



COMPOSITE SOLUTIONS

REINFORCEMENT GUIDE



Transforming the World with Advanced Solutions



OCV Reinforcements



OCV Technical Fabrics



OCV Non-Woven Technologies

INFORMATION AS OF MARCH 2011

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A World of Reinforcement Solutions

Welcome to our new and comprehensive reference guide to the nearly 500 reinforcement solutions from Owens Corning.

In the following 125 pages you will find the industry's broadest range of glass fiber reinforcements and other solutions, including the leading brands carefully tailored to serve the requirements of nearly 50 composite fabrication processes.

These materials are supplied from the industry's largest global network of manufacturing facilities – nearly 40 plants in 15 countries. We have 7,600 commercial, operations and technical experts around the world who communicate daily in more than 15 languages to understand your local market needs.

We are also committed to helping your business grow. We continually invest in new technology and facilities to provide the reinforcements, innovations and support you need to replace traditional materials with composites. Our commitment to the industry is reflected in the tagline on the cover of this guide – Transforming the World with Advanced Solutions.

As you read through these pages, we are confident you will find solutions for your current applications and new ideas that will help drive future success. We appreciate your interest in our offering and look forward to serving you.

Sincerely,

Arnaud Genis

Group President

Owens Corning Composite Solutions Business

Owens Corning Composite Solutions Business

The Owens Corning Composite Solutions Business is a pioneer and global leader in the composites industry making glass fiber reinforcements, technical fabrics and non-woven veils. The business is dedicated to creating customer value by delivering world-class products, expertise and support.

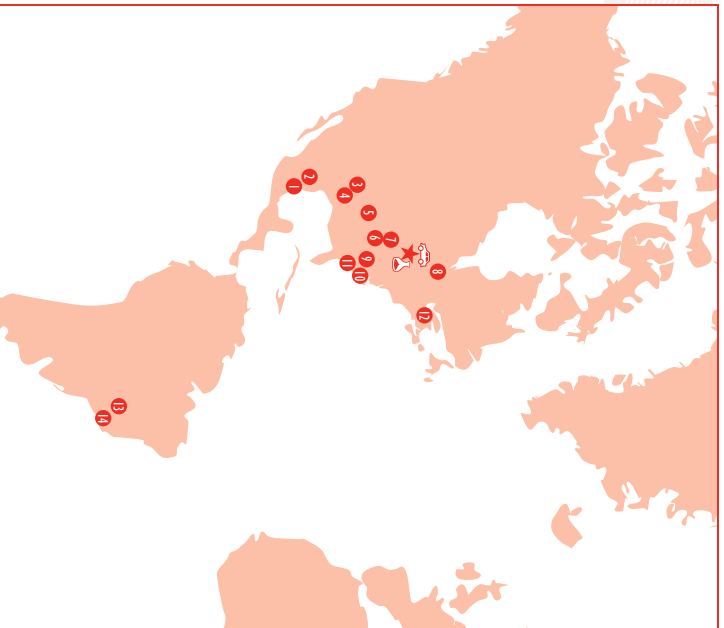
The composite business traces its roots to the mid-1930s when company researchers developed an idea for making continuous glass fibers in commercial quantities. Their success launched a revolution in materials technology that gave birth to the global composites industry. Annual sales for the Owens Corning Composite Solutions Business have grown to nearly \$2 billion and its 7,600 employees continue to innovate and lead the development and growth of the industry worldwide.

The business's strengths include a global network of nearly 40 manufacturing facilities in 15 countries with five regional research and development centers that focus on the specific needs of local markets. This global footprint, along with the breadth and quality of its products, are unmatched in the composites industry.

The business serves the market through three specialized units:

- **OCV™ Reinforcements** – Continuous filament and chopped fibers and mat, made with glass compositions designed to provide strength, resist corrosion and meet other specific needs
- **OCV™ Technical Fabrics** – Woven, knitted and stitched fabrics for advanced composite processes
- **OCV™ Non-Woven Technologies** – Surface finishing veils and reinforcing mats for a variety of other materials and systems

These focused teams recognize the value of working with their customers to develop new applications and expand the use of composite materials now and in the future.

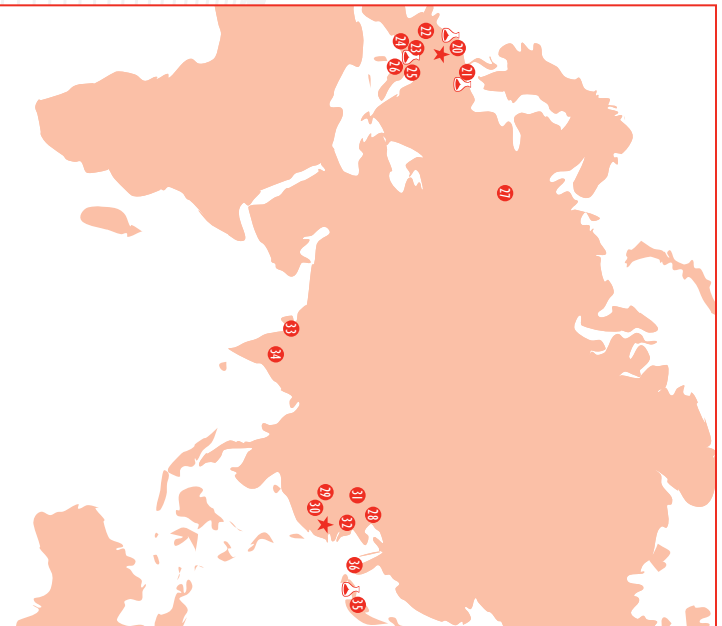


AMERICAS

- 1 Tlaxcala, Mexico
- 2 Mexico City, Mexico
- 3 Amarillo, Texas
- 4 Wichita Falls, Texas
- 5 Fort Smith, Arkansas
- 6 Jackson, Tennessee
- 7 Novi, Michigan, Automotive
- 8 Toledo, Ohio, World Headquarters
- 9 Granville, Ohio, Science & Technology
- 10 Guelph, Ontario, Canada
- 11 Concord, North Carolina

EUROPE

- 10 Starr, South Carolina
- 11 Aiken, South Carolina
- 12 Brunswick, Maine
- 13 Rio Claro, Brazil (2)
- 14 Capivari, Brazil
- 15 Lancaster, United Kingdom
- 16 Liversedge, United Kingdom
- 17 Andover, United Kingdom
- 18 Alcala, Spain
- 19 San Vicente, Spain



EUROPE

- 20** Zele, Belgium
-  Zele, Belgium, Science & Technology
-  Brussels, Belgium, Regional Headquarters
- 21** Apeldoorn, Netherlands
-  Apeldoorn, Netherlands, Science & Technology
-  Chambréry, France, Science & Technology
- 22** Vendôme, France
- 23** Chambréry, France (2)
- 24** L'Ardoise, France
- 25** Besana, Italy
- 26** Vado Ligure, Italy
- 27** Gous-Kroustalny, Russia

ASIA-PACIFIC

-  Shanghai, PR China, Regional Headquarters
- 28** Doudan (Beijing), PR China (2)
- 29** Hangzhou, PR China
- 30** Yuhang, PR China
- 31** Changzhou, PR China
- 32** Jiading (Shanghai), PR China
- 33** Taioja, India (2)
- 34** Thimmapur, India
-  Ibaraki, Japan, Science & Technology
- 35** Ibaraki, Japan
- 36** Kimchon, Korea (2)

Customer Service Contact Information

Customer Service Representatives

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Europe (non-wovens for ceilings)+32 2674 8269
Europe (non-wovens for flooring)+32 2674 8379
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Spain (reinforcements).....	+33 47975 5696
United Kingdom.....	+32-2-674-8280

Call 1-800-GET-PINK™ (1-800-438-7465)

You may also call our toll-free answer center in the USA at 1-800-GET-PINK™ (1-800-438-7465). Our team of service representatives is ready to provide the help you need.

Visit Our Regional Websites

Owens Corning is a global company with operations and partnerships around the world. To see our regional websites, visit www.owenscorning.com/worldwide.

Visit Us at a Trade Show Near You

Owens Corning exhibits at many trade shows around the world every year. Explore one of our exhibits and find out how the OCV™ businesses can serve your reinforcement needs and help develop new opportunities to serve your customers.

A list of upcoming trade shows the OCV™ businesses will be attending can be found on the company's website: www.owenscorning.com/composites.

OCV™ Technical Fabrics provides high-value-added solutions for demanding commercial and industrial applications. In its 10 factories, located in eight countries, OCV™ Technical Fabrics manufactures a comprehensive glass, carbon and hybrid product range including:

- A variety of 3D fabric reinforcements for closed-mold processes
- Multiaxial, woven and unidirectional carbon and aramid fibers with a dedicated aerospace-approved manufacturing facility
- Multiaxials, knits and combinations made with two or more layers of unidirectional fibers stitched together with a light polyester thread; also available are multiaxials that are powder-bonded instead of stitched
- Specialty mats made with chopped glass fibers with either a universal silane sizing or special sizings for thermoplastic or phenolic resins
- Unidirectionals and combinations of stitched, woven and hot-melt reinforcements in full width or tape form
- Woven roving (WR) fabrics and combinations made with glass and/ or other fibers, based on direct, assembled or texturized roving
- A complex of WR and chopped strand mat (CSM) either powder-bonded or mechanically stitched with a fine polyester or glass yarn without chemical binder

OCV™ Technical Fabrics is also developing advanced solutions to help its customers transform markets with new applications. A prime example is Ultrablade™ fabric developed to enable customers to produce longer and lighter wind blades.

The Technical Fabrics business is also working on solutions for the in-situ relining of pressurized pipe and fabrics for thermoplastic composites. Cured-in-place pipe (CIPP) relining uses winding and folding technology with oriented-chop fabrics and woven roving mat fabrics.

The business also has a fabrics excellence center at its facility in Zele, Belgium. The 5,500-square-meter (about 60,000 square feet) facility has both pilot- and full-scale state-of-the-art production equipment for developing, testing and evaluating new fabric technologies before production and use in customer processes.

OCV™ Non-Woven Technologies

Owens Corning is the leading global producer of glass-based specialty non-wovens. The products are made from randomly dispersed glass fibers, wet or dry laid and bonded into a thin sheet.

Veils and specialty non-wovens are used in multiple applications in several industries:

- Surfacing veils for glass-reinforced polymer (GRP) laminates including pipe and chemical storage tanks
- Surfacing veils for flat GRP panels
- Surfacing veils for gypsum sheathing and wallboard
- Core materials for flat panels

Nearly all of the non-woven products manufactured by Owens Corning are unique for each customer and application. Its business model is grounded in servicing individual customer needs. The market-focused organization works closely with a diverse set of market-leading global customers to identify and design new solutions.

OCV™ Reinforcements is dedicated to creating customer value by delivering world-class solutions, expertise and support. The business offers the widest range of glass fiber reinforcement products in the world.

Our industry-leading portfolio includes reinforcements focused on specific markets and applications to expand the use of composite materials. Markets and solutions include:

- Transforming translucent panels with OC HiLight™ roving
- Transforming advanced closed-mold processes with Uniconform® and other continuous filament mat
- Transforming automotive mufflers with Silentex® noise control solutions including new pre-form technology
- Transforming planes, pressure tanks and military vehicles with new high-performance reinforcements
- Transforming roads, runways and parking lots with TruPave® engineered paving mat that helps prevent cracking
- Transforming applications for corrosive environments with Advantex® E-CR glass fiber reinforcements
- Transforming reinforced concrete with Cem-FIL® alkali-resistant glass fibers
- Transforming reinforced thermoplastics with Twintex® co-mingled glass and thermoplastic reinforcements

All of these specialty products are:

- Engineered for high quality and premium performance
- Tailored to help you grow your business and develop new applications
- Designed to compete against steel, aluminium and other traditional materials

These products and others are commercially available and can help you expand the use of composites for years to come.

Advantex® E-CR Glass

Advantex® glass fiber reinforcements from Owens Corning are both an E-glass and a true E-CR glass according to ASTM D 578, ISO 2078, and DIN1259-1. The product provides improved corrosion resistance compared to standard E-glass.

When it was introduced in 1997, boron-free Advantex® glass was expected to provide superior corrosion resistance in acidic environments. That benefit was confirmed with field use data, and field experience also found that the product performs well in any aqueous environment, including water and alkaline solutions.

Compared to standard E-glass, Advantex® glass also decreases emissions and reduces the environmental impact of manufacturing fiberglass.

A recent study by Owens Corning also shows how Advantex® glass fiber outperforms standard E-glass reinforcements in stressed composite laminates in a corrosive environment. Previous testing examined the impact of corrosive chemicals on bare glass. The new study checked laminates under load in a corrosive environment to more closely simulate conditions an application may encounter in the field.

The study combined corrosion and stress testing and examined the laminates using SEM (Scanning Electron Microscopy) and EDX (Energy Dispersive X-ray) spectroscopy. Advantex® glass fiber laminates demonstrated superior corrosion resistance compared to E-glass in laminates exposed to a solution of 10 percent sulfuric acid. The study also confirmed previous findings on the leaching mechanism of E-glass in acidic environments.

The outcome provides a compelling reason for using Advantex® glass fiber reinforcements throughout a composite structure. While some designs require E-CR glass in a corrosion barrier and allow standard E-glass in the rest of the laminate, these results argue for reducing the risk of laminate failure by using E-CR glass throughout the structure.

Advantex® glass fibers provide a competitive advantage for our customers by helping them create high-value applications for the benefit of their customers and the end-users.

For additional information, visit www.owenscorning.com/composites/aboutAdvantex.asp

High-Performance Reinforcements

The OCV™ High-Performance Reinforcements product platform features ShieldStrand®, XStrand®, FireStrand® and WindStrand® high-strength reinforcement products targeted at ballistics, industrial, aerospace and wind energy markets.

Building on its heritage of leadership and innovation in glass fiber reinforcement and composite technology, Owens Corning developed a new generation of reinforcement technology that redefines the availability and value of high-performance glass fiber materials.

Owens Corning high-performance reinforcements offer these benefits:

- Strength – Up to 50 percent higher strength with S-glass versus conventional E-glass
- Modulus (stiffness) – Up to 20 percent higher modulus with S-glass versus conventional E-glass fibers
- Fatigue – End-use parts have higher fatigue properties, a key requirement for high-performance composite applications
- Impact Resistance – Up to 80 percent better impact resistance than conventional E-glass fibers
- Aging and Corrosion Resistance – Better aging and corrosion resistance than E-CR and conventional E-glass fibers
- Temperature Resistance – Better resistance at elevated temperatures than conventional E-glass fibers

Proprietary technology provides the nucleus for the growing array of products with special properties. In 2006, Owens Corning introduced large-scale production to high-strength glass fiber, an achievement previously thought to be technically unfeasible.

Capacity for the new direct-melt process is about 50 times the size of parameters typically used to produce high-strength glass. This scale production process was developed to make high-performance reinforcements widely available and achieve a level of value that enhances their competitiveness.

Wider availability provides greater choice and security of supply, encouraging the use of high-performance glass fiber reinforcements by designers and manufacturers.

Silentex® Engineered Noise Control Solutions

Owens Corning Silentex® engineered products are the preferred solutions for acoustic and thermal applications in harsh environments.

Silentex® engineered products have been used successfully in the automotive exhaust market for more than 25 years to meet acoustic and thermal requirements. The products are produced with proprietary Advantex® E-CR glass, which provides exceptional thermal and chemical durability.

The Silentex® product line uses specially formulated sizings to enable high-speed processing and ensure maximum texturization can be obtained to achieve acoustic and thermal performance requirements.

- Equipment that can be used to directly fill silencers (mufflers) of all types
- Custom-designed bags (polymer or glass) filled with texturized glass fibers for insertion into silencers
- Low-binder molded inserts (preforms) that provide rapid mistake-proof insertion of texturized glass fibers into silencers
- Continuous tangle-free strand with customized texturization

Owens Corning Advantex® glass production facilities are in Europe, Asia and the Americas. Operations for bags and preforms are available in each of these regions along with technical support to assist with applications.

The use of Silentex® engineered solutions is not limited to the automotive market. The products can be used wherever extreme acoustic and thermal insulation is required. Current applications include power sport vehicles (motorcycles, snowmobile and ATVs), industrial silencers and other non-automotive applications.

ADVANTEX® GLASS USE TEMPERATURE FOR MUFFLER APPLICATIONS	CHEMICAL DURABILITY IN SIMULATED EXHAUST PH2, 96°C, 100HRS	ADVANTEX® GLASS ANNEALING POINT	ADVANTEX® GLASS SINTERING POINT (25% FUSION RATIO)
< 740°C	< 2%	≥ 720°C	800°C

PRODUCT/SIZING	FILAMENT DIAMETER	TEX
ST2000	24µ	4800
ST2070	24µ	7000

Twintex® Co-Mingled Glass and Thermoplastic Reinforcements

Twintex® reinforcements are ready-to-use thermoplastic and glass combination designed for high mechanical properties, such as excellent stiffness-to-weight ratio and impact properties. The proprietary reinforcement also provides efficient and clean (no VOCs) process conditions, high freedom of design and is recyclable.

Twintex® products are made of co-mingled glass and thermoplastic filaments. Direct, single-end roving is the base material for the whole Twintex® reinforcement product line, and can be provided with a polypropylene matrix (PP) or co-polyester resin (PET).

Consolidation is achieved by heating the roving above melting temperature of the matrix (180°C–230°C/360°F–450°F for PP) and applying a pressure before cooling step under pressure.

The Twintex® PP product range also includes fabrics, plates and long glass fiber concentrated pellets:

Applications made with Twintex® reinforcements include:

- Bumper beams
- Kayak seats
- Truck panel skins
- Micro-car floors
- Under engine protection
- Small boat hulls
- Front end assemblies
- Inside door panels
- Standard profiles and profiles with external coating
- Pressure vessels

Cem-FIL® Alkali-Resistant Glass Fibers

Special alkali-resistant (AR) glass fibers have been developed for use with cement-based products (glass-reinforced concrete [GRC], mortars, composite cement, etc.). The fibers are manufactured with Zirconia content in compliance with ASTM C 1666/0 1666/M-07 and EN 15455. AR glass fibers from Owens Corning are marketed as Cem-FIL® glass fiber.

AR glass fibers have been in use for 40 years in more than 100 countries worldwide to create some of the world's most stunning architecture while offering strong and durable performance in widely varying cement- and mortar-based applications, including new and restored building facades, pre-cast components, utility poles, and residential and industrial flooring. In some flooring applications, AR glass fibers can replace the structural steel grid.

AR glass fibers are unique as a concrete reinforcement. They have the same specific gravity as the stone or gravel mixed in concrete so fiber dispersion is easier to achieve than with other fibers.

