



# Crosslinking peroxides for elastomers and thermoplastics



Perkadox<sup>®</sup> and Trigonox<sup>®</sup>

**Nouryon**

# The world's largest range of crosslinking peroxides

Nouryon's range of organic peroxides for the crosslinking of elastomers and thermoplastics is the world's largest. Companies all over the world depend on our Trigonox® and Perkadox® organic peroxide brands. Why? Because they are an important ingredient in the production of everything from hi-tech automotive parts such as hoses and belts to shoe soles and power distribution cables.

Examples include:

- **Trigonox 311**  
PEX pipes, rotomolding
- **Trigonox 145**  
PEX pipes, rotomolding
- **Trigonox 101**  
PEX pipes, polymer modification, technical rubber goods
- **Trigonox T**  
wire & cable (direct peroxide injection)
- **Perkadox 14**  
wire & cable, technical rubber goods footwear
- **Perkadox BC**  
wire & cable, footwear, technical rubber goods
- **Trigonox 117**  
for EVA-film (encapsulant)
- **Trigonox 29**  
for fast on-set of cure
- **Perkadox PD-50S-ps**  
extruded silicone rubber articles such as auto ignition cable, seals & tubes

Much of our success is due to our philosophy of creating close partnerships with our customers. What do you want to achieve? From optimizing applications, improving efficiencies, resolving difficulties or even developing new crosslinking peroxides, we're happy to meet with you to discuss your requirements.

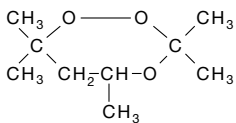
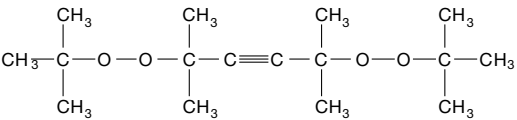
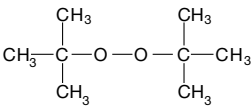
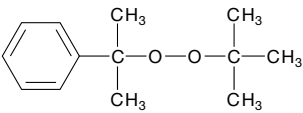
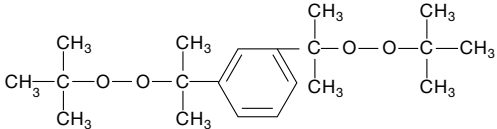
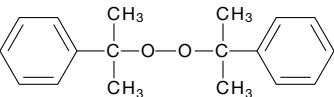
This product guide provides an overview of our main, commercially available crosslinking peroxides. We invite you to visit us at <https://polymerchemistry.nouryon.com> for complete product listings.

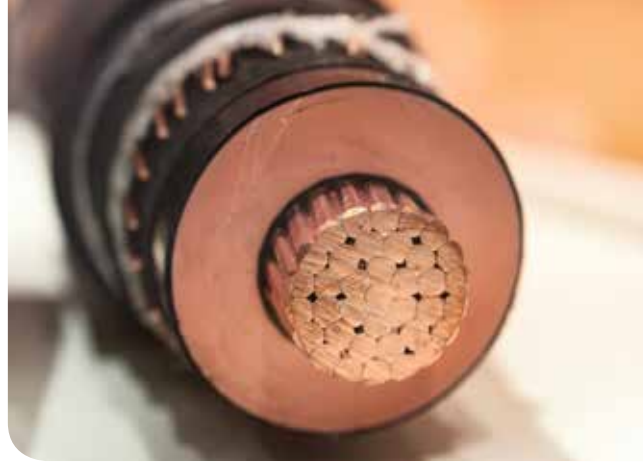
Formulations with phlegmatizers and carriers or concentrations other than those indicated, as well as unique custom made peroxide compositions can be made available with due observance of safety characteristics and the appropriate environmental and transportation regulations. Whatever your particular requirements, we can develop the product to match.



<sup>1</sup> Trigonox B has a boiling point of 110°C and a flash point of 6°C. Therefore, it is not recommended for standard rubber mixing procedures carried out in closed mixers (kneeding mixer type) or on an open two-roll mill.

