



**UNITED INITIATORS**  
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**NOROX<sup>®</sup>**

Thermoset Applications

PRODUCT CODE	CHEMICAL STRUCTURE	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY INFORMATION		APPLICATION TEMPERATURE																	
				Recommended max. storage temperature*	SADT	Ambient				Elevated				High									
		%	%	°C	°C	Handlay-up/Spray-up	Casting/Winding	Polymer Concrete & Marble, Buttons	Gelcoats	Body Fillers	Chemical Anchors & Mine bolts	RTM, vacuum infusion	Coatings	Resin Transfer Molding (RTM)	Cured In Place Pipes (CIPP)	Artificial marble	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	SPECIAL RESINS	Vylesters	Acrylic Resins	
<b>Ketone Peroxides</b>																							
Methyl ethyl ketone peroxide (CAS No. 1338-23-4)																							
NOROX®KP-9 *	General purpose MEKP with medium reactivity	9.1		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®KP-100 *	Faster gel & cure than NOROX®KP-9	9.7		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®SG-10 *	Faster gel than NOROX®KP-100	9.7		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®KP-200 *	Faster gel than NOROX®KP-100	9.5		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®KPM	Mixture with similar gel time but faster cure than NOROX®KP-9	7.7		30	60	●	●	●	●	●	●	●	●	●	●								
Methyl ethyl ketone peroxide (phthalatefree) (CAS No. 1338-23-4)																							
NOROX®ENP-90	General purpose MEKP with medium reactivity, approved gelcoat type	8.9		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®ENP-92	General purpose MEKP, faster gel than NOROX®KP-100	9.8		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®ENP-102 *	MEKP designed for VE Resins, less foaming	8.6		30	60	●	●	●	●	●	●	●	●	●	●						●		
Acetylacetone peroxide (CAS No. 13704-51-5)																							
NOROX®PD-40 *	Standard AAP	4.1		0-25	60	●	●	●	●	●	●	●	●	●	●								
NOROX®FC-100	AAP with improved cure performance	4.5		0-25	60	●	●	●	●	●	●	●	●	●	●								
NOROX®WPC-100	AAP for potable water application with improved cure performance	3.9		0-25	60	●	●	●	●	●	●	●	●	●	●								
Methyl isobutyl ketone peroxide (CAS No. 942-932-9)																							
NOROX®Pulcat S	MIBKP in aliphatic hydrocarbons	10,5		max 25	50	●	●	●	●	●	●	●	●	●	●						●	●	●
<b>Hydroperoxides</b>																							
Cumyl hydroperoxide (CAS No. 80-15-9)																							
NOROX®CHP	80-85%, low exotherm temperature for thicker laminates	8.5	80-85	30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®CHM-50 **	Promoted CHP for fast curing of some VE resins	4.5		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®MCP *	Lower exotherm temp, longer gel & cure than NOROX®MCP-75 , for thicker laminates	8.8		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®MCP-99 *	Similar to NOROX®MCP-75 but with faster gel time, for thicker laminates	9.3		30	60	●	●	●	●	●	●	●	●	●	●								
NOROX®MCP-75 *	Lower exotherm temp, long gel time, good final cure, for thicker laminates	8.9		30	60	●	●	●	●	●	●	●	●	●	●							●	

\* Available as red coloured system for improved homogenization during mixing. The colour disappears in the curing process.  
 \*\* Available as red coloured system for improved homogenization during the hole process. The colour remains in the final product.

