



NOROX[®]

**Thermoset Applications
Americas**

PRODUCT CODE	CHEMICAL STRUCTURE	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY INFORMATION	Recommended Storage Temperature	SADT	APPLICATION TEMPERATURE	Hand Lay-up/Spray-up	Coating/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)	Engineered Stone	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	SPECIAL RESINS	Vinylesters	Acrylic Resins
Ketone Peroxides		%	%	°F/°C	°F/°C		Ambient									Elevated		High						
Methyl ethyl ketone peroxides (CAS No. 1338-23-4)																								
NOROX®MEKP-925H	High dimer, lowest H ₂ O ₂ available, designed for VE resins & gelcoats, less foaming	8.9		max. 86/30	140/60		●	●	●	●	●		●	●	●							●		
NOROX®MEKP-925	High dimer for VE & IsoUPR, higher peak exotherm, more thorough cure	8.9		max. 86/30	140/60		●	●	●	●	●		●	●	●							●		
NOROX®MEKP-950	Medium gel time for low HAP gel coats	8.9		max. 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		max. 86/30	140/60		●	●	●	●	●		●	●	●							●		
NOROX®MEKP-9	Medium gel time, general purpose use	8.9		max. 86/30	140/60		●	●	●	●	●		●	●	●							●		
NOROX®MEKP-900	Fast gel time, general purpose lamination	8.9		max. 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		max. 86/30	140/60		NR ²	NR ²	NR ²	NR	NR ²		NR	NR ²	NR							NR ²		
NOROX®FS 100/9	Fastest gel time, medium cure, winter use	8.9		max. 86/30	140/60		●	●	●	NR	NR		NR	●	NR							NR		
Acetylacetone peroxides (CAS No. 37187-22-7)																								
NOROX®PD-40	Standard AAP	4.1		max. 77/25	140/60		●	●	●	NR ¹	●		●	●	●			●				●		
NOROX®AZOX	Improved AAP for more consistent application	4.5		max. 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		max. 77/25	140/60		●	●	●	NR ¹	●		●	●	●			●				●		
NOROX®AMP-50	AAP/MEKP blend for faster cure in thinner laminates	6.5		max. 77/25	140/60		●	●	●	NR ¹	●		●	●	●			●				●		
NOROX®SHP-90	AAP/TBPB blend for more heat, faster cure	4.5		max. 86/30	131/55		●	●	●	NR ¹	●		●	●	●			●				●		
NOROX®SHP-40	Diluted SHP-90	3.6		max. 86/30	131/55		●	●	●				●	●	●									
NOROX®FC-100	AAP with improved cure performance	4.5		max. 86/30	131/55		●	●	●	NR ¹	●		●	●	●			●				●		
NOROX®750E	AAP/CHP blend for fast cure, controlled exotherm	5.6		max. 86/30	140/60		●	●	●	NR ¹	●		●	●	●			●				●		
NOROX®757E	Diluted 750 for more accurate metering	3.5		max. 86/30	140/60									●	●							●		
NOROX®CHAP-21E	AAP/CHP blend for RTM moderate gel time, fast cure, controlled exotherm	7.0		max. 86/30	140/60		●	●	●	NR ¹	●		●	●	●			●				●		
Ketone peroxide blends (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		max. 86/30	140/60		●	●	●	NR	●				●									
NOROX®MEC	Cures well in thin film, not affected by temperature change as much as MEKP	8.9		max. 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.

● = Recommended application ● = Other possible application
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PRODUCT CODE	CHEMICAL STRUCTURE						APPLICATION TEMPERATURE										Elevated			High		SPECIAL RESINS				
		%	%	°F/°C	°F/°C		Ambient																			
Methyl isobutyl ketone peroxides (CAS No. 37206-20-5)																										
NOROX®PULCAT CMB	Non-refrigerated kick off initiator, modified for low odor	8,9		max. 86/30	140/60																					
NOROX®PULCAT CWM	Blend with MEKP-925 for faster start in continous panel production	8,9		max. 86/30	>140/60																					
tert-Butyl hydroperoxides (CAS No. 75-91-2)																										
NOROX®TBHP	70 % aqueous solution, convenient source of free radicals when water is present	12.5	70	max. 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	max. 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	>169/76	>169/76					NR																
NOROX®CHP-90	High assay CHP, low exotherm for thicker parts	9.0	86-90	>169/76	>169/76					NR																
NOROX®CHM-50	Promoted CHP for fast curing of some VE resins	4.5		max. 86/30	140/60					NR																
NOROX®MCP	Lower exotherm temperature, longer gel & cure than MCP-21, for thicker laminates	8.8		max. 86/30	140/60					NR																
NOROX®MCP-21	Lower exotherm temperature, longer gel & cure than MCP-75, for thicker laminates	8.9		max. 86/30	140/60					NR																
NOROX®MCP-75	Lower exotherm temperature, long gel time, good final cure; for thicker laminates	8.9		max. 86/30	140/60																					
NOROX®HDP	High dimer version of MCP	8.9		max. 86/30	140/60					NR																
NOROX®HDP-75	High dimer version of MCP-75	8.9		max. 86/30	140/60																					

