Long Glass Fiber Thermoplastics

Strong, Impact Resistant Solutions for Replacing Metal and Reducing Part Weight
Long Glass Fiber (LGF) Compounds
Exceptionally Strong, Stiff, and Impact Resistant Solutions

RTP Company has been a pioneer in developing Long Glass Fiber (LGF) pellets since the 1980s. We manufacture these compounds using a proprietary pultrusion process built on years of experience. The fibers are fully wetted, encapsulated, and the resulting LGF pellets have fibers the same length as the pellets themselves.

Our LGF Compounds are the go-to technology for replacement of welded metal assemblies, machined parts, or die castings because they are a lightweight and functional alternative to steel assemblies or die cast aluminum, magnesium, and zinc. Compared to Short Glass Fiber (SGF) Compounds, our LGF Compounds provide significantly improved impact resistance without sacrificing strength and stiffness, even at extreme temperatures.

Like many RTP Company compounds, LGF Compounds can be further enhanced and customized with additives that provide:

- long-term heat aging resistance
- low VOC/odor release
- UV protection
- and more!

Our LGF Compounds are available in a number of resin systems and can be efficiently injection molded into complex shapes without expensive finishing costs. We welcome the opportunity to collaborate with you and discuss the benefits of LGF Compounds from RTP Company. To get your project started, contact us, scan our code, or visit www.rtpcompany.com today!
Impact Resistance

Our LGF Compound formulations display a high degree of impact performance while also providing good strength and stiffness. This combination of properties provides protection from breakage, even in extreme temperatures.

When compared to SGF reinforced Polypropylene (PP) and Nylon (PA), LGF Compounds provide far better impact resistance at both ambient and extremely low temperatures (see Figure 2).

This is particularly useful for parts that must withstand impact in diverse environments – for example, recreational vehicle components that must operate safely in the heat of the desert or the extreme cold of the north.

Due to their high strength-to-weight ratio, our LGF Compounds are an excellent material choice for applications such as wheelchair wheels, which must stand up to extreme stress at a wide range of temperatures.

Figure 2: SGF vs. LGF Compound Impact Comparison
30% Glass Reinforced PP

These ATV beadlock rings are made from LGF Compounds, which can withstand extreme environments and be colored to eliminate secondary processing and enhance aesthetics.
Parts molded with our LGF Compounds are able to hold their dimensional accuracy, due, in part, to the length of the long fibers, which promote the creation of an internal skeletal structure to support the part. This structure reduces part shrinkage after molding, thus maintaining part size as intended.

We offer LGF Compounds in a variety of base resins with glass fiber content ranging from 20 - 60% wt. For reference purposes, the table (Figure 3) shows the mold shrinkage percentages of a variety of polymers with 50% glass content.

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<th>Polymer*</th>
<th>Mold Shrinkage (%)**</th>
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<tr>
<td>Polypropylene (PP)</td>
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<td>Polylphthalamide (PPA)</td>
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<td>Polyphenylene Sulfide (PPS)</td>
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<td>Polyetherimide (PEI)</td>
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<tr>
<td>Polyletheretherketone (PEEK)</td>
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</table>

* LGF Compounds with fiber content ranging from 20-60% are available to meet your specific requirements
** shrinkage measured in direction of flow after conditioning 48 hours at 23 °C

The long fibers in our LGF Compounds form a skeletal network during molding to provide dimensional stability for large structures such as an automotive trunk or “frunk”.

Our LGF Compounds offer structural integrity and high flowability for thin walls, which benefits complex parts like automotive door modules.

RTP Company provides shrinkage data to our customers for informational purposes only. RTP Company does not guarantee the shrinkage of a material. Any shrinkage values communicated by RTP Company should be used as a guideline only and further testing and verification of communicated data on a part configuration similar to the final product is recommended.
Regardless of polymer type, the introduction of long fibers will result in a compound with increased modulus and strength; this increase extends to elevated temperatures. Figures 4 and 5 show that even at significantly elevated temperatures, LGF Compounds maintain functional strength and stiffness.

Figure 4:  
**Tensile Stress-Strain**  
PP LGF40

![Graph showing Tensile Stress-Strain for PP LGF40 at different temperatures.](image)

Figure 5:  
**Tensile Strength vs. Temperature**  
LGF40

![Graph showing Tensile Strength vs. Temperature for various materials.](image)

Critical components like those used in oil drilling operations benefit from the durability of LGF Compounds, which maintain their physical properties under high pressure and extreme temperatures.
Some high temperature-resistant LGF Compounds offer excellent heat aging performance based on the inherent properties of the base polymer. Other LGF Compounds such as PA and PP benefit from the addition of stabilizer packages. When exposed to high temperatures over a significant amount of time, compounds with heat stabilization packages maintain performance better than standard compounds. In fact, heat stabilized PP LGF Compounds from RTP Company can maintain more than 90% of its strength, elongation, and impact properties at 140 °C after 1,000 hours of exposure (Figure 6). This makes heat stabilized LGF Compounds an excellent choice for extending the service life of parts that are exposed to high heat during operation.

