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NOROX[®]

Thermoset - Americas

PRODUCT CODE	DESCRIPTION	ACTIVE OXYGEN CONTENT %	PEROXIDE CONTENT %	SAFETY DATA		APPLICATION TEMPERATURE													SMC, BMC, GMC, TMC	SPECIAL RESINS	Vinylesters	Acrylics
				Recommended max. storage temp. °F/°C	SADT °F/°C	AMBIENT			ELEVATED			HIGH										
						Hand Lay-up/Spray-up	Casting/Winding	Polymer Concrete & Marble Buttons	Gelcoats	Body Fillers	Chemical Anchors & Mine bolts	RTM, vacuum infusion	Cultured Marble	RTM	Cured in Place Pipes (CIPP)	Engineered Stone	Closed Molding	Continuous Laminating	Pultrusion			
KETONE PEROXIDES																						
Methyl ethyl ketone peroxides - CAS No 1338-23-4																						
NOROX® MEKP-925H	High dimer, lowest H2O2 available, designed for VE resins & gelcoats, less foaming	8.9		86/30	140/60	●	●	●	●	●		●	●	●							●	
NOROX® MEKP-925	High dimer for VE & IsoUPR, higher peak exotherm, more thorough cure	8.9		86/30	140/60	●	●	●	●	●		●	●	●							●	
NOROX® MEKP-950	Medium gel time for low HAP gel coats	8.9		86/30	140/60	●	●	●	●	●		●	●	●							●	
NOROX® MEKP-9H	Longer gel time but same gel-to-cure time as MEKP-9; best for gel coat	8.9		86/30	140/60	●	●	●	●	●		●	●	●							●	
NOROX® MEKP-9	Medium gel time, general purpose use	8.9		86/30	140/60	●	●	●	●	●		●	●	●							●	
NOROX® MEKP-900	Fast gel time, general purpose lamination	8.9		86/30	140/60	●	●	●	NR	●		NR	●	NR							●	
NOROX® MEKP-30	Diluted MEKP-9, best used for when more volume is needed for metering equipment	5.5		86/30	140/60	NR ²	NR ²	NR ²	NR	NR ²		NR	NR ²	NR							NR ²	
NOROX® MEKP-30 HD	Diluted MEKP-925, best used for more accurate metering in filled systems	5.5		86/30	140/60	NR ²	NR ²	NR ²	NR	NR ²		NR	NR ²	NR							NR ²	
NOROX® KP 900 LE	9/TBHP BLEND for exotherm control without sacrificing gel time	8.9		86/30	140/60	●	●	●	NR	●		●	●	NR							NR	
NOROX® FS 100/9	Fastest gel time, medium cure; winter use	8.9		86/30	140/60	●	●	●	NR	NR		NR	●	NR							NR	
NOROX® TLC-88	MEKP-925H blend with TBPB, faster cure, higher peak exotherm	8.8		86/30	140/60	●	●	●	NR	●		●	●	●							●	
Acetylacetone peroxides - CAS No 37187-22-7																						
NOROX® PD-40	Standard AAP	4.1		77/25	140/60	●	●	●	NR ¹	●		●	●	●						●		
NOROX® AZOX	Improved AAP for more consistent application	4.5		86/30	140/60	●	●	●	NR ¹	●		●	●	●						●		
NOROX® AMP-20	AAP/MEKP blend for faster cure in thinner laminates without large gel time change	7.9		77/25	140/60	●	●	●	NR ¹	●		●	●	●						●		
NOROX® AMP-50	AAP/MEKP blend for faster cure in thinner laminates	6.5		77/25	140/60	●	●	●	NR ¹	●		●	●	●						●		
NOROX® RTM-12	Long gel time, moderate cure and peak for VRTM	4.7		86/30	131/55	●	●	●	NR ¹			●		●						●		