PRODUCT CODE	CHEMICAL STRUCTURE	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY INFORMATION		APPLICATION TEMPERATURE															
				Recommended max. storage temperature*	SADT	Ambient				Elevated				High				SPECIAL RESINS			
DIACYL PEROXIDES		%	%	°C	°C	Handlay-up/Spray-up	Casting/Winding	Polymer Concrete & Marble, Buttons	Gelcoats	Body Filters	Chemical Anchors & Mine bolts	RTM, vacuum infusion	Coatings	Resin Transfer Molding (RTM)	Cured In Place Pipes (CIPP)	Artificial marble	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	Vylesters	Acrylic Resins
Dibenzoyl peroxide (CAS No. 94-36-0)																					
BENOX®L-40LV-EU	40%, sprayable BPO dispersion	2.6	40	0-25	50	●	●	●	●	●	●	●	●	●						●	●
BENOX®C-50	50 % BPO powder with phtalate	3.3	50	30	60	●	●	●	●	●	●	●	●							●	●
BENOX®C-50S	50 % BPO powder with phtalate, free flowing	3.3	50	30	60	●	●	●	●	●	●	●	●							●	●
BENOX®A-75	75% BPO granules in water	5.0	75	0-25	70	●	●														●
PERESTERS																					
tert-Butylperbenzoate (CAS No. 614-45-9)																					
NOROX®TBPB	High efficient perester, lowest residual styrene levels	8.1	>98	10-25	60									●	●	●	●	●	●	●	
NOROX®P-20	Promoted TBPB for elevated temperature processes	6.6	80	10-25	60						●			●	●	●	●	●	●	●	
tert-Butylperoxy-2-ethylhexylcarbonate (CAS No. 34443-12-4)																					
NOROX®400	High efficient, low TOC-emission	6.4	97	max 20	70														●	●	●
tert-Butylperoxy-2-ethylhexanoate (CAS No. 3006-82-4)																					
NOROX®410	Fast curing perester for reduced cycle times	7,3	99	max 10	40									●					●	●	
tert-Butylperoxy-3,5,5-trimethylhexanoate (CAS No. 13122-18-4)																					
NOROX®425	High efficient perester, drinking water application	6.9	99	max20	60									●	●	●	●	●	●	●	
NOROX®425PR	Promoted TBPIN for elevated temperature processes	3.5	90	max20	55						●			●	●	●	●	●	●	●	
PEROXYDICARBONATES																					
Di(4-tert.butylcyclohexyl) peroxydicarbonate (CAS No. 15520-11-3)																					
NOROX®600	High efficient perester, lowest residual styrene levels	3.8	>96	max20	45									●	●				●	●	●
NOROX®600-CL2	Promoted TBPB for elevated temperature processes	3.5	mix	20	45									●					●		●
PERKETALS																					
1,1-Di(tert.butylperoxy)cyclohexane (CAS No. 3006-86-8)																					
NOROX®505-80	Hot curing initiator, long pot life, less affected by fillers and pigments	9.7	80	30	60														●	●	
1,1-Di(tert.butylperoxy)-3,3,5-trimethylcyclohexane (CAS No. 6731-36-8)																					
NOROX®500-90	Most efficient perketale	9.5	90	30	60														●	●	
NOROX®802-75	Accelerated curing performance	5.8	mix	max20	50														●	●	
1,1-Di(tert.amylperoxy)cyclohexane (CAS No. 15667-10-4)																					
NOROX®510-80-AL3	Improved SMC surface properties	8.8	80	30	60														●	●	

# 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

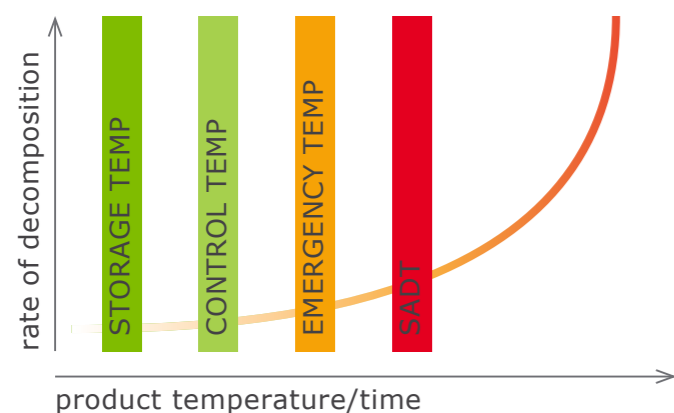
A: Arrhenius frequency factor

$E_A$ : 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 Temperature

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<sub>c</sub>)

The T<sub>c</sub> is the maximum transportation temperature recommended for the product's estimated time of arrival. T<sub>c</sub> is not required if the SADT exceeds 50°C (122°F). Generally, the T<sub>c</sub> 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 Transportation of Dangerous Goods.

## Emergency Temperature (T<sub>e</sub>)

The control temperature T<sub>c</sub> is supplemented by an emergency temperature, T<sub>e</sub>, which is higher than the T<sub>c</sub> but still well below the SADT. The T<sub>c</sub> may be exceeded if maintenance is necessary or until alternative cooling such as dry or wet ice is available. However, if the T<sub>e</sub> is reached, emergency procedures must be implemented immediately – for instance, cooling down the organic peroxides.