AR fiber contributes efficiently to tensile strength before concrete is able to crack, thanks to its high elastic modulus and its affinity for and efficient bonding with concrete. AR glass fiber reinforcements can reduce the weight and thickness of concrete by a factor of 10.

The benefits of Cem-FIL® AR glass fiber include:

- Excellent compatibility with cement matrix
- Excellent workability even at high dosage
- Increases chemical resistance (e.g. deicing products)
- Extends long-term durability of concrete
- Does not float or sink in concrete
- Does not entrain air
- Fast and uniform dispersion

Cem-FIL® fibers are manufactured under a quality management system approved as meeting the requirements for ISO 9001. Additionally, the performance of Cem-FIL® fibers has been subjected to independent assessment and approval in Germany (Zulassung N° Z-3.72.1731), and Cem-FIL® fibers meet the safety standards of European Directive 99/45/EC, 67/548/EEC and their latest amendments.

Glass Fiber Manufacturing

The manufacturing process for glass fiber reinforcements begins with raw materials, which are basically minerals. We mix those minerals based on the recipe of the glass formulation.

The three main ingredients used to make glass are silicon dioxide (SiO_2), lime (calcium oxide or CaO) and aluminum oxide (Al_2O_3). Changing the mix of those components and other minerals will result in significantly different glasses. E-glass (with good electrical insulation properties, hence the name) is a commonly used glass on the market.

Advantex[®] glass, which is recognized as the standard within the OCV[™] businesses, has no boron in the batch and as a result has better corrosion resistance and a smaller environmental footprint than standard E-glass. Other glasses (alkali-resistant glass [AR] for cement or high-performance glasses) are also available in the OCV[™] product line.

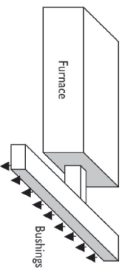
A furnace converts the mineral batch into molten glass and then distributes the glass through a channel into an area called the forehearth where the glass fibers are formed. A typical furnace is about the size of a three-car garage. It runs at a little more than 2,300°F (1250°C) for 24 hours a day and seven days a week.

Once completely molten, the liquid and homogeneous glass composition flows into heated refractory channels to feed the bushings. The bushings are made of a platinum and rhodium alloy that has small holes through which liquid glass flows.

The glass then solidifies into filament shape by rapid cooling. Once

solidified, the glass filaments are coated with a sizing made of chemical components which give the glass strands a good process-ability and adhesion with resins.

Several fabrication processes exist to produce different product formats: multi-end roving, chopped strands, veil or continuous filament mat.



Composite Advantages

Composites are combinations of two or more materials (reinforcing elements and resin) that retain their identities while acting in concert. Fiberglass-reinforced polymer (FRP) composites are safe and reliable solutions, able to face tough conditions in various environments and have outperformed traditional materials for many years.

Composites offer these important benefits:

- **Light Weight** – Composite parts help save weight compared to steel parts (up to 30 percent lighter) with similar thermo-mechanical properties.
- **High Strength** – Pound for pound, glass fibers are stronger than steel. Composites gain their strength when fibers are set within a resin matrix. Fibers carry the load while the resin spreads the load imposed on the composite.
- **Easy to Shape** – Composites can be molded into complex shapes at relatively low cost. This flexibility offers designers extensive latitude in new product design.
- **Integration of Functions** – Parts with multiple functions can often be made in a single step with composites.
- **Corrosion Resistance** – Composites provide long-term resistance to severe chemical and temperature environments. Composites are the material choice for outdoor exposure, chemical handling and severe environment service.
- **Durability** – Composite structures have an exceedingly long life span. Coupled with low maintenance requirements, the longevity of composites is a benefit when used in critical applications. After a half-century of use, many well-designed composite structures have yet to wear out.
- **Cost savings** – Thanks to their low weight and high mechanical properties, the use of composites in many applications reduces manufacturing, shipping and maintenance costs compared to traditional materials such as steel.

For more information about the advantages of composites, visit the website of the American Composite Manufacturers Association at www.acmanet.org/consumers/.

Composites and Sustainability

Composite materials have many benefits in end-use applications including four that have special significance for the environment.

- **Lightweight** parts for automobiles and trucks are contributing to fuel savings while resisting corrosion and lasting longer
- The use of **durable** fiberglass-reinforced polymer (FRP) pipe for oil, water and sewage projects takes advantage of the non-corrosive properties of FRP
- The Silentex[®] muffler filling system is being adopted by leading car and truck manufacturers to help **quiet** their vehicles
- With various technical methods now available, the **recycling** of glass strand is possible in both thermoplastic and thermoset applications

Owens Corning has worked with its customers to analyze the **environmental impact** of their products and similar goods made with competitive materials. Composite materials fared well in these studies. The embodied energy and greenhouse gas (GHG) environmental burden for the raw materials mined and used in finished composite parts were consistently lower than their steel or aluminum equivalents. The studies also quantified reduced energy and greenhouse gases during the transportation of finished parts due to their significantly lighter weight.

The company's proprietary Advantex[®] glass formulation contributes to sustainability by increasing mechanical properties and corrosion resistance – compared to standard E glass – while also decreasing emissions and **reducing the environmental impact** of manufacturing fiberglass.

Owens Corning glass fiber veils for carpet, ceilings and flooring are the first in the glass non-woven industry to earn two rigorous **indoor air quality certifications** from the GREENGUARD Environmental Institute. These products – for new interior applications – are now GREENGUARD Indoor Air Quality Certified[®], along with being certified for the more stringent GREENGUARD Children & SchoolsSM product emissions standard.

Glass fiber reinforcements for **wind turbine blades** enable commercial generation electricity from a renewable resource. Owens Corning is the leading provider of materials for wind energy.

Market and Product Matrix

The following table shows the processes and products commonly used in each of the principal markets for glass fiber reinforcements:

MARKETS	PROCESSES	PRODUCTS
Aerospace	Compression, infusion & injection molding, preforming, reaction injection molding (RIM) & resin transfer molding (RTM)	FliteStrand [®] high-performance reinforcements
Automotive	Injection & compression molding, SMC, BMC, RIM & RTM, LFI & muffler filling	Chopped strands, single-end roving (Type 30 [®] roving) for long-fiber thermoplastics, Silentex [®] thermal & noise control solutions, Twintex [®] co-mingled glass & thermoplastic fiber, veil & specialty non-woven mat, wet-formed mat, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics
Buildings	Continuous lamination, SMC, BMC, infusion molding, pultrusion & spray-up, glass fiber-reinforced concrete (GRC)	CFM, veil, wet-use chopped strands, veil & specialty non-woven mat, wet-formed mat, Twintex [®] co-mingled glass & thermoplastic fiber, Cem-FIL [®] fiber solutions for flooring, dry mix mortars & pre-cast elements, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics

MARKETS	PROCESSES	PRODUCTS
Consumer Goods	Injection & compression molding, BMC, filament winding, hand lay-up, pultrusion, RIM, RTM & spray-up	Chopped strands, continuous filament mat (CFM), pultrusion & electrical CFM, single-end roving & veil, specialty non-woven mat, Twintex [®] co-mingled glass & thermoplastic fiber, XStrand [®] high-performance reinforcements & fabrics, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics
Defense & Security		ShieldStrand [®] high-performance reinforcements & fabrics
Electronics	Continuous lamination, injection molding & RIM	Closed-mold roving, wet-formed mat, pultrusion & electrical CFM, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics
Heavy Transportation	Compression molding, continuous lamination, hand lay-up, preforming, pultrusion, RTM & spray-up	Wet-formed mat, chopped strand mat (CSM), chopped strands, closed-mold roving, molding & general purpose CFM, panel roving, single-end roving, Twintex [®] co-mingled glass & thermoplastic fiber, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics
Infrastructure	Centrifugal casting, filament winding, pultrusion, spray-up & hand lay-up	CSM, fabrics, non-woven surfacing veils, pultrusion & electrical CFM, single-end roving, TruPave [®] paving mat & woven fabrics
Marine	Cold press molding, hand lay-up, infusion molding, RTM, spray-up & vacuum bagging	CSM, CFM, multi- & single-end roving, surfacing veils, knitted & woven fabrics, Twintex [®] co-mingled glass & thermoplastic fiber, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics

MARKETS	PROCESSES	PRODUCTS
Sports & Recreation	Cold press molding, filament winding, infusion molding, preforming, pultrusion, RTM & spray-up	CSM, chopped strands, single-end roving, pultrusion & electrical CFM, surfacing veils, knitted & woven fabrics, Twintex [®] co-mingled glass & thermoplastic fiber, & XStrand [®] high-performance reinforcements, & Multimat [®] , Multimat [®] Lite, Multicore [®] & Flowtex [®] fabrics
Wind Energy	Hand lay-up, vacuum infusion, preforming, pultrusion, RTM, spray-up & vacuum bagging	CFM, knitted & woven fabrics, direct single-end roving, surfacing veils, veil, specialty non-woven mat, Twintex [®] co-mingled glass & thermoplastic fiber & WindStrand [®] high-performance reinforcements

Composite Processes

Soon after they found a way to make continuous strands of glass fibers in commercial quantities more than 70 years ago, Owens Corning pioneers started developing the processes for combining that material with resin to make reinforced composites. Basic processes like hand lay-up and spray-up came first, followed later by compression molding and filament winding. Today there is a host of sophisticated processes for combining glass reinforcements with a variety of resins to make literally thousands of products. Owens Corning was intimately involved in the development of many of the processes commonly used today.

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Bulk Molding Compound (BMC)	BMC is a two-step process: the first step is the manufacturing pre-impregnated compound of resin plus glass fibers & the second step is molding the compound by means of compression or injection.	Complex parts such as electrical equipment, car headlamps & housing components for electrical appliances & tools, in large industrial volumes	Chopped strands
Cold Press Molding	A semi-open molding process using lighter duty, reinforced cast composite matched tools mounted into a press. Reinforcements, usually continuous filament mat (CFM), are placed into the tool & a highly filled polyester resin is poured onto them. The press is closed & the part is cured. The process requires lower pressures, 15 - 100 lb/in ² , & temperatures averaging 130°F (55°C). Cycle times are in the range of 10 - 20 minutes. Other glass fiber fabrics, mats, veils & preforms are also used.	Consumer goods, heavy transportation, sports & recreation; parts usually have a fair-to-poor surface, so uses are under-hood auto & truck components like fan shrouds, brackets & battery supports	Continuous Filament Mat (CFM), Chopped Strand Mat (CSM), fabrics, multi-end roving & veil

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Compression Molding	<p>A mass production method where molding compounds & other resin/glass combinations are compressed in matched metal tools located between the platens in a press. Pressures of 150 lbs/in² & temperatures between 265°F (130°C) & 340°F (170°C) are required. Typical cycle times of 2 - 3 minutes are achieved. Molding compounds comprised of a thermoset resin, chopped roving, fillers & a catalyst are used in both sheet form (SMC) & paste (BMC). SMC is placed in the tool to produce parts such as automotive body panels, appliance housings & composite doors, while BMC — which can be injected — is used for parts needing less overall strength & no Class A surface.</p>	Automotive, appliance, heavy transportation	Multi-end roving, chopped strands, Chopped Strand Mat (CSM) & Continuous Filament Mat (CFM)
Hand Lay-Up	<p>A combination of reinforcements including chopped strand mat & woven or knitted fabric, is laid into an open mold with a gel-coat surface & impregnated with resin layer by layer. The resin is manually rolled into the reinforcement to remove any air pockets & to produce a consistent part. Once the resin cures, the finished part is removed from the mold.</p>	Consumer goods, infrastructure, marine, wind energy; hand lay-up is suited for making high strength parts of any size at low to medium production volumes	Chopped Strand Mat (CSM), fabrics & veil

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Continuous Lamination	Chopped multi-end roving, continuous filament mat, reinforcing fabric or chopped strand mat are combined with resin & "sandwiched" between two plastic carrier films. The sheet is pulled through forming rollers & the resin is heated & cured to form flat or contoured composite sheet.	Building products, electronics, heavy transportation; composite construction panels & electrical insulating materials are made in a continuous lamination process; applications include truck trailer linings, clear truck trailer roofs, wall coverings & corrugated roof panels	Multi-end roving, Chopped Strand Mat (CSM), Continuous Filament Mat (CFM), fabrics & veil
Centrifugal Casting	Chopped strand mat and/or fabrics are loaded into a mold that is then rotated at a high speed. Resin is applied to the interior of the mold & the reinforcements & resin are consolidated through centrifugal force to the internal profile of the mold. Chopped multi-end roving can also be sprayed with resin into a cylindrical mold that is already rotating at high-speed.	Cylindrical, hollow infrastructure applications such as tanks, pipes & poles	Multi-end roving, fabrics & Chopped Strand Mat (CSM)
Extrusion	The process of forming a continuous profile by forcing resin & reinforcements through an endless screw; the softened, compressed material then passes through an extrusion die to shape the product or part; extrusion is used to manufacture long parts such as pipe, cables, fencing & profiles, or molded parts for doors & windows.	Automotive, building products, consumer goods, infrastructure, sports & recreation	Chopped strands

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Filament Winding	Filament winding is an automated open molding process that uses a rotating mandrel as the mold. Type 30® single-end roving or specialized fabric tapes are drawn through a resin & pulled by the force of a rotating mandrel. The mandrel can be covered with a veil for an inner, corrosion resistant surface, & the roving is spun around the veil. An outer-surface veil can also be applied for corrosion resistance & aesthetics. The process is completed by heating & curing the composite into the final product.	Consumer goods, infrastructure, sports & recreation; filament winding is used to make high strength, hollow & (generally) cylindrical composite products such as pipe, storage tanks & pressure vessels	Single-end roving, fabrics & veil
Infusion Molding	Infusion molding processes use a single-sided mold that is covered with reinforcements & sealed with a flexible vacuum bag or film. A vacuum is drawn on the space between the mold & the seal containing the reinforcements & a thermoset resin is allowed to infiltrate the reinforcements. The resin flows through the reinforcements & cures to form the finished composite. Low-cost composite tooling can be used & environmental emissions are controlled within the closed process.	Building products, heavy transportation, infrastructure, marine & wind energy	Continuous Filament Mat (CFM), Chopped Strand Mat (CSM), fabrics & veil

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Injection Molding	Injection molding is a closed-molding process where filled or unfilled polymer resins are injected into closed matched-metal molds. Polymers are commonly thermoplastic, & processed by heating the raw polymer in pellet form to melt point & injecting it into the cooled mold. Thermosets such as Bulk Molding Compounds (BMC) are also used - they are injected into heated molds to effect the cross linking & cure. For higher strength parts, fillers, milled & chopped fibers are blended into the resin with a screw-type extruder. Long Fiber Thermoplastics (LFTP) have a longer fiber length that further improves strength - increasingly important in the appliance & automotive fields.	Automotive, building products, electrical & electronics, sports & recreation	Chopped strands, multi-end roving, long fiber thermoplastics (LFT) Type 30 [®] single-end roving, milled fibers, chopped strands
Lamination	Some manufacturers use a continuous process to produce a 2- to 3-mm thick composite skin that is laminated afterwards on both sides of a core material (plywood or foam) to make the complete panel. Some manufacturers produce the complete panel online, while some refrigerator truck panel manufacturers use a semi-continuous process in which they laminate composite skins on both sides of a thick polyurethane foam core by compression. Continuous molding between layers of film is used for the continuous production of sheets, both colored & translucent, in flat or profiled forms.	Truck panels, translucent panels for construction	Chopped strand mat, multi-end roving, woven roving, veils & Twintex [®] co-mingled glass & thermoplastic reinforcements

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Long Fiber Injection	A robot equipped with a chopper sprays 25 to 50mm long chopped strands from a multi-end roving into a temperature-controlled mold. A liquid mixture of isocyanate & polyol & catalyst is sprayed on at the same time. Once those components are sprayed into the mold, in less than 10 seconds, the mold is closed & filled in by the expansion of polyurethane foam, resulting from the reaction of the liquid. Two or three minutes later, the polymerization is finished & the component can be demolded & trimmed. If several molds are available, this process offers a high productivity for producing lightweight reinforced polyurethane components.	Interior car components such as dashboards, interior panels & under body shields	Multi-end roving
Muffler & Silencer Filling	This process is used to fill exhaust pipe mufflers with dry glass fiber that has thermal & acoustical insulation functions & which must resist very high temperatures (>500°C). The process consists of spraying a continuous strand from a single-end roving into a metal muffler through a distribution & texturization system that separates each filament to increase insulation performance. Other methods consist of filling in a bag or making a preform with a binder. Preforms or bags can then be placed into the muffler in a second step.	Noise control mufflers & silencers for a variety of transportation & other applications	Single-end roving

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Preforming	<p>Preforming is an intermediate molding process where the reinforcement is assembled in the shape of the part to be molded. This helps ensure uniform properties in a composite product & speed the molding cycle. Most common are directed fiber preforms made by chopping multi-end roving with a binder resin & applying it on top of a molded screen. Held in place with vacuum pressure, the screen is placed into an oven to dry & activate the binder. Another method uses continuous filament mat with a thermoformable binder. Complex preform assemblies can be made using combinations of materials & fabrics in bladder presses or under vacuum. Resin binder, adhesive or mechanical (plastic staples) can be used.</p>	Marine, sports & recreation, wind energy	Multi-end roving, single-end roving & fabrics
Pultrusion	<p>Pultrusion is a continuous process for making lightweight lineal profiles such as reinforcing rods, I-beams & tubing. After the reinforcement is impregnated with resin, the material is pulled through a heated die that gives it a cross sectional shape, & then is cured to create the composite profile.</p>	Consumer goods, infrastructure, sports & recreation, telecommunications	Single-end roving, bulky roving, Continuous Filament Mat (CFM), fabrics & veil

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Reaction Injection Molding (RIM)	RIM is a closed-molding process where reactive liquid components - usually thermoset polyurethane - are mixed in a high pressure mix head & injected into heated, closed, matched-metal molds. Parts have excellent surface appearance & some semi-structural properties. RIM includes RRIM, where a particulate filler, milled fiber or flake reinforcement is blended into the resin to produce higher strength parts, & SRIM, used for the highest strength parts. Here, reinforcements are loaded into tools to dry, & the reactive resin system can then be dispensed before the tool is closed or injected after closing.	Automotive, consumer goods, electronics	Milled fiber, chopped strands, Continuous Filament Mat (CFM) & fabrics.

