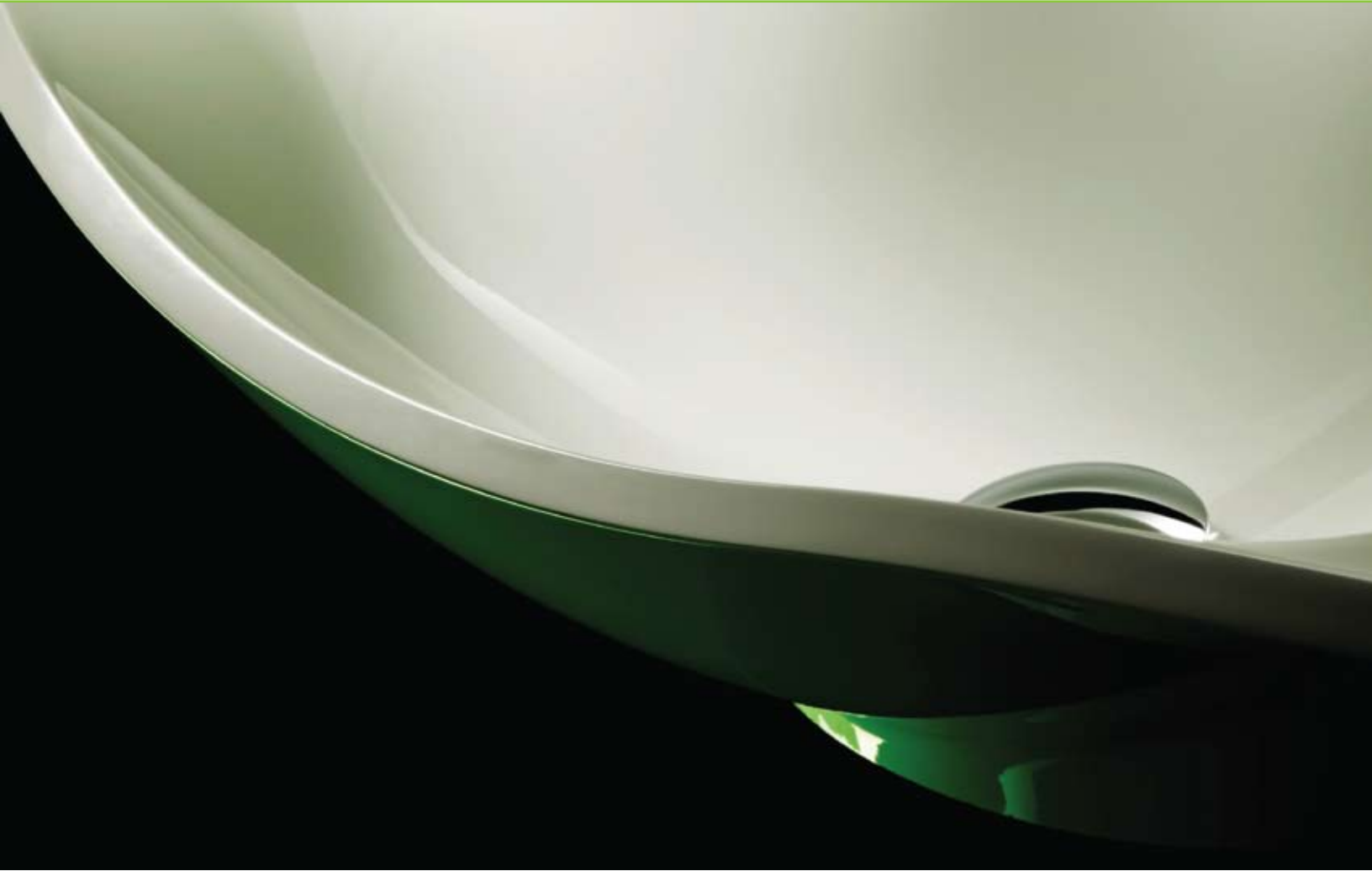




**UNITED INITIATORS**

*driving your success*



**NOROX<sup>®</sup>**

Thermoset Applications  
Ambient

# Driving your success

Founded in 1911, United Initiators (UI) is the only global producer of high-quality organic peroxides and persulfates with locations in four continents – Asia, Australia, Europe and North America.