Product Code	Chemical Name	Storage Temperature	EA [kJ/mol]	Half Life [°C]		
				10 h	1 h	1 min
IBP	Diisobutyl peroxide	●	110	23	39	73
CUPND	Cumylperoxy-neodecanoate	●	115	38	55	90
TOPND	1,1,3,3-Tetramethylbutylperoxy-neodecanoate	●	117	40	57	92
TAPND	tert. Amylperoxy-neodecanoate	●	113	44	62	100
*)	Peroxidicarbonates	●	144	47	61	90
TBPND	tert. Butylperoxy-neodecanoate	●	121	47	64	100
TBPNH	tert. Butylperoxy-neoheptanoate	●	116	51	69	107
TAPPI	tert. Amylperoxy-pivalate	●	121	53	71	110
DCLBP	Di(2,4-dichlorobenzoyl)peroxide	●	121	54	72	110
TBPPI	tert. Butylperoxy-pivalate	●	121	56	74	110
INP	Di(3,5,5-trimethyl-hexanoyl)peroxide	●	117	59	78	120
DP	Didecanoyl-peroxide	●	126	62	80	120
LP	Dilauroyl-peroxide	●	126	62	80	120
AIBN	2,2-Azobis(isobutyronitrile)	●	130	62	80	120
DHPEH	2,5-Dimethyl-2,5-di(2-ethylhexanoylperoxy)hexane	●	137	67	84	125
PMBP	Di(4-methylbenzoyl)peroxide	●	125	70	89	130
BP	Dibenzoyl-peroxide	●	126	72	91	130
TAPEH	tert. Amylperoxy-2-ethylhexanoate	●	126	72	91	130
TBPEH	tert. Butylperoxy-2-ethylhexanoate	●	135	74	92	130
TBPIB	tert. Butylperoxy-isobutyrate	●	130	77	96	135
TBPM	tert. Butyl-monoperoxy-maleate	●	116	82	104	150
ACH	1,1-Di(tert. amylperoxy)cyclohexane	●	135	87	106	152
CUROX *I	Methylisobutylketoneperoxide	●	125	90	110	155
TAPEHC	tert. Amylperoxy-(2-ethylhexyl)carbonate	●	151	95	113	150
TMCH	1,1-Di(tert. butylperoxy)-3,5,5-trimethyl-cyclohexane	●	143	95	114	155
CH	1,1-Di(tert. butylperoxy)cyclohexane	●	138	97	117	160
TBPIC	tert. Butylperoxy-isopropylcarbonate	●	138	97	117	160
TBPIN	tert. Butylperoxy-3,5,5-trimethyl-hexanoate	●	147	100	119	160
TBPEHC	tert. Butylperoxy-(2-ethylhexyl)carbonate	●	128	100	122	175
TBPA	tert. Butylperoxy-acetate	●	149	102	121	160
TAPB	tert. Amylperoxy-benzoate	●	143	102	122	160
TBPB	tert. Butylperoxy-benzoate	●	143	104	124	165
BU	2,2-Di(tert. butylperoxy)butane	●	143	104	124	165
NBV	n-Butyl-4,4-di(tert. butylperoxy)valerate	●	141	110	131	175
EBU	Ethyl-3,3-di(tert. butylperoxy)butyrate	●	144	114	135	180
DCUP	Dicumyl-peroxide	●	152	116	136	175
BCUP	tert. Butylcumyl-peroxide	●	154	118	138	180
DTAP	Di(tert. amyl)peroxide	●	129	118	142	190
DIPP	Di(2-tert. butylperoxy-isopropyl)benzene	●	142	120	142	190
DHBP	2,5-Dimethyl-2,5-di(tert. butylperoxy)hexane	●	142	120	142	190
DTBP	Di(tert. butyl)peroxide	●	152	125	146	190
DYBP	2,5-Dimethyl-2,5-di(tert. butylperoxy)hexyne-3	●	154	128	149	195
CUHP	Cumyl-hydroperoxide	●	133	140	166	223
TBHP	tert. Butyl-hydroperoxide	●	149	173	200	260
CUROX*CC-DC	2,3-Dimethyl-2,3-diphenylbutane	●	195	210	234	285
*) Peroxidicarbonates						
EHPC	Di(2-ethylhexyl)peroxydicarbonate	●	CHPC	Dicyclohexylperoxydicarbonate		
SBPC	Di(sec-butyl)peroxydicarbonate	●	NBPC	Di(n-butyl)peroxydicarbonate		
BCHPC	Di(4-tert. butylcyclohexyl)peroxydicarbonate	●	MYPC	Dimyristylperoxydicarbonate		
CEPC	Dicetylperoxydicarbonate	●				

Colour code for storage temperature:

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



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