Figure 6: 1000 Hour Heat Aging Property Retention
PP LGF40

Under-the-hood parts benefit from the long-term heat aging resistance provided by LGF Compounds.
In some situations, a part will deform from stress over a period of time, which is known as “creep”. Long fiber solutions are an excellent material choice when deflection over time is a concern for parts that are under constant load. The increased stiffness provided by LGF Compounds also results in improved creep resistance compared to unfilled or SGF Compounds (Figure 7).

Load bearing parts like snowmobile skis require rigidity to function properly and consistently. Unlike parts made from unfilled or SGF Compounds, components made from LGF Compounds resist creep over time.

Figure 7: Flexural Creep Strain vs. Time
33 MPa, 23 °C
30% Glass Reinforced PP

* RTP XP materials are high performance SGF Reinforced Compounds
EXTERIOR
Applications:
• Roof Systems
• Underbody
• Structural Trim

INTERIOR
Applications:
• Instrument Panel
• Consoles
• Seating

UNDER-THE-HOOD
Applications:
• Front End Modules
• Fan Shrouds
LGF Compounds for Automotive

EXTERIOR Applications:
• Roof Systems
• Underbody
• Structural Trim

DOOR SYSTEMS
Applications:
• Lift Gates
• Door Modules

PASSENGER SAFETY
Applications:
• Air Bag Housings
• Restraint Systems
With RTP Company’s engineering expertise, LGF Compounds can be formulated for UV protection and weatherability. Our long history with LGF Compounds and color formulation allows us to maintain the balance between preserving physical properties and color. We can formulate LGF Compounds specifically for standards such as SAE J2527, the standard for accelerated exposure of Automotive Exterior Materials, and test them accordingly. Our UV protection technology can be used in conjunction with LGF Compounds to modify a variety of plastics. As shown in Figure 8, the tensile strength and tensile modulus of a PP LGF Compound are maintained, even after UV exposure.

The plastic housing of this rooftop heat exchanger required an LGF Compound containing a UV stabilizer package to reduce damage from the sun’s rays and extreme weather conditions.

Figure 8: Physical Property Performance of PP LGF30 after 2500 kJ/m² UV Exposure
International legislation and automotive OEMs have identified the need to reduce odor, fogging, and total Volatile Organic Compounds (VOCs) to improve air quality and the safety of vehicle interiors. We offer a selection of PP LGF products designed to meet automotive interior VOC requirements.

These low emission PP LGF Compounds are designed for structural use and help OEMs meet strict interior cabin air quality standards. With reinforcement levels of 20 – 50 wt%, these compounds have been tested and authenticated by approved outside laboratories according to German Automotive Industry (VDA) test methods; results show that PP LGF products from RTP Company meet or exceed the OEM requirements in all three categories (see Figure 9).

**Figure 9: VDA Test Results: RTP Company PP LGF Compounds**

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<td>RTP 199 X 70836 B</td>
<td>PP LGF50, Automotive</td>
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Compliant with requirements from GM, Stellantis, Tesla, Ford

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Compliant with requirements from VW, Daimler, BMW
Metal-to-plastic conversion doesn’t have to be difficult or lengthy. We have extensive experience in guiding companies and teams through the process. Our experts can answer your questions, and develop a plan that will work for you. Here are 7 steps to make the metal-to-plastic conversion process as seamless and effortless as possible:

1. IDENTIFY PARTS
   What makes a part a good candidate for metal replacement?
   • High volume production parts
   • Parts with complex geometries, assemblies, or secondary operations that can be eliminated or reduced

2. DEFINE PART REQUIREMENTS
   Reduce risks by determining requirements up front such as:
   • Part environment: temperatures, Ultra Violet (UV), chemical and moisture exposure
   • Structural performance: strength, stiffness, and impacts

3. SPECIAL CONSIDERATIONS
   Are there any special requirements or attributes that the part must meet, such as:
   • Regulatory requirements (UL, FDA, NSF, EU, Biocompatibility)
   • Unique characteristics (wear, conductivity, color, flame retardancy)

4. COST ANALYSIS
   Plastics can provide a significant system cost decrease versus metals when all aspects are considered, such as the reduction of:
   • Raw material costs and density
   • Tooling and processing
   • Cycle times
   • Assembly steps and labor
   • Secondary operations

5. PROJECT DESIGN REVIEW AND SUPPORT
   Understanding the feasibility of a metal-to-plastic conversion is an important step in making it a reality. We offer additional services to ensure your metal-to-plastic conversion is a success, including:
   • Part, tooling, process, and design reviews
   • CAE support such as Autodesk Moldflow® and FEA

6. PROTOTYPE MOLDING AND PART VALIDATION
   We can assist in material molding trials and final part testing to ensure that you are ready for production.

