
BUTANOX M-60		9.9		solution in phthalate	25		60	3105	standard, medium reactivity
BUTANOX M-60VRD		9.9		solution in phthalate	25		60	3105	vanishing red version
BUTANOX M-50A		8.9		in aliphatic solvent	25		60	3105	medium reactivity, phthalate free
Methyl isopropyl ketone peroxide [33372-83-7]									
BUTANOX P-50		6.4		solution in phthalate	25		50	3109	fast cure
Acetylacetone peroxide [37187-22-7]									
TRIGONOX 44B		4.1		in solvent mixture	25	-10	60	3107	fast cure
TRIGONOX 44B VRE		4.1		in solvent mixture	25	-10	60	3107	vanishing red version
Methyl isobutyl ketone peroxide [37206-20-5]									
TRIGONOX 233		8.0		solution in isododecane	25		50	3105	medium reactivity
TRIGONOX HMS		8.8		in mineral oil	25		50	3105	high reactivity
Cyclohexanone peroxide [12262-58-7]									
CYCLONOX 11		4.9		solution in solvent mixture	25		50	3105	high reactivity
CYCLONOX GT-50 LP		7.0		gel with phlegmatizers	25		50	3106	low reactivity
CYCLONOX LE-50		5.3		in solvent mixture	25		50	3105	medium reactivity
CYCLONOX LR		5.1		in solvent mixture	25		60	3105	low reactivity
CYCLONOX LR-50BA		2.5		in solvent mixture	25		60	3105	low reactivity
Diacyl peroxides									
Dibenzoyl peroxide [94-36-0]									
PERKADOX 20S		20	1.4	powder with inert fillers	25		70		low reactivity
PERKADOX 33		33	2.2	powder with inert filler	25		60		medium reactivity
PERKADOX BM-15LS		15	1.0	paste in solvent mixture	25		50		low reactivity, excellent stability
PERKADOX BM-25LS		25	1.7	paste in solvent mixture	25		45	3108	medium reactivity
PERKADOX BM-50R		50	3.3	paste in solvent mixture	25		50	3108	high reactivity
PERKADOX BM-50LS		50	3.3	paste in solvent mixture	25		50	3108	high reactivity, excellent stability
PERKADOX CH-50		50	3.3	powder with phthalate	25		55	3106	for standard applications
PERKADOX CH-50L		50	3.3	powder with phthalate	25		55	3106	for transparent applications
PERKADOX CH-50X		50	3.3	powder with phthalate	25		55	3106	standard, free flowing
PERKADOX CH-34RP		33	2.2	powder with phthalate and inert filler	25		55		for roadpaints
PERKADOX L-40 RPS		40	2.6	suspension in solvent mixture	25		50	3109	low viscosity
PERKADOX L-W40 SN		40	2.6	suspension in water	30	0	60	3109	low viscosity

Our Curing Agents

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	STORAGE TEMPERATURES T _g max. (°C) T _g min. (°C)	SADT (°C)	UN No.	FEATURES	
Peroxyesters									
tert-Butyl peroxybenzoate [614-45-9]									
TRIGONOX 93		79	6.5	solution with promoter	25	55	3103	high reactivity	
TRIGONOX C		98	8.0	liquid	25	10	60	3103	medium reactivity
2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy)hexane [13052-09-0]									
TRIGONOX 141		92	6.8	liquid	20	-20	35	3113	high reactivity and efficiency
tert-Butyl peroxy-2-ethylhexanoate [3006-82-4]									
TRIGONOX 21S		97	7.2	liquid	20	-30	35	3113	high reactivity
TRIGONOX 21LS		88	6.5	solution with stabilizer	20		35	3113	for very long shelf life
tert-Butyl peroxy-3,5,5-trimethylhexanoate [13122-18-4]									
TRIGONOX 42S		97	6.7	liquid	25	-20	55	3105	medium reactivity
TRIGONOX 42PR		89	6.2	solution with promoter	25	-20	55	3105	high reactivity
tert-Butyl monoperoxymaleate [1931-62-0]									
PERKADOX PF-DBM25		25	2.1	paste in dibutyl maleate	25		60	3108	micronized injectable for cont. process
PERKADOX PF-MT40		40	3.4	paste in dibutyl maleate	25		50	3108	standard non-yellowing for clear acrylic
PERKADOX PF-MT40Z		40	3.4	paste in dibutyl maleate	25		60	3108	stabilized non-yellowing acrylic
Peroxyketals									
1,1-Di(tert-butylperoxy)-3,3,5-trimethylcyclohexane [6731-36-8]									
TRIGONOX 29-C50		50	5.3	solution in odorless mineral spirits	25		60	3107	for long compound shelf life
TRIGONOX 29-IN50		50	5.3	solution in phthalate	25		60	3107	for long compound shelf life
1,1-Di(tert-butylperoxy)cyclohexane [3006-86-8]									
TRIGONOX 22-C50		50	6.1	solution in odorless mineral spirits	25		70	3105	for long compound shelf life
Hydroperoxides									
Cumyl hydroperoxide [80-15-9]									
TRIGONOX 239		44	4.6	in solvent mixture	25		55	3109	high reactivity
TRIGONOX 239 VR		44	4.6	in solvent mixture	25		55	3109	vanishing red version
TRIGONOX K-90		88	9.3	in aromatic solvent mixture	40	-30	70	3109	low reactivity

