



CURING OF UNSATURATED POLYESTER RESINS



> Cold curing peroxides

	Phlegmatizer	Active Oxygen (%)	Gel time (min)*	Cure time (min)*	Exothermic Peak (°C)*	Kick off temperature (°C)	Recommended maximum storage temperature (°C)	Applications
Methyl Ethyl Ketone Peroxide								
Luperox® K1	Phthalate	9,2	13,1	30,7	120	70	30	Medium activity MEKP. A standard general purpose hardener for a variety of ambient temperature applications. Low hydrogen peroxide content makes K1 ideal for use in gel coats.
Luperox® K10	Phthalate	9,9	10	22,2	141	70	30	Low activity MEKP. Gives fast gel and cure time for a variety of ortho and isophthalic resin systems.
Luperox® K12	Phthalate	8,5	6	18	135	70	27	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 moulded pieces. Suitable for fast curing of vinyl ester resins to obtain blister free laminates.
Methyl Isobutyl Ketone Peroxide								
Luperox® K2	Phthalate	10,1	12,8	27,1	139	60	27	MIKP 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	Phthalate	10,1	14,2	30,6	134	60	27	As Luperox® K2 but longer pot life when used with a cobalt accelerator.
Acetyl Acetone Peroxide								
Luperox® K3	Plasticizer	4,1	7,8	14,7	163	90	27	Rapid propagation from gel to exothermic peak in many resin systems. This 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 colour stability as well as fast curing is required. It is not recommended for gel coats and vinyl ester resins.
Cyclohexanone Peroxide								
Luperox® K4CE	Plasticizer	5,1	15,9	34	59	80	27	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 Peroxide Blends								
Luperox® Z11	Phthalate	7,7	12,8	21,8	151	70	27	Ketone peroxides blends for technologies requiring a comparable gel time with Luperox® K1 but faster curing times with peak temperatures lower than those obtained with Luperox® K3 . In a wide variety of resins, Luperox® Z13 has a slightly higher activity than Luperox® Z11 .
Luperox® Z13	Phthalate	6,8	13,9	23	156	70	27	
Luperox® Z19	Phthalate	7,7	–	–	–	70	25	Special blend of ketone peroxide that allow controlled curing at temperatures up to more than 60°C. This blend is suitable for continuous and semi-continuous processes.

* Tests were carried out at 21°C in 50 g of a standard orthophthalic resin, with 2% of each peroxides and 90 ppm of cobalt accelerator (1% metal content solution).

> Hot curing peroxides

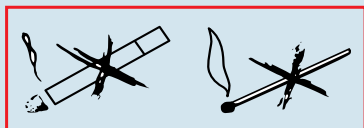
	Phlegmatizer	Active Oxygen (%)	Cure time at 145 °C (seconds)*	Cure time at 160 °C (seconds)*	Recommended maximum storage temperature (°C)	Applications
Perketals peroxides						
Luperox® 231M50	Mineral oil	6,1	50	36	30	As Luperox® P , but lower molding temperatures. Used when heavy metals are present which affect the pot life of peresters peroxides.
Luperox® 231P50	Phthalate					
Luperox® 331M50	Mineral oil	6,1	51	36	30	
Luperox® 331P50	Phthalate					
Peresters peroxides						
Luperox® P	–	8,1	57	38	between 8°C and 30°C	For hot press molding between 130 - 160°C. Suitable when high gloss surfaces are required.
Luperox® DP10	Acetyl Acetone and phthalate	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® 26	–	7,2	29	24	15	Hot curing above 60°C. Requires transport and storage below 15°C.
Luperox® 26SR90	Organic agent	6,7	30	25	20	Activity like Luperox 26 , but longer potlife in preregs.
Peroxycarbonates						
Luperox® TBEC	–	6,2	53	37	30	For hot press molding between 130 - 160°C.
Luperox® MC	–	6,0	–	–	30	Activity similar to Luperox TBEC , but it gives lower residual styrene in the final article.

> Benzoyl peroxides

	Phlegmatizer	Physical Form	Peroxide content (%)	Active Oxygen (%)	Recommended maximum storage temperature (°C)	Applications
Benzoyl peroxide						
Luperox® A75	Water	solid (fine granules)	75	4,9	between 5°C and 30°C	Benzoyl 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® ANS50	Phthalate + emulsifier	paste	50	3,3	between 5°C and 30°C	
Luperox® ANS50G	Maleate + filler	paste	50	3,3	between 5°C and 30°C	
Luperox® ANS50N	Phthalate + filler	paste	50	3,3	between 5°C and 30°C	

* Tests made in a generic UPR formulation, containing fillers but no inhibitor, thickening agent or glass fibre. 1,5 phr of each peroxide added for all tests. Trials have been carried out on a "SMC Technology" press (thickness of parts: 4mm for all trials).

Safe handling of organic peroxides



- 1 Observe exact **storage temperature** indicated on product label.
- 2 Keep away from sources of ignition and heat.
- 2 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

A global chemical player, Arkema combines 3 related and integrated business segments:

Vinyl Products, Industrial Chemicals, and Performance Products. Present in over 40 countries with 18400 employees, Arkema achieves sales of 5.7 billion euros (2005). With its research centers in France, the United States and Japan, and internationally recognized brands, Arkema holds leadership positions in its principal markets.

The information contained in this document is based on trials carried out by our Research Centres and data selected from the literature, but shall in no event be held to constitute or imply any warranty, undertaking, express or implied commitment from our part. Our formal specifications define the limit of our commitment. No liability whatsoever can be accepted by Arkema with regard to the handling, processing or use of the product or products concerned which must in all cases be employed in accordance with all relevant laws and/or regulations in force in the country or countries concerned.



4-8, cours Michelet
92800 Puteaux - France
Tél. : 33 (0)1 49 00 80 80
Fax : 33 (0)1 49 00 83 96
www.arkema.com

www.luperox.com