

Product data

Synolite 1408-P-1

Chemical/physical nature

Synolite 1408-P-1 is a low viscous, pre-accelerated, promoted, thixotropic, medium reactive unsaturated polyester resin based on orthophthalic acid. An LSE additive and a colour change system have been incorporated. Synolite 1408-P-1 does not contain monomeric amines.

Major applications

Synolite 1408-P-1 has been especially developed for hand lay-up and spray-up applications to produce all kind of constructional laminates.

Principal properties

Synolite 1408-P-1 combines good mechanical properties with optimal processability. This resin shows very good fibre wetting and impregnation properties and can be used in combination with different types of glass mats (powder and emulsion bounded), woven roving and fabrics. Thick laminates can be made mostly in one go due to the low exothermic heat development combined with fast through cure, even in very thin laminates. An LSE system is incorporated to get excellent Low Styrene Emission. Extra application properties can be found on pages 3-7. For short gel times Synolite 1408-P-2 can be used.

Product specifications

Property	Range	Unit	TM
Solids content, IR	54.5 - 56.5	%	2033
Appearance	Hazy	-	2265
Viscosity at 2 s-1	950 - 1200	mPa.s	2313
Viscosity at 20 s-1	320 - 400	mPa.s	2313
Viscosity at 250 s-1	200 - 230	mPa.s	2313
Gel time from 25°C to 35°C	23 - 27	minutes	2625
Cure time from 25°C to peak	40 - 50	minutes	2625
Peak temperature	70 - 100	°C	2625

Remarks

TM2313: spindle Z2, 2/20/250 s-1, 23°C
 TM2625: 2.0 g Butanox M-50 in 100 g resin.

Properties of the liquid resin (typical values)

Property	Value	Unit	TM
Density, 23°C	appr. 1100	kg/m³	2160
Colour on sight	blue	-	-
Flash point	appr. 33	°C	2800
Stability, no init., dark, 25°C	6	Months	-

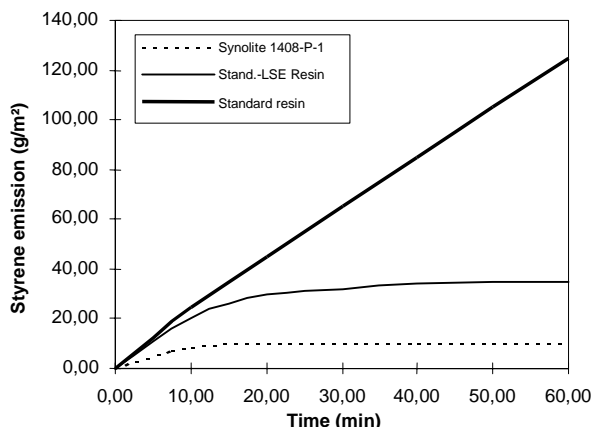
Properties of cast unfilled resin (typical values)

Property	Value	Unit	TM
Tensile strength	70	MPa	ISO 527-2
Tensile E-modulus	3900	MPa	ISO 527-2
Elongation at break	2.5	%	ISO 527-2
Flexural strength	125	MPa	ISO 178
Flexural E-Modulus	3900	MPa	ISO 178
Heat Deflection Temp. (HDT)	72	°C	ISO 75-A
Impact res. - unnotched sp.	12	kJ/m²	ISO 179
Hardness	45	Barcol	2604
Density, 23°C	1180	kg/m³	-
Volume shrinkage	7.5	%	-

Curing conditions

Cured with 1% Butanox M-50. Postcured 24 hrs at RT followed by 24 hrs 60°C and 24 hrs 80°C.

Graph showing reduced styrene emission versus standard resin



Remarks

Measured in a stove at 23°C with certain ventilation, resins not initiated.

The LSE system in Synolite 1408-P-1 is responsible for good low styrene emission properties.

Remarks on curing agents

Butanox M-50 is an AKZO Nobel product, methyl ethyl ketone peroxide (MEKP).



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Processing

Synolite 1408-P-1 contains barrier forming agents to reduce emission of styrene. These agents may reduce the bonding strength of overlaminates. Good strength can be obtained with overlaminating of the base laminate after delayed lay-up if the surface is not too resin rich. In other cases the surface might need sanding.

Guidelines before use

The resin should be conditioned at 15°C minimum before use to obtain a sufficient cure when MEKP is used as a curing system. Stir the resin before use.

Storage guidelines

The resin should be stored in a dark and dry place at temperatures between 5°C and 25°C. The shelf life of styrene containing unsaturated polyesters will be significantly reduced when exposed to light. Store in dark and in 100% light tight containers only.

Material Safety

A material safety data sheet for the product is available on request.

