Very Long Fiber Compounds

Strong, Stiff, and Impact Resistant Solutions Using Very Long Fiber Technology

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RTP Company has been a pioneer in developing Very Long Fiber (VLF) Compounds since the 1980s. Our VLF Compounds are thermoplastic pellets that encapsulate long fibers the same length as the pellets themselves. We manufacture these materials using a proprietary pultrusion process built on years of experience.

VLF 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, VLF Compounds provide significantly improved impact resistance without sacrificing strength and stiffness, even at extreme temperatures.

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

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

Our VLF 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 VLF Compounds from RTP Company. To get your project started, contact us, scan our code, or visit www.rtpcompany.com today!

VLF versus SGF Pellets: What's the Difference?

VLF pellets are longer in length than SGF pellets, and have long, continuous fibers that extend the entire length of the pellet (see Figure 1). When VLF pellets are processed via injection molding, the long fibers inside will entangle, creating an internal skeletal network of reinforcement; this increases mechanical properties and can improve dimensional stability of the molded part. Pellets made from RTP Company VLF Compounds can be processed in standard injection molding equipment, with easy material flow. In addition, we offer both Technical and Computer Aided Engineering (CAE) Services to guide you throughout the process.

Figure 1:

VLF vs. SGF Pellet Comparison

VLF pellets:

- 11mm long
- Fibers are continuous and equal to the length of the pellet
- Fibers are fully wetted with thermoplastic resin

SGF pellets:

- 3mm long
- Random fibers vary in length and orientation through the pellet

Impact Resistance

Due to their high strength-to-weight ratio, VLF 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.

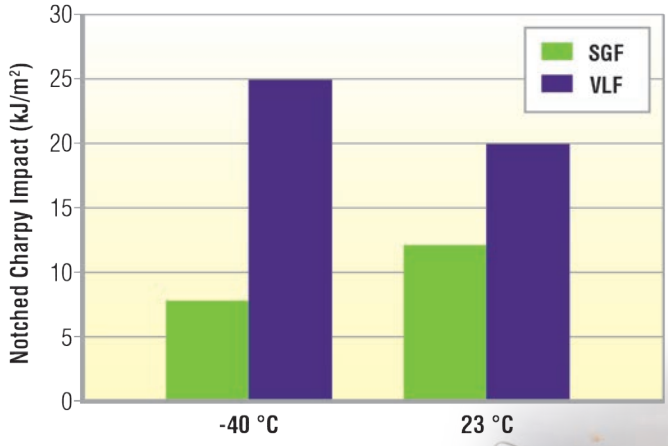
Our VLF Compound formulations display a high degree of impact performance while also providing good strength and stiffness. This combination of properties provides protection from breakage, even in extreme temperatures.

When compared to SGF reinforced Polypropylene (PP) and Nylon (PA), VLF 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.

Figure 2:

SGF vs. VLF Compound Impact Comparison 30% Glass Reinforced PP



These ATV beadlock rings are made from VLF Compounds, which can withstand extreme environments and be colored to eliminate secondary processing and enhance aesthetics.