<sup>2</sup> Other concentrations are available on request

Product name	Chemical name [CAS no.]	Mol. weight	Assay (%)	Main carrier / solvent	Processing data	
					Safe processing temperature (°C)	Typical crosslink temperature (°C)
Trigonox 311	3,3,5,7,7-Pentamethyl-1,2,4-trioxepane [215877-64-8]	174.3	95		180	220
						
Trigonox 145-E85	2,5-Dimethyl-2,5-di(tert-butylperoxy)hexyne-3 [1068-27-5]	286.4	85	mineral oil	145	185
Trigonox 145-45B-PD			45	calcium carbonate		
						
Trigonox B <sup>1</sup>	Di-tert-butyl peroxide [110-05-4]	146.2	99		145	180
						
Trigonox 101	2,5-Dimethyl-2,5-di(tert-butylperoxy)hexane [78-63-7]	290.4	92		135	175
Trigonox 101-50D-PD			50	silica		
Trigonox 101-45B-GR			45	calcium carbonate		
Trigonox 101-45D-PD			45	silica		
Trigonox 101-20PP-PD <sup>2</sup>			20	PP		
Trigonox 101-45S-PS			45	silicone oil		
Trigonox T	tert-Butyl cumyl peroxide [3457-61-2]	208.3	95		135	175
						
Perkadox 14S-(FL)	Di(tert-butylperoxyisopropyl)benzene [25155-25-3; 2212-81-9]	338.5	98		135	175
Perkadox 14-40B-PD/GR-S			40	calcium carbonate		
Perkadox 14-40K-PD-S			40	clay		
Perkadox 14-40MB-GR-S			40	EPR, calcium carbonate		
						
Perkadox BC-FF	Dicumyl peroxide [80-43-3]	270.4	99		130	170
Perkadox BC-40B-PD/GR			40	calcium carbonate		
Perkadox BC-40K-PD			40	clay		
Perkadox BC-40MB-GR			40	EPR, calcium carbonate		
Perkadox BC-40S-PS			40	silicone oil		
						



PD = powder  
GR = granules  
PS = paste  
MB = EPR bound

Product name	Chemical name [CAS no.]	Mol. weight	Assay (%)	Main carrier / solvent	Processing data	
					Safe processing temperature (°C)	Typical crosslink temperature (°C)
Trigonox 17-40B-PD/GR Trigonox 17-40MB-GR	Butyl 4,4-di(tert-butylperoxy)valerate [995-33-5]	334.5	40	calcium carbonate	125	160
	<chem>CC(C)(C)OC(OOC(=O)CCCC)OC(C)(C)C</chem>		40	EPR, calcium carbonate		
Trigonox 117	tert-Butylperoxy 2-ethylhexyl carbonate [34443-12-4]	246.3	>98		120	150
	<chem>CCCCC(C)COC(=O)OC(C)(C)C</chem>					
Trigonox 29-40B-PD/GR Trigonox 29-40MB-GR	1,1-Di(tert-butylperoxy)-3,3,5-trimethylcyclohexane [6731-36-8]	302.5	40	calcium carbonate	115	145
	<chem>CC(C)(C)OC1C(C)C(C)C(C)C1OC(C)(C)C</chem>		40	EPR, calcium carbonate		
Trigonox C Trigonox C-50D-PD	tert-Butyl peroxybenzoate [614-45-9]	194.2	98	silica	100	140
	<chem>CC(C)(C)OC(=O)c1ccccc1</chem>		50			
Perkadox PM-50S-PS	Di(4-methylbenzoyl) peroxide [895-85-2]	270.3	50	silicone oil	85	110
	<chem>CC1=CC=C(C)C=C1C(=O)OOC(=O)C2=CC=C(C)C=C2</chem>					
Perkadox L-50S-PS	Dibenzoyl peroxide [94-36-0]	242.2	50	silicone oil	85	105
	<chem>O=C(OOC(=O)c1ccccc1)c2ccccc2</chem>					
Perkadox PD-50S-PS	Di(2,4-dichlorobenzoyl) peroxide [133-14-2]	380.0	50	silicone oil	75	90
	<chem>ClC1=CC=C(C=C1)C(=O)OOC(=O)C2=CC=C(Cl)C=C2</chem>					