Our Curing Agents

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	ASSAY (%)	ACTIVE OXYGEN (%)	PHYSICAL FORM	STORAGE TEMPERATURES		SADT (°C)	UN No.	FEATURES
					T _g max. (°C)	T _g min. (°C)			
Peroxide mixtures									
Acetylacetone peroxide and tert-butyl hydroperoxide [37187-22-7; 75-91-2]									
TRIGONOX 51		5.8		in solvent mixture	25	-10	60	3105	low peak exotherm
Mixture of methyl ethyl ketone peroxide and acetylacetone peroxide [37187-22-7; 1338-23-4]									
TRIGONOX 61		7.8		in solvent mixture	25	-10	50	3105	fast cure
TRIGONOX 63		6.6		in solvent mixture	25	-10	55	3105	fast cure
Methyl ethyl ketone peroxide and tert-butyl hydroperoxide [1338-23-4; 75-91-2]									
TRIGONOX 75		9.9		solution in phthalate	25		60	3105	medium reactivity, reduced peak exotherm
TRIGONOX 82		8.5		in solvent mixture	25		60	3105	low reactivity, very low peak exotherm
Methyl ethyl ketone peroxide and cumyl hydroperoxide [1338-23-4; 80-15-9]									
TRIGONOX 249 VR		8.5		solution in phthalate	25		60	3105	medium reactivity, reduced peak exotherm
Acetylacetone peroxide and tert-butyl peroxybenzoate [614-45-9; 37187-22-7]									
TRIGONOX 219		2.7		in solvent mixture	25		60	3105	low reactivity, efficient cure
TRIGONOX 269		3.5		in solvent mixture	25	-5	60	3105	medium reactivity, efficient cure
TRIGONOX 279		4.5		in solvent mixture	25	-5	60	3105	high reactivity, efficient cure
TRIGONOX 524		4.9		in solvent mixture	25	-5	60	3103	efficient cure
Peroxy(di)carbonates									
Di(4-tert-butylcyclohexyl) peroxydicarbonate [15520-11-3]									
PERKADOX 16		96	3.9	powder	20		40	3114	high reactivity
PERKADOX 16-40PS		40	1.55	paste	20		40	3119	pumpable paste
tert-Butylperoxy isopropyl carbonate [2372-21-6]									
TRIGONOX BPIC-C75		75	6.8	solution in odorless mineral spirits	25	-20	70	3103	high efficiency
tert-Butylperoxy 2-ethylhexyl carbonate [34443-12-4]									
TRIGONOX 117		95	6.2	liquid	20		60	3105	high efficiency