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Resin Transfer Molding (RTM) & Light RTM	<p>RTM is a liquid molding process where a thermosetting resin is injected into a closed molding cavity to make moderate volume semi-structural or appearance parts. Dry fiber reinforcement is placed in the bottom half of matching molds, the mold is closed & sealed, then resin is pumped into the mold. The resin wets through the reinforcement & solidifies to form a composite part such as semi-truck parts & electrical cabinets. Molding pressure is lower than in the compression molding process, so tooling & equipment capital costs are lower than high volume compression molding, but higher than open molding processes.</p> <p>In RTM, the mold is opened & closed with a press & generally made of metal so as not to deform under high pressure. In Light RTM, light molds made of composite can be moved quite easily & are closed with the help of a vacuum applied in a peripheral area. Vacuum can also be used to help the resin to fill in the mold from a peripheral injection channel.</p>	Consumer goods, heavy transportation, sports & recreation, wind energy	Continuous Filament Mat (CFM), Chopped Strand Mat (CSM), fabrics, multi-end roving & veil

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Sandwich Panel Molding	Sandwich panels are typically made using two different processes: a continuous process & a discontinuous process that applies (sometimes by hand) pre-cut veils, films, foam & reinforcements. This sandwich is then molded at about 150°C, with isocyanate used as a glue to hold all the layers together.	Car headliners	Chopped Strand Mat (CSM), multi-end roving
Sheet Molding Compound (SMC)	Sheet Molding Compound is a two-step process: the first step is manufacturing a pre-impregnated compound of resin plus glass fibers & the second step is molding of the compound by means of compression.	Bodywork or structural automotive components, components for electric household appliances, bath equipment & commercial venue furniture (stadium & cinema seating)	Multi-end roving
Spray-Up	Spray-up uses multi-end roving that is fed into a "gun" & chopped into bundles of predetermined length. The bundles are sprayed into a resin stream & deposited onto a mold cavity that is gel-coated for a consistent, smooth surface finish. After spraying onto the mold, hand rolling is necessary to thoroughly flatten & compact the glass-resin mixture onto the mold surface & eliminate air bubbles generated by the spraying. Once the resin cures, the part is removed from the mold. Spray-up is similar to & often combined with the hand lay-up process.	Building products, consumer goods, heavy transportation, marine; large, complex parts such as boat hulls & bath tubs	Multi-end roving

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Twintex® Reinforcement & Thermoplastic processes	Twintex® reinforcement is co-mingled strands of glass & thermoplastic fibers. Twintex® roving can be processed directly to make a composite part, or can be transformed into an intermediate format for final processing in a second step. All Twintex® reinforcement processes allow molding of components with good mechanical properties thanks to long or continuous fibers. Glass ratio can reach 75% by weight.	Building products, consumer goods, marine, sports & recreation, wind energy	Twintex® co-mingled glass & thermoplastic reinforcements
Vacuum Bagging	Materials that are pre-impregnated with resin are typically laminated with vacuum bagging. The components include a film or fabric, breather medium & plastic film that is applied in sequence on top of a laminate stack in an airtight mold. Air between the mold & film is extracted with a vacuum pump, resulting in a positive-pressure force; this compression forces air & excess resin from a composite laminate or components. Vacuum bagging is also used in conjunction with other processes such as infusion molding & wet lay-up.	Aerospace, heavy transportation, infrastructure, marine, sports & recreation, wind energy	Continuous Filament Mat (CFM), Chopped Strand Mat (CSM), fabrics & veil

PROCESS NAME	DESCRIPTION	TYPICAL MARKETS	PRODUCTS USED
Weaving	<p>Weaving produces fabrics that can be used in many thermoset composite processes (hand lay-up, infusion, lamination of truck panels, etc.). Two main types of products are made by weavers:</p> <p>Woven roving obtained by crossing single-end roving perpendicularly in a carefully-defined manner (typical structures are plain, twill & satin), possibly adding chopped strands from ME roving stitched onto the woven roving</p> <p>Unidirectionals & multiaxials obtained by stitching one or several layers of parallel single-end roving strands oriented, generally in the machine direction (0° or warp), perpendicularly (90° or weft) or diagonally (+ or -45°).</p>	Aerospace, automotive, building products, consumer goods, heavy transportation, infrastructure, marine, sports & recreation	Single-end roving
Wet Compression Molding	<p>This process consists of placing one or several layers of mat and/or woven roving into the mold cavity, spraying or pouring resin on, & closing the mold by press or by hand with a peripheral vacuum. Pressure applied by the mold makes the resin flow & impregnate the reinforcements. The molds can be made of metal or composites & can be temperature controlled for a shorter cycle as desired.</p>	Dielectric panels & U & W profiles up to a maximum of three meters in length, bumper, car frames, truck & agricultural machine body panels	Chopped strand mat, Unifilo® mat & woven roving

Portfolio of Products

Owens Corning offers the widest range of world-class composite reinforcements and other solutions. The company makes those products using global processes that provide consistent quality wherever they are manufactured or used. The following table shows the products available from the OCV™ businesses.

Reinforcements and Other Solutions

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
Acoustic and Thermal Insulation	Continuous texturized and untexturized roving, filled bags and inserts (preforms) made with texturized roving that provides noise control and thermal and chemical durability (marketed as Silentex® solutions)	Direct filling of silencers (mufflers) of all types, custom-designed bags and molded preforms for insertion into silencers and texturized roving for filament winding	Automotive, industrial	Transportation, power sport vehicles (motorcycles, snowmobile and ATVs), industrial silencers and other non-automotive applications	N/A
Alkali-Resistant (AR) Glass	Glass fibers manufactured with Zirconia for use with cement-based products (marketed as Cem-Fil® reinforcements)	Glass-reinforced concrete (GRC), mortars, composite cement, stucco and others	Construction	New and restored building facades, pre-cast components, utility poles, and residential and industrial flooring	N/A
Bulky Roving	Lofted assembled roving with a uniformly disoriented but essentially continuous filament structure	Pultrusion	Building materials	Window lineals, structural profiles	UP, EP, VE

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
Chopped Strand	Fibers of varying diameters chopped into a standard length of 4mm and coated with a chemical sizing for particular resin compatibility; also chopped fibers with fine filament diameters and advanced chemical sizing for engineering resin compatibility	Extrusion, injection molding, sheet molding compound and bulk molding compound	Transportation, recreation, construction, consumer, electrical/ electronics and corrosion resistance	Appliances, auto parts, electronics, appliances and plumbing components	UP, PA, PBT, PP, PPO, PPS, PC, PET, PU, PVC, SMA, ABS, SAN, LCP, PA, PEEK
Chopped Strand Mat	Mat comprised of randomly oriented chopped glass fiber strands bonded together into mats, either with an emulsion binder or with a small amount of highly soluble polyester powder	Hand lay-up, compression molding, continuous lamination and vacuum bagging	Marine, transportation, recreation, construction, consumer and corrosion resistance	Auto parts, boats, chemical tanks, surfboards, panels, swimming pools	UP, DCPD, VE, PN, PU
Co-Mingled Glass and Thermoplastic Fibers	Intimately mixed continuous glass and thermoplastic fibers that can be processed directly to make a composite part, or transformed into an intermediate format (fabrics, plates or pellets) for final processing in a second step (marketed as Twintex®)	Vacuum molding, thermo stamping, panel lamination, long-fiber thermoplastics, extrusion and compression, diaphragm forming, injection molding, co-molding, thermoplastic filament winding, thermoplastic pultrusion and pulextrusion	Transportation, construction, consumer and recreation, marine and ballistic protection	Automotive structural parts, under-engine protection, door modules, instrument panels and bumper beams; kayaks and small boat hulls; truck panel skins, trailer doors, flooring, skirt and scuff liners; reinforced-PVC profiles; LPG pressure vessels; domestic wind	PP, PET

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Reinforcements and Other Solutions

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
Continuous Filament Mat	Continuous fiber, non-woven mats containing either a soluble or insoluble binder	Compression molding, infusion molding and pultrusion	Electrical apparatus, utility and transportation	Electrical and nonelectrical laminates, ladder rails, rapid-transit third-rail covers and high-voltage transmission line equipment	UP, PU, VE, EP, PN
High-Performance Reinforcements	High-strength continuous glass filaments, gathered and wound, without mechanical twists, into a square-edge cylindrical roving package and trademarked WindStrand®, FliteStrand®, ShieldStrand® and XStrand®.	Hand lay-up, filament winding, infusion molding, knitting and weaving, preforming, pultrusion, RTM, vacuum bagging, press molding	Wind energy, aerospace, ballistic armor, industrial sports and recreation	Large wind turbine blades, aircraft flooring, cargo liner, helicopter blades, spall liners, add-on armor, shelters, high pressure tank wraps, high-performance marine vessels, rubber reinforcement, friction applications, cured-in-place pipe rehabilitation	EP, multi-compatibility
Milled Fiber	Glass filaments coated with a sizing to enhance resin compatibility and milled to a specified bulk density; made in two forms (powder and floccular) with powder having the shorter fiber length	Thermoplastic, thermoset and other compounds	Automotive, electrical, consumer, construction, aerospace	Paints, elastomers and putties; gaskets and seals; brakes and clutches; asphalt roofing coatings	UP, VE, EP, PN, PU, PTFE, PC, PA and other thermoplastics
Multi-End Continuous Roving	A collection of continuous glass filaments, gathered and wound, without mechanical twists, into a square-edge cylindrical package	Sheet Molding Compound (SMC), Continuous Molding Compounds (CMC), Glass Mat Thermoplastics (GTM), Long Fiber Injection (LFI)	Automotive, recreational vehicles, business equipment, construction, corrosion resistant, marine, consumer, recreation, transportation	Automotive internal components and exterior body panels with Class A surfaces, recreational vehicle housings, automotive and recreational semistructural applications, business equipment	VE, PU, PP, EP, UP

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
Single-End Continuous Roving	Single-end continuous roving (trademarked Type 30 [®]) are individual fibers pulled directly from the bushing and wound onto a roving package ready for shipment	Filament winding, long-fiber thermoplastics, pultrusion, knitting and weaving	Aerospace, military, transportation, electrical	Small diameter oil field pipe, down hole tubing, well casing, chemical processing pipe, electrical rod, grating systems, handrails, large cross-section structural parts, knitted and woven glass fabrics, central stiffness members of fiber optic cabling, filament wound pipe, tubes or tanks	UP, VE, EP, PN, PP, PA, N
Surfacing Veil (Available as Dry-Process C Veils and Wet-Laid E-CR Veils)	Chopped filaments of fiberglass reinforcement bonded together with a proprietary soft binder system designed to conform and be compatible with composite resin systems	Filament winding, compression molding, hand lay-up, panels, pultrusion	Automotive, building products, marine, recreation and transportation	Acoustical ceiling panels, flooring, insulation, gypsum and exterior products, batteries, panels and separator applications, and headliner reinforcement	UP, VE, EP
Wet-Formed Mat	Randomly dispersed chopped glass fibers bonded together with a resinous binder system	Used as a substrate for asphalt-coated products	Building products	Roofing shingles, underlayment and other water proofing systems	Not applicable
Wet-Use Chopped Strands	Coated fiberglass filaments specifically engineered for use in wet-process, non-woven applications	Used in wet-process, non-woven applications	Building products, construction, industrial	Residential and commercial roofing, facers and flooring tiles; specialty papers such as filters, gaskets, printed circuit boards, acoustic tiles, thermal barriers and felt for vinyl-coated flooring	Disperse uniformly and quickly in water-based bonding systems, whether acidic, neutral or basic

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Fabrics

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
Biaxial Fabrics	Comprised of continuous fibers in a 0° and 90° direction, held in place by either interweaving a lightweight hot melt yarn to lock the unidirectional fibers in place, or by stitching the fibers in place using yarn	Various processes	Various markets	Boat hulls, truck and trailer panels, wind blades, recreational sporting equipment and bridge decks	Multiple resin systems
BiPly™ Fabrics	Fabrics comprised of woven roving and chopped roving stitch-bonded into one fabric	Various processes	Various markets	Boat hulls, underground storage vessels and other cost-sensitive structural laminates	Multiple resin systems
Double Bias Fabrics	Stitch-bonded, non-crimp reinforcement combining warp (0°), weft (90°) and double bias ($\pm 45^\circ$) plies into a single multiaxial fabric	Various processes	Various markets	Wind blades, marine panels, snowboards, complex parts	Multiple resin systems
FlowRo® Fabric	Woven roving and continuous filament mat stitch-bonded into a single fabric	Closed molding	Marine, wind, infrastructure, transportation, industrial	Boat hulls and decks, wind turbine blades and nacelles	UP, VE, EP
FlowTex™ Fabrics	Stitch-bonded reinforcement combining equal amounts of continuous fiber oriented in the +45° and -45° directions into a single fabric	Various processes	Various markets		Multiple resin systems

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
High-Performance Fabrics	High-performance fabrics offer increased strength, stiffness or temperature resistance compared to traditional glass fabrics; this family of products is produced with strong lightweight materials other than E-glass and are designed for applications where product performance must exceed that of E-glass; the most common materials used for making high-performance fabrics include H-, R- and S-glass, aramid (e.g., Kevlar [®] and Twaron [®]) and carbon	Various processes	Various markets	Ballistic armor protection, aerospace and high-performance boats, rotor blades, aircraft wings and high-performance sporting goods	Multiple resin systems
Molding Mat	Non-woven synthetic core stitch-bonded between two layers of binder-free chopped fiberglass; Uniconform [®] continuous filament mat is needled and does not contain synthetic materials	Various closed molding techniques including resin transfer (RTM), vacuum-assist (VARTM) and press molding	Marine	Boats	UP, VE, EP

Kevlar is a trademark of E. I. du Pont de Nemours and Company

Twaron is a trademark of Teijin Aramid B.V. Ltd.

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Fabrics

NAME	DESCRIPTION	COMMONLY USED PROCESS	MARKETS	APPLICATION EXAMPLES	RESIN COMPATIBILITY
Quadaxial Fabrics	Stitch-bonded, non-crimp reinforcement combining either a warp (0°) or weft (90°) ply with double bias ($\pm 45^\circ$) plies into a single multiaxial fabric.	Various processes	Various markets	Boat hulls and decks, trailer panels, shipping containers and pultruded profiles	Multiple resin systems
Triaxial Fabrics	Stitch-bonded non-crimp reinforcement comprised of unidirectional warp (0°) and weft (90°) plies	Various processes	Various markets	Wind blades, boat hulls, storage tanks, trailer panels and pultruded profiles such as bridge decks	Multiple resin systems
Unidirectional Fabrics and Tape	Fabrics and tapes comprised of direct roving in a single direction reinforcement with the strength of continuous filaments	Various processes	Various markets	Wind blades, poles, boat stringers, columns, beams, pipe and fittings	Multiple resin systems
Woven Roving	OCV™ Technical Fabrics combines reinforcing materials to achieve special performance benefits; fabrics include woven roving, high performance fabrics, knitted fabrics, specialty products and tape	Virtually all processes from hand lay-up and spray-up to the more complex closed molding processes	Marine, transportation, recreation, construction, consumer and corrosion resistance	Shipping containers, ballistic armor, wind turbine blades and doors	Fabric has mechanical and resin compatibility characteristics tailored to specific end-use applications

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Glass Property Summary

PROPERTY	TEST METHOD	UNIT	E-GLASS	ADVANTEK [®] E-CR GLASS	OCV [™] H-GLASS	OCV [™] R-GLASS	OCV [™] S-GLASS	OCV [™] AR-GLASS
FIBER AND BULK GLASS PROPERTIES								
Density	ASTM C693	g/cm ³	2.55-2.58	2.62	2.61	2.55	2.45	2.68
Refractive Index (bulk annealed)	ASTM C1648	-	1.547-1.562	1.565	1.566	1.54	1.522	1.562
Conductivity	ASTM C177	watts/m•K	1.0-1.3	1.22	/	/	1.34	/
Pristine Fiber Tensile Strength	ASTM D2101	MPa	3450-3790	3750	4130	4510	4955	3700
Specific Pristine Strength	Calculation	x 10 ⁵ m	1.36-1.50	1.46	1.58	1.83	2.06	1.38
Young's Modulus		GPa	69-72	81	87.5	87	88	77
Specific Modulus	Calculation	x 10 ⁶ m	2.73-2.85	3.15	3.33	3.48	3.67	2.85
Elongation at Break		%	4.8	4.9	4.9	5.35	5.5	/
THERMAL PROPERTIES								
Coefficient of Thermal Expansion, 23-300 °C	ASTM D696	x 10 ⁻⁶ cm/cm•°C	5.4	6	5.3	4.1	3.4	/
Specific Heat @ 23 °C	ASTM C832	kJ/kg•K	0.807	0.79	/	0.75	0.810	/
FIBER TENSILE STRENGTH VS. TEMPERATURE								
Pristine Fiber Tensile Strength, -196 °C	ASTM D2101	MPa	5310	5935	/	7220	7826	/
Pristine Fiber Tensile Strength, 22 °C	ASTM D2101	MPa	3450-3790	3751	4130	4478	5047	/
FIBER WEIGHT LOSS @ 96 °C, 24 HOURS, 17 μM FIBER								
10% HCl		%	31.7	7.9	7.6	6.2	1.5	/
1.5 10% H ₂ SO ₄		%	32.0	6.9	6.5	5.1	1.2	/

Glass Property Summary

PROPERTY	TEST METHOD	UNIT	E-GLASS	ADVANTEXTM [®] E-CR GLASS	OCVTM [™] H-GLASS	OCVTM [™] R-GLASS	OCVTM [™] S-GLASS	OCVTM [™] AR-GLASS
FIBER WEIGHT LOSS @ 96 °C, 24 HOURS, 17 μM FIBER								
1 N Nitric		%	23.5	7.2	6.7	5.2	1.4	/
NaOH pH=12.88		%	5.4	3.2	12.6	/	19.3	/
FIBER WEIGHT LOSS @ 50°C, 1000 HOURS, 19 μM FIBER								
2M HCl	EN 175	%	/	/	/	/	/	< 1
2M NaOH	EN 175	%	/	/	/	/	/	< 0.2
IMPREGNATED STRAND PROPERTIES								
Tensile Strength	ASTM D2343	MPa	2000-2500	2200-2600	2400 -2900	3050-3400	3410-3830	/
	EN 9163	MPa	/	/	/	/	/	2160
Tensile Modulus	ASTM D2343	GPa	78-80	81	90	90	91.3	/
	EN 9163	GPa	/	/	/	/	/	74
Toughness	ASTM D2343	MPa	37	56	/	69	Sep-82	/
UNIDIRECTIONAL COMPOSITE PROPERTIES^{1, 2}								
Tensile Strength	ISO 527-5	MPa	1120	1200	1260	1560	1550	940
Tensile Modulus	ISO 527-5	GPa	46	48	52.5	51.6	53	41
Poisson's Ratio	ASTM D638	-	0.29	0.33	0.33	0.32	0.27	/
Fiber Volume Fraction	ASTM D2734	%	60	60	60	60	60	50

1. Hexion MGS RIM 135 epoxy resin + RIMH 137 hardener

2. In AR-Glass, Derakane vinyl ester resin has been used

Dry-Use Chopped Strand for Thermoplastics

Designed to reinforce thermoplastics through compounding and injection molding processes. Provide key benefits for production productivity and high-performance composite components including outstanding mechanical and sustainability properties, and complex design with a high degree of function integration.