NOROX® SHP-90	AAP/TBPB blend for more heat, faster cure	4.5		86/30	131/55	●	●	●	NR ¹	●		●	●	●						●		
NOROX® SHP-40	Diluted SHP-90	3.6		86/30	131/55	●	●	●				●	●	●								
NOROX® FC-100	AAP with improved cure performance	4.5		86/30	131/55	●	●	●	NR ¹	●		●	●	●						●		
NOROX® 750	AAP/CHP blend for fast cure, controlled exotherm	5.6		86/30	140/60	●	●	●	NR ¹	●		●	●	●						●		
NOROX® 757	Diluted 750 for more accurate metering	3.5		86/30	140/60								●	●								
NOROX® CHAP-21	AAP/CHP blend for RTM moderate gel time, fast cure, controlled exotherm	7.0		86/30	140/60	●	●	●	NR ¹	●		●	●	●						●		
Ketone Peroxides Blend - CAS No 1338-23-4 & CAS No 12262-58-7																						
NOROX® MEC-EX	Fast gel & cure as compared to MEKP; developed for low temperature gel & cure	8.9		86/30	140/60	●	●	●	NR	●			●	●								
NOROX® MEC	Cures well in thin film, not affected by temperature change as much as MEKP	8.9		86/30	140/60	●	●	●	●	●		●	●	●								
Methyl isobutyl ketone peroxides - CAS No 37206-20-5																						
NOROX® PULCAT CMB	Fast gel & cure as compared to MEKP; developed for low temperature gel & cure	8.9		86/30	140/60										●		●	●	●			
NOROX® PULCAT CWM	Blend with MEKP-925 for faster start in continuous panel production	8.9		86/30	>140/60								●	●		●	●	●	●			
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	86/30	>176/80																	●
Dicumyl peroxides - CAS No 80-43-3																						
NOROX® DCP	An excellent source of free radical above 302°F/150°C for SMC/BMC use	5.9	99	86/30	>158/70															●	●	
HYDROPEROXIDES																						
Cumyl hydroperoxides - CAS No 80-15-9																						
NOROX® CHP	80-85%, low exotherm temperature for thicker laminates	8.5	80-85	86/30	>169/76	●	●	●	NR			●	●	●	●	●	●	●	●	●	●	●
NOROX® CHP-90	High assay CHP, low exotherm for thicker parts	9.0	86-90	86/30	>169/76	●	●	●	NR			●	●	●	●	●	●	●	●	●	●	●
NOROX® CHM-50	Promoted CHP for fast curing of some VE resins	4.5		86/30	140/60	●	●	●	NR			●	●	●	●	●	●	●	●	●	●	●
NOROX® MCP	Lower exotherm temperature, longer gel & cure than MCP-21; for thicker laminates	8.8		86/30	140/60	●	●	●	NR			●	●	●	●	●	●	●	●	●	●	●
NOROX® MCP-21	Lower exotherm temperature, longer gel & cure than MCP-75; for thicker laminates	8.9		86/30	140/60	●	●	●	NR			●	●	●	●	●	●	●	●	●	●	●
NOROX® MCP-75	Lower exotherm temperature, long gel time, good final cure; for thicker laminates	8.9		86/30	140/60	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●
NOROX® HDP	High dimer version of MCP	8.9		86/30	140/60	●	●	●	NR			●	●	●	●	●	●	●	●	●	●	●
NOROX® HDP-75	High dimer version of MCP-75	8.9		86/30	140/60	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●
NOROX® 771	Faster gel time version of MCP-75	8.9		86/30	140/60	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●