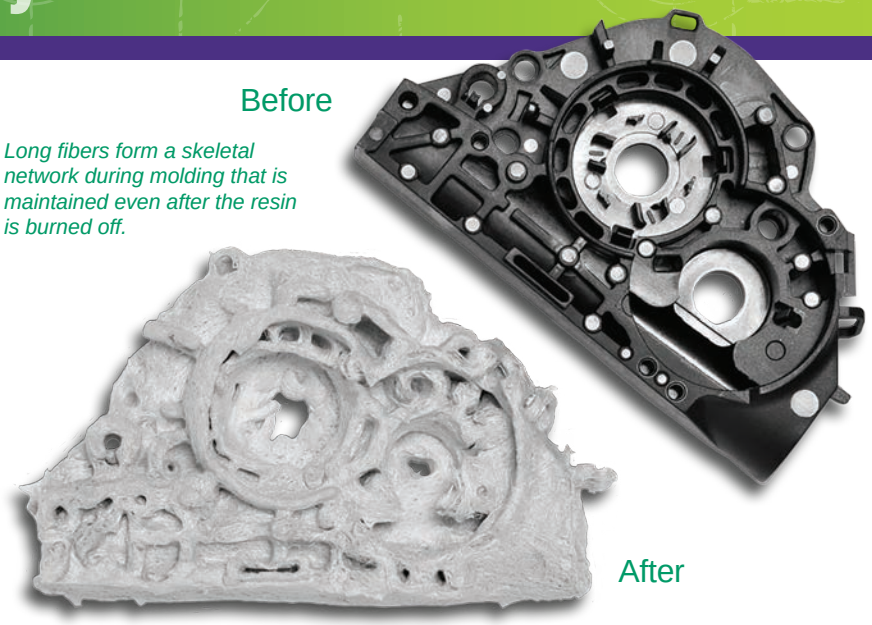
Dimensional Stability

Parts molded with VLF 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 as shown in photo to the right. The structure reduces part shrinkage after molding, thus maintaining part size as intended.

We offer VLF 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.

Before

Long fibers form a skeletal network during molding that is maintained even after the resin is burned off.



After

Critical components like this automotive shifter casing require structural integrity; when molded from VLF Compounds, the dimensional stability of these complex parts is achieved with help from the skeletal structure of long fibers.

Figure 3: ***Mold Shrinkage of Various 50% VLF Compounds***

Polymer*	Mold Shrinkage (%)**
Polypropylene (PP)	0.20
Nylon 6/6 (PA 6/6)	0.18
Rigid Thermoplastic Polyurethane (RTPU)	0.15
Polyphthalamide (PPA)	0.20
Polyphenylene Sulfide (PPS)	0.15
Polyetherimide (PEI)	0.15
Polyetheretherketone(PEEK)	0.20

* VLF 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

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, VLF Compounds maintain functional strength and stiffness.

Figure 4: ***Tensile Stress-Strain 40% VLF PP***

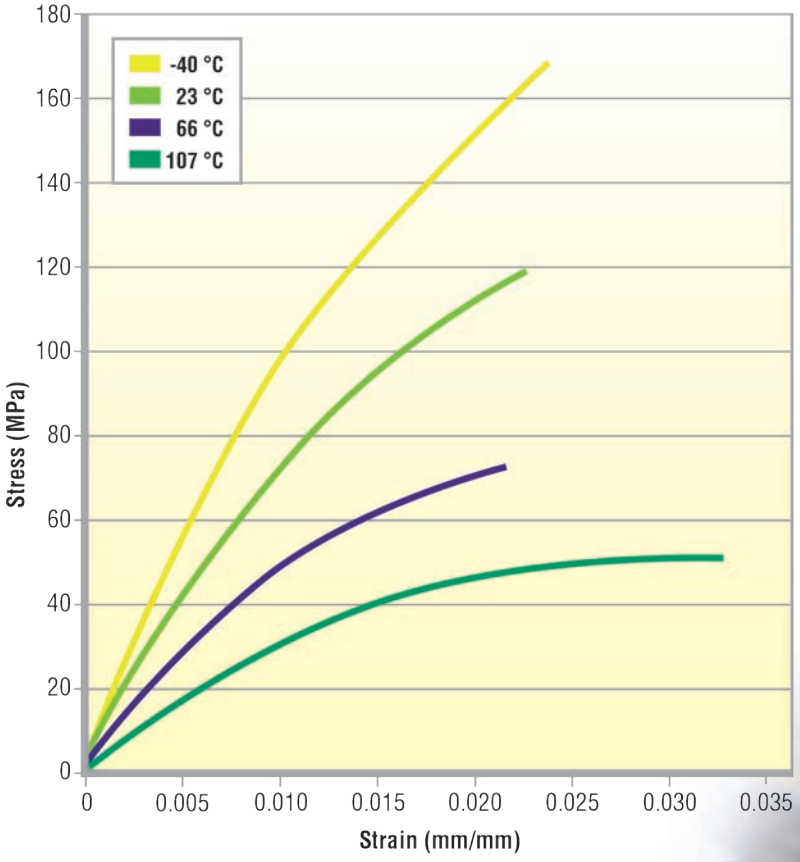
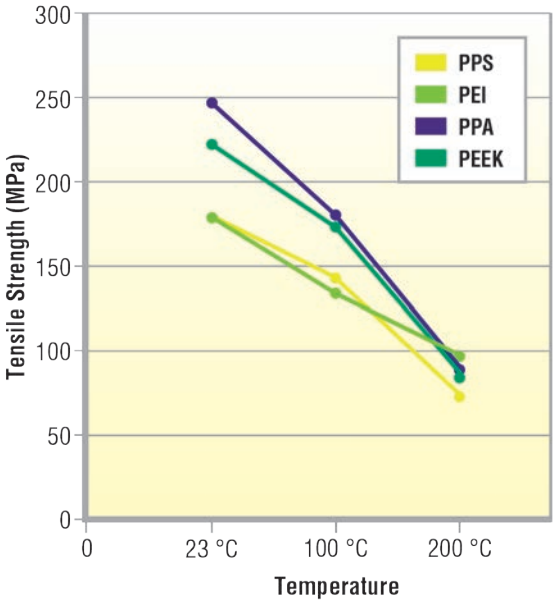