Dry-Use Chopped Strand for Thermoplastics

SIZING	FILAMENT DIAMETER (µm)	THERMOPLASTIC RESIN TO BE REINFORCED											PROCESSES	APPLICATIONS						
		PE		STYRENICS		POM		PPS & HT RESINS			PPO				LCP		PC		PVC & TPU	
		MECHANICALS DAM	MECHANICALS DAM	LIGHT COLOR	MECHANICALS DAM	LOW MOLD DEPOSIT	MECHANICALS DAM	MECHANICALS AFTER HOT WATER AGING	LOW OFF-GASING	LOW MOLD DEPOSIT	MECHANICALS DAM	MECHANICALS AFTER HOT WATER AGING			MECHANICALS DAM	LOW BLISTERING	"NON-BONDING" MECHANICALS GF <20%	"BONDING" MECHANICALS GF >20%	MECHANICALS DAM	IMPREGNATION
983	10 & 13																			
995	10 & 13																			
DS1173	10, 11 & 13		+	+	+															
CSPA	11																			
952/952A*	10 & 13																			
183F	11 & 13																			
147A	14	+																		
968/968A**	13	+																		
910/910A***	10 & 13							++	+	++	++		++	+			+	+		
91F	10							++	+++	++										
473A	14																			
415A	14	++												+++			++	++		
122Y	14		++	++							++	+				++				
FT142A	14										++	+++								
923	10												++	+++						
408A	14	++	+	+	+								++	++		+	+	+		
584	14		++	++									+	+						

* 952A: Solvent-free/low VOC version introduced at the same time the furnace was converted to Advantex® glass

** 968A: Optimized DAM mechanicals at the same time the furnace was converted to Advantex® glass

*** 910A: NPE-free 910 version introduced at the same time the furnace was converted to Advantex® glass

GF Length: 4mm in North America & Asia Pacific. 4,5mm in Europe & Latin America

Thermoplastic compounding and injection molding

Transportation, electrical and electronics, consumer goods

Dry-Use Chopped Strand for Thermoplastics

SIZING	FILAMENT DIAMETER (µm)	THERMOPLASTIC RESIN TO BE REINFORCED														PROCESSES	APPLICATIONS				
		PE		STYRENICS		POM		PPS & HT RESINS				PPO		LCP				PC		PVC & TPU	
		MECHANICALS DAM	MECHANICALS DAM	LIGHT COLOR	MECHANICALS DAM	LOW MOLD DEPOSIT	MECHANICALS DAM	MECHANICALS AFTER HOT WATER AGING	LOW OFF-GASING	LOW MOLD DEPOSIT	MECHANICALS DAM	MECHANICALS AFTER HOT WATER AGING	MECHANICALS DAM	LOW BLISTERING	"NON-BONDING" MECHANICALS GF <20%			"BONDING" MECHANICALS GF >20%	MECHANICALS DAM	MECHANICALS DAM	IMPREGNATION
PerforMax [®] PA-1	10																				
PerforMax [®] PA-2	10																				
PerforMax [®] PBT/PET	10																				
PerforMax [®] PP	10																				
PerforMax [®] POM-1	10				***	**															
PerforMax [®] POM-2	10				**	***															
PerforMax [®] PPS-1	10						***	***	**												
PerforMax [®] PPS-2	10						**	**	**	***											
PerforMax [®] PPE	13									***	***										
PerforMax [®] LCP-1	10											**	**								
PerforMax [®] LCP-2	10											**	***								
PerforMax [®] PC	13														***						
MicroMax [®] PPS	6						***	***	**												
MicroMax [®] LCP	6												***	**							

Thermoplastic compounding and injection molding

Transportation, electrical and electronics, consumer goods

Chopped Strand For BMC (Bulk Molding Compound)

Reinforcement for thermoset molding compounds used in compression molding applications.

SIZING	FIBER LENGTH (MM)	FILAMENT DIAMETER (μm)	HIGH PERF.	GAL PURP.	PHENOLICS & FRICTION MATERIALS	UNSATURATED POLYESTER & EPOXY	AVAILABILITY
979 Indirect CS	3.6 & 12	14		X		X	Europe
R63 Indirect CS	3.6 & 12	14	X		X		
101C Indirect CS	3.6 & 12	13	X			X	
P316 Direct CS	3.6 & 12	17		X		X	
914 Direct CS	4.5	14	X		X		
5349 Indirect CS	3 & 6	11	X		X		
DS5102-13C Direct CS	3.2, 6.4 & 13	13		X		X	North America
CS 405B	3.2, 4.7, 6.4 & 13	13		X	X	X	South America
DS 5407-17R	3.2, 6.4	17		X	X	X	
979 Indirect CS	3, 6, 9 & 12	14		X		X	China
979	3, 4.5, 6 & 12	14		X		X	India
P 546	3, 4.5, 6 & 12	13.5		X	X		India
P526	6 & 12	13.5			wet usage		
101C Indirect CS	3.6 & 12	13		X	3mm	X	Korea

Wet-Use Chopped Strand

Wet-Use Chopped Strand are coated fiberglass filaments specifically engineered for use in wet-process, non-woven applications.

SIZING	FIBER DIAMETER (MICRONS)	CHOP LENGTH (IN)	CHOP LENGTH (MM)	PROCESS	APPLICATIONS	PRODUCTS CHARACTERISTICS	AVAILABILITY
WS2301	10		6 & 10	Wet			Europe
	11		6, 10 & 13				
	13		6, 10				
WS9501	11		6, 10 & 13	Wet	Specialties (battery separator, catalyst filter, specialty paper)		
	13		6, 13 & 18				
	23		13				
WS790A	16		6 & 13	Dry	Gypsum	Good flowability, low moisture.	
OptiFlow® 790C	16		6 & 13	Dry	Gypsum	High flowability, low moisture.	
CS790C	16	½"		Dry	Gypsum	High flowability, low moisture.	Americas
CS9501	16	¼" to 1 3/8"		Wet	Roofing		
	13	¼" to 1"			Speciality Roofing		

Type 30® Single-End Roving

Single-End Roving is produced by pulling individual fibers directly from the bushing and winding them onto a roving package ready for shipment. The uniform distribution of a proprietary sizing system ensures excellent resin-to-glass bonding.

Type 30® Single-End Roving (North America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
158B	K	675	13	735	Epoxy	Filament winding	Product to be used in applications demanding excellent burst strength; approved for high pressure vessels	North America
	M	450	16	1100				
	M	250	16	2000				
	M	225	16	2200				
346	K	675	13	735	Epoxy	Filament winding	High-pressure pipe	North America
	M	450	16	1100				
	M	250	16	2000				
366	M	450	16	1100	Polyester, vinyl ester, epoxy	Pultrusion, filament winding	Pultrusion and filament winding applications in polyester, vinyl ester and epoxy resin systems	North America
	Q	330	19	1500				
	S	250	22	2000				
	T	113	23	4400				

Type 30® Single-End Roving (North America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
399	na	62	31	8000	Polyester, vinyl ester, epoxy	Pultrusion	Processes needing very high tex (low yield) such as ladder rails, pultruded structural shapes and grating systems	North America
	na	56	33	8800				
	na	52	34	9600				
R25H	N	825	17	600	Polyester, vinyl ester, epoxy	Pultrusion, filament winding	Chemical and sewage pipe, water distribution pipe, pultrusion of central stiffness members for fiber optic cable	North America
	N	413	17	1200				
	U	207	24	2400				
	U	103	24	4800				
SEI200	N	825	17	600	Polyester, vinyl ester, epoxy	Knitting/weaving, pultrusion, filament winding	Knitted or woven glass fabrics, central stiffness members for fiber optic cable, and filament wound pipe, tubes or tanks	North America
	K	675	13	735				
	M	450	16	1100				
	N	413	17	1200				
	Q	330	19	1500				
	M	250	16	2000				
	M	225	16	2200				
	N	207	17	2400				
T	113	23	4400					

Type 30® Single-End Roving (North America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE1500	M	1650	16	300	Epoxy	Knitting/weaving, filament winding	Woven, knitted and multiaxial fabrics or pre-pregs, wind turbine blades or automotive leafsprings, filament wound pipe, tubes or tanks	North America
	N	825	17	600				
	N	413	17	1200				
	N	207	17	2400				
	U	103	24	4800				
SE2348	M	450	16	1100	Epoxy	Filament winding	Small-diameter oil field pipe, down-hole tubing, well casing and chemical processing pipe, aerospace, military transportation and electrical applications	North America
	S	250	22	2000				
SE2348AS	S	250	22	2000				
SE2350L (low solids)	S	248	22	2000	Epoxy	Filament winding	Small-diameter oil field pipe, down-hole tubing, well casing and chemical processing pipe, aerospace, military, transportation and electrical applications	North America
SE2350	M	250	16	1985				

Type 30® Single-End Roving (North America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE412I	N	207	17	2400	Polypropylene	Long fiber thermoplastics, direct long fiber thermoplastics	Suitable with Direct-LFT processes as well as with pellet manufacturing, processes using long chopped fibers	North America
SE453I	N	207	17	2400	Polyamide	Long fiber thermoplastics, direct long fiber thermoplastics.	Designed to reinforce polyamides through the long fiber pellet manufacturing process (LFT)	
SE8380	T	113	23	4400	Phenolic	Pultrusion	Used in structural profiles requiring low smoke level and fire resistance classification obtained with phenolic resins	
SE8400 LS	T	113	23	4400	Polyester, vinyl ester, epoxy	Pultrusion - electrical applications	Epoxy FRP rods used in electrical insulators	
ST2000	U	103	24	4800	-	Muffler filling technology - Silentex® solution	Muffler filling applications		North America

Type 30® Single-End Roving (Latin America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
158B	M	450	16	1100	Epoxy	Filament winding	Product to be used in applications demanding excellent burst strength; approved for high pressure vessels	Latin America
	M	450	16	1100				
	M	450	16	1100				
	M	450	16	1100				
346	M	450	16	1100	Epoxy	Filament winding	High-pressure pipe	Latin America
	M	450	16	1100				
	M	450	16	1100				
R25H	N	825	17	600	Polyester, vinyl ester, epoxy	Pultrusion, filament winding	Chemical and sewage pipe, water distribution pipe, pultrusion of central stiffness members for fiber optic cable	Latin America
	N	413	17	1200				
	U	207	24	2400				
	U	103	24	4800				

Type 30® Single-End Roving (Latin America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SEI200	N	4960	13	100	Polyester, vinyl ester, epoxy	Knitting/weaving, pultrusion, filament winding	Knitted or woven glass fabrics, central stiffness members for fiber optic cable, and filament wound pipe, tubes or tanks	Latin America
	N	2480	13	200				
	M	1650	16	300				
	N	1200	16	410				
	N	825	17	600				
	K	675	13	735				
	M	450	16	1100				
	M	250	16	2000				
	M	225	16	2200				
	U	207	24	2400				
	T	113	23	4400				
	U	103	24	4800				
na	56	33	8800					

Type 30® Single-End Roving (Latin America)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE1500	N	4960	13	100	Epoxy	Knitting/weaving, filament winding	Woven, knitted and multiaxial fabrics or pre-pregs, wind turbine blades or automotive leafsprings, filament wound pipe, tubes or tanks	Latin America
	N	2480	13	200				
	M	1650	16	300				
	M	825	16	600				
	N	413	17	1200				
	N	207	17	2400				
SE2350	K	673	13	735	Epoxy	Filament winding	Small-diameter oil field pipe, down-hole tubing, well casing, and chemical processing pipe, aerospace, military, transportation and electrical applications	Latin America
	N	450	16	1100				

Type 30® Single-End Roving (Europe except Russia)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
111A	16	300	M	1653	Polyester, vinyl ester, epoxy	Knitting/weaving	Knitting and weaving applications in polyester, vinyl ester and epoxy resin systems	Europe
	16	320	M	1550				
	16	410	M	1209				
	17	480	N	1033				
	17	600	N	825				
	14	900	L	551				
	17	1200	N	413				
	17	2400	N	207				
346	17	1200	N	413	Epoxy	Filament winding	High-pressure pipe	Europe
R25H	17	600	N	825	Polyester, vinyl ester, epoxy	Pultrusion, filament winding	Chemical and sewage pipe, water distribution pipe, pultrusion of central stiffness members for fiber optic cable	Europe
	17	1200	N	413				
	24	2400	U	207				
	24	4800	U	103				
SE1200	17	600	N	825	Polyester, vinyl ester, epoxy	Knitting/weaving, pultrusion, filament winding	Knitted or woven glass fabrics, central stiffness members for fiber optic cable, and filament wound pipe, tubes or tanks	Europe
	17	1200	N	413				
	17	2400	N	207				
	24	2400	U	207				
	24	4800	U	103				

Type 30® Single-End Roving (Europe except Russia)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE1500	16	300	M	1650	Epoxy	Knitting/weaving, filament winding	Woven, knitted and multiaxial fabrics or pre-pregs, wind turbine blades or automotive leafsprings, filament wound pipe, tubes or tanks	Europe
	17	600	N	825				
	17	1200	N	413				
	17	2400	N	207				
	24	4800	U	103				
SE4121	17	2400	N	207	Polypropylene	Long fiber thermoplastics, direct long fiber thermoplastics	Suitable with Direct-LFT processes as well as pellet manufacturing, processes using long chopped fibers	Europe
ST1048	28	4800	na	103	-	Muffler filling technology - Silentex® solution	Muffler filling applications	Europe
ST2070	24	7000	U	70				

Type 30® Single-End Roving (Russia)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
76	13	420	K	1180	Epoxy, Phenolic	Knitting/weaving, filament winding	Knitted or woven glass fabrics and filament wound pipe, tubes or tanks	Russia/CIS (Confederation of Independent States)
117A	13	140	K	3540	Polyester, vinyl ester, epoxy	Weaving, pultrusion, filament winding	Knitted or woven glass fabrics, different types of pultrusion profiles, and filament wound pipe, tubes or tanks	Russia/CIS
	13	600	K	825				
	13	735	K	675				
	16	1100	M	450				
	17	1200	N	413				
	20	1600	Q	310				
	21	1800	R	275				
	23	2000	T	248				
	24	2400	U	207				
202	12	320	J	1550	Epoxy, polyester, vinyl ester	Weaving, pultrusion, filament winding	Suitable for all textile processes, knitted or woven glass fabrics, different types of pultrusion profiles, and filament wound pipe, tubes or tanks	Russia/CIS
	14	408	L	1215				
	17	1200	N	413				
	17	2400	N	207				

Type 30® Single-End Roving (Russia)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
PI96	17	600	N	825	Polyester, vinyl ester, epoxy	Weaving, pultrusion, filament winding	Knitted or woven glass fabrics, central stiffness members for fiber optic cable, and filament wound pipe, tubes or tanks	Russia/CIS
	17	1200	N	413				
	24	2400	U	207				
PI96T	16	600	M	825	Polyester, vinyl ester, epoxy	Weaving/twisting & texturization	Knitted or woven glass fabrics such as roofing and wall covering	Russia/CIS
SE1200	14	300		1650	Polyester, vinyl ester, epoxy	Knitting/weaving, pultrusion, filament winding	Knitted or woven glass fabrics, central stiffness members for fiber optic cable, and filament wound pipe, tubes or tanks	Russia/CIS
	17	600	N	825				
	17	1200	N	413				
	17	2400	N	207				
	24	2400	U	207				
	24	4800	U	103				
SE1500	13	735	K	675	Epoxy	Knitting/weaving, filament winding	Woven, knitted and multiaxial fabrics or pre-pregs, wind turbine blades or automotive leafsprings, filament wound pipe, tubes or tanks	Russia/CIS
	17	1200	N	413				
	24	2400	U	207				

Type 30® Single-End Rovings (Asia Pacific)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
158B	Q	675	19	735	Epoxy	Filament winding	Product to be used in applications demanding excellent burst strength; approved for high-pressure vessels	India
	M	450	16	1100				China, India, Korea
	M	207	16	2100				India
	N	207	17	2400				China, Korea
366	M	225	16	2200	Polyester, vinyl ester, epoxy	Pultrusion, filament winding	Pultrusion and filament winding applications in polyester, vinyl ester and epoxy resin systems	Korea
	T	113	23	4400				Korea
	na	56	33	8800				Korea
R25H	N	825	17	600	Polyester, vinyl ester, epoxy	Pultrusion, filament winding	Chemical and sewage pipe, water distribution pipe, pultrusion of central stiffness members for fiber optic cable	India
	Q	675	19	735				India
	N	413	17	1200				India
	U	207	24	2400				Korea
	T	113	23	4400				Korea
	U	103	24	4800				India

Type 30® Single-End Roving (Asia Pacific)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE1200	J	1650	16 and M fiber	300	Polyester, vinyl ester, epoxy	Knitting/weaving, pultrusion, filament winding	A variety of processes to manufacture knitted or woven glass fabrics, central stiffness members for fiber optic cable and filament wound pipe, tubes or tanks	India, China
	N	825	17	600				China, India, Korea
	K	675	13	735				Korea
	N	430	17	1150				Korea
	N	413	17	1200				China, India, Korea
	M	225	16	2200				Korea
	N	207	17	2400				China, India, Korea
	T	113	23	4400				Korea
	U	103	24	4800				India

Type 30® Single-End Roving (Asia Pacific)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE1500	J	1650	16 and M fiber	300	Epoxy	Knitting/weaving, filament winding	Woven, knitted and multiaxial fabrics or pre-pregs, wind turbine blades or automotive leafsprings, filament wound pipe, tubes or tanks	India, China
	N	825	17	600				China, India, Korea
	L	550	15	900				China, India
	N	413	17	1200				China, India, Korea
	N	207	17	2400				China, India, Korea
	U	103	24	4800				China, India, Korea
SE2348AS	S	250	22	2000	Epoxy	Filament winding	Small-diameter oil field pipe, down-hole tubing, well casing and chemical processing pipe, aerospace, military transportation and electrical applications	China
SE2350	S	250	22	2000	Epoxy	Filament winding	Small-diameter oil field pipe, down-hole tubing, well casing and chemical processing pipe, aerospace, military, transportation and electrical applications	China

Type 30® Single-End Roving (Asia Pacific)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
SE4121	N	825	17	600	Polypropylene	Long fiber thermoplastics, direct long fiber thermoplastics	Suitable for direct long fiber thermoplastics processes as well as with pellet manufacturing processes using long chopped fibers	China
	N	413	17	1200				China
	N	207	17	2400				Korea, China
ST1000	U	103	24	4800	-	Muffler filling technology - Silentex® solution	Muffler filling applications	Korea
ST2070	U	70	24	7000				China
475G	M	431	16	1150	Polyester, vinyl ester, epoxy	Weaving	Knitting and weaving applications in polyester, vinyl ester and epoxy resin systems	Japan
	M	215	16	2310				
F08	K	670	13	740	Polyester, vinyl ester, epoxy	Filament winding, pultrusion	Used in wide range of applications and processes where low fuzz and fast impregnation are required	Japan
	M	431	16	1150				
	M	223	16	2220				
	N	207	17	2400				
	T	111	23	4450				
	T	107	23	4630				

Type 30® Single-End Roving (Asia Pacific)

SIZING	FILAMENT	YIELD (YDS/LB)	AVERAGE FILAMENT DIAMETER (MICRONS)	TEX	RESIN COMPATIBILITY	COMPOSITE MANUFACTURING PROCESS	APPLICATIONS	AVAILABILITY
FT805	K	335	13	1480	Polypropylene	Long fiber thermoplastics, direct long fiber thermoplastics	High-pressure pipe applications	Japan
	M	207	17	2400				
FW35	M	431	16	1150	Epoxy	Filament winding	Epoxy applications	Japan
FW300	M	223	16	2220	Polyester, vinyl ester, epoxy	Filament winding, pultrusion	Applications where excellent chemical resistance is required, such as high- pressure pipe applications	Japan
	T	107	23	4630				

Multi-End Continuous Roving

OC[®] Multi-End Continuous Roving provides outstanding performance in a variety of spray-up, chopping, sheet molding compound, centrifugal casting, long-fiber injection, glass-mat thermoplastics, pultrusion and weaving processes to mold many types of composite applications.