2 NR = Not recommended
 NR¹ = Not recommended for gel coats without testing for color shift
 NR² = 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

● = Preferred for the application
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PRODUCT CODE	DESCRIPTION	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY DATA		APPLICATION TEMPERATURE																			
				Recommended max. storage temp.	SADT	AMBIENT				ELEVATED				HIGH				SPECIAL RESINS							
DIALKYL PEROXIDES		%	%	°F/°C	°F/°C	AMBIENT				ELEVATED				HIGH				SPECIAL RESINS							
NOROX® 305	Technically pure flake	4.0	99	86/30	122/50																				
NOROX® DTBP	An excellent source of free radicals above 212°F (100°C)	10.8	99	81/27	167/75																				
NOROX® DTAP	t-Amyl version of DTBP	8.7	96	81/27	194/90																				
DIBENZOYL PEROXIDES - CAS No 94-360																									
BENOX® L-40LV	40%, sprayable BPO dispersion	2.6	40	32-77/10-25	>122/50	●	●	●	NR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BENOX® B-50	50% BPO paste in white color	3.3	50	32-77/10-25	>122/50	●	●	●	NR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BENOX® B-55	55% BPO paste in a plasticizer	3.6	55	32-77/10-25	>122/50	●	●	●	NR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BENOX® C-50	50% BPO free flowing, non-caking powder with a phthalate ester plasticizer	3.3	50	86/30	140/60	●	●	●	NR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BENOX® A-75	75% BPO granules in water	5.0	75	32-77/0-25	>149/65	●	●	●	NR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BENOX® A-70	70% BPO granules in water	4.5	70	32-77/0-25	>149/65	●	●	●	NR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PERESTERS																									
tert-Butyl perbenzoate - CAS No 4511-39-1																									
NOROX® TBPB	Efficient perester, „kicker“, helps reduce residual styrene	8.1	>98	50-77/10-25	140/60					●				●	●	●	●	●	●	●	●	●	●	●	●
NOROX® P-20	Promoted TBPB for elevated temperature processes with cobalt; ETA sub for 410	6.6	80	50-77/10-25	140/60					●				●	●	●	●	●	●	●	●	●	●	●	●
tert-Amyl perbenzoate - CAS No 614-45-9																									
NOROX® TAPB	High efficient perester, lowest residual styrene levels	7.6	98	50-77/10-25	149/65					●				●	●	●	●	●	●	●	●	●	●	●	●
tert-Butyl peroxy-2-ethylhexyl carbonate - CAS No 34443-12-4																									
NOROX® 400	High efficient, low TOC-emission	6.4	97	max 68/20	158/70																	●	●	●	●
tert-Amyl peroxy-2-ethylhexyl carbonate - CAS No 70833-40-8																									
NOROX® 401	t-Amyl version, better cure, lower residual styrene	6.2	97	max 68/20	131/55																	●	●	●	●
tert-Butyl peroxy-2-ethylhexanoate - CAS No 3006-82-4																									
NOROX® 410	Fast curing perester for reduced cycle times	7.3	99	max 50/10	95/35									●				●	●	●	●	●	●	●	●
NOROX® 410-500MS	50% diluted in Odorless Mineral Spirits (OMS) for better metering	3.8	50	59/15	104/40									●				●	●	●	●	●	●	●	●
tert-Amyl peroxy-2-ethylhexanoate - CAS No 686-31-7																									
NOROX® 411	t-Amyl version for lower residual styrene, better cure	7.3	99	max 68/20	104/40									●				●	●	●	●	●	●	●	●
NOROX® 411-750MS	25% dilution in Odorless Mineral Spirits (OMS) for better metering	5.2	75	50/10	95/35									●				●	●	●	●	●	●	●	●
tert-Butyl peroxyperneodecanoate - CAS No 26748-41-4																									
NOROX® 420-750MS	75% solution in Odorless Mineral Spirits (OMS), fast starter, economical	6.2	75	23/-5	59/15													●	●	●	●	●	●	●	●
tert-Butyl peroxy-3,5,5-trimethylhexanoate - CAS No 13122-18-4																									
NOROX® 425	Environment friendly, high efficient perester, drinking water application	6.9	99	max 68/20	140/60									●				●	●	●	●	●	●	●	●
NOROX® 425 PR	Promoted NOROX® 425 for elevated temperature processes	6.3	90	max 68/20	131/55									●				●	●	●	●	●	●	●	●
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 68/20	113/45									●				●	●	●	●	●	●	●	●
NOROX® 600-CL2	Class II-Fast kick off peroxide for two-step curing	3.5	89		104/40									●				●	●	●	●	●	●	●	●
Dimyrisyl peroxydicarbonate - CAS No 53220-22-7																									
NOROX® 605	Technically pure flake, low kick off temperature, economical	3.0	97	max 68/20	95/35									●				●	●	●	●	●	●	●	●
TBIC	Most efficient styrene scavenger	6.8	75	81/27	140/60													●	●	●	●	●	●	●	●
bis(2-Ethylhexyl) peroxydicarbonate - CAS No 53220-22-7																									
NOROX® 608-75-AL3	fast kick off peroxide for two-step curing	3.5	75	max 5/-15	41/5													●	●	●	●	●	●	●	●
PERKETALS																									
1,1-Di(tert.butylperoxy)cyclohexane - CAS No 3006-86-8																									
NOROX® 505-80-AL3	Hot curing initiator, long pot life, less affected by fillers and pigments	9.7	80	86/30	140/60																	●	●	●	●
1,1-Di(tert.amylperoxy)cyclohexane - CAS No 15667-10-4																									
NOROX® 510-80-AL3	Hot curing initiator, long pot life, less affected by fillers and pigments	8.8	80	86/30	131/55																	●	●	●	●
1,1-Di(tert.butylperoxy)-3,3,5-trimethylcyclohexane - CAS No 6371-36-8																									
NOROX® 500-90-AL3	Most efficient perketal, diluted version	5.3	90	86/30	158/70									●				●	●	●	●	●	●	●	●
NOROX® 802-75-AL3	Most useful for pigmented systems above 212°F (100°C) for pultrusion, SMC/BMC	6.3	75	59/15	104/40									●				●	●	●	●	●	●	●	●