Figure 5: ***Tensile Strength vs. Temperature 40% VLF***

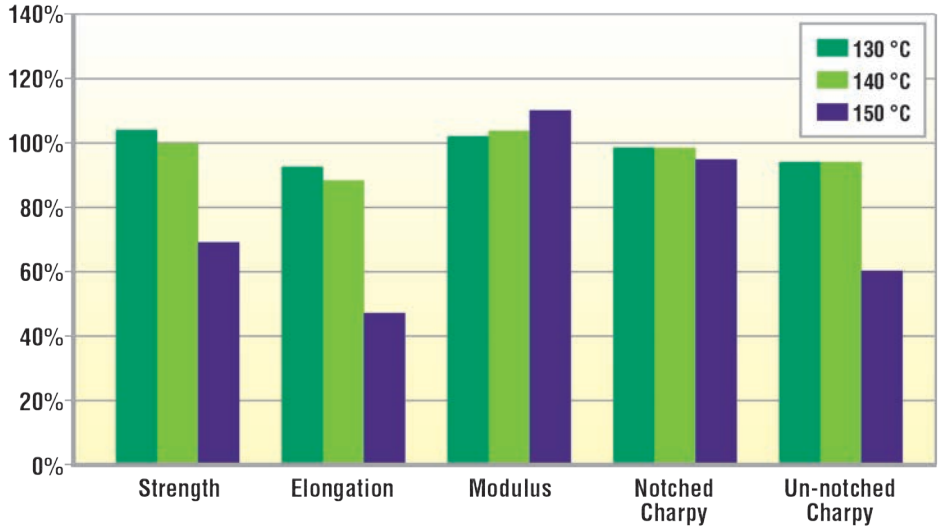


Critical components like those used in oil drilling operations benefit from the durability of VLF Compounds, which maintain their physical properties under high pressure and extreme temperatures.

Long-term Heat Aging Resistance

Some high temperature-resistant VLF Compounds offer excellent heat aging performance based on the inherent properties of the base polymer. Other VLF 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 VLF PP 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 VLF 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 40% VLF PP***