Driving your success is based on a threefold approach: reliable service, product development innovation and responsible care & safety. It all starts with using UI's high-quality peroxide chemicals and leveraging our expertise for innovative solutions in research, production and service. UI is a preferred provider of choice in polymerization, cross-linking, chemical synthesis, bleaching or other peroxide oxidation applications. Together, this approach provides competitive advantage and drives your company's success to the next level.

## Reliable Service & Product Development Innovation

UI continuously optimizes our operations and supply chain management while strengthening operational skills, teamwork and communications for improved performance such as on time and on budget for customer product readiness and satisfaction. Our global footprint and technology capabilities support responsive in-person and online services. Additionally, our best practices in product and safety training offerings ensure your staff will handle our products with the necessary care and precautions. Consulting and collaborating are value-added services that can improve your operational efficiencies and productivity, and solve unique product challenges. Product development innovation is focused on delivering added value by extending product performance and broadening product applications.

## Responsible Care & Safety

Producing peroxides requires a continuous and steadfast focus on safety throughout our company. Safety awareness is everyone's top priority so safety and environmental standards are integrated into UI's human, technology, capital, process and product development initiatives. For example, UI develops our entire operating sequence into a seamless process: from design and development to safe delivery, storage and byproduct disposal. Our goal is to keep our people and their work environments safe and healthy. Our environmental and integrity standards are high and apply globally. Working closely with our surrounding communities is a key strategy for developing our corporate policies.



**More than 100 years -  
A Culture of Continuity and Change**

Our history has been marked by constant and, sometimes, profound changes, without sacrificing tradition and key principles. United Initiator's mission is to become the provider of choice in markets that use high-quality peroxide solutions.

UI provides a consistent framework for people, plants, processes, production and performance. Our cornerstone is to remain a benchmark in the industry for: safety, quality, efficiency and deliverable service systems.

**1911**

Elektrochemische Werke München



**1961**

Laporte Organics



**1968**

Peroxid-Chemie

**Peroxid-Chemie**

**1994**

Laporte acquires Aztec Catalysts from Phillips Petroleum



**2001**

degussa

**degussa.**

**2007**

Evonik Industries



**2008**

United Initiators



**UNITED INITIATORS**

**2011**

VC acquires majority stake



**2012**

Acquisition of Syrgis



- |   |   |
|---|---|
| <p>1909 Patent for the production of Hydrogen Peroxide</p> <p>1911 Foundation of Elektrochemische Werke Adolph &amp; Pietzsch</p> <p>1928 Merck AG becomes shareholder. Conversion into EWM AG</p> <p>1930s Inorganic Peroxide production</p> <p>1935 Breakthrough: Concentration of Hydrogen Peroxide solutions up to 81%, fuel for submarines and airplanes</p> <p>1936 Production of sodium percarbonate begins</p> <p>1938 Production of carbamide peroxide</p> <p>1954 Entry into the field of organic chemistry (Organic Peroxides)</p> <p>1961 Takeover by Laporte Industries, new Hydrogen Peroxide process</p> | <p>1970 Joint Venture of Laporte and SOLVAY forms Interlox</p> <p>1992 Demerger of the Interlox Group, Peroxid-Chemie becomes a 100% Laporte subsidiary</p> <p>2001 Takeover of Laporte by Degussa</p> <p>2004 Peroxid-Chemie becomes Degussa Initiators</p> <p>2007 Degussa becomes Evonik Industries</p> <p>2008 Sale to Speyside Equity. Birth of United Initiators</p> <p>2011 Vision Capital becomes majority shareholder (81%)</p> <p>2012 Acquisition of Syrgis Performance Initiators</p> |
|---|---|

