Resin formulation

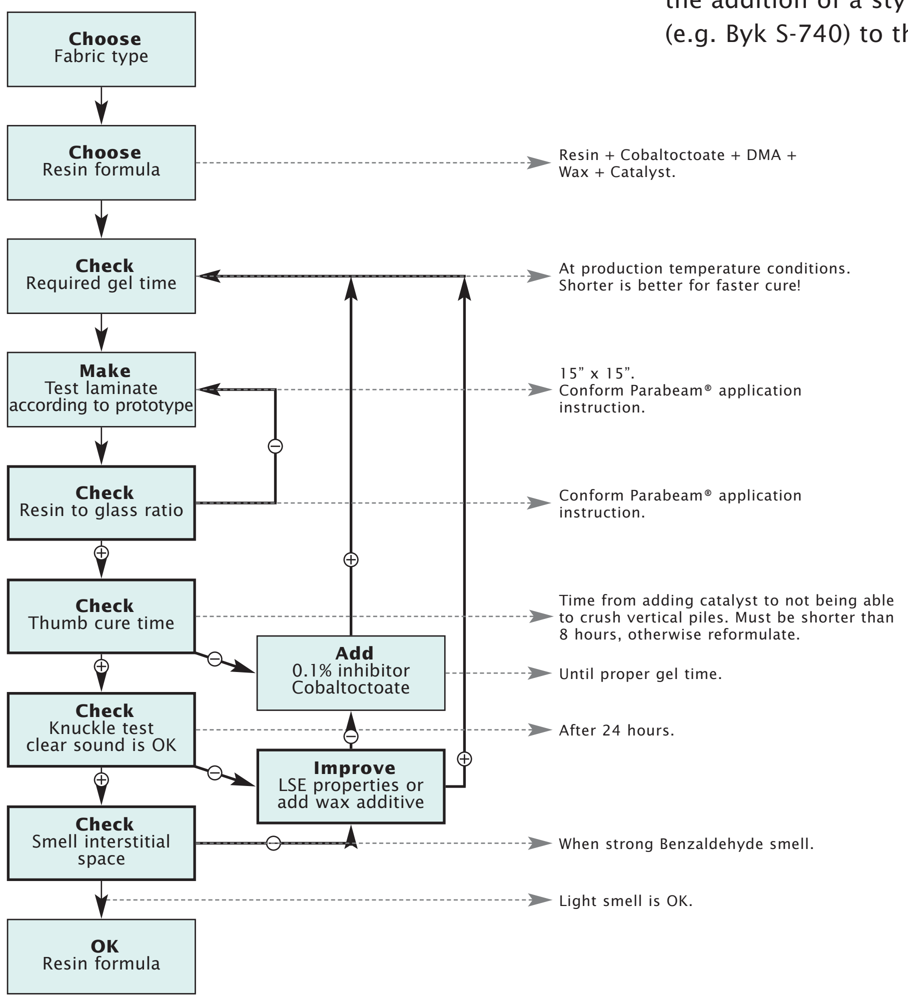
Parabeam® 3D Glass Fabric is compatible with nearly all thermoset resins like polyester, vinylester, epoxy, phenol and filled (ATH) resins. Parabeam has tested and formulated many of these resins and information is available upon request.
The resin quantity is related to the surface area of the fabric. To avoid using too much or too little resin, the size of the area to be laminated should be calculated with care, especially for smaller and sometimes frayed surfaces.

Glass/resin ratio

- Polyester / vinylester / phenol 1:1.1 (tank fabrics 1:1.4)
- Epoxy 1:0.95

FLOW SCHEDULE

For polyester / vinylester resins



When calculating the amount of resin needed, keep count with the fact that some resin stays behind in the roller(s). Especially with smaller surfaces, this effect can amount to around 30% extra.

Resin reactivity (polyester and vinylester)
To compensate the low masses of resin and therewith decreased curing temperature in the vertical pile threads, a highly reactive cure is recommended. This can be achieved with an increased catalyst level and with an increased accelerator level (preferably Cobaltoctoate) compensated with an inhibitor to set the gel time.

Cure inhibition
Due to entrapment of volatile styrene within the impregnated Parabeam® 3D Glass Fabric, precautions should be taken to avoid cure inhibition. A low styrene emission (LSE) type of resin or alternatively the addition of a styrene emission reducer (e.g. Byk S-740) to the resin is recommended.

Parabeam® 3D Glass Fabrics are manufactured in conformity with strict product specifications and certifications thereof are available upon request.

PARABEAM
3D GLASS FABRICS

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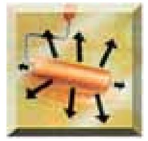
TIUS-02-2

TECHNICAL INFORMATION

Application instruction

PARABEAM® APPLICATION

1. Evenly apply approximately 40% of the recommended resin quantity on the surface (see resin consumption indicator on the backside).



2. Apply the Parabeam® 3D Glass Fabric into the resin layer and roll the fabric firmly from the centre outwards with a mohair roller or a longitudinally grooved aluminium roller to achieve a good contact with the surface underneath.

