Intrinsic UV Resistance System for Pultruded GFRP Members

Pultruded glass-fibre-reinforced polymer members are engineered with a multi-barrier ultraviolet-resistance system built into the polymer matrix during manufacture.

UV SYSTEM
Multi-barrier

PROTECTION TYPE
Intrinsic

APPLICATION
Pultruded GFRP

CONFORMANCE STATEMENT

The complete UV package comprises chemical quenchers, pigment-based reflectors and a sacrificial surfacing veil, all locked into a fully cured thermoset resin through a computer-controlled pultrusion line. The UV-resistance system is built into the member and is not post-applied.

PULTRUSION AND RESIN FORMULATION

Base resin
ISO/ortho-blend polyester or vinyl-ester depending on fire and chemical class, with controlled styrene level and gel-time tolerance.

In-line resin injection
Static mixers provide controlled additive dispersion; heated die cure followed by post-cure supports low residual exotherm.

Surfacing veil
UV-stabilised E-glass continuous-filament mat helps arrest micro-cracking and fibre bloom.

CHEMICAL UV-BARRIER PACKAGE

Additive family	Chemical type / example	Typical loading	Primary function	Synergy
UVA	Hydroxyphenyl-triazine UV absorber	0.25 phr	Absorbs 290-400 nm and converts energy to harmless heat	Protects polymer bulk
HALS	Hindered amine light stabiliser	0.35 phr	Free-radical scavenger; recycles peroxyls	Prevents chain scission
Antioxidant	Phosphite antioxidant	0.15 phr	Hydro-peroxide decomposer	Supports HALS regeneration
Pigment	Rutile titanium dioxide	2-4 phr	Physical reflector and scatterer below 380 nm	Lowers surface temperature
Carbon black	Furnace black for dark tones	1-2 phr	Near-total UV-opaque layer	Works with titanium dioxide in hybrid greys

All additives are dispersed prior to catalyst addition to avoid premature gel and are compatible with cobalt-promoted, MEKP-initiated systems.

Performance, Protection Mechanism and Conclusion

Summary of weathering performance, stabilisation mechanism and conformance position for DM Composites pultruded FRP.

PERFORMANCE AND COMPLIANCE

Standard compliance
Profiles are qualified to EN 13706-3, Grade E23 for structural use, including weathering clauses.
Accelerated weathering
Representative grey and safety-yellow coupons exposed to QUV-A Cycle 1 retained tensile strength >= 92% of baseline, interlaminar shear >= 90%, and colour change Delta E* <= 3.0.
Xenon-arc confirmation
Exposure testing showed less than 10% modulus loss and no fibre bloom.

MECHANISM OF PROTECTION

Layer	Protection mechanism
1	UVA and titanium dioxide intercept incident UV flux, converting most photons below 380 nm to low-grade heat before they reach the polymer backbone.
2	HALS capture radicals formed under exposure, operating in a catalytic cycle that regenerates the active stabilising species.
3	Phosphite antioxidant decomposes hydro-peroxides formed under combined UV and thermal stress, interrupting the oxidation sequence.
4	Surfacing veil acts as a sacrificial resin-rich layer; micro-crazing remains within the skin, helping prevent fibre exposure.

CONCLUSION

The combination of UV absorbers, HALS, antioxidant phosphite, high-opacity pigments and a UV-stabilised surface veil, homogeneously distributed through controlled pultrusion, provides a durable intrinsic defence against photochemical degradation. Weathering data confirms long-term structural integrity and colour stability of DM COMPOSITES™ pultruded FRP in Australia's high-UV environment.

REPORT NOTE

This statement relates to the UV-stabilisation system incorporated into the pultruded GFRP members and the performance mechanisms described above.