PRODUCT CODE	DESCRIPTION	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY DATA SADT	Recommendation
KETONE PEROXIDES		%	%	°F/°C	°F/°C
Methyl ethyl ketone peroxide – CAS No 1338-23-4					
NOROX MEKP-925H	High Dimer, lowest H <sub>2</sub> O <sub>2</sub> available, designed for VE resins & gel coats. Less foaming	8.9		140 / 60	86 / 30
NOROX MEKP-925	High Dimer for VE & Iso UPR, higher peak exotherm, more thorough cure	8.9		140 / 60	86 / 30
NOROX MEKP-950	Medium gel time for low HAP gel coats	8.9		140 / 60	86 / 30
NOROX MEKP-9H	Longer gel time but same gel-to-cure time as MEKP-9; best for gel coat	8.9		140 / 60	86 / 30
NOROX MEKP-9	Medium gel time, general purpose use	8.9		140 / 60	86 / 30
NOROX MEKP-900	Fast gel time, general purpose lamination	8.9		140 / 60	86 / 30
NOROX MEKP-30	Diluted MEKP-9, best used for when more volume is needed for metering equipment	5.5		140 / 60	86 / 30
NOROX KP 900 LE	MEKP/TBHP blend for exotherm control without sacrificing gel time	8.9		140 / 60	86 / 30
NOROX FS 100/9	Fastest gel time, medium cure. Winter use	8.9		140 / 60	86 / 30
NOROX TLC-88	MEKP-925H blend with TBPB, faster cure, higher peak exotherm	8.8		140 / 60	86 / 30
Acetylacetone peroxide – CAS No 37187-22-7					
NOROX PD-40	Standard AAP	4.1		>149 / 65	86 / 30
NOROX AZOX	Improved AAP for more consistent application	4.5		140 / 60	86 / 30
NOROX RTM-12	Long gel time, moderate cure and peak for VRTM	4.7		131 / 55	86 / 30
NOROX SHP-90	AAP/TBPB blend for more heat, faster cure	4.5		131 / 55	86 / 30
NOROX SHP-40	Diluted SHP-90	3.6		131 / 55	86 / 30
NOROX FC-100	AAP with improved cure performance	4.5		131 / 55	86 / 30
NOROX 750	AAP/CHP blend for fast cure, controlled exotherm	5.6		140 / 60	86 / 30
NOROX 757	Diluted 750 for more accurate metering	3.5		140 / 60	86 / 30
Others – CAS No 1338-23-4					
NOROX MEC-EX	Fast gel & cure as compared to MEKP; devolped for low temp gel & cure	8.9		140 / 60	86 / 30
NOROX MEC	Cures well in thin film, not affected by temperature change as much as MEKP	8.9		140 / 60	86 / 30
NOROX AQUACURE	Safer version of 415, water extended to use applications that require dewatering	1.8		>122 / 50	68 / 20
Methyl isobutyl ketone peroxide – CAS No 37206-20-5					
NOROX Pulcat AMB	Non refrigerated kick off initiator, modified for low odor; anchor for ETA system	8.9		>140 / 60	86 / 30
NOROX Pulcat AWM	Blend with MEKP-925 for faster start in continuous panel production	8.9		>140 / 60	86 / 30
tert-Butyl hydroperoxide – CAS No 75-91-2					
NOROX TBHP	70% aqueous solution convenient source of free radicals when water is present	12.5	70	>176 / 80	86 / 30
Dicumyl peroxide – CAS No 80-43-3					
NOROX DCP	An excellent source of free radical above 150°C for SMC/BMC use	5.9	99	>158 / 70	86 / 30
NOROX DCP-40	40% active, 60% filler allows compounder more efficient mixing and use of DCP	2.4	40	>158 / 70	86 / 30
HYDROPEROXIDES					
Cumyl hydroperoxide – CAS No 80-15-9					
NOROX CHP	80-85%, low exotherm temperature for thicker laminates	8.5	80-85	>169 / 76	86 / 30
NOROX CHM-50	Promoted CHP for fast curing of some VE resins	4.5		140 / 60	86 / 30
NOROX MCP	Lower exotherm temp, longer gel & cure time than MCP-21. For thicker laminates	8.8		140 / 60	86 / 30
NOROX MCP-21	Lower exotherm temp, longer gel & cure time than MCP-75. For thicker laminates	8.9		140 / 60	86 / 30
NOROX MCP-75	Lower exotherm temp, long gel time, good final cure. For thicker laminates	8.9		140 / 60	86 / 30
NOROX HDP-75	High Dimer version of MCP -75	8.9		140 / 60	86 / 30
NOROX 771	Faster gel time version of MCP -75	8.9		140 / 60	86 / 30
Dibenzoyl peroxide – CAS No 94-36-0					
BENOX L-40LV	40%, sprayable BPO dispersion	2.6	40	>122 / 50	32-77/0-25
BENOX B-50	50% BPO paste in white color	3.3	50	>122 / 50	50-77/10-25
BENOX B-55	55% BPO paste in a plasticizer	3.6	55	>122 / 50	50-77/10-25
BENOX C-50	50% BPO free flowing, non-caking powder with a phthalate ester plasticizer	3.3	50	140 / 60	86 / 30
BENOX A-80	80% BPO granules in water	5.2	79	>149 / 65	32-77/0-25
BENOX A-75	75% BPO granules in water	5.0	75	>149 / 65	32-77/0-25
BENOX A-70	70% BPO granules in water	4.5	70	>149 / 65	32-77/0-25