3. Evenly apply the remaining approximately 60% of the recommended resin quantity over the fabric. The capillary forces in the Parabeam® 3D Glass Fabric will automatically impregnate the fabric. De-airing is not necessary since the layers are thin and air will escape on all sides.

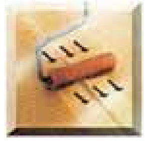
4. Gentle rolling of the top face of the fabric will secure a plain surface.
For all fabrics up to 0.87 inch, the maximum height is achieved by finishing with gently rolling in weft direction against the pile direction.
For advise please contact your local Parabeam® dealer or Parabeam directly.

* Additional layers can be applied wet-in-wet on top of the Parabeam® laminate.

PARABEAM® JOINTS

Instruction for a straight Parabeam® joint cover with the help of Paratape.
Parabeam® laminates may be cured or still wet. In case the Parabeam® laminates are cured, approx. 3.2 inches Parabeam® surface on each side of the joint should be roughened to achieve a good bonding between the Parabeam® laminate and the Paratape.

1. Bring the Parabeam® fabrics as closely together as possible, however do not overlap. The maximum distance should be 0.8 inch from selvedge to selvedge (see pictogram).



2. Separately impregnate the chopped strand mat side of the Paratape.

3. Apply the Paratape to the Parabeam® joint with the impregnated chopped strand mat side towards the Parabeam®.

4. Apply resin and distribute it evenly on top of the Paratape.
De-air by means of a de-airing roller to complete the impregnation of the Paratape.

PARABEAM
3D GLASS FABRICS

Technical data sheet

FOR 3D LAMINATES WITH POLYESTER RESIN[1]

Fabric					PARAGLASS								PARATANK		
Type					3	5	8	10	12	15	18	22	3	4,5	6
For laminated thickness															
Laminate			in		0.12	0.20	0.31	0.39	0.47	0.59	0.71	0.87	0.12	0.18	0.24
Face			in		0.016	0.016	0.016	0.024	0.024	0.024	0.024	0.024	0.016	0.016	0.016
Weight[2]															
Fabric			oz/ft²		2.56	2.82	3.05	4.70	4.92	5.25	5.64	5.51	2.46	2.79	2.95
Laminate			oz/ft²		5.37	5.92	6.40	9.87	10.33	11.02	11.84	11.57	5.90	6.72	7.21
Thermal Properties															
Thermal Conductivity	λ	DIN 52616	Btu in/ft²h°F		0.42	0.42	0.42	0.56	0.56	0.56	0.56	0.56	0.42	0.42	0.42
Thermal Resistance	R	DIN 52616	ft²h°F		0.28	0.47	0.75	0.70	0.84	1.05	1.27	1.55	0.28	0.42	0.56
Mechanical Properties															
Compressive strength	σ_c	ASTM 365	psi	typ	1275.4	697.9	391.6	217.6	159.5	145.0	130.5	58.0	1160.3	1015.3	580.2
				min	1137.5	543.1	290.1	203.1	145.0	130.5	101.5	48.2	1029.8	783.2	580.2
Shear strength	τ	ASTM 273	psi	typ	145.0	116.0	65.5	49.6	33.8	25.1	20.6	13.0	217.6	420.6	333.6
				min	130.5	101.5	47.4	32.9	24.1	17.2	13.9	9.5	101.5	188.5	145.0
Shear modulus	G_c	ASTM 273	psi	typ	831.9	1375.2	1941.7	1061.1	994.1	294.1	258.0	115.0	11603.0	10152.6	8702.3
				min	606.4	1101.4	1500.8	257.6	241.6	167.2	119.4	83.0	1740.5	6526.7	2900.8
Bending stiffness	EI	ASTM 393	lbf in²	typ	325.0	1130.3	2610.3	6320.6	9144.6	13255.8	19483.8	15345.9	341.5	676.0	1442.7
				min	188.0	990.9	2372.6	4732.3	7521.8	8928.0	10903.1	11415.1	261.4	571.5	1059.3

Note: All mechanical and thermal properties are obtained on laminates prepared according to the Application instruction. The mechanical properties are classified in two categories: typ(ical) and min(imum). A typical value is the mean average of a number of test values and a minimum value is the minimum property. The values differ with the direction of the fabric. Weft direction results in better mechanical properties than warp direction.

[1] Standard polyester resin with average mechanical properties.

[2] Glass/resin ratio see Resin formulation.

