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EPOXY AND POLYURETHANE SYSTEMS

DURATEK 1200

LOW VISCOSITY EPOXY BASED FIBRE LAMINATION RESIN

- Mainly designed for the closed mold lamination processes such as vacuum infusion, RTM and L-RTM, but it is also suitable for hand lamination, vacuum bagging and filament winding techniques under certain conditions;
- A wide pot life span between 70 – 600 minutes with different hardeners;
- Low exothermic → suitable for the production of thick parts;
- Large structures such as marine vessels and wind turbine blades can be infused in one shot;
- Fast, medium and slow hardeners are approved by Germanischer Lloyd, extra slow hardener is approved by Lloyd's Register;
- Room temperature curing system;
- Mechanical properties can be maximised at relatively low post curing temperatures.

DESCRIPTION

DURATEK 1200 System consists of one resin (**DTE 1200**) and four different hardeners: Fast hardener **DTS 2110**, medium slow hardener **DTS 1151**, slow hardener **DTS 1155** and extra slow hardener **DTS 1110**. Fast hardener is suggested for small parts and quick production cycles, extra slow hardener is suggested for very large and / or thick structures, where more time is needed.

System is more suitable for the production techniques such as infusion, RTM and L-RTM, where low viscosity is needed. Therefore, it may drain on vertical surfaces, if used for open mold techniques.

PHYSICAL PROPERTIES

	Unit	DTE 1200 + DTS 2110	DTE 1200 + DTS 1151	DTE 1200 + DTS 1155	DTE 1200 + DTS 1110
Density	kg / lt	1,10 ± 0,05	1,10 ± 0,05	1,10 ± 0,05	1,10 ± 0,05
Viscosity	mPas	350 ± 50	300 ± 50	275 ± 50	300 ± 50
Pot Life (@23°C, 100 ml)	Minutes	70 ± 10	180 ± 20	350 ± 50	675 ± 75

MIXING

Hardeners must be mixed with the resin at the given mixing ratios. Correct tools of measurement must be used for mixing; intuitive estimates must be avoided. If one of the components is measured less, system will never cure correctly and maximum mechanical and chemical strengths will never be reached.

MIXING RATIO

	DTE 1200	DTS 2110	DTS 1151	DTS 1155	DTS 1110
By Weight	100	25	27	30	39
By Volume	100	32	33	37	47

Measured components must be mixed together using an electrical mixer at low rpm (400 – 500 rev/min). If mixed too fast, air bubbles will be introduced into the mixture. Mixing must continue, till a homogenous mixture is obtained (appr. for 2 – 4 minutes). Material at the hard to reach places of the container (at the sides and bottom of it) must be mixed well. Mixer must be moved vertically and horizontally.

Pot life will be shorter, if mixed in large quantities and / or at high temperatures. Pot life can be extended and / or air bubbles can be removed more easily, if material mixed in a deep container is transferred into a broad and shallow container.

Properly adjusted mixing pumps result in the best and most reliable mixing.

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APPLICATION

Properly mixed system as described in the previous section is ready to use. Ambient temperature has to be between 15 – 25°C, relative humidity mustn't exceed 65%. If material is stored in cold storages at poor conditions, or if material is used at poor conditions or on cold surfaces, curing time of the system will be longer, application quality of the system may decrease dramatically due to the increased viscosity, surface may stay tacky and ''amine blushing'' may occur. It must also be taken into consideration, that material will cure faster at higher temperatures.

It is crucial, that epoxy, ambient temperature and application surface all have the same or approximately the same temperature.

Application surface has to be dry and free of oil, dust and other contaminants. If the application surface is the mold surface, particular attention must be paid to apply the correct mold release properly.

Even though the mixing ratios are not the same, hardeners can be mixed together to adjust the curing period. Before doing so, please check out the mixing ratios of different hardeners.

Mixed materials must be consumed, before the pot life is reached. Temperature development within the container must be followed and recorded.

Under normal circumstances, the resin consumption for hand lamination or vacuum bagging is (1,0 - 1,5 x the fibre weight). This ratio may be different for different types of the fibre or it may change at different temperatures.

When hand lay-up or vacuum bagging is used, special care must be given to wet the fibres with the resin applied before the fibres are laid. Fibres must be wetted with the resin coming through the gaps of fibres utilizing special lamination rollers. This will not only help that fibres are thoroughly laminated, it will also decrease the risk of delamination by integrating different layers of fibres and taking out the air bubbles between the layers. When using the lamination roller, fibre layers shouldn't get accumulated, or damaged.

In order to prevent resin starvation during vacuum bagging, vacuum should not start, till resin is partially cured or vacuum should start at very low levels. This is especially important, if extra slow resin is preferred for the application.

