

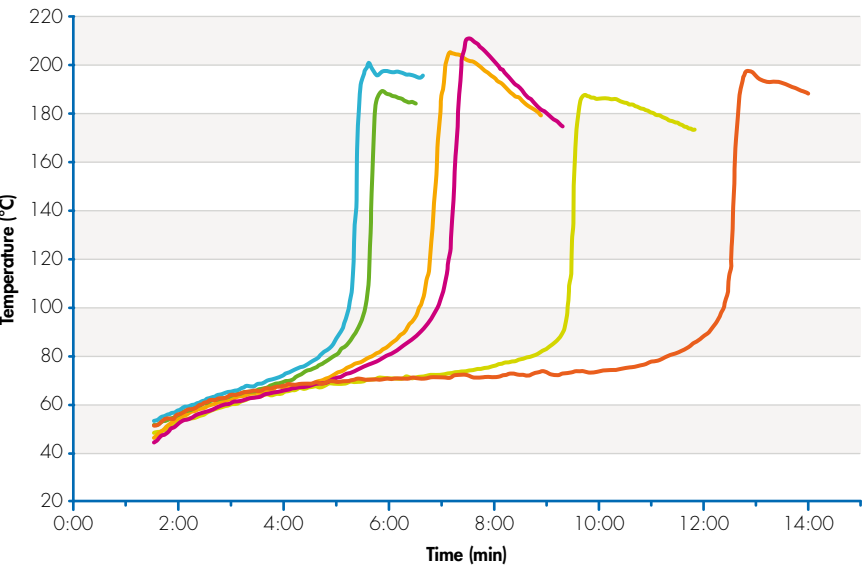
Curing of unsaturated polyester resins



PEROXIDES FOR CURING OF UNSATURATED POLYESTER RESINS

CURE PERFORMANCE AT 80°C COMPARISON

CURE PERFORMANCE AT 80°C
IN A MEDIUM REACTIVITY ORTHOPHTHALIC RESIN



Tradename	Peroxide quantity	Cobalt 6% quantity	Gel time (min:s)	Cure time (min:s)	Peak exotherm (°C)	Pot life at 30°C (hours)
Luperox® K2	2 phr	No cobalt	05:47	07:35	201	06:00
Luperox® K21	2 phr	No cobalt	05:48	07:03	203	06:00
Luperox® 26M70	2 phr	No cobalt	08:36	10:26	190	>24
Luperox® ANS50G	2 phr	No cobalt	12:37	13:22	197	>24
Luperox® DP10G	2 phr	0.25 phr	05:17	05:58	190	14:09
Luperox® DP40	2 phr	0.25 phr	04:40	05:28	204	10:30

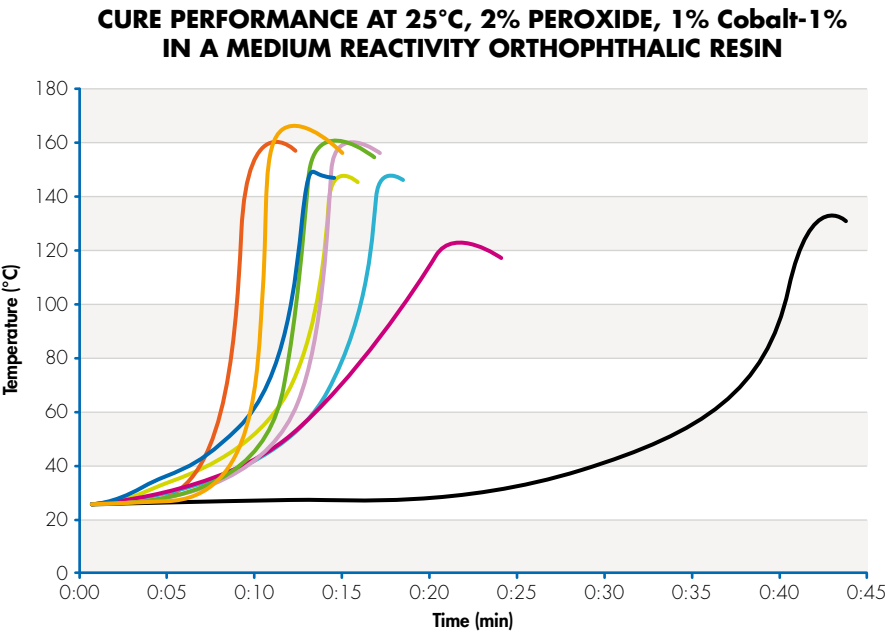
CONDITIONS OF EXPERIMENT

Resin: medium reactivity orthophthalic resin
Peroxide: 2%
Cobalt (6% solution): depending on test
Resin initial temperature: 25°C
Testing temperature: 80°C
Resin sample: 25 g