Test methods

Test methods (TM) referred to in the table(s) are available on request.

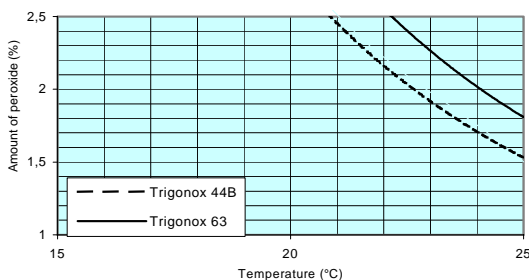
Note

The research department is responsible for the information in the tables in the pages below.

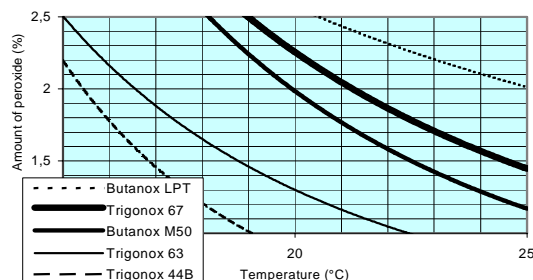
Gel times

Measured with 5 different peroxides between 15°C and 25°C

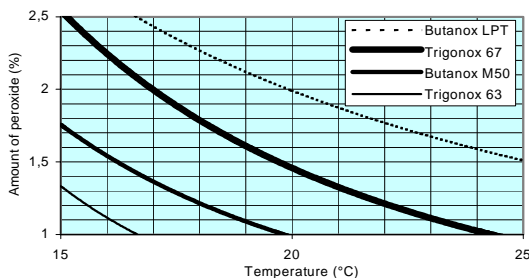
Amount of peroxide to reach 20 min gel time



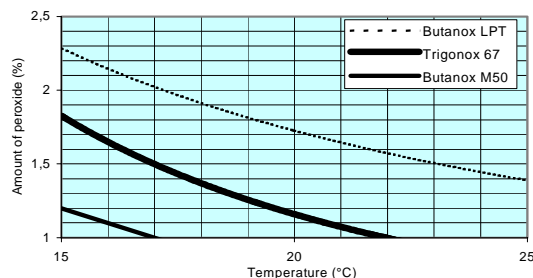
Amount of peroxide to reach 40 min gel time



Amount of peroxide to reach 60 min gel time



Amount of peroxide to reach 80 min gel time

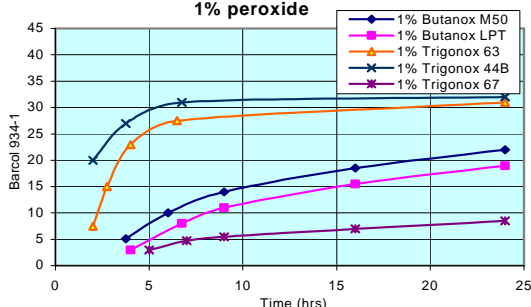


Gel times have been measured according to DIN 16945. Vetrotex M5 (emulsion bound) gives similar results.

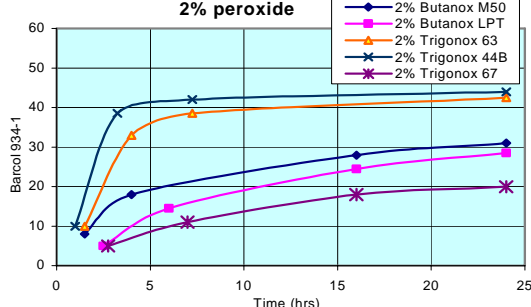
Barcoll hardness

Measured with 1% and 2% peroxide measured at laminates made with 4 layers powder bound CSM 450 g/m² (Vetrotex, M123)