Multi-End Continuous Roving

SIZING	AVAILABILITY				YIELD	DIAMETER (μ)	TEX	BUNDLE TEX	APPLICATION
	LA	NA	EMEA	AP					
ME3021		x			207, 165	11	2400 and 3000	69	Spray up, general purpose
ME3030		x			207, 124	11.8	2400 and 4000	56	Spray up general purpose
ME3040		x			207	13	2400	53	Spray up general purpose
ME3050	x				207, 124	14	2400 and 4000	56.6	Spray up, general purpose
P207			x		207	12 and 13	2400	60	Spray up, general purpose
P209				x	207	12	2400	60	Spray up, general purpose
P224			x		207	12	2400	48	Spray up, general purpose
P218			x		207, 165	14	2400 and 3000	75	Spray up, general purpose, with fast wet through and easy de-airing
ME3003				x	207, 148	12.1	2400 and 3360	80	Spray up, general purpose
ME3023				x	207, 143	12.7	2400 and 3460	66	Spray up, general purpose

Multi-End Continuous Roving

SIZING	AVAILABILITY				YIELD	DIAMETER (μ)	TEX	BUNDLE TEX	APPLICATION
	LA	NA	EMEA	AP					
495	x				207	13	2400	78.5	Pipe and tanks, drostholm process
495			x		207	13	2400	33	Pipe and tanks, drostholm process
495		x			207 and 103	12	2400 and 4800	44	Panel
495				x	207	13	2400	34	Pipe and tanks, drostholm process and other chopping applications
495-EP		x			207	13	2400	34	Pipe and tanks, drostholm process
ME4040	x				207, 155, 124	13	2400, 3200 and 4000	33.3	Panel
ME3040L		x			207	13	2400	53	Gun roving
P244			x		207	13 and 16	2400	20,33 and 50,67,80	Headliner, complexes, panel, gypsum
P244				x	207	13	2400	33	Complexes, headliner
P244		x			207 and 103	12	2400 and 4800	33	Complexes
ME4017		x			207 and 103	11.8	2400 and 4800	44	Panel and gun roving
ME1018	x				103	13	4800	66.7	Headliner
ME4024				x	207	12.1	2400	40	Headliner
P243				x	207	12.7 and 14	2400	33 and 34.3	Panel, continuous lamination
P243			x		207	13	2400	33	Panel, continuous lamination

Multi-End Continuous Roving

SIZING	AVAILABILITY				YIELD	DIAMETER (μ)	TEX	BUNDLE TEX	APPLICATION
	LA	NA	EMEA	AP					
365				x	207	12.1	2400	40	Panel
OC HiLight™		x	x		207 and 103	13	2400 and 4800	40	Translucent Panel
905		x			110	13	4500	70	Structural SMC, preforming
973C	x	x			113	16	4400	78.5	SMC, general purpose
973 and 973C		x			110	16	4500	74	SMC class A, headliner
ME1975		x			110	16	4500	92	SMC class A for truck
985		x			109	15	4565	91	General purpose SMC with improved wetting, long fiber injection
956		x			110	12.5	4500	55	Pigmented SMC, headliner
957		x			110	12.5	4500	73	Pigmented SMC, bathtub/showers and tactile panels
P204			x		207 and 103	16	2400 and 4800	80 or 100	SMC, general purpose and low profile
P204				x	207 and 103	13.5, 14, 14.5	2400 and 4800	75, 80, 85	SMC, general purpose
P204		x			207 and 103	14.5	2400 and 4800	85	SMC
P215				x	207	13.5	2400	44	SMC and chop
R63			x		207 and 103	14	2400 and 4800	70	Continuous impregnated compound process
R66A				x	103	13.6	4800	75	SMC

Multi-End Continuous Roving

SIZING	AVAILABILITY				YIELD	DIAMETER (μ)	TEX	BUNDLE TEX	APPLICATION
	LA	NA	EMEA	AP					
R07			x		207 and 103	14	2400 and 4800	75	SMC, sanitary and applications requiring increased mechanical properties
R07EX1				x	207 and 103	13.6	2400 and 4800	75	SMC, general purpose
ME1211				x	103	13.7/15.7	4800	75/80	SMC, sanitary
P219			x		207	13	2400	66	Pipe and tanks, centrifugal casting
ME1020				x	103 and 77.5	15.7	4800 and 6400	100	Long-fiber injection
P249			x		103	13	4800	66	Automotive semi-structural parts, long fiber injection process
P213			x		207	13	2400	80	Glass-mat thermoplastics
ME1037				x	207	13.6	2400	75	Glass-mat thermoplastics
PI85			x		413, 207	13	1200 and 2400	400	Weaving and pultrusion

Chopped Strand Mat

OC[®] Chopped Strand Mat provides outstanding performance in a variety of hand lay-up processes to mold many types of applications with both polyester and vinyl ester resins for use in transportation, recreation, marine and construction.

Chopped Strand Mat

SIZING	BINDER TYPE	AVAILABILITY				STANDARD WEIGHTS (GR/M ²)	AVAILABLE WEIGHT (OZ/FT ²)	AVAILABLE WIDTH (CM)	AVAILABLE WIDTH (IN)	STANDARD TRIMMED EDGES	APPLICATION/ PROCESS	SPECIFIC CHARACTERISTICS / BENEFITS
		LA	NA	EU	AP							
M723A	Powder		x	x		225, 300, 450, 600, 900	0.5, 1, 1.5, 2, 3	95, 125	37.4, 49.2	1ST	General purpose	Excellent dry handling, fast wetting, good fiber distribution
M723	Powder				x	300, 380, 450, 600	1, 1.27, 1.5, 2	104	41	2ST	General purpose	Good translucency, tensile strength and fast wetting; no blistering
M723 S	Powder				x	225, 300, 380, 450, 600	0.5, 1, 1.27, 1.5, 2	104	41	2ST	General purpose	Good translucency, tensile strength and slow wetting; no blistering, reduced resin consumption
M705	Emulsion			x	x	225, 300, 450, 600, 900	0.5, 1, 1.5, 2, 3	95, 104, 125	37.4, 41, 49.2	1ST	Hand lay-up	Quick wetting, rapid air release, good conformability
M705 X12	Emulsion				x	225, 300, 450, 600	0.5, 1, 1.5, 2	95, 104, 125	37.4, 41, 49.2	1ST	Hand lay-up	Same as M705 but enhanced surface finish
M710B	Powder	x				300, 375, 450, 600	1, 1.25, 1.5, 2	140	55.12	2ST	General purpose	Quick wetting, high solubility, rapid air release, good conformability

Chopped Strand Mat

SIZING	BINDER TYPE	AVAILABILITY				STANDARD WEIGHTS (GR/M ²)	AVAILABLE WEIGHT (OZ/FT ²)	AVAILABLE WIDTH (CM)	AVAILABLE WIDTH (IN)	STANDARD TRIMMED EDGES	APPLICATION / PROCESS	SPECIFIC CHARACTERISTICS / BENEFITS
		LA	NA	EU	AP							
M710C	Powder	x				450	1.5	140	55.12	2ST	General purpose	Quick wetting, rapid air release, good conformability
M723B	Powder	x				450	1.5	140	55.12	2ST	General purpose	Excellent dry handling, fast wetting
M821B	Emulsion	x				300, 450	1, 1.5	140	55.12	2ST	Vacuum, RTM, S-Rim, compression molding	Good conformability, softness, fiber washing resistance
M720	Powder	x				300, 450, 600, 900	1, 1.5, 2, 3	140	55.12	2ST	Hand lay-up	High conformability, quick wetting, easily torn by hand
M5	Emulsion			x		225, 300, 375, 450, 600, 900	0.5, 1, 1.25, 1.5, 2, 3	92, 125	36.2, 49.2	1ST, 2ST	Hand lay-up	Like M705 with lower impregnation speed and less conformability
M515	Emulsion			x		300, 450, 600	1, 1.5, 2	10, 20, 125, 130	3.94, 7.87, 49.2, 51.2	2ST	Marine	Wet carrying, quick de-airing, excellent mold conformability
M6	Emulsion				x	225, 300, 450, 600	0.5, 1, 1.5, 2	52, 104	20.47, 41	1ST	Hand lay-up	Reasonably fast wet out, good solubility and tensile strength
M123	Powder			x		225, 300, 450, 600, 900	0.5, 1, 1.5, 2, 3	92, 125	49.2	1ST	General purpose	Good mold conformability, fiber distribution and clarity

Chopped Strand Mat

SIZING	BINDER TYPE	AVAILABILITY				STANDARD WEIGHTS (GR/M ²)	AVAILABLE WEIGHT (OZ/FT ²)	AVAILABLE WIDTH (CM)	AVAILABLE WIDTH (IN)	STANDARD TRIMMED EDGES	APPLICATION / PROCESS	SPECIFIC CHARACTERISTICS / BENEFITS
		LA	NA	EU	AP							
M123	Powder				x	300, 380, 450, 600	1, 1.27, 1.5, 2	104	41	2ST	General purpose	Good mold conformability
M113	Powder			x		100, 225, 300, 450, 600	0.33, 0.5, 1, 1.5, 2	Various	Various	2ST	Panel applications	Excellent surface finishing and tensile strength
M137	Powder				x	300, 380, 450, 600	1, 1.27, 1.5, 2	104, 300	41, 118.11	2ST	Hand lay-up	Excellent mold conformability and mechanical performance in the laminate, quick wetting
M534	Emulsion			x		300, 450, 600	1, 1.5, 2	125	49.2	1ST	Hand lay-up, compression molding	Good mechanical properties in the laminate, quick wetting and good mold conformability
M413	Emulsion			x		100, 150, 300	0.33, 0.5, 1	130	51.18	1ST	Compression molding, roofing, marine	Good tensile strength, fast wet out, excellent mold conformability

Unifilo® Continuous Filament Mat (CFM)

Unifilo® reinforcements are a range of continuous filament mat in multiple layers of randomly oriented glass fiber strands held together with a binder.

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
M8643	Liquid	2.25-6.75	24	From 225 to 900	From 0.75 to 3	up to 213	up to 84	Pultrusion	Stiffer mat for an improved tensile strength, and fast pultruding speeds; standard product for the US market.
U527	Liquid	4-4.4	25	From 225 to 900	From 0.75 to 3	up to 300	up to 118		Soft mat, for easier conformability; white color
U528	Liquid	4.2-6	25	From 225 to 900	From 0.75 to 3	up to 300	up to 118		Standard mat for the European market; white color
U529	Liquid	5.8-6.2	25	From 225 to 900 ²	From 0.75 to 3	up to 300	up to 118		Stiffer mat for an improved tensile strength, and fast pultruding speeds; standard product for the US market; white color

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
U614	Liquid	4.5	36	From 225 to 900	From 0.75 to 3	up to 213	up to 84	RTM, light-RTM, wet compression, resin infusion molding, S-RIM	Only available for the US market; easy unrolling, cutting and handling
U812	Thermoset Powder	2.2	25	From 225 to 900	From 0.75 to 3	up to 300	up to 118		Medium-high conformability; ideal for molds of complex shape
U813	Thermoset Powder	3.5	25	From 100 to 900	From 0.34 to 3	up to 300	up to 118		Standard product with medium conformability, easy unrolling, cutting and handling
U816	Thermoset Powder	6	25	From 100 to 900	From 0.34 to 3	up to 300	up to 118		Standard product with limited conformability, ideal for simple shapes; few loose fibers; easy unrolling, cutting and handling
Uniconform® UM2A	No binder (mechanically bonded)	N/A	25	From 300 to 2400	From 1 to 8	125 & 250	49 ¼ 98 ½	Light-RTM	Highly conformable material (waste and molding time reduced by up to 50%), with good translucency and excellent thermal resistance (can bear up to 200°C with no permanent damage); strong needling to reduce the risk of loose fibers

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
Uniconform® UM2B	No binder (mechanically bonded)	N/A	25/50	From 300 to 2400	From 1 to 8	125 & 250	49¼ 98½	Light-RTM	Highly conformable material (waste and molding time reduced by up to 50%), with good translucency and excellent thermal resistance (can bear up to 200°C with no permanent damage); light needling to improve finish surface; the coarser filaments (50 tex) provide outstanding resin flow and fast wet-out
Uniconform® UM5B	No binder (mechanically bonded)	N/A	25/50	From 300 to 2400	From 1 to 8	125 & 250	49¼ 98½		Highly conformable material (waste and molding time reduced by up to 50%), with excellent thermal resistance (can bear up to 200°C with no permanent damage); light needling to improve finish surface; the coarser filaments (50 tex) provide outstanding resin flow and fast wet-out; stiffer and less translucent than UM2A and UM2B
Multiconform® UM2P	No binder	N/A	25/50	From 780 to 1980	From 2.5 to 6.5	125 & 250	49¼ 98½		Equivalent to UM2B with PP core to enhance conformability and reduce compressibility

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
U852	Thermoset powder	2.5	25/50	From 225 to 900	From .75 to 3	up to 300	up to 118	Infusion	Product specially designed for resin infusion process; the coarser filaments (50 tex) in the core provides outstanding resin flow and fast wet-out; it can also be used in molding complex shapes with highly filled resins
U850	Thermoset powder	6	25/50	From 225 to 900	From .75 to 3	up to 300	up to 118		
U720	Thermoplastic powder	10	25	From 300 to 900	From 1 to 3	up to 300	up to 118	Preforming	Product designed for automatic stiff preforming; excellent strength and durability of preforms
U740	Thermoplastic powder	8	25/50	From 300 to 900	From 1 to 3	up to 300	up to 118		Product designed for heavy preforming in highly filled resins; the coarser filaments (50 tex) provide outstanding resin flow; non-calendared mat to increase thickness
U746	Thermoplastic powder	6	25/50	From 300 to 900	From 1 to 3	up to 300	up to 118		Product designed for soft preforming in highly filled resins; the coarser filaments (50 tex) provide outstanding resin flow; non-calendared mat to increase thickness

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
U750	Thermoplastic powder	8	25/50	From 300 to 900	From 1 to 3	up to 300	up to 118	Preforming	Product designed for heavy preforming in highly filled resins, the coarser filaments (50 tex) provide outstanding resin flow; calendared mat to reduce the risk of loose fiber
U756	Thermoplastic powder	6	25/50	From 300 to 900	From 1 to 3	up to 300	up to 118		Product designed for soft preforming in highly filled resins; the coarser filaments (50 tex) provide outstanding resin flow; calendared mat to reduce the risk of loose fiber
S750	Thermoplastic powder	8	25/50	From 300 to 900	From 1 to 3	up to 300	up to 118		Product designed with high deformability rate during preforming (Unistretch: enhanced stretchability); for heavy preforming in highly filled resins; the coarser filaments (50 tex) provide outstanding resin flow; calendared mat to reduce the risk of loose fiber

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
T754	Thermoplastic powder	4	25/50	From 300 to 900	From 1 to 3	up to 300	up to 118	Preforming	Product designed with transverse oriented properties to enhance mechanical performance in cross direction (Unitop: 60-70 % UD); for soft preforming in highly filled resins; the coarser filaments (50 tex) provides outstanding resin flow; calendared mat to reduce the risk of loose fiber
U801	Thermoset powder	1.6	25	From 225 to 900	From .75 to 3	up to 300	up to 118	PU-forming panels	Softest mat with excellent conformability and good adaptability to complex shape molds; used to reinforce low density polyurethane foams and to produce complex parts molded at low pressure
U809	Thermoset powder	0.9	25	From 225 to 900	From .75 to 3	up to 300	up to 118		Very low binder content allowing even dispersion in the PU matrix during foam expansion; widely used in LNG carrier thermal insulation

Unifilo® Continuous Filament Mat (CFM)

SIZING	BINDER TYPE	LOSS ON IGNITION (%)	TEX	WEIGHT (GR/M ²)	WEIGHT (OZ/FT ²)	WIDTH (CM)	WIDTH (IN)	APPLICATION/ PROCESS	CHARACTERISTICS & BENEFITS
U101	Thermoplastic powder	4.5	25	From 150 to 600	From 0.5 to 2	up to 300	up to 118	Panels	Good translucency; ideal product to make translucent sheets for building applications (roofing) and panels for trucks and vehicle bodies

Closed Molding Fabric

Closed molding fabric is designed for processes such as closed cavity bag molding (CCBM), compression molding, vacuum infusion (VIP) and lightweight resin transfer molding (RTM-lite).