Our Range of Auxiliaries

PRODUCT NAME	CHEMICAL NAME [CAS NUMBER]	ASSAY (%)	PHYSICAL FORM	STANDARD PACKAGE
Cobalt-free accelerators ¹				
NOURYACT CF12	Metal complex cobalt free [142-71-2]	1.6	in solvent mixture	25 kg HDPE can
NOURYACT CF13	Metal complex cobalt free [7758-89-6]	3.2	in solvent mixture	25 kg HDPE can
NOURYACT CF20	Metal complex cobalt free [6156-78-1]	3.0	in solvent mixture	25 kg HDPE can
Low cobalt accelerators				
NOURYACT 383S	Metal complex [136-52-7]	4	in solvent mixture	25 kg HDPE can
NOURYACT 553S	Metal complex [136-52-7]	1.9	in solvent	25 kg HDPE can
NOURYACT LCC9	Metal complex [136-52-7]	0.5	in solvent mixture	25 kg HDPE can
Cobalt accelerators ²				
ACCELERATOR NL-48P	Cobalt octoate [136-52-7]	0.5	in solvent mixture	180 kg drum
ACCELERATOR NL-49P	Cobalt octoate [136-52-7]	1	in solvent mixture	25 kg HDPE can
ACCELERATOR NL-51P	Cobalt octoate [136-52-7]	6	in solvent mixture	25 kg HDPE can
ACCELERATOR NL-53	Cobalt octoate [136-52-7]	10	in aliphatic solvents	25 kg HDPE can
ACCELERATOR NL-23	Cobalt/Amine mix [136-52-7; 121-69-7]	3	in aliphatic solvents	25 kg HDPE can
ACCELERATOR 55028	Metal mix [2457-01-4; 136-52-7]	2.2	in aliphatic solvents	25 kg HDPE can
Amine accelerators				
ACCELERATOR NL-63-100	Dimethyl aniline [121-69-7]	99	liquid	25 kg HDPE can
ACCELERATOR NL-63-10P	Dimethyl aniline [121-69-7]	10	in aliphatic solvents	25 kg HDPE can
ACCELERATOR NL-64-100	Diethyl aniline [91-66-7]	99	liquid	25 kg HDPE can
ACCELERATOR NL-64-10P	Diethyl aniline [91-66-7]	10	in aliphatic solvents	25 kg HDPE can
ACCELERATOR NL-65-100	Dimethyl-p-toluidine [99-97-8]	99	liquid	25 kg HDPE can
ACCELERATOR NL-65-10P	Dimethyl-p-toluidine [99-97-8]	10	in aliphatic solvents	25 kg HDPE can
Vanadium accelerators				
ACCELERATOR VN-2	Vanadium monobutyl dihydrophosphite [1314-62-1]	0.2	in special solvent	25 kg HDPE can
Zinc accelerator				
ACCELERATOR ZTA	Proprietary organo sulfur compound		liquid	25 kg HDPE can
Inhibitors				
INHIBITOR NLC-10	4-tert-Butyl-1,2-dihydroxybenzene [98-29-3]	10	in aliphatic solvents	25 kg drum
INHIBITOR NLC-1	4-tert-Butyl-1,2-dihydroxybenzene [98-29-3]	1	solution in styrene	20 kg drum
INHIBITOR NLD-20	2,6-Di-tert-butyl-4-methylphenol [100-42-5]	20	solution in styrene	25 kg drum
Promoters				
PROMOTOR C	2,4-Pentanedione [123-54-6]	99	liquid	25 kg HDPE can
PROMOTOR D	N,N-Diethylacetoacetamide [2235-46-3]	97	liquid	25 kg HDPE can
Release agents				
RELEASE AGENT NL-1	Mixture of waxes [64742-82-1]		in odorless mineral spirits, paste	20 kg drum
RELEASE AGENT NL-2	Polyvinylalcohol [9002-89-5]	8	in solvent mixture	25 kg HDPE can
Electroconductive blacks				
KETJENBLACK EC-330 JMA	Electroconductive carbon black [1333-86-4]	30	on 2-hydroxy-ethylmethacrylate, powder	35 kg drum
KETJENBLACK EC-300J	Electroconductive carbon black [1333-86-4]	100	soft pellets	10 kg PE bag
KETJENBLACK EC-600JD	Electroconductive carbon black [1333-86-4]	100	soft pellets	8 kg PE bag

¹ Cobalt-free accelerators based on other metals are available on request.

² Low-Cobalt accelerators based on cobalt neodecanoate are available on request.



Our dedicated R&D efforts has also led to the development of a dust free, easy-to-process electroconductive carbon black. This unique product is available under the name Ketjenblack® EC-330 JMA. It is possible to produce antistatic and semiconductive composites by the addition of very small quantities of Ketjenblack EC-330 JMA (0.5-2%). Please contact us for more information.



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Additional information

Product Data Sheets (PDS) and Material Safety Data Sheets (MSDS) are available at www.akzonobel.com/polymer. On request we also provide specific publications on the use and the safe handling and storage of our products.

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