Application guidelines		
Solvent	Active Oxygen (%)	Recommended maximum storage temperature (°C)
		Recommended Other possible application
		Gel coats & top coats
		Hand lay-up
		Spray-up
		Compound marble (blocks)
		Polymer concrete
		Casting
		Resin transfer moulding (RTM)
		Vacuum moulding / infusion
		Centrifugal casting
		Filament winding
		Panels & sheets
		Compound quartz (slabs)
		SMC / BMC / DMC
		Pultrusion
		Varnishes
		Putties
		Vinylester & bisphenol resins
		Acrylic resins
		Buttons
		Paper Impregnation

METHYL ETHYL KETONE PEROXIDES																				
Luperox® K18	Dimethyl phthalate	9.9	25	Very high activity MEKP. Gives fast gel and cure time for a variety of ortho and isophthalic resin systems.	□	■	■	□	■		□	□	■	□	■		■		□	
Luperox® K10	Dimethyl phthalate	9.9	25	High activity MEKP. Gives fast gel and cure time for a variety of ortho and isophthalic resin systems.	□	■	■	□	■		□	□	■	□	■		■		□	
Luperox® K1 S	Dimethyl phthalate	9.2	30	Medium activity MEKP. Standard general-purpose hardener for a variety of ambient temperature applications. Low hydrogen peroxide content makes Luperox® K1 S ideal for use in gel coats.	■	■	■	□	■	■	■	■	■	■	■		■	■	□	
Luperox® K1 G	Aliphatic	9.2	30	Medium activity MEKP. It is same product than Luperox® K1 S but it is diluted with non phthalic solvent, so it is suitable for "phthalate-free" labeled applications.	■	■	■	□	■	■	■	■	■	■	■		■	■	□	
Luperox® K12 G	Aliphatic	8.5	30	Low activity MEKP that gives long gel times in a wide variety of ortho and isophthalic resin systems. Particularly suitable during the warm season and for very large molded pieces. Suitable for fast curing of vinyl ester resins to obtain blister free laminates. Diluted with non phthalic solvent, so it is suitable for "phthalate-free" labeled applications.	■	■	□			■	□	□	■	■	□			□	■	
METHYL ISOBUTYL KETONE PEROXIDES																				
Luperox® K2	Dimethyl phthalate	10.1	25	MIBKP for short curing cycles at medium and high temperatures from 65°C to 120°C even without cobalt accelerator. Mostly used for the manufacture of flat and corrugated sheets in continuous processes.											■	■		■	□	
Luperox® K21	Dimethyl phthalate	10.1	27	As Luperox® K2 but longer pot life when used with a cobalt accelerator.											■	■				
ACETYL ACETONE PEROXIDE																				
Luperox® K3	Plasticizer	4.1	27	Rapid propagation from gel to exothermic peak in many resin systems. Fast curing and heat dissipation are particularly useful for continuous and semi-continuous production processes. Its high activity makes it suitable during cold season. Luperox® K3 / cobalt is the only alternative to a benzoyl peroxide / amine system if color stability as well as fast curing is required. It is not recommended for gel coats and vinyl ester resins.		■		□	□	■		■	■	■	■	■		■	□	
CYCLOHEXANONE PEROXIDE																				
Luperox® K4CE	Dimethyl phthalate	5.1	25	High activity cyclohexanone peroxide, it gives relatively short gel times and gradual curing with a low peak temperature. This product ensures curing of even thick wall pieces without stress or crack formation.	□	■		□		■	□		□	■	■		■	■		
KETONE PEROXIDES BLENDS																				
Luperox® Z11 S	Dimethyl phthalate	7.7	25	Ketone peroxides blends for technologies requiring a comparable gel time with Luperox® K1 S but faster curing times with peak temperatures lower than those obtained with Luperox® K3 . In a wide variety of resins, reactivity ranking is: Luperox® Z33 S > Luperox® Z13 S > Luperox® Z11 S .	□	■	■	■	■		■	■	■	■	□		□			
Luperox® Z13 S	Dimethyl phthalate	6.8	30				■	■	■	■		■	■	■	■	□		□		
Luperox® Z33 S	Dimethyl phthalate	5.6	30				■	■	■	■		■	■	■	■	□		□		
Luperox® Z11 G	Aliphatic	7.7	25	Identical to Luperox® Z11 S but diluted with non phthalic solvent, so it is suitable for "phthalate-free" labeled applications.	□	■	■	■	■		■	■	■	■	□		□			