Closed Molding Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	SKIN WEIGHT (GSM)	CORE WEIGHT (GSM)	SKIN WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Multimat® Fabric (knitted glass core)	S375G500S375	S375/G500/S375	375	500	375	125	49	66	Mat-G Core-Mat	North America
	S450G500S450	S450/G500/S450	450	500	450	125	49	60	Mat-G Core-Mat	North America
	S600G500S600	S600/G500/S600	600	500	600	125	49	52	Mat-G Core-Mat	North America
	S600G900S600	S600/G500/S600	600	900	600	125	49	44	Mat-G Core-Mat	North America
	S900G900S900	S900/G900/S900	900	900	900	125	49	39	Mat-G Core-Mat	North America
	S300G500S300	S300/G500/S300	300	500	300	125	-	-	Mat-G Core-Mat	Europe

Closed Molding Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	SKIN WEIGHT (GSM)	CORE WEIGHT (GSM)	SKIN WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Multimat® Fabric (knitted glass core) continued	S375G500S375	S375/G500/S375	375	500	375	125	-	-	Mat-G Core-Mat	Europe
	S450G500S450	S450/G500/S450	450	500	450	125	-	-	Mat-G Core-Mat	Europe
	S600G500S600	S600/G500/S600	600	500	600	125	-	-	Mat-G Core-Mat	Europe
	S600G900S600	S600/G900/S600	600	900	600	125	-	-	Mat-G Core-Mat	Europe
	S900G900S900	S900/G900/S900	900	900	900	125	-	-	Mat-G Core-Mat	Europe
Multimat® Lite (knitted glass - PE core)	S300/GPI35/S300	S300/GPI35/S300	300	135	300	125	-	-	Mat-GP Core-Mat	Europe
	S450/GPI35/S450	S450/GPI35/S450	450	135	450	125	-	-	Mat-GP Core-Mat	Europe
	S600/GPI35/S600	S600/GPI35/S600	600	135	600	125	-	-	Mat-GP Core-Mat	Europe
	S450/GPI70/S450	S450/GPI70/S450	450	170	450	125	-	-	Mat-GP Core-Mat	Europe
	S600/GPI70/S600	S600/GPI70/S600	600	170	600	125	-	-	Mat-GP Core-Mat	Europe

*Above products are the most common. Other variations are available upon request.

Closed Molding Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	SKIN WEIGHT (GSM)	CORE WEIGHT (GSM)	SKIN WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Multicore® Fabric (polypropylene core)	S300-V180-S300	S300/PP180/S300	300	180	300	125	49	71	Mat-PP Core-Mat	North America
	S300-V250-S300	S300/PP250/S300	300	250	300	125	49	56	Mat-PP Core-Mat	North America
	S450-V180-S450	S450/PP180/S450	450	180	450	125	49	55	Mat-PP Core-Mat	North America
	S450-V250-S450	S450/PP250/S450	450	250	450	125	49	49	Mat-PP Core-Mat	North America
	S600-V180-S600	S600/PP180/S600	600	180	600	125	49	46	Mat-PP Core-Mat	North America
	S600-V250-S600	S600/PP250/S600	600	250	600	125	49	40	Mat-PP Core-Mat	North America
	S900-V180-S900	S900/PP180/S900	900	180	900	125	49	37	Mat-PP Core-Mat	North America
	S900-V250-S900	S900/PP250/S900	900	250	900	125	49	15	Mat-PP Core-Mat	North America
	S300-V180	S300/PP180	300	-	-	125	49	71	Mat-PP Core	North America

Closed Molding Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	SKIN WEIGHT (GSM)	CORE WEIGHT (GSM)	SKIN WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Multicore® Fabric (polypropylene core) continued	S450-V180	S450/PP180	450	-	-	125	49	42	Mat-PP Core	North America
	S600-V180	S600/PP180	600	-	-	125	49	60	Mat-PP Core	North America
	S900-V180	S900/PP180	900	-	-	125	49	53	Mat-PP Core	North America
	S300/PP180/S300	S300/PP180/S300	300	180	300	125	-	-	Mat-PP Core-Mat	Europe
	S300/PP250/S300	S300/PP250/S300	300	250	300	125	-	-	Mat-PP Core-Mat	Europe
	S450/PP180/S450	S450/PP180/S450	450	180	450	125	-	-	Mat-PP Core-Mat	Europe
	S450/PP250/S450	S450/PP250/S450	450	250	450	125	-	-	Mat-PP Core-Mat	Europe
	S600/PP180/S600	S600/PP180/S600	600	180	600	125	-	-	Mat-PP Core-Mat	Europe
	S600/PP250/S600	S600/PP250/S600	600	250	600	125	-	-	Mat-PP Core-Mat	Europe

*Above products are the most common. Other variations are available upon request.

Closed Molding Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	SKIN WEIGHT (GSM)	CORE WEIGHT (GSM)	SKIN WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Multicore® Fabric (polypropylene core) continued	S900/PP180/S900	S900/PP180/S900	900	180	900	125	-	-	Mat-PP Core-Mat	Europe
	S900/PP250/S900	S900/PP250/S900	900	250	900	125	-	-	Mat-PP Core-Mat	Europe
	PP180/S300	PP180/S300	300	180	-	125	-	-	Mat-PP Core	Europe
	PP180/S450	PP180/S450	450	180	-	125	-	-	Mat-PP Core	Europe
	PP180/S600	PP180/S600	600	180	-	125	-	-	Mat-PP Core	Europe
	PP180/S900	PP180/S900	900	180	-	125	-	-	Mat-PP Core	Europe
Polypropylene Core	MM 200/200/200	-	200	200	200	125	49	68	Mat-PP Core-Mat	South America
	MM 300/200/300	-	300	200	300	125	49	60	Mat-PP Core-Mat	South America
	MM 350/200/250	-	350	200	350	125	49	56	Mat-PP Core-Mat	South America
	MM 350/250/350	-	350	250	350	156	61	56	Mat-PP Core-Mat	South America
	MM 450/200/450	-	450	200	450	156	61	50	Mat-PP Core-Mat	South America
	MM 450/250/450	-	450	250	450	250	98	48	Mat-PP Core-Mat	South America
	MM 600/200/600	-	600	200	600	125	49	40	Mat-PP Core-Mat	South America
	MM 600/250/600	-	600	250	600	250	98	38	Mat-PP Core-Mat	South America

Closed Molding Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	SKIN WEIGHT (GSM)	CORE WEIGHT (GSM)	SKIN WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Chopped Strand Mat Core	MM 900/M821B/100	-	900	450	100	190	75	30	Mat-G Core-Mat	South America
	MM 600/M821B/450	-	600	450	450	200	79	30	Mat-G Core-Mat	South America
	MM 900/M821B/250	-	900	450	250	25	10	30	Mat-G Core-Mat	South America
FlowTex™ Multiaxials with CFM 0/90°	CDF 800.300	LT0800/SUF300	800	300		125	-	-	0/90/CFM	Europe
	CDFM 650.300.250	LT0800/SUF300/S250	800	300	250	125	-	-	0/90/CFM/Mat	Europe
	CDFM 800.300.450	LT0800/SUF300/S450	800	300	450	125	-	-	0/90/CFM/Mat	Europe

Woven Roving Fabric

Woven roving fabric is composed of direct rovings woven into a fabric or tape. It is designed to be compatible with multiple resin systems and can be customized to meet specific product requirements.

Woven Roving Fabric											
PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	WOVEN WEIGHT (OZ/YD2)	WOVEN WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Woven Roving	WR08/3010	WR0270	8.94	270	-	-	97, 127, 152	38, 50, 60	135	5 x 4 (1x1)	North America
	WR10/3011	WR0340	10.01	340	-	-	97, 127, 152	38, 50, 60	150	5 x 2 (hot melt weft)	North America
	WR17/3600	WR580	17.47	580	-	-		87, 97, 110	234	5x4 (2x1)	North America
	WR18/3600	WR610	17.88	610	-	-	97, 127, 152	38, 50, 60	130	5 x 4 (2x1)	North America
	WR18/3010	WR610	19.02	610	-	-	97, 127, 152	38, 50, 60	120	5 x 4 (1x1)	North America
	WR18A/3010	WR610A	19.02	610	-	-	97, 127, 152	38, 50, 60	120	5x4 (1x1 hot melt leno)	North America

Woven Roving Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	WOVEN WEIGHT (OZ/YD ²)	WOVEN WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Woven Roving continued	WR22/3601	WR0750	22.29	750	-	-		97, 100, 110, 131	167	5 x 4 (2x1)	North America
	WR24/3600	WR810	24.71	810	-	-	97, 127, 152	38, 50, 60	100	5 x 4 (2x1)	North America
	WR24/3010	WR0810	24.5	810	-	-	97, 127, 152	38, 50, 60	90	5 X 4 (1x1)	North America
	WR24A/3010	WR0810	24.5	810	-	-	97, 127, 152	38, 50, 60	90	5 x 4 (1 x1 hot-melt leno)	North America
	T111A 600 g/m ²	-	17.70	600	-	-	140	55	50	5 x 3	South America
	T111A 800 g/m ²	-	23.61	800	-	-	140	55	50	5 x 4	South America
	RT300	WR0300	-	300	-	-	125/100	-	-	Woven	Europe
	RT350	WR0350	-	350	-	-	125/100	-	-	Woven	Europe
	RT490	WR0490	-	490	-	-	125/100	-	-	Woven	Europe
	RT500	WR0500	-	500	-	-	125/100	-	-	Woven	Europe
	RT600	WR0600	-	600	-	-	125/92	-	-	Woven	Europe
	RT800	WR0800	-	800	-	-	125/100	-	-	Woven	Europe

*Above products are the most common. Other variations are available upon request.

Woven Roving Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	WOVEN WEIGHT (OZ/YD2)	WOVEN WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Stitchmat	SM1810/3600	WR0610/S300	18	610	1	300	97, 127, 152	38, 50, 60		Woven + Mat	North America
	SM1810/3002	WR0610/S300	18.32	610	1	300	97, 127, 152	38, 50, 60	70	Woven + Mat	North America
	SM1815/3600	WR0610/S450	17.61	610	1.5	450	97, 127, 152	38, 50, 60	60	Woven + Mat	North America
	SM1815/3001	WR0610/S450	18.3	610	1.5	450	97, 127, 152	38, 50, 60	70	Woven + Mat	North America
	SM2415/3600	WR810/S450	24.67	810	1.5	450	97, 127, 152	38, 50, 60	55	Woven + Mat	North America
	SM2415/3000	WR810/S450	24.35	810	1.5	450	97, 127, 152	38, 50, 60	61	Woven + Mat	North America
	SM3615/3600	WR1221/S450	36.42	1221	1.5	450	97, 127, 152	38, 50, 60	50	Woven + Mat	North America

Woven Roving Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	WOVEN WEIGHT (OZ/YD2)	WOVEN WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Hot-Melt Uni	WU13/3001	WRX0440	13.25	440	-	-	97, 127, 152	38, 50, 60	135	Uni (hot-melt weft)	North America
	WU22/3001	WRX0746	21.28	746	-	-	97, 127, 152	38, 50, 60	70	Uni (hot-melt weft)	North America
	WU26/3002	WRX0882	26.59	882	-	-	97, 127, 152	38, 50, 60	50	Uni (hot-melt weft)	North America
FlowRo™ Fabric	FR2420/3001	WR0800/UF600	24.1	800	2	600	127, 152	50, 60	40	Woven + CFM	North America
Biply	BP6030	-	17.70	600	1	300	140	55	30	Woven + Mat	South America
	BP6045	-	17.70	600	1.5	450	140	55	30	Woven + Mat	South America
	BP8030	-	23.61	800	1	300	140	55	30	Woven + Mat	South America
	BP8045	-	23.61	800	1.5	450	140	55	30	Woven + Mat	South America

*Above products are the most common. Other variations are available upon request.

Woven Roving Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	WOVEN WEIGHT (OZ/YD2)	WOVEN WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Complexes	RT300/S300	WR0300/S300	300	300	-	-	125	-	-	Woven + Mat	Europe
	RT500/S300	WR0500/S300	500	300	-	-	125	-	-	Woven + Mat	Europe
	RT500/S450	WR0500/S450	500	450	-	-	125	-	-	Woven + Mat	Europe
	RTK500/S450	WRt0500-1/3/S450	500	450	-	-	125	-	-	Woven + Mat	Europe
	RT600/S300	WR0600/S300	600	300	-	-	125	-	-	Woven + Mat	Europe
	RT800/S300	WR0800/S300	800	300	-	-	125	-	-	Woven + Mat	Europe
	RE1500/S300	WRt1500-1/3/S300	1500	300	-	-	125	-	-	Woven + Mat	Europe

*Above products are the most common. Other variations are available upon request.

Knitted Fabric

Knitted fabric includes:

- Multiaxial, woven and unidirectional carbon and aramid fibers with a dedicated aerospace-approved manufacturing facility
- Multiaxials, knits and combinations made with two or more layers of unidirectional fibers stitched together with a light polyester thread; also available are multiaxials that are powder-bonded instead of stitched.

Knitted Fabric											
PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD2)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
0°/90° Biaxial	C1800/1001	LT0610	18.45	610	-	-	127	50	125	0°/90° Knit (MC input)	North America
	C2400/1001	LT0810	26.65	810	-	-	97, 127, 152	38, 50, 60	100	0°/90° Knit (MC input)	North America
	C1000	-	29.49	975	-	-	127	50	89	UD	South America
	C950	-	28.73	950	-	-	127	50	89	UD	South America
	C930	-	28.13	930	-	-	127	50	95	UD	South America

*Above products are the most common. Other variations are available upon request.

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD2)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
0°/90° Biaxial with Mat	CM1510/1002	LT0510/S300	16.44	510	1	300	127	50	90	0°/90° + Mat Knit (MC input)	North America
	CM1808/3001	LT0610/S270	18.45	610	0.75	270	127	50	80	0°/90° + Mat Knit (MC input)	North America
	CM1815/1001	LT0610/S450	18.45	610	1.5	450	127	50	60	0°/90° + Mat Knit (MC input)	North America
	CM2408/1005	LT0810/S270	24.65	810	0.75	270	97, 127, 152	38, 50, 60	65	0°/90° + Mat Knit (MC input)	North America
	CM2415/1005	LT0810/S450	24.65	810	1.5	450	97, 127, 152	38, 50, 60	55	0°/90° + Mat Knit (MC input)	North America
	CM3205/1001	LT1090/S150	35.50	1090	0.5	150	97, 127, 152	38, 50, 60	65	0°/90° + Mat Knit (MC input)	North America
	CM3208/1005	LT1090/S270	34.73	1090	0.75	270	97, 127, 152	38, 50, 60	60	0°/90° + Mat Knit (MC input)	North America

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD ²)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
0°/90° Biaxial with Mat continued	CM3215/1001	LT1090/S450	34.73	1090	1.5	450	97, 127, 152	38, 50, 60	45	0°/90° + Mat Knit (MC input)	North America
	CM3220/1001	LT1090/S600	34.73	1090	2	600	97, 127, 152	38, 50, 60	45	0°/90° + Mat Knit (MC input)	North America
	CM3610/1007	LT1220/S300	36.82	1220	1	300	97, 127, 152	38, 50, 60	70	0°/90° + Mat Knit (MC input)	North America
	CM4410/1003	LT1490/S300	41.47	1490	1	300	127	50	45	0°/90° + Mat Knit (MC input)	North America
	ELTM 300/300	LT0300/S300	300	300	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 600/225	LT0600/S225	600	225	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe

*Above products are the most common. Other variations are available upon request.

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD2)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
0°/90° Biaxial with Mat continued	ELTM 600/300	LT0600/S300	600	300	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 600/450	LT0600/S450	600	450	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 800/250	LT0800/S250	800	250	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 850/150	LT0850/S150	850	150	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 850/200	LT0850/S200	850	150	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 850/300	LT0850/S300	850	300	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD2)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
0°/90° Biaxial with Mat <i>continued</i>	ELTM 850/450	LT0850/S450	850	450	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
	ELTM 1700/150	LT1700/S150	1700	150	-	-	125	-	-	0°/90° + Mat Knit (MC input)	Europe
+/-45° Double Bias	X1300/1002	BX0440	13.34	440	-	-	127	50	164	+/-45° Knit (MC input)	North America
	X1800/1001	BX0610	18.42	610	-	-	127	50	190	+/-45° Knit (MC input)	North America
	X2400/1002	BX0810	24.62	810	-	-	127	50	100	+/-45° Knit (MC input)	North America
	DB800	-	24.12	800	-	-	254	100	45	+/-45° Knit	South America
	DB830	-	25.10	830	-	-	127	50	89	+/-45° Knit	South America
	DB1000	-	30.24	1000	-	-	127	50	89	+/-45° Knit	South America

*Above products are the most common. Other variations are available upon request.

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD2)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
+/-45° Double Bias continued	DB450	BX0450	-	450	-	-	127 / 125	-	-	+/-45° Knit (MC input)	Europe
	DB600	BX0600	-	600	-	-	127 / 125	-	-	+/-45° Knit (MC input)	Europe
	DB800	BX0800	-	800	-	-	127 / 125	-	-	+/-45° Knit (MC input)	Europe
+/-45° Double Bias+Mat	XM1308/1001	BX0440/S270	13.34	440	0.75	270	127	50	105	+/-45° + Mat Knit (MC input)	North America
	XM1808/1002	BX0610/S270	18.42	610	0.75	270	127	50	90	+/-45° + Mat Knit (MC input)	North America
	XM2408/1002	BX0810/S270	24.62	810	0.75	270	127	50	75	+/-45° + Mat Knit (MC input)	North America
	XM2415/1002	BX0810/S450	24.62	810	1.5	450	127	50	65	+/-45° + Mat Knit (MC input)	North America

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD2)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
+/-45° Double Bias+Mat continued	XM3208/1001	BX1085/S270	31.42	1085	0.75	270	127	50	60	+/-45° + Mat Knit (MC input)	North America
	DBM8030	-	33.27	1100	-	-	254	100	45	+/-45° + Mat Knit	South America
	DB600/225	BX0600/S225	-	440	-	225	127 / 125	-	-	+/-45° + Mat Knit (MC input)	Europe
	DBM 800.100	BX0800/S100	-	610	-	270	127 / 125	-	-	+/-45° + Mat Knit (MC input)	Europe
Triaxial	CDB800	LTX0800	-	800	-	-	127 / 125	-	-	+/-45°/0°	Europe
	CDB800	-	24.12	800	-	-	127	50	89	0° +/- 45 Knit	South America
	CDB1215	-	36.90	1220	-	-	127	50	82	0° +/- 45 Knit	South America
	DDBI170	-	35.39	1170	-	-	62.5	24.6	52	90° +/- 45 Knit	South America

*Above products are the most common. Other variations are available upon request.

Knitted Fabric

PRODUCT NAME	LOCAL PRODUCT CODE	GLOBAL PRODUCT CODE	FABRIC WEIGHT (OZ/YD ²)	FABRIC WEIGHT (GSM)	MAT WEIGHT (OZ/FT ²)	MAT WEIGHT (GSM)	STANDARD WIDTHS (CM)	STANDARD WIDTHS (INCHES)	ROLL LENGTH (YARDS)	CONSTRUCTION	AVAILABILITY
Quadriaxial	CDDBM 800.100 127 cm	QX0800/S100		800		100	127 / 125			+/-45°/90° Mat Knit (MC input)	Europe
	CDDBI150	QXI150		1150		-	127 / 125			+/-45°/90°	Europe

*Above products are the most common. Other variations are available upon request.