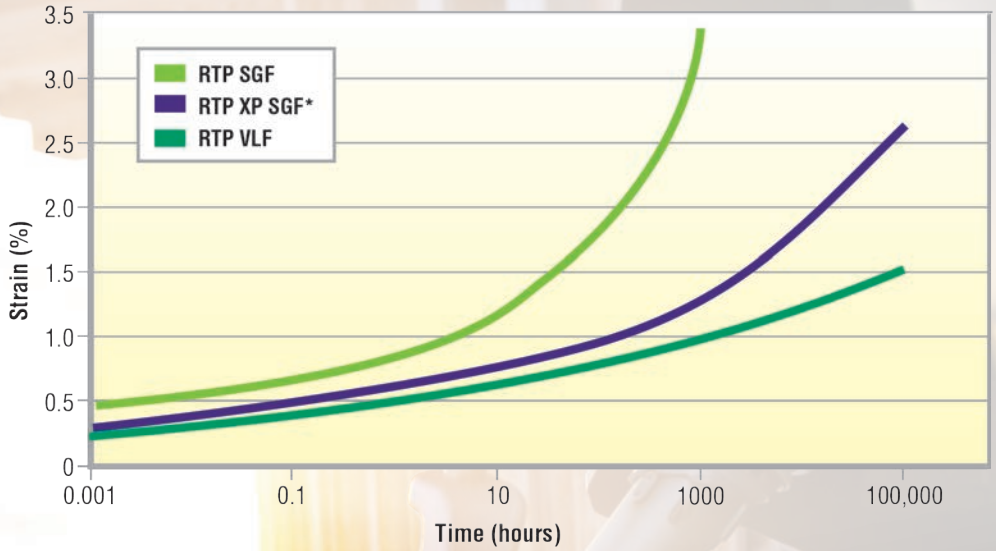
Under-the-hood parts benefit from the long-term heat aging resistance provided by VLF Compounds.

Creep Resistance

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 VLF Compounds also results in improved creep resistance compared to unfilled or SGF Compounds (Figure 7).

Figure 7:

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



* RTP XP materials are high performance SGF Reinforced Compounds

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

INTERIOR

Applications:

- Instrument Panel
- Consoles
- Seating

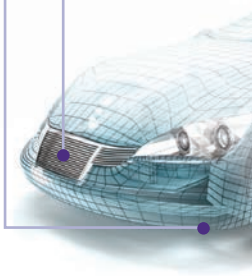
Suggested Products:

- RTP 199 X 136017 H (30% VLF PP High Impact)
- RTP 199 X 151100 A (20% VLF PP)
- RTP 199 X 151100 B (30% VLF PP)

EXTERIOR

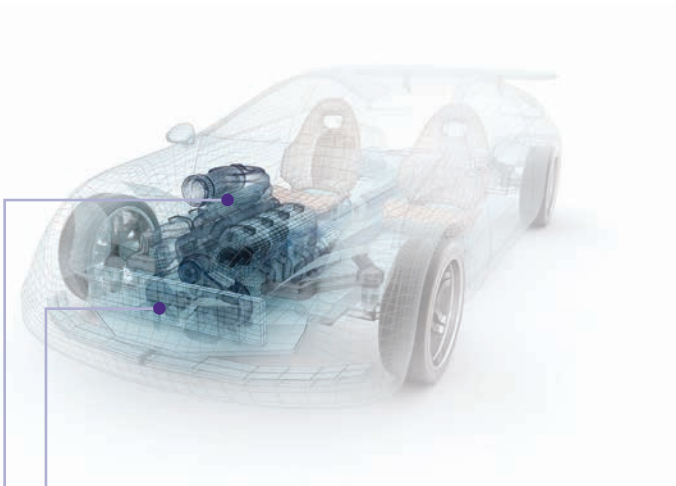
Applications:

- Roof Systems
- Underbody
- Structural Trim



Suggested Products:

- RTP 199 X 151100 A (20% VLF PP)
- RTP 199 X 123127 A (30% VLF PP UV)
- RTP 199 X 123127 B (40% VLF PP UV)



