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FireShield Manufacturing Instructions: Pultrusion Process

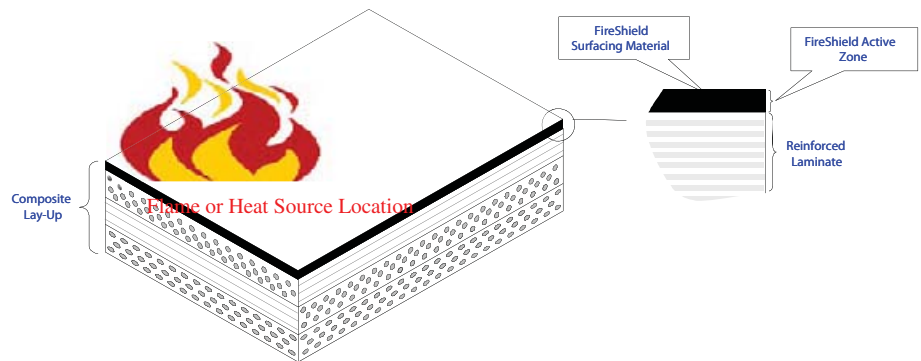
This guide provides a basic introduction on how to use FireShield for the fabrication of pultrusions using epoxy, polyester and vinyl ester resin systems reinforced with glass or carbon fibre.

The Regina FireShield product:

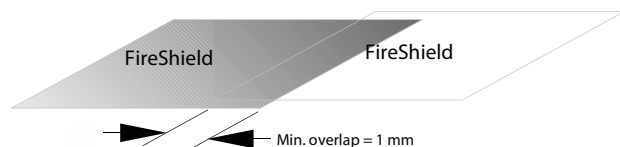
- Enables your composite product to achieve industry standard fire specifications by simply placing a layer of FireShield at the outer surface;
- Avoids the environmental problems of halogenated systems through the use of low smoke intumescent chemical;
- Under the action of a fire or flame, produces a well-bonded, charred layer on the surface of the product. This bonded char layer insulates the product and inhibits the passage of oxygen, thereby smothering the flame;
- Avoids loss of strength by not filling the base resins with fire retardant chemicals, permitting smaller, lighter weight sections;
- Can replace hazardous, phenolic resins, whilst maintaining a high fire rating.

General Things to know about FireShield:

- Optimum performance of FireShield is achieved when it is placed as the outermost layer of the laminate, closest to the heat loaded region.



- Industrial grade epoxy, polyester and vinyl ester resin systems are compatible with FireShield
- FireShield may be used in standard composite manufacturing processes. These include hand lay-up, vacuum bagging, Vacuum Bag Resin Infusion (VBRI), RTM Lite, RTM, pultrusion and autoclave (prepreg) processes
- FireShield is NOT applicable to the Dough Moulding Compound (DMC) manufacturing processes
- FireShield is to be treated in the same manner as a reinforcement ply located on one or both outermost surfaces of the laminate. FireShield may also be used to encapsulate the entire surface of the composite
- Fire, smoke and toxicity screening tests should be performed in accordance with test specifications for the application requirement. Usually, the test specimen thickness is to be no thicker than the minimum thickness for the application.
- Any cosmetic coating (paints, adhesives, resins, etc) applied after fabrication will hinder the performance of FireShield. If the finished part is to have a cosmetic coating of any kind, the specimen must be subjected to screening tests in the as-finished condition to confirm whether the part meets the specification requirements
- FireShield materials should always be stored in sealed polyethylene bags to reduce damage, contamination of surrounding chemicals and moisture absorption. FireShield left out of the protective pack may pick up moisture, causing blisters in the final product.
- Only one ply of FireShield is necessary to protect the region requiring fire protection. Multiple layers of FireShield should not be applied sequentially in the part lay-up
- In regions where two or more plies of FireShield meet due to geometry constraints, a minimum overlap of 1 mm must be maintained. It is crucial that all surfaces requiring fire protection are covered with FireShield. If for some reason there are regions that cannot be physically covered with FireShield, an intumescent coating must be applied after the part is fabricated. See final Section of this document for intumescent paints available on the market.



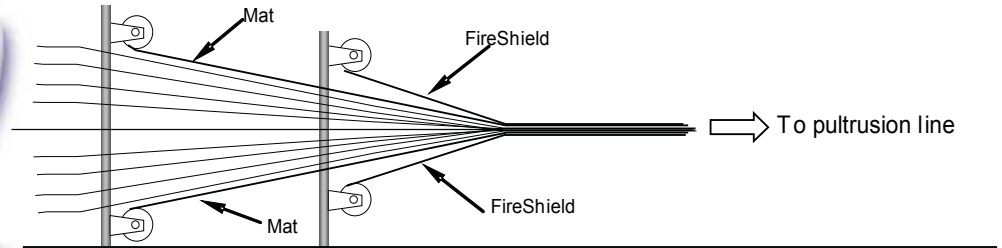


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Pultrusion Parameters

To ensure correct usage of FireShield during the pultrusion process, the following are recommended:

- Wear powder-free gloves while handling FireShield.
- FireShield offcuts may be disposed of using standard in-house waste stream practices.
- Before implementing FireShield into a production environment, it is highly recommended that specimens / prototypes are fabricated to refine production parameters.
- Treat FireShield as you would a surface veil in the pultrusion process.
- Place FireShield on the surface of the pultrusion to be exposed to a heat source or flame.
- Encapsulate the entire surface of the pultrusion if it is not certain which side/surfaces will be exposed to the heat source or flame.



- If blisters result during production, reduce die temperatures. If this does not address the creation of blisters, it may be necessary to place a light-weight fibreglass veil on top of FireShield.
- Observe surface quality after fabrication. If tacky resin is present (due to cure inhibition), a postcure temperature no higher than 190°C for two hours is recommended.
- NOTE: FireShield should NOT be subjected to temperatures above 200°C before being placed in the field.
- A cosmetic coating may be applied after fabrication. Some coatings may burn off quickly, exposing FireShield, and allowing it to create the char layer. To assess the performance, the coated part should be subjected to the fire test.

Post-Production Practices

Surface or Through-Thickness Intrusions

If the laminate surface is damaged or holes are drilled through the thickness such that resin/fibres are exposed, an intumescent coating/paint must be applied over that region to protect the exposed resin/fibre.

The following intumescent coating suppliers have products that have been tested successfully with FireShield. Review the technical data sheets and MSDS from the suppliers for procedures on how to use these coatings.

The two tested intumescent coatings are:

- Firefree 88 (<http://www.firefree.com>):
 - Distributor:
Brenntag Australia Pty. Ltd.
Headoffice: 260-262 Highett Road, Highett VIC 3190
With branches in Brisbane, Sydney and Perth.
Tel: +61 3 9559 8333 Fax: +61 3 9532 0802
Email: info-aus@brenntag-asia.com
- NoFire (<http://www.nofiretechnologies.com>):
 - Distributor:
NQ Fire Protection Pty Ltd
3 Scott Street
Cairns, QLD 4870, Australia
Tel: 1 300 666 447
Email: nofire@nqfire.com

FireShield Manufacturer
Supplier & Technical Support:

21 Regina Street, Ballarat, Victoria 3350, Australia
Tel: +61 (0)3 5339 2214, Fax: +61 (0)3 5338 1013
Contact: Arthur Rendell; Email: Arthurp@optusnet.com.au