The most crucial point for closed mold techniques such as infusion, RTM and L-RTM is the air leakage. Air leakage will cause air bubbles to enter into the composite and slow down resin's flow, which may end up with resin starvation.

After lamination operation is finished, the initial curing period at 23°C of the fast hardener (**DTS 2110**) is appr. 15 hours, of the medium slow hardener (**DTS 1151**) is appr. 24 hours, of the slow (**DTS 1155**) and the extra slow hardener (**DTS 1110**) is appr. 48 hours. Temperature has to stay constant at about 23°C day and night.

Oven curing may decrease curing period. However, if oven curing cures the wet resin too fast, stress formation may occur on the fibre. Therefore, temperature should be increased gradually, rather than applying very high temperatures right away.

If the laminates' initial curing is completed, their mechanical properties can be maximised by post curing. Post curing is especially important for slow and extra slow systems. Generally, longer post curing periods and / or post curing at higher temperatures provide better properties.

Laminates produced with **DT 1200** can be removed from the mold after completing the initial curing. Post curing can be applied on demolded parts. However, if the parts are too heavy and large, or if they are produced with slow or extra slow hardeners, post curing should take place before demolding. If demolding is needed before post curing, all necessary supports must be placed into the laminates to prevent any deforming. Supports can be removed after the parts are cooled down.

Post curing must not be done right after initial curing. If there are different parts to be adhered together, complete structure can be post cured after the assembly / adhesion. Large parts have to be supported by

molds or extra fixtures, as described before. Time period between initial curing and post curing should not exceed several weeks depending on the ambient temperature. Please note that temperature's homogenous distribution in a closed part will be harder.

Temperature's homogenous distribution on the composite part during post curing is essential to prevent local property differences and to ensure equal curing throughout the part. (Ventilated ovens should be preferred.)

Temperature must be kept stable during initial and post curing. Temperature decrease during curing will increase the actual curing period. If not noticed, laminates' strength will be less than estimated. To spot temperature changes, environment can be followed with thermo couples.

Gel coat compatibility must be tested by the end user. Do not add any filler, solvent, etc. into the system.

MECHANICAL PROPERTIES OF THE CAST RESIN

SYSTEM: DTE 1200 + DTS 2110 (Fast)			CURING: 48 Hours @ 23°C +			
Property	**Unit**	**Standard**	**16h @ 50°C**	**12h @ 60°C**	**8h @ 80°C**	**4h @ 100°C**
Tensile Strength	N / mm^2	ISO 527 – 2	78 – 83	78 – 83	75 – 80	69 – 74
Elongation @Max. Str.	%	ISO 527 – 2	4,5 – 5,0	4,6 – 5,1	4,6 – 5,1	4,1 – 4,6
Tensile E – Module	kN / mm^2	ISO 527 – 2	3,1 – 3,4	3,0 – 3,3	3,6 – 4,1	2,9 – 3,2
Flexural Strength	N / mm^2	EN ISO 178	113 – 118	106 – 111	112 – 117	113 – 118
Flexural E – Module	kN / mm^2	EN ISO 178	3,0 – 3,3	2,7 – 3,0	2,5 – 2,8	2,7 – 3,0
HDT	°C	ISO 75 – 2	77 – 82	78 – 83	93 – 98	91 – 96
Water Absorption	mg	EN ISO 175	48 – 53	43 – 48	35 – 40	39 – 44

SYSTEM: DTE 1200 + DTS 1151 (Medium)			CURING: 48 Hours @ 23°C +			
Property	**Unit**	**Standard**	**16h @ 50°C**	**12h @ 60°C**	**8h @ 80°C**	**4h @ 100°C**
Tensile Strength	N / mm^2	ISO 527 – 2	76 – 81	76 – 81	76 – 81	76 – 81
Elongation @Max. Str.	%	ISO 527 – 2	3,5 – 4,0	3,5 – 4,0	4,2 – 4,7	4,5 – 5,0
Tensile E – Module	kN / mm^2	ISO 527 – 2	3,4 – 3,7	3,3 – 3,6	3,0 – 3,3	3,1 – 3,4
Flexural Strength	N / mm^2	EN ISO 178	113 – 118	113 – 118	113 – 118	128 – 133
Flexural E – Module	kN / mm^2	EN ISO 178	3,1 – 3,4	2,9 – 3,2	2,9 – 3,2	3,4 – 3,7
HDT	°C	ISO 75 – 2	68 – 73	77 – 82	78 – 83	77 – 82
Water Absorption	mg	EN ISO 175	50 – 55	46 – 51	42 – 47	41 – 46

