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NOROX[®]

Thermoset Applications

PRODUCT CODE	DESCRIPTION	ACTIVE OXYGEN CONTENT %	PEROXIDE CONTENT %	SAFETY INFORMATION Recommended max. storage temp. SADT		APPLICATION TEMPERATURE																	
				°C	°C	Hand Lay-up/Spray-up	Casting/Winding	Polymer Concrete & Marble, Buttons	Gelcoats	Body Fillers	Chemical Anchors & Nuts/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 Vinylesters	Acrylics		
KETONE PEROXIDES						AMBIENT						ELEVATED			HIGH								
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 KP-9	9,7		30	60	●	●	●	●	●		●		●				●					
NOROX® SG-10*	Faster gel than KP-100	9,7		30	60	●	●	●	●					●				●					
NOROX® KP-200*	Faster gel than KP-100	9,5		30	60	●	●	●						●				●					
NOROX® MEKP-925H	MEKP designed for VE resins, less foaming	8,9		30	60	●	●		●			●	●	●				●		●			
NOROX® MEKP-925	MEKP for VE, UP & gelcoats	8,9		30	60	●	●		●			●	●	●				●		●			
NOROX® KPM	Mixture with similar gel time but faster cure than 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. 37187-22-7)																							
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. 37206-20-5)																							
NOROX® Pulcat S	MIBKP in aliphatic hydrocarbons	10,5		max 25	50		●	●					●					●	●		●		
HYDROPEROXIDES																							
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 MCP-75, for thicker laminates	8,8		30	60	●	●					●		●				●		●			
NOROX® MCP-99*	Similar to 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	●	●					●		●				●		●			

2 * Available as colored-discolorizing system for improved homogenization during mixing. Natural resin color is restored during curing (optional).

● = Recommended application ● = Other possible application

PRODUCT CODE	DESCRIPTION	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY INFORMATION		APPLICATION TEMPERATURE															
				Recommended max. storage temp.	SAOT	Hand Lay-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	Vinylesters
		%	%	°C	°C	AMBIENT				ELEVATED				HIGH							
DIACYL PEROXIDES																					
Dibenzoyl peroxide (CAS No. 94-36-0)																					
BENOX® L-40LV-EU	40%, sprayable BPO dispersion	2,6	40	0-25	50	●		●		●	●	●	●						●	●	
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	max 20	60										●	●		●	●	●	
NOROX® 425 PR	Promoted TBPIN for elevated temperature processes	6,3	90	max 20	55							●		●	●			●	●	●	
PEROXYDICARBONATES																					
Di(4-tert.butylcyclohexyl) peroxydicarbonate (CAS No. 15520-11-3)																					
NOROX® 600	Fast kick off peroxide for two step curing	3,8	>96	max 20	45								●		●			●	●	●	
NOROX® 600-CL2	Fast kickoff peroxide blend, low burning rate	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	max 20	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

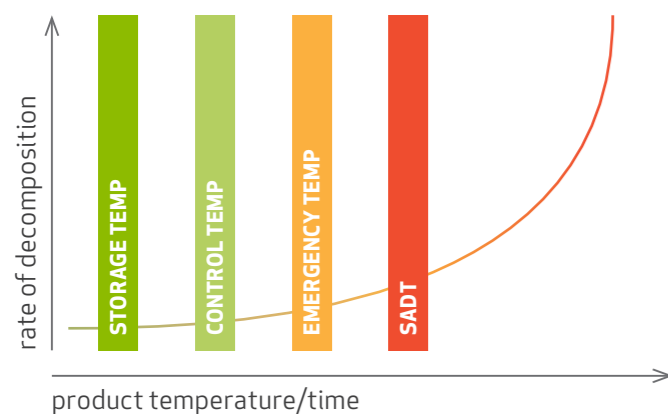
Half-Life

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_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 Transportation 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 [°C]		
					10 H	1 H	1 MIN
	DIPND	Di(2-neodecanoylperoxy-isopropyl)benzene	●	114	37	54	85
	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
	*)	Peroxydicarbonates	●	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
	NOROX* 410	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
	NOROX* Pulcat S	Methylisobutylketoneperoxide	●	125	90	110	155
	TAPEHC	tert. Amylperoxy-(2-ethylhexyl)carbonate	●	151	95	113	150
	NOROX* 500-50	1,1-Di(tert. butylperoxy)-3,5,5-trimethyl-cyclohexane	●	143	95	114	155
	NOROX* 505-80	1,1-Di(tert. butylperoxy)cyclohexane	●	138	97	117	160
	NOROX* 510-80-AL3	1,1-Di(tert. amylperoxy)cyclohexane	●	135	87	106	152
	TBPIC	tert. Butylperoxy-isopropylcarbonate	●	138	97	117	160
	NOROX* 425	tert. Butylperoxy-3,5,5-trimethyl-hexanoate	●	147	100	119	160
	DHPBZ	2,5-Dimethyl-2,5-di(benzoylperoxy)hexane	●	147	100	119	160
	NOROX* 400	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
	NOROX* 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
	HMCN	3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxa-cyclononane	●	146	135	158	205
	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
*) PEROXYDICARBONATES							
	EHPC	Di(2-ethylhexyl)peroxydicarbonate	●	CHPC	Dicyclohexylperoxydicarbonate		
	SBPC	Di(sec-butyl)peroxydicarbonate	●	NBPC	Di(n-butyl)peroxydicarbonate		
	NOROX* 600	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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