Milled Fiber

OCV™ milled fiber are Advantex® glass filaments that have been hammered into specified bulk densities to form powders or floccular masses with specific chemical sizings to maximize end-use performance.

Milled Fiber						
SIZING	SCREEN SIZE (INCH)	SCREEN SIZE (MM)	BULK DENSITY	PRODUCT APPEARANCE	PRODUCT BENEFITS & USE	AVAILABILITY
731	1/32		0.65	Powdery	Putties, coatings, adhesives	Americas
	1/16		0.3	Floccular		
	1/8		0.17	Floccular		
737	1/64		1.05	Powdery	Putties, potting compounds, coatings, thermoplastics	Americas
	1/32		0.6	Floccular		
	1/16		0.45	Floccular		
739	1/32		1	Powdery	PTFE, coatings	Americas
	1/16		0.5	Floccular	Compounds	
VS1304	Cyclone particle separator is used (a 0.80 mm sieve is applied to block contaminates)		1.2	Powdery	Thermoplastic and thermoset (polyester, epoxy, phenolic) compounds, painting applications	Europe

Milled Fiber

SIZING	SCREEN SIZE (INCH)	SCREEN SIZE (MM)	BULK DENSITY	PRODUCT APPEARANCE	PRODUCT BENEFITS & USE	AVAILABILITY
VSI320K	(About 1/6)	0.4	0.65	Floccular	Thermoplastic and thermoset (polyester, epoxy, phenolic) compounds, reinforcing repair putties	Europe
REV1	(About 1/17)	0.15	1.05	Powdery	PTFE, high temperature applications, filler for paints, filler for resins	Global
REV4	(About 1/10)	0.25	0.96	Powdery	PTFE, high temperature applications, filler for paints, filler for resins	Asia Pacific
REV7	(About 1/10)	0.25	0.96	Powdery	Filler for paints	Asia Pacific
REV8	(About 1/5)	0.5	0.96	Powdery	Thermoplastic compounds	Asia Pacific

Non-Wovens

OCV™ veils and specialty non-wovens are made from randomly dispersed glass fibers, wet or dry laid and bonded into a thin sheet. They are used in multiple applications in several industries such as flooring, wallboard and battery separators.

Non-Wovens												
SIZING	AVAILABILITY			THICKNESS (MILS)	THICKNESS (MM)	BASIC WEIGHT (G/M ²)	STYRENE SOLUBILITY	STANDARD WIDTHS (INCHES)	STANDARD WIDTHS (CM)	ROLL LENGTH (FEET)	ROLL LENGTH (M)	APPLICATION
	AMERICAS	EUROPE	ASIA PACIFIC									
M524 - C33	x	x	x	12	0.33	33	Insoluble		50 - 200		250-900	Surfacing GRP laminates; suitable for filament winding of GRP & GRE pipe
M524 - C50	x	x	x		0.55	50	Slightly soluble		50 - 200		250-900	
M524 - C64	x	x	x	11	0.29	30	Soluble		50 - 200		250-900	
M524 - ECR20A	x	x	x		0.23	20	Slightly soluble		3.5- 210		500-3000	
M524 - ECR25A	x	x	x	10	0.27	25	Slightly soluble		3.5- 210		500-3000	
M524 - ECR30A	x	x	x		0.3	30	Slightly soluble		3.5- 210		500-3000	
M524 - ECR30S	x	x	x	19	0.33	30	Soluble		3.5- 210		500-3000	
M524 - ECR50A/3	x	x	x		0.43	50	Slightly soluble		3.5- 210		500-3000	

Non-Wovens

SIZING	AVAILABILITY			THICKNESS (MILS)	THICKNESS (MM)	BASIC WEIGHT (G/M ²)	STYRENE SOLUBILITY	STANDARD WIDTHS (INCHES)	STANDARD WIDTHS (CM)	ROLL LENGTH (FEET)	ROLL LENGTH (M)	APPLICATION
	AMERICAS	EUROPE	ASIA PACIFIC									
M524 - ECR70A/3	x	x	x	27	0.55	70	Slightly soluble		3.5- 210		500-3000	Surfacing GRP laminates; suitable for filament winding of GRP & GRE pipe
VL8101 (different grade available)		x			min 1.00	115-300	Insoluble		3.5 - 210		500-3000	
S20-FA16	x	x	x		0.26	21	Insoluble		up to 3.2 m		up to 1.2 m diameter	Flat panels surfacing veils for continuous lamination processes
W25-FA17	x	x	x		0.32	25	Insoluble		up to 4.2 m		up to 1.2 m diameter	

Non-Wovens

SIZING	AVAILABILITY			THICKNESS (MILS)	THICKNESS (MM)	BASIC WEIGHT (G/M ²)	STYRENE SOLUBILITY	STANDARD WIDTHS (INCHES)	STANDARD WIDTHS (CM)	ROLL LENGTH (FEET)	ROLL LENGTH (M)	APPLICATION
	AMERICAS	EUROPE	ASIA PACIFIC									
W35-FA8	x	x	x		0.42	35	Insoluble		up to 4.2 m		up to 1.2 m diameter	Flat panels surfacing veils for continuous lamination processes
VL3110	x			30-40		103		47.5-51			2600	Gypsum
VL3600	x			40-50		327		22-28			2600	
VL3570	x			25-35		224		31.5-51			2600	
VL3576	x			25-35		220		47.5-51			2600	
VL3580	x			30-40		327		47.5-51			2600	
VL3590	x			35-45		293		47.5-51			2600	
VL3591	x			35-45		293		47.5-51			2600	
VL3589	x			30-40		239		47.5-51			2600	
GC302	x			30-40		327		47.5-51			2600	
P300C-HA12		x			n/a	315	No		up to 3.2 m		up to 1.53 m diameter	

Non-Wovens

SIZING	AVAILABILITY			THICKNESS (MILS)	THICKNESS (MM)	BASIC WEIGHT (G/M ²)	STYRENE SOLUBILITY	STANDARD WIDTHS (INCHES)	STANDARD WIDTHS (CM)	ROLL LENGTH (FEET)	ROLL LENGTH (M)	APPLICATION
	AMERICAS	EUROPE	ASIA PACIFIC									
P300C-HA15		x			n/a	315	no		up to 3.2 m		up to 1.2 m diameter	Gypsum
P200-AT01		x	x		n/a	200						
P80-AT20		x	x		n/a	80						
P300 C-AT40		x	x		n/a	300						
C1035 KA06 or CoreTex™ reinforcement		x			1.1	54	-		up to 3.2 m		up to 1.2 m diameter	GRP core materials
C3050 KA18 or CoreTex™ reinforcement		x			3.2	260	-		up to 3.2 m		up to 1.2 m diameter	
TruPave® road paving mat	x		x	0.33	0.83	136.59	-	50-149	127-378	360	109	Road paving

High-Performance Reinforcements

OCV™ high-performance reinforcements are a product platform featuring ShieldStrand®, XStrand®, FliteStrand® and WindStrand® high-strength and modulus reinforcement products developed for defense and survivability, industrial, aerospace and wind energy markets.

High-Performance Reinforcements

PRODUCT NAME	SIZING	TEX RANGE	RESIN COMPATIBILITY				PROCESS					APPLICATION	PRODUCT CHARACTERISTICS & BENEFITS
			UP	VE	EP	PN	FILAMENT WINDING	PULTRUSION	WEAVING	INFUSION	PREPREGS		
WindStrand® H roving	EPW 17	300 up to 2400			x				x	x		Wind Energy	Compared to standard E-glass: - Up to 15% higher strength - Up to 15% increased stiffness - Up to 20% weight savings - Significant corrosion and fatigue resistance

High-Performance Reinforcements

PRODUCT NAME	SIZING	TEX RANGE	RESIN COMPATIBILITY				PROCESS					APPLICATION	PRODUCT CHARACTERISTICS & BENEFITS
			UP	VE	EP	PN	FILAMENT WINDING	PULTRUSION	WEAVING	INFUSION	PREPREGS		
XStrand® H roving	EPX13	1100 up to 2000			x		x					Industrial	Compared to standard E-glass: - Up to 15% higher strength - Up to 15% increased stiffness - Up to 20% weight savings - Significant corrosion and fatigue resistance
	EPX15	600 up to 2400			x	x	x		x				
	EPX17	300 up to 2400			x		x		x				
	MCX21	600 up to 4800	x	x	x		x	x			x		
	MCX23	4800 up to 9600	x	x	x			x					
	MCX24	1100 up to 4800	x	x	x			x					
	MCX26	300 up to 2400	x	x	x		x	x	x	x			

High-Performance Reinforcements

PRODUCT NAME	SIZING	TEX RANGE	RESIN COMPATIBILITY				PROCESS					APPLICATION	PRODUCT CHARACTERISTICS & BENEFITS
			UP	VE	EP	PN	FILAMENT WINDING	PULTRUSION	WEAVING	INFUSION	PREPREGS		
XStrand® R roving	EPX10	300 up to 2400			x		x		x			Industrial	Compared to standard E-glass: - Up to 35% higher strength - Up to 15% increased stiffness - Up to 70% increased toughness - Significantly better thermal and corrosion resistance properties
	MCX21	300 up to 2400		x	x		x	x		x			
XStrand® S roving	EPX-S 10	300 up to 2400			x		x		x		x	Industrial	Compared to standard E-glass: - Up to 50% higher strength - Up to 20% increased stiffness - Up to 80% increased toughness - Outstanding fatigue and impact performance, superior mechanical properties, higher thermal performance and excellent corrosion resistance
	EPX-S 15	360 up to 2400			x		x		x		x		
	MCX-S 21	300 up to 2400		x	x		x	x		x	x		

High-Performance Reinforcements

PRODUCT NAME	SIZING	TEX RANGE	RESIN COMPATIBILITY				PROCESS					APPLICATION	PRODUCT CHARACTERISTICS & BENEFITS
			UP	VE	EP	PN	FILAMENT WINDING	PULTRUSION	WEAVING	INFUSION	PREPREGS		
FliteStrand® S roving	EPF11	337 up to 675			x		x			x	x	Aerospace	Compared to standard E-glass: - Up to 35% weight saving Compared to metal and CFRP: - Excellent impact resistance
	MCF14	337 up to 675		x	x					x	x		
ShieldStrand® R roving	EPS10	600			x					x	x	Ballistics/armor	- Up to 48% weight saving compared to steel - Up to 37% weight saving compared to aluminum - Higher structural performance than aramid, polyethylene and polypropylene fibers - Meets all fire, smoke and toxicity (FST) requirements for military vehicles
	EPS11	600				x				x	x		

High-Performance Reinforcements

PRODUCT NAME	SIZING	TEX RANGE	RESIN COMPATIBILITY				PROCESS					APPLICATION	PRODUCT CHARACTERISTICS & BENEFITS	
			UP	VE	EP	PN	FILAMENT WINDING	PULTRUSION	WEAVING	INFUSION	PREPREGS			
ShieldStrand® S roving	EPS-S11	360				x					x	x	Ballistics/armor	<ul style="list-style-type: none"> - Up to 50% weight saving compared to steel - Up to 40% weight saving compared to aluminum - Higher structural performance than aramid, polyethylene and polypropylene fibers - Meets all fire, smoke and toxicity (FST) requirements for military vehicles

PRODUCT NAME	SIZING	RESIN COMPATIBILITY	WARP WEIGHT (OZ/SQ-YD)	WEFT WEIGHT (OZ/SQ-YD)	THICKNESS (IN)	APPLICATION	PRODUCT CHARACTERISTICS & BENEFITS
ShieldStrand® R fabric	WSS24/3000	Epoxy & Multi-compatible	11.63	12.90	0.03	Ballistics/armor	Provide a unique blend of lightweight, high-strength performance for numerous processes including compression molding, pultrusion, continuous lamination and infusion of complex shapes
ShieldStrand® S fabric	WSSS24/3000						

Twintex® Reinforcements

Twintex® reinforcements are co-mingled thermoplastic and glass fibers that provide high glass content, and excellent stiffness-to-weight ratio and impact resistance. The proprietary product also helps meet environmental regulations and is recyclable.

Twintex® Reinforcements						
PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	GLASS CONTENT (% BY WEIGHT)	TP RESIN	NOMINAL WEIGHT	NOMINAL WEIGHT
Twintex® Roving	TW TR PP 60 BLACK 1870	TW TR PP 60 BLACK 1870	60%	PP	1870 Tex	265,26 y.p.p
	TW TR PP 60 NATURAL 1870	TW TR PP 60 NATURAL 1870	60%	PP	1870 Tex	265,26 y.p.p
	TW TR PP 82 NATURAL 1398	TW TR PP 82 NATURAL 1398	82%	PP	1398 Tex	354,83 y.p.p
	TW TR PET 70 NATURAL 1345	TW TR PET 70 NATURAL 1345	70%	PET	1345 Tex	368,81 y.p.p

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	DIMENSIONS ¹	DIMENSIONS ²	COLOR	FEATURES	PROCESS
Twintex® Roving	TW TR PP 60 BLACK 1870	TW TR PP 60 BLACK 1870	N/R	N/R	Salt & Pepper	Direct roving	Pultrusion, pull extrusion, filament winding, weaving, hybrid thermoplastic (except TW, TR and PET)
	TW TR PP 60 NATURAL 1870	TW TR PP 60 NATURAL 1870	N/R	N/R	Natural	Direct roving	
	TW TR PP 82 NATURAL 1398	TW TR PP 82 NATURAL 1398	N/R	N/R	Natural	Direct roving	
	TW TR PET 70 NATURAL 1345	TW TR PET 70 NATURAL 1345	N/R	N/R	Natural	Direct roving	

Twintex® Reinforcements

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	GLASS CONTENT (% BY WEIGHT)	TP RESIN	NOMINAL WEIGHT	NOMINAL WEIGHT
Twintex® Fabrics	TW TF PP 60 745 Black Twill	WRt0750-PP60B	60%	PP	745 g/m ²	22 Oz/Yd ²
	TW TF PP 60 745 Natural Twill	WRt0750-PP60W	60%	PP	745 g/m ²	22 Oz/Yd ²
	TW TF PP 60 1485 Black Twill	WRt1490-PP60B	60%	PP	1485 g/m ²	44 Oz/Yd ²
	TW TF PP 60 1485 Natural Twill	WRt1490-PP60W	60%	PP	1485 g/m ²	44 Oz/Yd ²
	TW TF PP 60 980 Black Twill	WRt0980-PP60B	60%	PP	980 g/m ²	29 Oz/Yd ²
	TW TF PP 60 980 Natural Twill	WRt0980-PP60W	60%	PP	980 g/m ²	29 Oz/Yd ²
	TW TF PP 60 935 Black Plain 4/1	WRx0940-PP60B	60%	PP	935 g/m ²	27,50z/Yd ²
	TW NCF LT PP 60 1050 Black	LTx1050-PP60B	60%	PP	1050 g/m ²	31 Oz/Yd ²

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	DIMENSIONS ¹	DIMENSIONS ²	COLOR	FEATURES	PROCESS
Twintex® Fabrics	TW TF PP 60 745 Black Twill	WRt0750-PP60B	150 or 300	4.9 or 9.8	Salt & Pepper	Twill pattern	Lamination, vacuum bag molding
	TW TF PP 60 745 Natural Twill	WRt0750-PP60W	150 or 300	4.9 or 9.8	Natural	Twill pattern	
	TW TF PP 60 1485 Black Twill	WRt1490-PP60B	100 or 150 or 300	3.3 or 4.9 or 9.8	Salt & Pepper	Twill pattern	
	TW TF PP 60 1485 Natural Twill	WRt1490-PP60W	150 or 300	4.9 or 9.8	Natural	Twill pattern	
	TW TF PP 60 980 Black Twill	WRt0980-PP60B	150 or 300	4.9 or 9.8	Salt & Pepper	Twill pattern	
	TW TF PP 60 980 Natural Twill	WRt0980-PP60W	150 or 300	4.9 or 9.8	Natural	Twill pattern	
	TW TF PP 60 935 Black Plain 4/1	WRx0940-PP60B	100	3.3	Salt & Pepper	Plain pattern 80-20	
	TW NCF LT PP 60 1050 Black	LTx1050-PP60B	122	4.0	Salt & Pepper	Multiaxial 80-20	

1. Fabrics: Width [cm] Plates: Length* Width [cm x cm] Pellets: Length [mm]

2. Fabrics: Width [ft] Plates: Length* Width [ft x ft] Pellets: Length [in]

*Above products are the most common. Other variations are available upon request.

Twintex® Reinforcements

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	GLASS CONTENT (% BY WEIGHT)	TP RESIN	NOMINAL WEIGHT	NOMINAL WEIGHT
Twintex® Plates	TW TF PP 60 745 Black Twill	P-WRt0750-PP60B	60%	PP	745 g/m ²	22 Oz/Yd ²
	TW TF PP 60 745 Natural Twill	P-WRt0750-PP60W	60%	PP	745 g/m ²	22 Oz/Yd ²
	TW TF PP 60 1485 Black Twill	P-WRt1490-PP60B	60%	PP	1485 g/m ²	44 Oz/Yd ²
	TW TF PP 60 1485 Natural Twill	P-WRt1490-PP60W	60%	PP	1485 g/m ²	44 Oz/Yd ²
	TW TF PP 60 935 Black Plain 4/1	P-WRx0940-PP60B	60%	PP	935 g/m ²	27,5 Oz/Yd ²
	TW TF PP 60 1870 Black Plain 4/1	P-WRx01870-PP60B	60%	PP	1870 g/m ²	55 Oz/Yd ²
	TW TS PP60 888 AF200	P-WRt0890-PP60W	60%	PP	888 g/m ²	26,2 Oz/Yd ²
	TW TS PP60 1636 AF250	P-WRt1640-PP60W	60%	PP	1636 g/m ²	48,3 Oz/Yd ²

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	DIMENSIONS	DIMENSIONS	COLOR	FEATURES	PROCESS
Twintex® Plates	TW TF PP 60 745 Black Twill	P-WRt0750-PP60B	200*150	6.6*4.9	Salt & Pepper	Twill pattern	Lamination, thermocompression, hybrid thermoplastic
	TW TF PP 60 745 Natural Twill	P-WRt0750-PP60W	200*150	6.6*4.9	Natural	Twill pattern	
	TW TF PP 60 1485 Black Twill	P-WRt1490-PP60B	200*150	6.6*4.9	Salt & Pepper	Twill pattern	
	TW TF PP 60 1485 Natural Twill	P-WRt1490-PP60W	200*150	6.6*4.9	Natural	Twill pattern	
	TW TF PP 60 935 Black Plain 4/1	P-WRx0940-PP60B	200*150	6.6*4.9	Salt & Pepper	Plain pattern 80-20	
	TW TF PP 60 1870 Black Plain 4/1	P-WRx01870-PP60B	200*150	6.6*4.9	Salt & Pepper	Plain pattern 80-20	
	TW TS PP60 888 AF200	P-WRt0890-PP60W	300*150	9.8*4.9	White Top Layer Film	Twill pattern	
	TW TS PP60 1636 AF250	P-WRt1640-PP60W	300*150	9.8*4.9	White Top Layer Film	Twill pattern	

*Above products are the most common. Other variations are available upon request.