SYSTEM: DTE 1200 + DTS 1155 (Slow)			CURING: 48 Hours @ 23°C +			
Property	**Unit**	**Standard**	**16h @ 50°C**	**12h @ 60°C**	**8h @ 80°C**	**4h @ 100°C**
Tensile Strength	N / mm^2	ISO 527 – 2	69 – 64	72 – 77	70 – 75	75 – 80
Elongation @Max. Str.	%	ISO 527 – 2	3,4 – 3,7	4,0 – 4,3	4,0 – 4,3	4,6 – 4,9
Tensile E – Module	kN / mm^2	ISO 527 – 2	3,1 – 3,4	3,0 – 3,3	3,1 – 3,4	3,1 – 3,4
Flexural Strength	N / mm^2	EN ISO 178	99 – 104	106 – 111	108 – 113	112 – 117
Flexural E – Module	kN / mm^2	EN ISO 178	3,1 – 3,4	2,7 – 3,0	2,9 – 3,2	2,7 – 3,0
HDT	°C	ISO 75 – 2	65 – 70	70 – 75	75 – 80	78 – 83
Water Absorption	mg	EN ISO 175	42 – 47	43 – 48	46 – 51	48 – 53

SYSTEM: DTE 1200 + DTS 1110 (Extra Slow)			CURING: 48 Hours @ 23°C +			
Property	**Unit**	**Standard**	**16h @ 50°C**	**12h @ 60°C**	**8h @ 80°C**	**4h @ 100°C**
Tensile Strength	N / mm^2	ISO 527 – 2	62 – 67	63 – 68	62 – 67	67 – 72
Elongation @Max. Str.	%	ISO 527 – 2	3,4 – 3,9	3,7 – 4,0	3,0 – 3,5	3,6 – 4,1
Tensile E – Module	kN / mm^2	ISO 527 – 2	2,8 – 3,1	2,7 – 3,0	3,0 – 3,3	3,0 – 3,3
Flexural Strength	N / mm^2	EN ISO 178	92 – 97	100 – 105	100 – 105	99 – 104
Flexural E – Module	kN / mm^2	EN ISO 178	2,7 – 3,0	2,7 – 3,0	2,9 – 3,2	2,5 – 2,8
HDT	°C	ISO 75 – 2	60 – 65	60 – 65	65 – 70	68 – 73
Water Absorption	mg	EN ISO 175	60 – 65	61 – 66	60 – 65	60 – 65

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THINNER

DO NOT ADD ANY THINNER!

SAFETY MEASURES

- In case of contact of the mixed or unmixed components of the material on skin or eyes, wash with plenty of water and seek immediate medical help.
- Do not wash the material contaminants on the skin with solvent. Solvent thins the material. Thinned material can penetrate into the skin easier. Hot water, soft soap and wood dust combination is the best cleaner.
- If clothes are contaminated with the material, they must be changed and washed. Material might contact the skin through the cloth.
- Never get the material into contact with food. Do not eat or swallow contaminated food. In such a case, seek medical assistance.
- Use protective cream or glows, clothes and goggles. Caution: Operators cannot feel the contamination, if they are wearing glows. When they touch machine knobs, door handles and similar common use parts with contaminated glows, other operators without glows may get into contact with the material! In such a case, follow the procedures described before.
- Working area has to be ventilated.
- Keep the material away from children.

EQUIPMENT CLEANING

PR 20 is recommended for cleaning tools. Tools are soaked in **PR 20** and then rinsed under running water.

PACKAGING

A and B components are provided in separate packages in can, drum or IBC form.

STORAGE AND SHELF LIFE

System must be kept in its original, unopened package in closed and dry warehouse conditions between 15 – 25 °C. Avoid direct sun light exposure. Shelf life under these conditions is 12 months.

Used but unfinished containers have to be kept in closed and dry warehouse conditions between 15 – 25 °C as well. Containers have to be closed immediately after dispensing to avoid amine blushing due to reaction with CO_2 in the air. Shelf life of unfinished material in opened containers is shorter, therefore they should be consumed as soon as possible.

Material may crystallize, if stored at low temperatures. It should be heated to dissolve crystallization before use. DO NOT USE CRYSTALLIZED MATERIAL! Temperature and time of heating depends on the packaging size. Bigger packages need more temperature and time.

ATTENTION

- Temperature of the application area must be 15°C – 25°C.
- During application, mixed product must be consumed within the pot life.
- If mixed in large quantities, or if any one of the temperature criteria is too high, pot life will be shorter than expected.

The facts on this Technical Data Sheet are based on laboratory test results. This data sheet is valid until subsequent issue. Duratek A.S. reserves the right to change the given data without notice.
Please consult our technical department for further information.

Duratek®
Duratek Koruyucu Malzemeler San. ve Tic. A.Ş.
Gebze Organize Sanayi Bölgesi 700. Sokak No:720 41480 Gebze - Türkiye
Tel: +90 (262) 751 2060 Fax: +90 (262) 751 0159
e-mail: info@duratek.com.tr www.duratek.com.tr