## Recommended dosage levels

Peroxide	Trigonox 29-40	Trigonox 17-40	Perkadox BC-40	Perkadox 14-40	Trigonox 101-45
Safe Processing Temperature (°C)	115	125	130	135	135
Typical Crosslink Temperature (°C)	145	160	170	175	175
Polymer	parts of peroxide per 100 parts of polymer				
NR; IR	2.3 - 4.5	2.5 - 5.0	2.0 - 4.1	1.3 - 2.5	1.3 - 2.4
BR	1.0 - 2.1	1.1 - 2.3	0.9 - 1.9	0.5 - 1.2	0.5 - 1.2
CR	1.1 - 3.0	1.3 - 3.3	1.0 - 2.7	0.6 - 1.7	0.6 - 1.6
SBR	1.9 - 4.1	2.1 - 4.6	1.7 - 3.7	1.1 - 2.3	1.1 - 2.2
NBR	2.6 - 4.5	2.9 - 5.0	2.4 - 4.1	1.5 - 2.5	1.4 - 2.4
HNBR	6.8 - 11.3	7.5 - 12.5	6.1 - 10.1	3.8 - 6.3	3.7 - 6.1
AU (ester type)	5.3 - 9.1	5.8 - 10.0	4.7 - 8.1	3.0 - 5.1	2.9 - 4.9
EPM; EPDM	6.8 - 11.3	7.5 - 12.5	6.1 - 10.1	3.8 - 6.3	3.7 - 6.1
PE	1.5 - 7.6	1.7 - 8.4	1.4 - 6.8	0.8 - 4.2	0.8 - 4.0
CM <sup>1</sup>	6.8 - 10.6	7.5 - 11.7	6.1 - 9.5	3.8 - 5.9	3.7 - 5.7
EVA	2.6 - 5.3	2.9 - 5.8	2.4 - 4.7	1.5 - 3.0	1.4 - 2.9
Q <sup>2</sup>			1.0 - 2.0	0.4 - 0.8	0.4 - 0.8

<sup>1</sup> Addition of a coagent is recommended.

<sup>2</sup> Silicone rubber can also be crosslinked with Perkadox PD-50S, Perkadox L-50S and Perkadox PM-50S.

Required amounts of peroxide: 1.1 - 2.3 phr, 0.7 - 1.4 phr and 1.1 - 2.3 phr respectively.

Typical crosslink temperatures 90°C, 105°C and 110°C.

## Peroxide versus sulfur crosslinking

### Advantages of peroxide crosslinking in comparison to sulfur cure:

- Simple formulation.
- Storage of the peroxide-containing compound without bin scorch.
- High processing temperature.
- Rapid vulcanization without reversion.
- Good compression set, particularly at elevated temperatures.
- High temperature resistance.
- Limited extractable constituents from final product.
- No staining of the finished parts
- No discoloration of crosslinked product by contact with metals and PVC.
- Most peroxides do not cause blooming.
- Co-vulcanization of saturated and unsaturated elastomers.

- Co-vulcanization of elastomers and thermoplastics.
- Copolymerization with polymerizable plasticizers or coagents to give controlled hardness and stiffness, coupled with easy processing.

### Points of attention for peroxide crosslinking:

- Sensitivity to oxygen under curing conditions.
- Certain components of the rubber compound such as
  - fillers
  - extender oils
  - antioxidants
  - resins
 must be selected with care because they may, under certain conditions, consume free radicals.

- Usually, tensile and tear strength properties are reduced by about 15%, when compared to a conventional sulfur based crosslinking system.
- Scorch and cure time are less flexible, since they are determined mainly by the temperature.
- During cure, some peroxides may lead to distinct odors.
- Post cure may be necessary.

# Contact us

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## Additional information

Product Data Sheets (PDS) and Safety Data Sheets (SDS) for our polymerization initiators are available at [polymerchemistry.nouryon.com](http://polymerchemistry.nouryon.com)

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