Luperox® Z390	Plasticizer	4.6	25	High activity blend of acetyl acetone peroxide that allows full curing at temperatures above 60°C. This blend is suitable for continuous and semi-continuous processes. Reduces residual styrene content without need of post curing.					□				■	■	■					
Luperox® Z350	Plasticizer	4.3	25	High activity blend of acetyl acetone peroxide that allows full curing at temperatures above 60°C. This blend is suitable for continuous and semi-continuous processes. Reduces residual styrene content without need of post curing. Luperox® Z350 doesn't contain and doesn't generate any aromatic compound (BTEX) and it's faster than Luperox® Z390 .					□				■	■	■					
Luperfoam® 329 Luperox® DP33G	Water Aliphatic	- 9.0	30 30	Exclusive foaming system that transforms UPB in a foamed structural resin. Overall weight reduction, faster cycle times and better mold filling are its main advantages. Can be used in ortho or isophthalic resins, glass reinforced or not.				□		■		■	■	□		□				
HYDROPEROXIDES																				
Luperox® CU80	Cumene	8.4	30	Suitable at medium and high temperatures (120°C and more) where slow gelling and curing are required, with moderate heat evolution. May be used in combination with ketone peroxides /cobalt systems to reduce surface tackyness.	□										□		□		■	
Luperox® CU50VE	Promoter	4.7	30	Especially developed for vinyl ester resins. Used without promoter. Much faster curing than CU80, it reduces exothermicity avoiding microcracks. Particularly suitable for the production of thick parts.														■		
Luperox® TBH70X	Water	12.4	30	Always used in combination with ketone peroxides /cobalt systems. It reduces curing speed and peak temperature keeping good curing quality. By post curing it greatly reduces residual styrene content.		□			□				■	□	□			□	■	
PERESTERS PEROXIDES																				
Luperox® 26	-	7.2	20	Hot curing above 60°C. Requires transport and storage controlled in temperature.											■	□	■	■		
Luperox® 26M70	Aliphatic	5.1	20																□	■
Luperox® 26SR90	Inhibitor	6.7	20		Activity like Luperox® 26 , but longer pot life in prepregs.											■	■	■		
Luperox® P	-	8.1	30 (can freeze below 6°C)	For hot press molding between 130 - 160°C. Suitable when high glass surfaces are required.											□		■	■		
Luperox® DP10 G	Promoter	6.2	30	Typical molding temperature of 60 - 100°C with cobalt accelerator. A substitute for Luperox® 26 where storage and transport of this peroxide present a problem. Especially suitable for polymer concrete and artificial marble process system.								□		□	□	■	■	■		
Luperox® DP40	Promoter	6.3	30	Like Luperox® DP10G , but it doesn't generate BTEX.								□		□	□	■	■	■		
PEROXYCARBONATES																				
Luperox® TBC70M	Aliphatic	6.8	30	For hot press molding between 130 - 160°C.												■				
Luperox® TBEC	-	6.2	30														■			
Luperox® MC	-	6.0	30		Faster molding cycles and lower residual styrene in the final article compared to Luperox® TBEC .												■			
PERKETALS																				
Luperox® 231M50	Isododecane	5.3	30	As Luperox® P but lower molding temperatures. Used when heavy metals are present which affect the pot life of peresters peroxides.												■	■			
Luperox® 331M50	Isododecane	6.1	30														■	■		
Luperox® 331MO50	Isododecane																			
BENZOYL PEROXIDES																				
Luperox® A75 (powder)	Water	4.9	30 (can freeze below 5°C)	Dibenzoyl peroxide is used to cure both at room temperature and medium temperatures. At ambient temperatures it requires the use of tertiary aromatic amines as activator. The peroxide + amines system gives quick gel and cure times and it is mainly used for polyester repair putties and mine bolts. In hot press molding, benzoyl peroxide can be used alone and gives quick cycles at 100 - 120°C. Pastes are available in different colours.						■							□		■	
Luperox® ANSSOG (paste)	Dibutyl maleate + emulsifiers	3.3	30 (can freeze below 5°C)			□			■	□	□	□	□	■			□	□	■	□