1% peroxide



2% peroxide



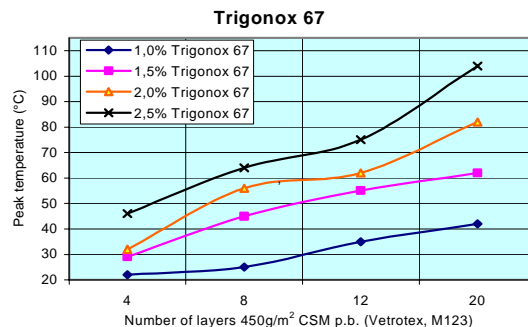
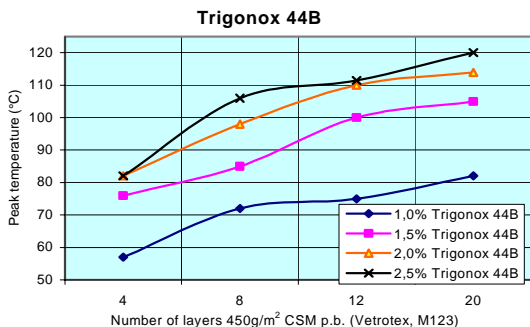
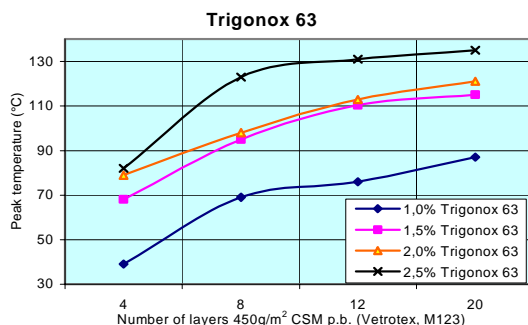
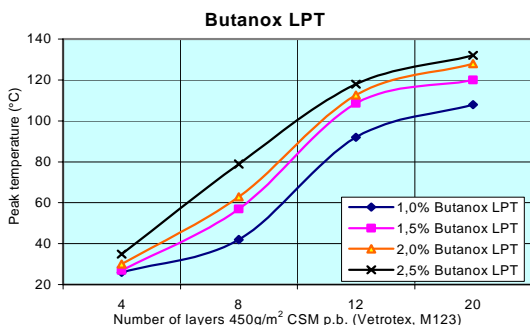
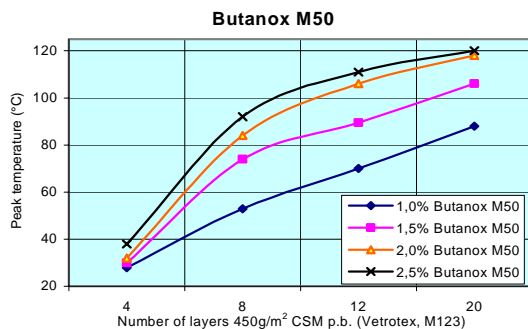
Barcoll hardness type 934-1. Vetrotex M5 (emulsion bound) gives similar results.



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Peak exotherm

Peak exotherm values with 5 different peroxides in various laminate thicknesses



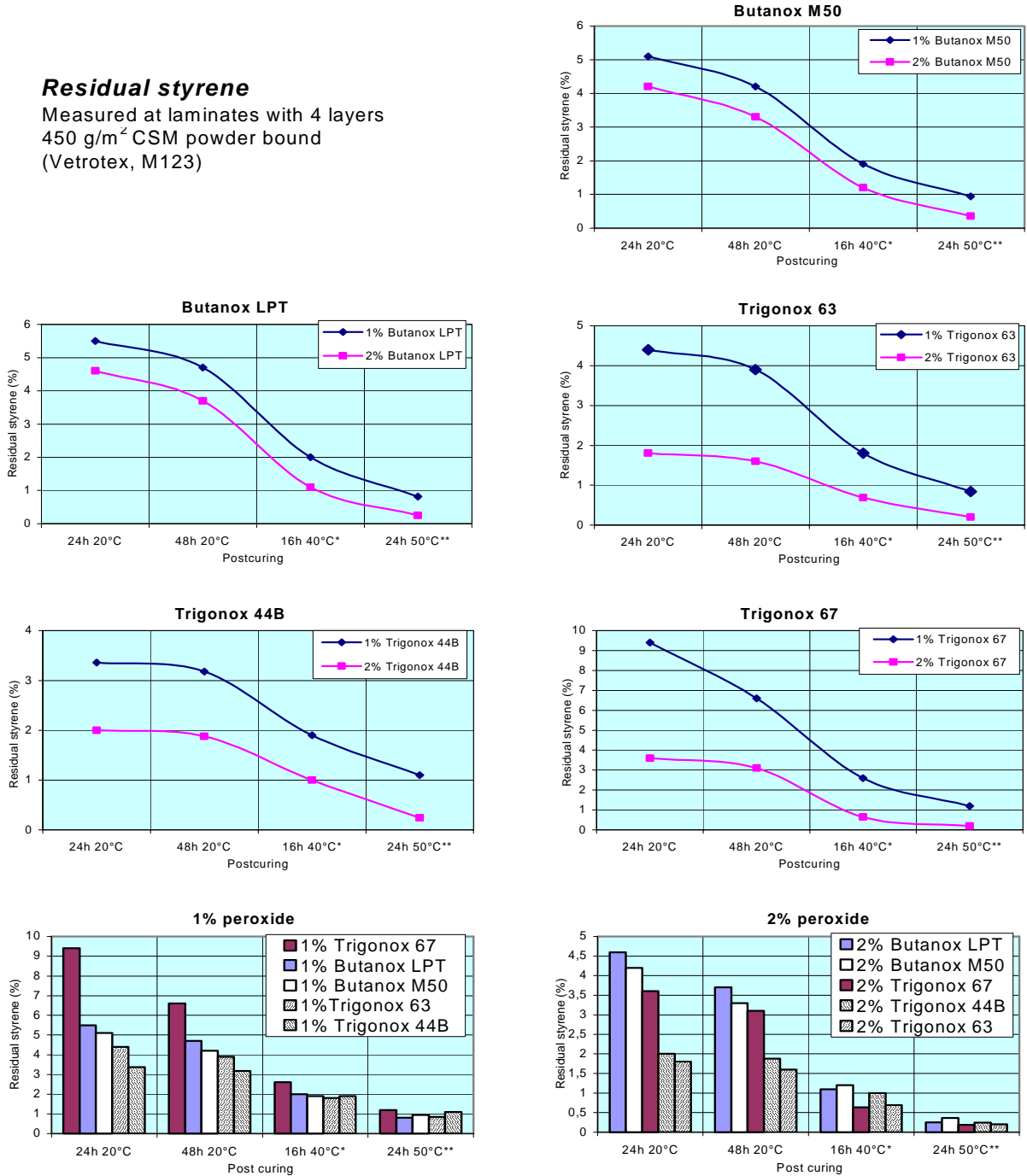
Start temperature 20°C. Vetrotex M5 (emulsion bound) gives similar results.