NR<sup>1</sup> = Not recommended for gel coats without testing for color shift.

4 NR<sup>2</sup> = Not recommended simply to extend gel time in hot weather. Many times that practice will result in an "undercure" state that will turn into a "postcure" problem later. Recommended products are one of the MEKP/CHP blends.



# Safety Information

## Half-life

Peroxide decomposition rates are commonly reported in terms of half-life time or when 50% of the peroxide has decomposed at a certain temperature. Recommended organic peroxide heat temperatures commonly reflect the half-life time at 10 hours, 1 hour and 1 minute. The higher the half-life temperature, the more stable the peroxide. Half-life temperatures can vary based on formulations and solvents.

Using the Arrhenius equation, acronyms related to half-life time include:

$$k_d = A \cdot e^{-E_A/RT} \text{ and } t_{1/2} = \ln(2/k_d)$$

$k_d$ : Rate constant of the peroxide dissociation

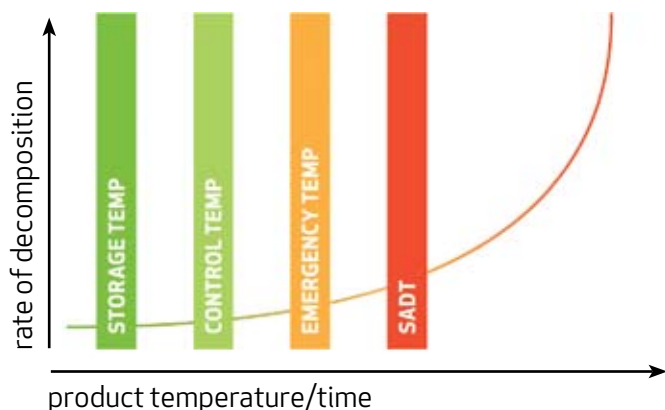
A: Arrhenius frequency factor

$E_A$ : Activation energy for the dissociation

R: Ideal gas constant

T: Temperature

$t_{1/2}$ : Half-life time



Controlling the temperature is the most important constant. If the temperature is maintained well below its self-accelerating decomposition temperature (SADT), most hazards are avoided when shipping, handling or storing. For storage over a longer period of time, follow the manufacturer's temperature recommendations.

## Self-Accelerating Decomposition Temperature (SADT)

The SADT is the lowest constant temperature for self-accelerating decomposition when transporting packaged peroxides. At the SADT, when elevated heat temperatures from decomposition exceed the heat loss, over time, the peroxide's temperature increases and it decomposes faster or self accelerates. The final decomposition may be uncontrollable.

## Minimum/Maximum recommended storage temperatures

The maximum recommended storage temperature is lower than the control temperature for quality assurance purposes not safety. Keep in mind, some liquid or paste organic peroxides must not be stored below a certain minimum temperature as turbidity, phase separation, crystal deposits or solidification can occur.

## Control Temperature ( $T_c$ )

The  $T_c$  is the maximum transportation temperature recommended for the product's estimated time of arrival.  $T_c$  is not required if the SADT exceeds 50°C (122°F). Generally, the  $T_c$  mirrors SADT canister guidelines:

$$T_c = \text{SADT minus } 20^\circ\text{C if SADT} < 20^\circ\text{C}$$

$$T_c = \text{SADT minus } 15^\circ\text{C if SADT} < 35^\circ\text{C}$$

$$T_c = \text{SADT minus } 10^\circ\text{C if SADT} < 50^\circ\text{C}$$

SADT transportation temperatures are based on recommendations by the UN Committee of Experts on the Transport of Dangerous Goods.