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PRODUCT CODE	CHEMICAL STRUCTURE	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY INFORMATION		APPLICATION TEMPERATURE										SPECIAL RESINS						
		%	%	°F/°C	°F/°C		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)	Engineered Stone	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	Vinylesters	Acrylic Resins
Dialkyl Peroxides		%	%	°F/°C	°F/°C		Ambient							Elevated			High					
Methyl ethyl ketone peroxides (CAS No. 1338-23-4)																						
NOROX®305	Technically pure flake	4.0	99	max. 86/30	122/50												●		●			●
NOROX®DTBP	An excellent source of free radicals above 212 °F (100 °C)	10.8	99	max. 81/27	167/75																	
NOROX®DTAP	tert-Amyl version of DTBP	8.7	96	max. 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		140/60		●	●	●	NR	●			●							●	●
BENOX®C-50 PF	50 % BPO free flowing, non-caking powder with a phthalate free plasticizer	3.3	50		140/60		●	●	●	NR	●			●							●	●
BENOX®A-75	75 % BPO granules in water	5.0	50		149/65		●	●	●	NR	●	●					●					●
BENOX®A-70	70 % BPO granules in water	4.5	70		49/65		●	●	●	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	tert-Amyl version, better cure, lower residual stryene	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®410-50OMS	50% diluted in Odorless Mineral Spirits (OMS) for better metering	3.8	50	max. 59/15	104/40										●					●	●	●
tert-Amyl peroxy-2-ethylhexanoate (CAS No. 686-31-7)																						
NOROX®411	tert-Amyl version for lower residual stryene, better cure	7.3	99	max. 68/20	104/40											●				●	●	●
NOROX®411-75OMS	25 % dilution in Odorless Mineral Spirits (OMS) for better metering	5.2	75	max. 50/10	95/35											●				●	●	●
tert-Butyl peroxyneodecanoate (CAS No. 26748-41-4)																						
NOROX®420-75OMS	75 % solution in Odorless Mineral Spirits (OMS), fast starter, economical	4.9	75	max. 23/-5	68/20															●	●	●

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PRODUCT CODE	CHEMICAL STRUCTURE	ACTIVE OXYGEN CONTENT	PEROXIDE CONTENT	SAFETY INFORMATION	Recommended Storage Temperature	SADT	APPLICATION TEMPERATURE	Hand Lay-up/Spray-up	Coating/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)	Engineered Stone	Continuous Laminating	Pultrusion	SMC, BMC, GMC, TMC	SPECIAL RESINS	Vinylesters	Acrylic Resins
Peresters		%	%	°F/°C	°F/°C		Ambient									Elevated			High					
<i>tert</i> -Amyl peroxyneodecanoate (CAS No. 26748-41-4)																								
NOROX®422-75-AL1	75 % solution, diluted version, fast starter, economical	4.7	75	max. 23/-5	68/20																			
<i>tert</i> -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- <i>tert</i> -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	max. 68/20	104/40																			
Dimyristyl 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	max. 81/27	140/60																			
Di-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(<i>tert</i> -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	max. 86/30	140/60																			
1,1-Di(<i>tert</i> -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	max. 86/30	131/55																			
1,1-Di(<i>tert</i> -butylperoxy)-3,3,5-trimethylcyclohexane (CAS No. 6371-36-8)																								
NOROX®500-90-AL3	Most efficient perketal, diluted version	5.3	90	max. 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	max. 59/15	104/40																			

Safety Information

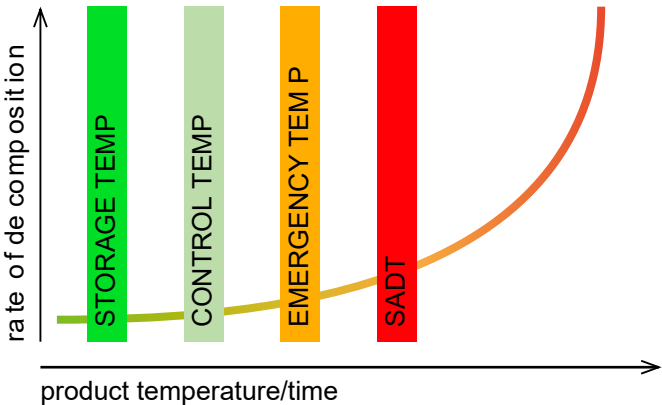
Half-life

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:

$k_d = A \cdot e^{-EA/RT}$ 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 Temperature	EA [kJ/mol]	Half Life [°C]		
				10 h	1 h	1 min
IBP	Diisobutyl peroxide	●	110	23	39	73
CUPND	Cumyl peroxyneodecanoate	●	115	38	55	90
TOPND	1,1,3,3-Tetramethylbutyl peroxyneodecanoate	●	117	40	57	92
TAPND	<i>tert</i> -Amyl peroxyneodecanoate	●	113	44	62	100
CEPC	Dicetyl peroxydicarbonate	●	124	41	57	90
MYPC	Dimyristyl peroxydicarbonate	●	124	41	57	90
SBPC	Di-sec-butyl peroxydicarbonate	●	120	41	57	90
EHPC	Di-2-ethylhexyl peroxydicarbonate	●	121	47	64	83
TBPND	<i>tert</i> -Butyl peroxyneodecanoate	●	121	47	64	100
BCHPC	Di-4- <i>tert</i> -butylcyclohexyl peroxydicarbonate	●	129	48	64	82
NBPC	Di- <i>n</i> -butyl peroxydicarbonate	●	130	49	65	99
TBPNH	<i>tert</i> -Butyl peroxyneohexanoate	●	116	51	69	107
TAPPI	<i>tert</i> -Amyl peroxyisobutyrate	●	121	53	71	110
DCLBP	Di-2,4-dichlorobenzoyl peroxide	●	121	54	72	110
TBPPI	<i>tert</i> -Butyl peroxyisobutyrate	●	121	56	74	110
INP	Di-3,5,5-trimethylhexanoyl 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	<i>tert</i> -Amyl peroxy-2-ethylhexanoate	●	126	72	91	130
TBPEH	<i>tert</i> -Butyl peroxy-2-ethylhexanoate	●	135	74	92	130
TBPIB	<i>tert</i> -Butyl peroxyisobutyrate	●	130	77	96	135
TBPM	<i>tert</i> -Butyl monoperoxymaleate	●	116	82	104	150
ACH	1,1-Di(<i>tert</i> -amylperoxy)cyclohexane	●	135	87	106	152
MIKP	Methyl isobutyl ketone peroxide	●	125	90	110	155
TAPEHC	<i>tert</i> -Amylperoxy-(2-ethylhexyl)carbonate	●	151	95	113	150
TMCH	1,1-Di(<i>tert</i> -butylperoxy)-3,5,5-trimethyl-cyclohexane	●	143	95	114	155
CH	1,1-Di(<i>tert</i> -butylperoxy)cyclohexane	●	138	97	117	160
TBPIC	<i>tert</i> -Butyl peroxyisopropyl carbonate	●	138	97	117	160
TBPIN	<i>tert</i> -Butyl peroxy-3,5,5-trimethylhexanoate	●	147	100	119	160
TBPEHC	<i>tert</i> -Butyl peroxy-2-ethylhexyl carbonate	●	128	100	122	175
TBPA	<i>tert</i> -Butyl peroxyacetate	●	149	102	121	160
TAPB	<i>tert</i> -Amyl peroxybenzoate	●	143	102	122	160
TBPB	<i>tert</i> -Butyl peroxybenzoate	●	143	104	124	165
BU	2,2-Di(<i>tert</i> -butylperoxy)butane	●	143	104	124	165
NBV	<i>n</i> -Butyl-4,4-di(<i>tert</i> -butylperoxy)valerate	●	141	110	131	175
EBU	Ethyl-3,3-di(<i>tert</i> -butylperoxy)butyrate	●	144	114	135	180
DCUP	Dicumyl peroxide	●	152	116	136	175
BCUP	<i>tert</i> -Butyl cumyl peroxide	●	154	118	138	180
DTAP	Di(<i>tert</i> -amyl) peroxide	●	129	118	142	190
DIPP	Di[2-(<i>tert</i> -butylperoxy)-isopropyl]benzene	●	142	120	142	190
DHBP	2,5-Dimethyl-2,5-di(<i>tert</i> -butylperoxy)hexane	●	142	120	142	190
DTBP	Di(<i>tert</i> -butyl) peroxide	●	152	125	146	190
DYBP	2,5-Dimethyl-2,5-di(<i>tert</i> -butylperoxy)hexyne-3	●	154	128	149	195
CUHP	Cumyl hydroperoxide	●	133	140	166	223
TBHP	<i>tert</i> -Butyl hydroperoxide	●	149	173	200	260
CUROX®CC-DC	2,3-Dimethyl-2,3-diphenylbutane	●	195	210	234	285



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