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Residual styrene

Measured at laminates with 4 layers
450 g/m² CSM powder bound
(Vetrotex, M123)



Percentage residual styrene is of total laminate weight. Vetrotex M5 (emulsion bound) gives similar results.

* Postcure according to Lloyds; Registered of Shipping.

** Postcure according to Det Norske Veritas; Tentative Rules for Boats.

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Gel time ranges and peak exotherm values

Measured at laminates with 8 layers 450 g/m² CSM powder bound (Vetrotex, M123) at 15°C, 20°C and 25°C.

gel time range (min)	Butanox M50 (%)				Butanox LPT				Trigonox 63 (%)				Trigonox 44B (%)				Trigonox 67 (%)				
	1,0	1,5	2,0	2,5	1,0	1,5	2,0	2,5	1,0	1,5	2,0	2,5	1,0	1,5	2,0	2,5	1,0	1,5	2,0	2,5	
15°C	35-40																x				
	40-45										x	x				x					
	45-50														x						
	50-60			x	x						x										
	60-70		x							x											x
	70-80								x											x	
	90-100	x						x											x		
	150-175							x										x			
325-350					x																
20°C	20-25																104				
	25-30											98	123			98					
	30-35				92							95				85					
	35-40			84											72						64
	40-50		74						79	69										56	
	50-60							63											45		
	60-70	53																			
	90-100						57											25			
190-215					42																
25°C	15-20										x	x				x	x				
	20-25				x						x			x	x						x
	25-30			x					x											x	
	30-35		x							x											
	35-40							x											x		
	40-50	x																			
	50-60																	x			
	60-70						x														
130-155					x																

Vetrotex M5 (emulsion bound) gives similar results.

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<p>Peroxide information</p>	<p><u>Butanox M50</u> Product description Methyl ethyl ketone peroxide in dimethyl phthalate. Clear and colourless liquid. Peroxide content 33% Specifications Total active oxygen 8,8-9,0%</p>
<p><u>Butanox LPT</u> Product description Methyl ethyl ketone peroxide in diisobutyl phthalate. Clear and colourless liquid. Peroxide content 35% Specifications Total active oxygen 8,4-8,6%</p>	<p><u>Trigonox 63</u> Product description Mixture of methyl ethyl ketone peroxide and acetylacetone peroxide in solvents. Clear liquid. Peroxide content 33% Specifications Total active oxygen 6,5-6,7%</p>
<p><u>Trigonox 44B</u> Product description Acetylacetone peroxide in solvents Clear liquid Peroxide content 33% Specifications Total active oxygen 4,0-4,2%</p>	<p><u>Trigonox 67</u> Product description Mixture of acetylacetone peroxide and tert-butyl hydroperoxide in solvents. Clear liquid. Peroxide content 20% Specifications Total active oxygen 2,8-3,0%</p>
<p>Remarks</p> <ul style="list-style-type: none"> ~ Values are typical and can differ due to conditions and other variables (e.g. glass fibre content). ~ Most UP resins suffer from minor gel time drift over time. Hence, the cure related values could differ from original properties. ~ For shorter gel times and faster cure cycles, Synolite 1408-P-2 is available. ~ Butanox and Trigonox are trade marks of AKZO Nobel. 	



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