▶ KETONE PEROXIDES FOR CURING OF UNSATURATED POLYESTER RESINS



Tradename	Gel time (mins)	Cure time (mins)	Peak exotherm (°C)
 Luperox® K15/K1G	09:24	17:21	146
 Luperox® K18	06:52	13:29	150
 Luperox® K10	07:32	15:01	147
 Luperox® K12G	27:48	42:23	135
 Luperox® K3	06:48	11:10	162
 Luperox® K4CE	08:34	21:21	126
 Luperox® Z11S/Z11G	09:33	15:57	161
 Luperox® Z13S	08:52	14:39	158
 Luperox® Z390	08:22	12:08	166

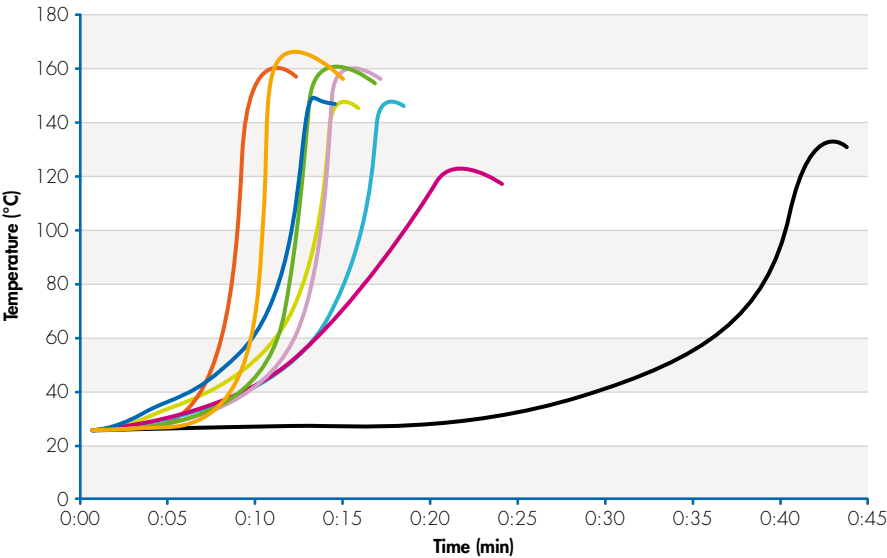
CONDITIONS OF EXPERIMENT

Resin: medium reactivity orthophthalic resin
Peroxide: 2%
Cobalt (1% solution): 1%
Resin initial temperature: 25°C
Resin sample: 50 g

↓ KETONE PEROXIDES FOR CURING OF UNSATURATED POLYESTER RESINS

CURE PERFORMANCE AT ROOM TEMPERATURE COMPARISON

CURE PERFORMANCE AT 25°C, 2% PEROXIDE, 1% Cobalt-1%
IN A MEDIUM REACTIVITY ORTHOPHTHALIC RESIN



Tradename	Gel time (min:s)	Cure time (min:s)	Peak exotherm (°C)
Luperox® K1S/K1G	09:24	17:21	146
Luperox® K18	06:52	13:29	150
Luperox® K10	07:32	15:01	147
Luperox® K12G	27:48	42:23	135
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Luperox® K4CE	08:34	21:21	126
Luperox® Z11S/Z11G	09:33	15:57	161
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↓ CONDITIONS OF EXPERIMENT

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SAFETY HANDLING OF ORGANIC PEROXIDES



1 Observe exact **storage temperature** indicated on product label.



2 Keep away from sources of ignition and heat.
Store in a cool dark place - well **separated** from accelerators and other flammable material.



3 **Danger of explosion:** never mix peroxides and accelerators together; add each component separately to the resin.

4 Store peroxides in **original containers**. Contact with rust, ash, dirt, accelerators and many other chemicals can cause violent decompositions.

5 Even in diluted form peroxides have a **corrosive** effect on the skin and eyes. Always **wear gloves** and protective **goggles** when handling peroxides.



Smoking and naked flames strictly prohibited in work and storage areas!

IN CASE OF ACCIDENTS: FIRST AID



EYES

In case of eye contact, rinse immediately with large quantities of water for at least 10-15 minutes. Contact an ophthalmologist immediately.



INGESTION

In case of accidental swallowing, do not induce vomiting. Administer water in small sips and charcoal tablets in addition. Call a doctor immediately.



SKIN • BODY

Remove soaked clothes immediately. Wash skin with plenty of water and cover skin with sterilized bandages. Seek medical advice.



SPILLAGE

If peroxide is spilled, absorb with inert material e.g. Vermiculite or clean sand immediately and destroy in accordance with local regulations.



FIRE

Suitable extinguishers are waterspray and foam. In case of large fires: Fight fire from safe distance (10-15 m). Cool containers/tanks with water spray. Call fire brigade immediately.

Consult Safety Data Sheets before handling organic peroxides

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