Twintex® Reinforcements

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	GLASS CONTENT (% BY WEIGHT)	TP RESIN	NOMINAL WEIGHT	NOMINAL WEIGHT
Twintex® Pellets	TW TP PP 75 TP200 13	TW TP PP 75 TP200 13	75%	PP	N/R	N/R
	TW TP PP 75 TP200 25	TW TP PP 75 TP200 25	75%	PP	N/R	N/R
	TW TP PP 75 TP301 13	TW TP PP 75 TP301 13	75%	PP	N/R	N/R
	TW TP PP 75 TP301 25	TW TP PP 75 TP301 25	75%	PP	N/R	N/R
	TW TP PP 75 TP303 13	TW TP PP 75 TP303 13	75%	PP	N/R	N/R

PRODUCT TYPE	GLOBAL PRODUCT NAME	LOCAL PRODUCT NAME	DIMENSIONS	DIMENSIONS	COLOR	FEATURES	PROCESS
Twintex® Pellets	TW TP PP 75 TP200 13	TW TP PP 75 TP200 13	13	0.5	Black	no LTHA	Injection molding, extrusion, compression molding, hybrid thermoplastic
	TW TP PP 75 TP200 25	TW TP PP 75 TP200 25	25	1	Black	no LTHA	
	TW TP PP 75 TP301 13	TW TP PP 75 TP301 13	13	0.5	Black	LTHA 1000h 150°C (302°F)	
	TW TP PP 75 TP301 25	TW TP PP 75 TP301 25	25	1	Black	LTHA 1000h 150°C (302°F)	
	TW TP PP 75 TP303 13	TW TP PP 75 TP303 13	13	0.5	Black	LTHA 500h 150°C (302°F)	

Cem-FIL® Alkali-Resistant Glass Fiber

Cem-FIL® alkali-resistant (AR) glass fibers have created some of the world's most stunning architecture while offering strong and durable performance in widely varying cement and mortar-based applications including floorings, renders, top screeds, tunnels and utility poles.

Cem-FIL® Alkali-Resistant Glass Fiber

PRODUCT REFERENCE	FORMAT	FILAMENT DIAMETER (μM)	ASPECT RATIO (L/D)	TEX	AVAILABLE LENGTHS (MM)	APPLICATION	PRODUCT BENEFITS / APPLICATION
Anti-Crak® W70	Monofilament	14	-	-	6, 12	Ready mix & precasted concrete	Avoids plastic shrinkage cracking
Anti-Crak® HD	Monofilament	14	-	-	6, 12, 18		Avoids plastic shrinkage cracking
Anti-Crak® HP 74/12	Filaments bundle	14	74/12	-	12		Crack prevention and containment / shrinkage and temperature cracking (secondary reinforcement)
Anti-Crak® HP 110/18	Filaments bundle	14	110/18	-	18		Crack prevention and containment / shrinkage and temperature cracking (secondary reinforcement)
Anti-Crak® HP 74/18	Filaments bundle	18	74/18	-	18		Crack prevention and containment / shrinkage and temperature cracking (secondary reinforcement)

Cem-FIL® Alkali-Resistant Glass Fiber

PRODUCT REFERENCE	FORMAT	FILAMENT DIAMETER (μM)	ASPECT RATIO (L/D)	TEX	AVAILABLE LENGTHS (MM)	APPLICATION	PRODUCT BENEFITS / APPLICATION
Anti-Crak® HP 67/36	Filaments bundle	20	67/36	-	36	Ready mix & precasted concrete	Welded wire mesh replacement / low ductility crack control (primary reinforcement in some cases)
Anti-Crak® HP Roving	Assembled roving	14	-	82(2500)	-		Crack prevention and containment / shrinkage and temperature cracking (secondary reinforcement)
Cem-FIL® 70	Monofilament	20	-	-	3, 6, 9, 12	Dry mix	Prevention of plastic shrinkage cracking
Anti-Crak® HD	Monofilament	14	-	-	3, 6, 12,		Prevention of plastic shrinkage cracking
Cem-FIL® 62	Filaments bundle	14	-	45, 82	6, 12		Crack prevention and containment (shrinkage and temperature cracking), impact resistance and flexural strength increase
Anti-Crak® HP 74/12	Filaments bundle	14	74/12	-	12		Crack prevention and containment (shrinkage and temperature cracking), impact resistance improvement
Cem-FIL® 60 45Tex	Filaments bundle	14	-	45	6, 12	GRC	High workability and good flexural strength for premix and sprayed premix GRC

Cem-FIL® Alkali-Resistant Glass Fiber

PRODUCT REFERENCE	FORMAT	FILAMENT DIAMETER (μM)	ASPECT RATIO (L/D)	TEX	AVAILABLE LENGTHS (MM)	APPLICATION	PRODUCT BENEFITS / APPLICATION
Cem-FIL® 60 82Tex	Filaments bundle	14	-	82	6, 12, 18	GRC	High workability and good flexural strength for premix and sprayed premix GRC
Cem-FIL® 60 135Tex	Filaments bundle	14	-	135	6, 9, 12, 18		High workability and good flexural strength for premix and sprayed premix GRC
Cem-FIL® 62 45Tex	Filaments bundle	14	-	45	6, 12, 18		Good workability and excellent flexural strength for premix GRC
Cem-FIL® 62 82Tex	Filaments bundle	14	-	82	6, 12, 18, 36		Good workability and excellent flexural strength for premix GRC
Cem-FIL® 61 82Tex	Assembled roving	14	-	82 (2500)	-		Good workability for premix GRC, excellent chopability for spray GRC, excellent flexural strength
Cem-FIL® 54 38Tex	Assembled roving	14	-	38 (2450)	-		Good chopability and flexural strength for spray and industrial GRC
Cem-FIL® 54 76Tex	Assembled roving	14	-	76 (2450)	-		Good chopability and excellent flexural strength for spray GRC
Cem-MAT® M601	Chopped strands mat	14	-	120g/m2	-		Excellent impregnation with hydraulic mortars in industrial GRC

Cem-FIL® Alkali-Resistant Glass Fiber

PRODUCT REFERENCE	FORMAT	FILAMENT DIAMETER (μM)	ASPECT RATIO (L/D)	TEX	AVAILABLE LENGTHS (MM)	APPLICATION	PRODUCT BENEFITS / APPLICATION
Cem-FIL® 5325 320Tex	Direct roving	14	-	320	-	GRC and woven mesh	Good unwinding and high mechanical strength for weaving and filament winding
Cem-FIL® 5325 640Tex	Direct roving	14	-	640	-		Good unwinding and high mechanical strength for weaving & filament winding
Cem-FIL® 5325 1200Tex	Direct roving	19	-	1200	-		Good unwinding and high mechanical strength for weaving & filament winding
Cem-FIL® 5325 2400Tex	Direct roving	27	-	2400	-		Good unwinding and high mechanical strength for weaving & filament winding
ARcoteX® 5326 1200Tex	Direct roving	19	-	1200	-	FRP	Good unwinding and high mechanical strength for weaving, filament winding & pultrusion; good impregnation with UP, VE resins, especially indicated in highly corrosive environments
ARcoteX® 5326 2400Tex	Direct roving	27	-	2400	-		Good unwinding and high mechanical strength for weaving, filament winding & pultrusion; good impregnation with UP, VE resins, especially indicated in highly corrosive environments
ARcoteX® CSM M201	Chopped strand mat	14	-	300, 450, 600 g/m ²	-		Good impregnation with UP, VE resins; especially indicated in highly corrosive environments

Following are definitions of some uncommon terms used in this Guide:

Advantex® glass: A patented boron-free glass formulation with excellent corrosion resistance in a wide range of environments; it is both an E-CR glass and an E-glass as defined by ASTM D578.

Bare glass: Glass fiber from the bushing before binder or sizing is applied.

Basis weight: Nominal weight of mat for a certain area, ex. 1.5 oz/ft².

Beaming: The operation of winding yarns onto a beam, usually in preparation for slashing, weaving or warp knitting. Also called warping.

Biaxial material: Material having fibers oriented in both the warp (0 degree) and weft (90 degree) direction.

Binder: The agent applied to glass roving, glass mat or preforms to bind the fibers prior to laminating or molding.

Bundle: A general term for a collection of essentially parallel filaments or fibers.

Bundle TEX: A measure of the size of the glass bundles in the mat.

Burst strength: The ability of a material to resist rupture by pressure.

Cem-FIL® reinforcements: Alkali-resistant (AR) glass fiber reinforcements for concrete.

Chop length: The length to which the glass fibers have been cut.

Composite: A combination of two or more materials (reinforcing elements, filler, and resin). The constituents retain their identities though they act in concert.

Count: Determined by the number of warp and weft (fill) yarns per cm/ inch of fabrics. Indicates tightness of weave.

Creel: A device for holding the required number of roving balls or mat plies in the desired position before they are fed into the resin bath.

Crimp: The amount of extra yarn required to allow for warp and weft (fill) to make a meter (yard) of fabric. Often expressed as a percent.

Cure: To irreversibly change the properties of a thermosetting resin by chemical reaction.

Dry strength: Strength of the mat as received, an indication of it's handling properties prior to addition of resin.

E-glass: A family of glasses composed primarily of the oxides of calcium, aluminum and silicon that have chemical compositions as listed in ASTM D578-05 for glasses that are used as reinforcements in general applications.

Fabric, non-woven: A textile structure produced by bonding or interlocking fibers by mechanical, chemical or solvent means.

Fabric, woven: Material constructed of interlaced yarns, fibers or filaments.

Fiber: A general term used to refer to filamentary materials; it is the general term for a filament of finite length.

Filament: The smallest unit of fibrous material. Yarn that consists of one strand is called monofilament. Most textile filament yarns are multifilament, meaning there are many continuous filaments or strands.

Fill: See Weft.

Finish: In composite applications, a finish or sizing promotes adhesion between fiber glass and a matrix resin or coating. Sizing compounds are applied to yarn to bind the fiber together and stiffen the yarn to provide abrasion resistance.

FiteStrand® reinforcements: High-performance reinforcements for aerospace applications.

Knitted fabrics: Produced by interlooping strands of yarn, roving, etc.

Laminate: Material composed of successive layers of resin and reinforcement bonded together.

Loss on ignition (LOI): Weight loss, usually expressed as percent of total, after burring off an organic sizing from glass fibers, or an organic resin from a glass fiber laminate.

Mat: A fibrous material for reinforced plastic consisting of randomly oriented chopped filaments, or swirled continuous filaments, loosely held together with a binder; available in various widths, weight, and lengths.

Modulus: The measurement of stiffness in a material, equaling the ratio of applied load (stress) to the resultant deformation of the material. A high modulus indicates a stiff material.

Ply: The number of single yarns twisted together to form a plied yarn, or the number of plied yarns twisted together to form a cord.

Polyester resin: The term generally used for unsaturated polyesters, formed by the reaction of dibasic organic acids and polyhydric alcohol.

Polymer: An organic compound, natural or synthetic, whose structure can be represented by a repeated small unit, such as polyethylene, rubber, polyester and cellulose.

Prepreg: Abbreviation for pre-impregnated reinforcement fibers. Prepreg is any reinforcing material loaded with B-stage resin, catalyst and pigment ready for placement in the mold.

Print Through: Appearance of fiber pattern on part surface.

Profile: A shape, referring to the cross-section of the part to be pultruded.

Pultrusion: A continuous process for manufacturing composites with a constant cross-sectional shape. The process consists of pulling a fiber reinforcing material through a resin impregnation bath and through a shaping die, where the resin is heated and cured.

Reinforced plastics: Plastic parts consisting of resins to which reinforcing fibers, mats, fabrics, etc., have been added before the forming operation.

Reinforcements: Material used in plastic processes to give physical and mechanical properties that plastic alone cannot provide. Typically fiberglass, graphite, aramids and others in roving, mat and/or fabric form.

Resin: A solid or pseudo-solid organic material that exhibits a tendency to flow under stress. Most resins are polymers. In reinforced plastics, the material used to bind together the reinforcement material.

Roving: A number of strands, tows or ends collected into a parallel bundle with little or no twist of reinforcing fibers.

Roving yield: A unit of measure of the linear density of a fiberglass roving in yards/lb., the lower the number the larger the size of the roving bundle.

S-glass: A magnesia-alumina-silicate glass, especially designed to provide very high tensile strength glass filaments.

Scrim: A lightweight, open-weave, coarse fabric.

Selvage or selvedge: The narrow edge of a woven fabric that runs parallel to the warp. It is woven more tightly to prevent the fabric from unraveling.

ShieldStrand® reinforcements: High-performance reinforcements for armor and ballistic protection applications.

Silentex® system: A durable noise control system for automotive and industrial mufflers and silencers.

Sizing: Any treatment consisting of starch, gelatin, oil, wax or other suitable ingredient that is applied to yarn or fibers at the time of formation to protect the surface and aid the process of handling and fabrication. The treatment contains ingredients that provide surface lubricity and binding action, but no coupling agent.

Surfacing mat: A very thin ply, usually 7-20 mils thick, of non-woven glass or synthetic fiber used primarily to produce a smooth, cosmetic surface on a reinforced-plastic laminate.

Tear strength: The resistance of the mat to shearing or tearing.

Tensile strength: The strength exhibited by a fabric subjected to tension, as distinct from torsion, compression or shear.

TEX: Weight in grams per kilometer (1,000 meters) of yarn, fiber, filament or strands.

Thermoplastic: Capable of being repeatedly softened by increase of temperature and hardened by decrease in temperature; applicable to those materials whose change upon heating is substantially physical rather than chemical and that in the softened stage can be shaped by flow into articles by molding or extrusion.

Thermoset: A plastic that, when cured by application of heat or chemical means, changes into a substantially infusible and insoluble material.

Thickness: Fabrics range in thickness and are commonly from .025 mm to 1.27 mm (.001" to .050").

Twintex® reinforcement: A co-mingled glass and thermoplastic fiber reinforcement for lightweight, high stiffness, abrasion- and impact-resistant laminates.

Veil: A non-woven glass fiber material used to enhance surface finish, weather-ability, appearance and smoothness to the touch (see surfacing mat).

Warp: The set of yarns that runs lengthwise and parallel to the selvage, and is interwoven with the fill. The sheet of yarns wound together on a beam for the purpose of weaving or warm knitting.

Warping: The operation of winding yarns onto a beam, usually in preparation for slashing, weaving or warp knitting. Also called beaming.

Weave: The system or pattern of intersecting warp and filling yarns. The three most common are plain, twill and satin.

Wet (fill): The transverse threads or fibers in a woven fabric; those fibers running perpendicular to the warp. Each crosswise length is called a pick. In the weaving process, the filling yarn is carried by the shuttle, rapier or some other type of yarn carrier. Weft is also called the fill or filling yarn.

Weight ratio: The ratio of warp to fill.

Wet strength: The apparent strength of mat after addition of resin, an indication of mat performance during impregnation and molding.

WindStrand® reinforcements: High-performance reinforcements for wind blade applications.

Woven fabric: Manufactured on a loom, a fabric consists of a warp and a weft (fill). Together, the warp and weft determine the type of weave.

XStrand® reinforcements: High-performance reinforcements for commercial and industrial applications.

Yarn size: Weight, thickness and coverage of the fabric, thus determining performance characteristics.

Yield: The maximum allowable stress in a material, less than the maximum attainable stress, at which an increase in strain occurs without an increase in stress. Only materials that exhibit this unique phenomenon of yielding have a yield point. Fiberglass-reinforced thermoset plastics generally do not exhibit a yield point. Also a term to describe weight per unit length in yards/lb., for example a 113 yield product weighs 113 yards/lb.

Useful Acronyms

BMC	.....	Bulk Molding Compound
CFM	.....	Continuous Filament Mat
CIPP	.....	Cured-in-Place Pipe
CSM	.....	Chopped Strand Mat
CS	.....	Chopped Strands
DUCS	.....	Dry-Use Chopped Strands (CS for thermoplastics)
EMEA	.....	Europe, Middle East and Africa
FW	.....	Filament Winding
GRC	.....	Glass-Reinforced Concrete
GRP	.....	Glass-Reinforced Plastics
HLU	.....	Hand Lay-Up
MAX	.....	Multi-Axial fabric
ME roving	.....	Multi-End roving
RTM	.....	Resin Transfer Molding
SE roving	.....	Single-End roving
SMC	.....	Sheet Molding Compound
SU roving	.....	Spray-Up roving
UD	.....	Uni-Directional fabric
WR	.....	Woven Roving

Conversion Tables

English to Metric

	ENGLISH UNIT	CONVERSION	METRIC
Weight	oz/yd ²	x 33.9057	g/m ²
Density	lb/in ³	x 27.6799	g/cm ³
Length	inch	x 25.40	millimeter
	inch	x 2.54	centimeter
	foot	x 0.3048	meter
	yard	x 0.9144	meter
Mass	ounce	x 28.3495	gram
	pound	x 0.4536	kilogram
Volume	inch ³	x 16.3871	cm ³
	foot ³	x 0.0283	meter ³
	yard ³	x 0.7646	meter ³

Metric to English

	METRIC UNIT	CONVERSION	ENGLISH
Weight	g/m ²	x 0.0295	oz/yd ²
Density	g/cm ³	x 0.0361	lb/in ³
Length	millimeter	x 0.03937	inch
	centimeter	x 0.3937	inch
	meter	x 3.2808	foot
	meter	x 1.0936	yard
Mass	gram	x 0.0353	ounce
	kilogram	x 2.2046	pound
Volume	cm ³	x 0.0610	inch ³
	meter ³	x 35.3147	foot ³
	meter ³	x 1.3080	yard ³

Linear Density of Rovings

TEX = 496052 / Y.P.P. Y.P.P. = 496052 / TEX Y.P.P.: Yards per Pound	TEX	Y.P.P.
	160	3100
	660	750
	1200	416
	2400	207
	4800	104

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