7. TRANSITION TO PLASTIC PRODUCTION
   We will also help optimize your production molding processes to ensure a smooth transition while maximizing benefits.
   Services include:
   • Production molding process
   • Material release specifications
   • Supply chain support
RTP Company CAE Engineers can provide assistance with injection molding analysis or structural FEA analysis on complex parts like this automotive door carrier module.

Our team of experienced CAE analysts provide assistance with structural analyses to predict how an actual molded part might perform, or with flow simulation filling and warpage analyses to anticipate the injection molding cycle and ultimate part shape. Because fiber orientation impacts how a material will behave under different conditions, analyses performed by our CAE team can be instrumental in successful plastic part or component development. We offer product design review and consultation of the following:

- Injection molding analysis
- Structural analysis (FEA)
- Structural failure consultation
- Quick mechanical structural design review
- Mold design assistance
- Product testing recommendation
We manufacture LGF Compounds in Asia, Europe, and multiple sites in North America to provide our customers with custom solutions and support wherever they are located. When combined with support from Product Development Engineers in each region that understand the process and formulations, your application will be well positioned for success.

Supporting today's global economy with products worldwide is an important facet of the thermoplastic materials industry. RTP Company is committed to offering LGF Compounds around the world that meet global specifications in markets such as: Automotive, Industrial, Healthcare, Consumer Goods, and more.

To learn more, contact us, scan our code, or visit www.rtpcompany.com to get your project started today!
## Property Comparison

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
<th>Specific Gravity</th>
<th>Tensile Strength (MPa)</th>
<th>Tensile Modulus (MPa)</th>
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* Concentrate grade is formulated to be blended with various types and levels of PP or PE.

The materials listed here are a small selection of our LGF compounds; for a listing of our complete portfolio, visit www.rtpcompany.com. For additional data, such as temperature, flow, and crossflow, or to learn how other technologies can be incorporated, contact your local RTP Company representative.
RTP COMPANY THERMOPLASTIC TECHNOLOGIES

COLOR
Color inspires, energizes, and builds brand recognition, and choosing the right supplier is as important as selecting the right color. We offer color technology options in standard precolored resins or custom compounds, UniColor®, Masterbatches, or cube blends.

CONDUCTIVE
We offer compounds for electrostatic discharge (ESD) protection, EMI shielding, or PermaStat® permanent anti-static protection. Available in particulate and all polymeric-based materials, these compounds can be colored as well.

FLAME RETARDANT
Whether you are developing a new product or need to reformulate due to ever-changing regulations, we can custom engineer a flame retardant material with the exact properties you require.

HIGH TEMPERATURE
We formulate our high temperature compounds precisely to retain their performance properties, provide better dimensional stability, and offer excellent electrical characteristics in continuous-use high temperatures.

ENGINEERED SHEET
If you need engineered sheet material for your plastic part, we can extrude custom thermoplastic formulations into cut sheet in various sizes and thicknesses.

LONG GLASS FIBER
As pioneers in developing a proprietary pultrusion process, we’ve perfected the manufacturing of our Long Glass Fiber (LGF) Compounds. These pellets encapsulate long fibers for superior strength, stiffness and impact resistance, making them ideal for metal replacement.

STRUCTURAL
Our reinforced Structural Compounds are formulated to increase strength and stiffness, and provide resistance to impact, creep, and/or fatigue. These materials can be customized to meet cost and performance targets.

TPE
Our thermoplastic elastomers provide rubber-like performance with the processing benefits of thermoplastic resin. Our portfolio ranges from standard, in-stock resins to custom compounds designed to meet your specifications.

WEAR RESISTANT
Our wear resistant thermoplastic compounds can incorporate internal lubricants to reduce wear and friction, thereby lengthening the service life of your application and reducing your processing costs.

ENGINEERED SHEET
Through our sister company, Wiman Corporation, we can provide you with polymer film in a variety of resins, and customized with additives to provide specific properties.

No information supplied by RTP Company constitutes a warranty regarding product performance or use. Any information regarding performance or use is only offered as a suggestion for investigation for use, based upon RTP Company or other customer experience.

RTP Company makes no warranties, expressed or implied, concerning the suitability or fitness of any of its products for any particular purpose. It is the responsibility of the customer to determine that the product is safe, lawful and technically suitable for the intended use. The disclosure of information herein is not a license to operate under, or a recommendation to infringe on any patents.

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Please contact your local RTP Company Sales Engineer by calling 1-507-454-6900 or 1-800-433-4787 (U.S. only), by email at rtp@rtpcompany.com, or visit www.rtpcompany.com