## Emergency Temperature ( $T_e$ )

The Control Temperature,  $T_c$ , is supplemented by an Emergency Temperature,  $T_e$ , which is higher than the  $T_c$  but still well below the SADT. The  $T_c$  may be exceeded if maintenance is necessary or until alternative cooling such as dry or wet ice is available. However, if the  $T_e$  is reached, emergency procedures must be implemented immediately – for instance, cooling down the organic peroxides.

PRODUCT CODE	CHEMICAL NAME	STORAGE TEMP	EA [KJ/MOL]	HALF LIFE TIME [°F/°C]		
				10H	1H	1MIN
BENOX	Dibenzoyl-peroxide	●	126	162/72	196/91	266/130
NOROX 305	Dilauroyl-peroxide	●	126	144/62	176/80	248/120
NOROX 401	tert.Amylperoxy-(2-ethylhexyl)carbonate	●	151	203/95	235/113	302/150
NOROX 415	2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy)hexane	●	137	153/67	183/84	257/125
NOROX 411	tert.Amylperoxy-2-ethylhexanoate	●	126	162/72	196/91	266/130
NOROX 410	tert.Butylperoxy-2-ethylhexanoate	●	135	165/74	198/92	266/130
NOROX 400	tert.Butylperoxy-(2-ethylhexyl)carbonate	●	128	212/100	252/122	347/175
NOROX 420-75	tert. Butylperoxy-neodecanoate 75% ASSAY	●	121	117/47	147/64	212/100
NOROX 425	tert. Butylperoxy-3,5,5-trimethyl-hexanoate	●	147	212/100	246/119	320/160
NOROX 425 PR	tert. Butylperoxy-3,5,5-trimethyl-hexanoate	●	147	212/100	246/119	320/160
NOROX 500-75	1,1-Di(tert.butylperoxy)-3,5,5-trimethyl-cyclohexane	●	143	203/95	237/114	311/155
NOROX 505-80	1,1-Di(tert.butylperoxy)cyclohexane	●	138	207/97	243/117	320/160
NOROX AZOX	Acetylacetone Peroxide	●	N/A*	N/A*	N/A*	N/A*
NOROX CHP	Cumyl Hydroperoxide	●	>75**	300/149	358/181	424/218
NOROX DCP	Dicumyl-peroxide	●	152	241/116	277/136	347/175
NOROX DHBP	2,5-Dimethyl-2,5-di(tert.butylperoxy)hexane	●	142	248/120	288/142	374/190
NOROX DTAP	Di(tert.amyl)peroxide	●	129	244/118	288/142	374/190
NOROX DTBP	Di(tert.butyl)peroxide	●	152	257/125	295/146	374/190
NOROX MEKP	Methyl Ethyl Ketone Peroxides	●	N/A*	N/A*	N/A*	N/A*
NOROX Pulcat	Methylisobutylketoneperoxide	●	125	194/90	230/110	311/155
NOROX TAPB	tert.Amylperoxy-benzoate	●	143	216/102	252/122	320/160
NOROX TBIC	tert. Butylperoxy-isopropylcarbonate	●	138	207/97	243/117	320/160
NOROX TBPB	tert. Butylperoxy-benzoate	●	143	219/104	255/124	329/165
NOROX P-20	Accelerated tert. Butylperoxy-benzoate	●	143	192/89	226/108	261/127
NOROX TBHP	tert. Butyl-hydroperoxide	●	149	343/173	392/200	500/260
<b>PEROXYDICARBONATES</b>						
NOROX 600	Di(4-tert.butylcyclohexyl)peroxydicarbonate	●		106/41	135/57	194/90
NOROX 600CL2	Di(4-tert.butylcyclohexyl)peroxydicarbonate	●		125/52	152/67	212/100
NOROX 605	Dimyrstylperoxydicarbonate	●		106/41	135/57	194/90
NOROX 608-75	Di(2-ethylhexyl)peroxydicarbonate 75% ASSAY	●		106/41	135/57	194/90

Color code for storage temperature:

● = Deep refrigeration ● = Moderate refrigeration ● = Ambient temperature For precise values, see specific product data sheets.

\*No single values are stated due to the multi-species nature of these products.

\*\*Hydroperoxides can be autocatalytic, therefore activation energy can vary with conditions and no single value is stated.



# UNITED INITIATORS

*driving your success*



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Plant



Office and plant

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