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● = Preferred for the application ● = Recommended for the application ● = Other possible application

Safety Information

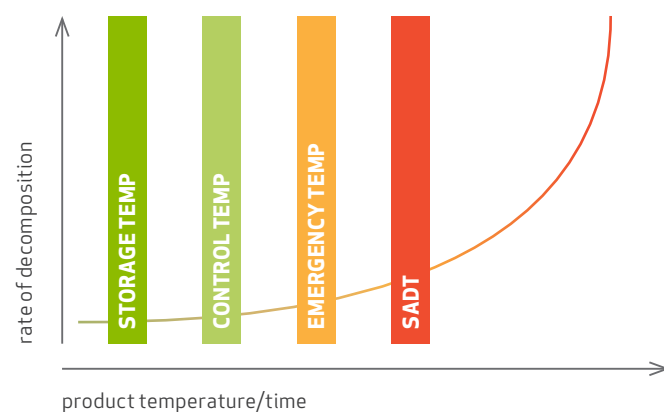
Half-Life

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.

$$T_C = \text{SADT minus } 36^\circ\text{F if SADT} < 68^\circ\text{F}$$

$$T_C = \text{SADT minus } 27^\circ\text{F if SADT} < 95^\circ\text{F}$$

$$T_C = \text{SADT minus } 18^\circ\text{F if SADT} < 122^\circ\text{F}$$

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
NOROX® 420	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
NOROX® 305	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
BENOX®	Dibenzoyl-peroxide	●	126	72	91	130
NOROX® 411	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 C	Methylisobutylketoneperoxide	●	125	90	110	155
NOROX® 401	tert. Amylperoxy-(2-ethylhexyl)carbonate	●	151	95	113	150
NOROX® 500-90	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	1,1-Di(tert.amylperoxy)cyclohexane	●	135	87	106	152
NOROX® TBIC	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
NOROX® CHP	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						
NOROX® 608-75	Di(2-ethylhexyl)peroxydicarbonate	●	CHPC	Dicyclohexylperoxydicarbonate		
SBPC	Di(sec-butyl)peroxydicarbonate	●	NBPC	Di(n-butyl)peroxydicarbonate		
NOROX® 600	Di(4-tert.butylcyclohexyl)peroxydicarbonate	●	NOROX® 605	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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