Laminated thickness

Note: this is an average of the **laminate** thickness and not the thickness of the **dry fabric.**

Final laminate thickness may vary due to

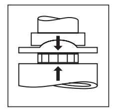
- tolerance in dry fabric thickness (+/- 0,016 inch)
- pile angle (70/80° advised)
- resin type used
- laminating process as well as working conditions

Mechanical Properties

Compressive strength

Compression Test according to ASTM365

$$\sigma_c = \frac{P_{max}}{w \cdot l}$$

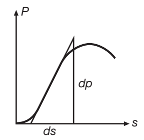


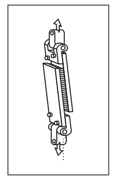
Shear strength / Shear modulus

Shear Test according to ASTM273

$$\tau = \frac{P_{max}}{w \cdot l}$$

$$G_c = \frac{h}{w \cdot l} \cdot {}^{dP}\!/_{ds}$$





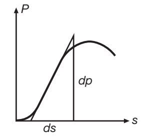
Bending stiffness

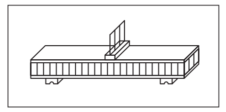
Three Point Bending Test according to ASTM393

$$E = \frac{L^3}{48 \cdot I} \cdot {}^{dP}\!/_{ds}$$

L: Support Length

I : Moment of Inertia

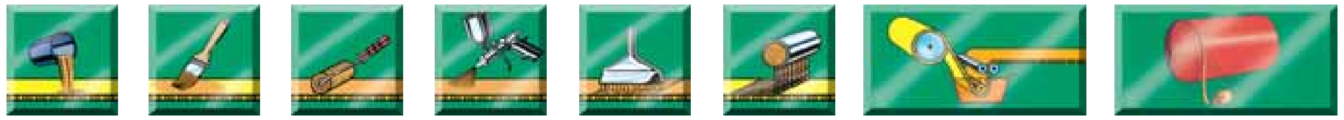




PARABEAM® HANDLING & STORAGE

PARABEAM® UTILIZATION PROCESSES

Processes in which the Parabeam® 3D Glass Fabric can be utilized:

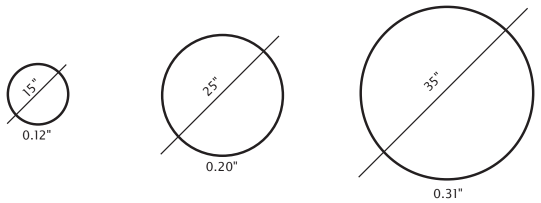


hand lay-up | **brush** | **roller** | **spray-up** | **nozzles** | **film** | **immersion and squeeze-off** | **filament winding**

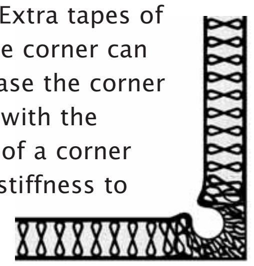
PARABEAM® DRAPEABILITY

The Parabeam® 3D Glass Fabric can be shaped in three-dimensional forms depending on the thickness of the fabric and the complexity of the shape. Lower fabrics in general have a better drapeability than the higher fabrics. When wound on a cylinder, following diameters can be taken as a guideline:

- ParaGlass/3: diameter 15".
- ParaGlass/5: diameter 25".
- ParaGlass/8: diameter 35".



In a corner with 90 degrees angle, the Parabeam® 3D Glass Fabric is squeezed down with a corner roller. Within 0.6 inch of the corner, the fabric will raise to its original thickness. Extra tapes of reinforcement in the corner can be applied to increase the corner stiffness. Together with the geometry stiffness of a corner this adds superior stiffness to your product.

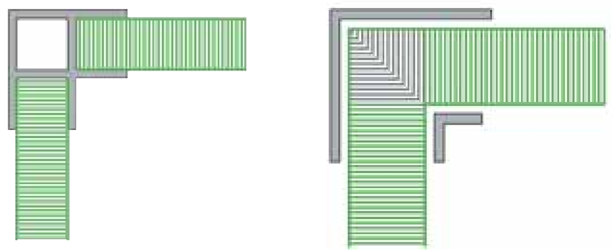


PARABEAM® FINISHINGS

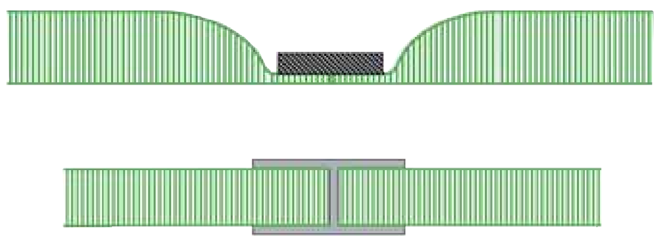
Additional decklayers like CSM, stone, wood, HPL or aluminum can be added wet-in-wet on both sides of the Parabeam®. Should a rough surface be required to bond the additional decklayers, a peelply can be used or the surface of the Parabeam® can be sanded like any other composite material.

When a smooth surface of the Parabeam® is required, a film can be used (e.g. mylar foil) on both sides. Also the Parabeam® can be foamed to increase mechanical properties and/or seal of the hollow space between the decklayers.

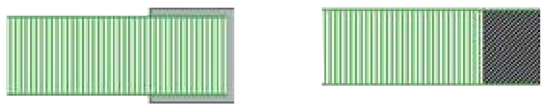
Corners



Connections



Edges



Fastening