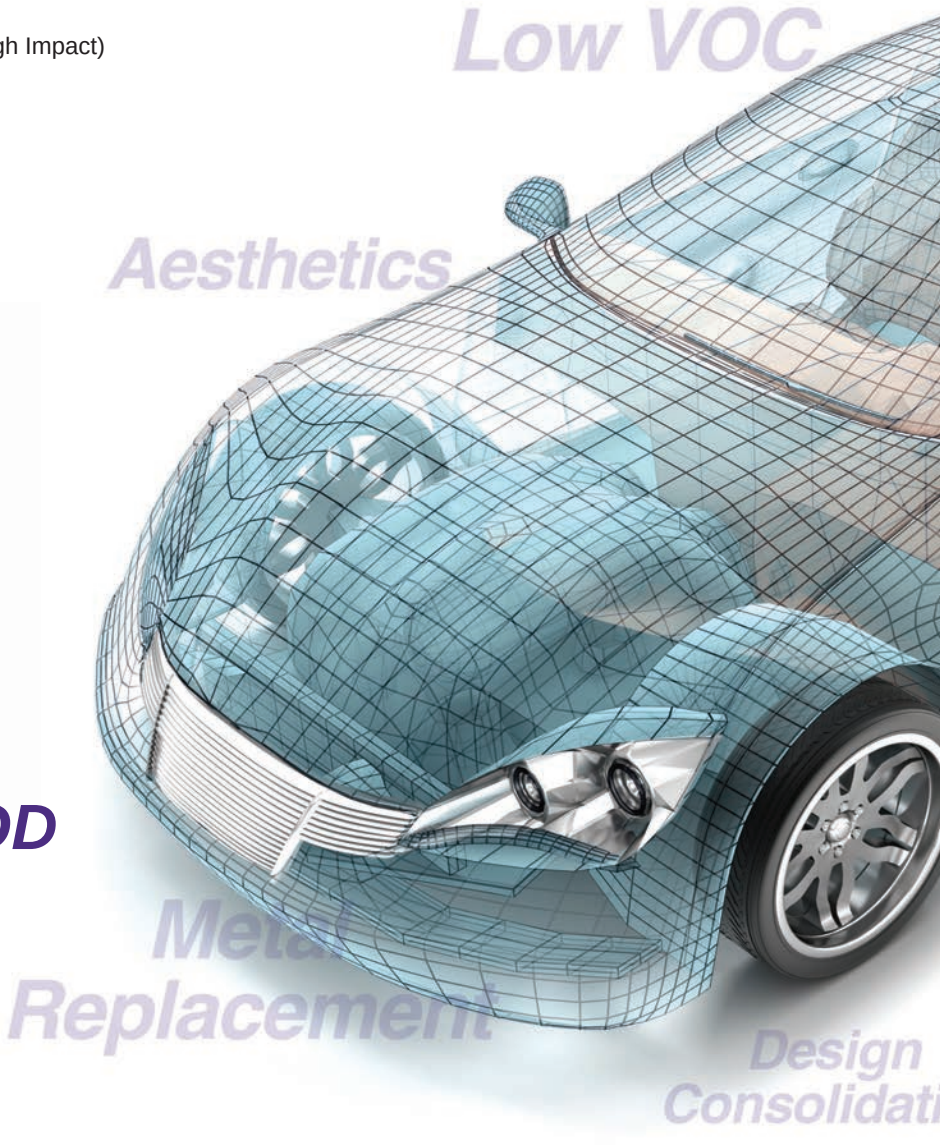
UNDER-THE-HOOD

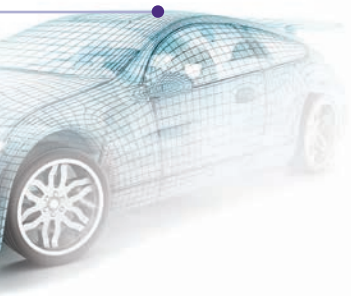
Applications:

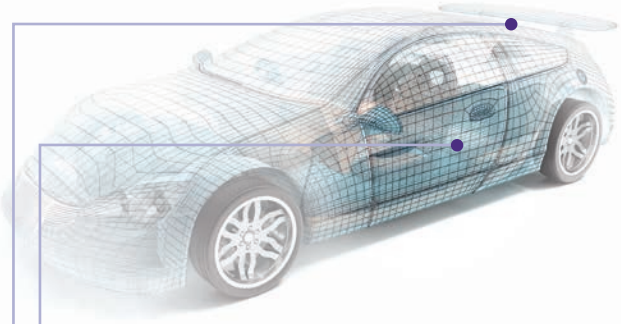
- Front End Modules
- Fan Shrouds

Suggested Products:

- RTP 199 X 151100 B (30% VLF PP)
- RTP 199 X 151100 C (40% VLF PP)
- RTP 299 X 98619 C (60% VLF PA6/6)







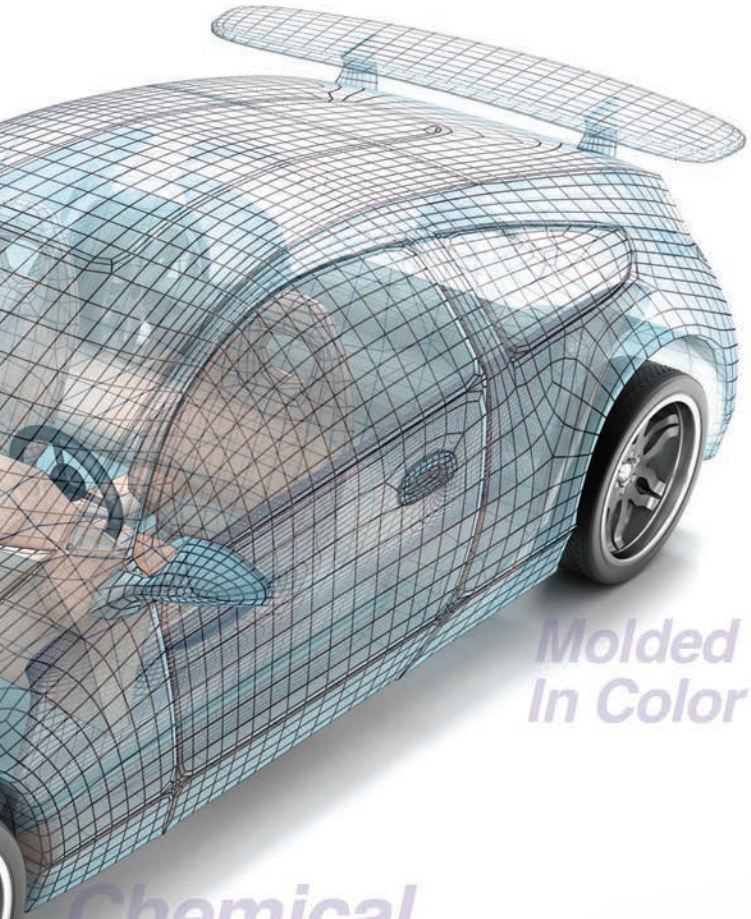
DOOR SYSTEMS

Applications:

- Lift Gates
- Door Modules

Suggested Products:

- RTP 199 X 151100 A (20% VLF PP)
- RTP 199 X 151100 B (30% VLF PP)
- RTP 199 X 151100 C (40% VLF PP)



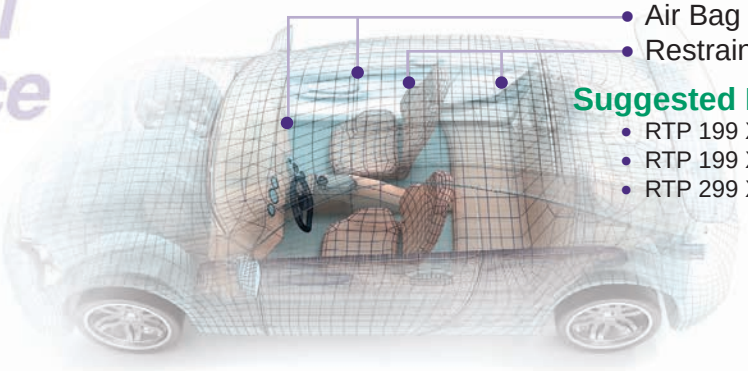
PASSENGER SAFETY

Applications:

- Air Bag Housings
- Restraint Systems

Suggested Products:

- RTP 199 X 136017 H (30% VLF PP High Impact)
- RTP 199 X 151100 C (40% VLF PP)
- RTP 299 X 98619 C (60% VLF PA6/6)

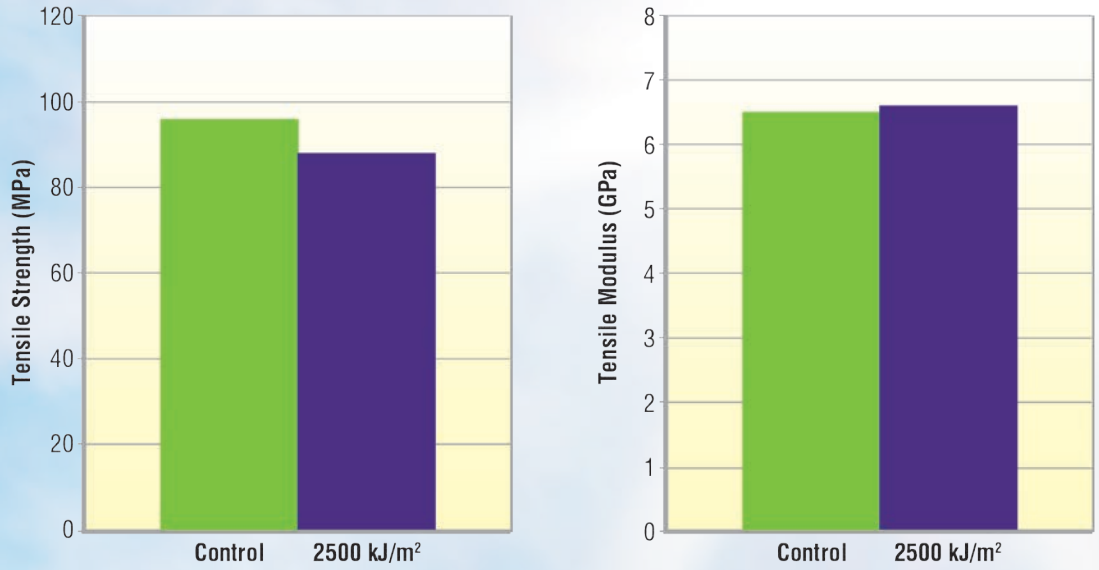


UV Protection

With RTP Company's engineering expertise, VLF Compounds can be formulated for UV protection and weatherability. Our long history with VLF Compounds and color formulation allows us to maintain the balance between preserving physical properties and color.

Figure 8:

Physical Property Performance of 30% VLF PP After 2500 kJ/m² UV Exposure



We can formulate VLF 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 VLF Compounds to modify a variety of plastics. As shown in Figure 8, the tensile strength and tensile modulus of a VLF PP Compound are maintained, even after UV exposure.

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

Low VOC/Odor Release

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 VLF PP products designed to meet automotive interior VOC requirements.

These low emission VLF PP 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 VLF PP products from RTP Company meet or exceed the OEM requirements in all three categories (see Figure 9).

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

Low Emission Grades		VDA 270			VDA 277	VDA 278	
% Glass Fiber	RTP Company Nomenclature	A1 (23 °C/24h)	A2 (40 °C/24h)	A3 (80 °C/2h)	Total Carbon µgC/g	VOC µg/g	FOG µg/g
VLF 30	RTP 199 X 123150 A	≤ 2	≤ 3	≤ 3	≤ 20	≤ 50	≤ 100
VLF 40	RTP 199 X 123150 B	≤ 2	≤ 3	≤ 4	≤ 20	≤ 50	≤ 100
VLF 50	RTP 199 X 123150 C	≤ 2	≤ 3	≤ 5	≤ 20	≤ 50	≤ 100

Metal-to-Plastic Conversion

Metal-to-plastic conversion doesn't have to be a 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, Biocompatability)
- 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 the yourproduction molding processes to ensure a smooth transition while maximizing benefits.

Services include:

- Production molding process
- Material release specifications
- Supply chain support

Computer Aided Engineering (CAE) Services

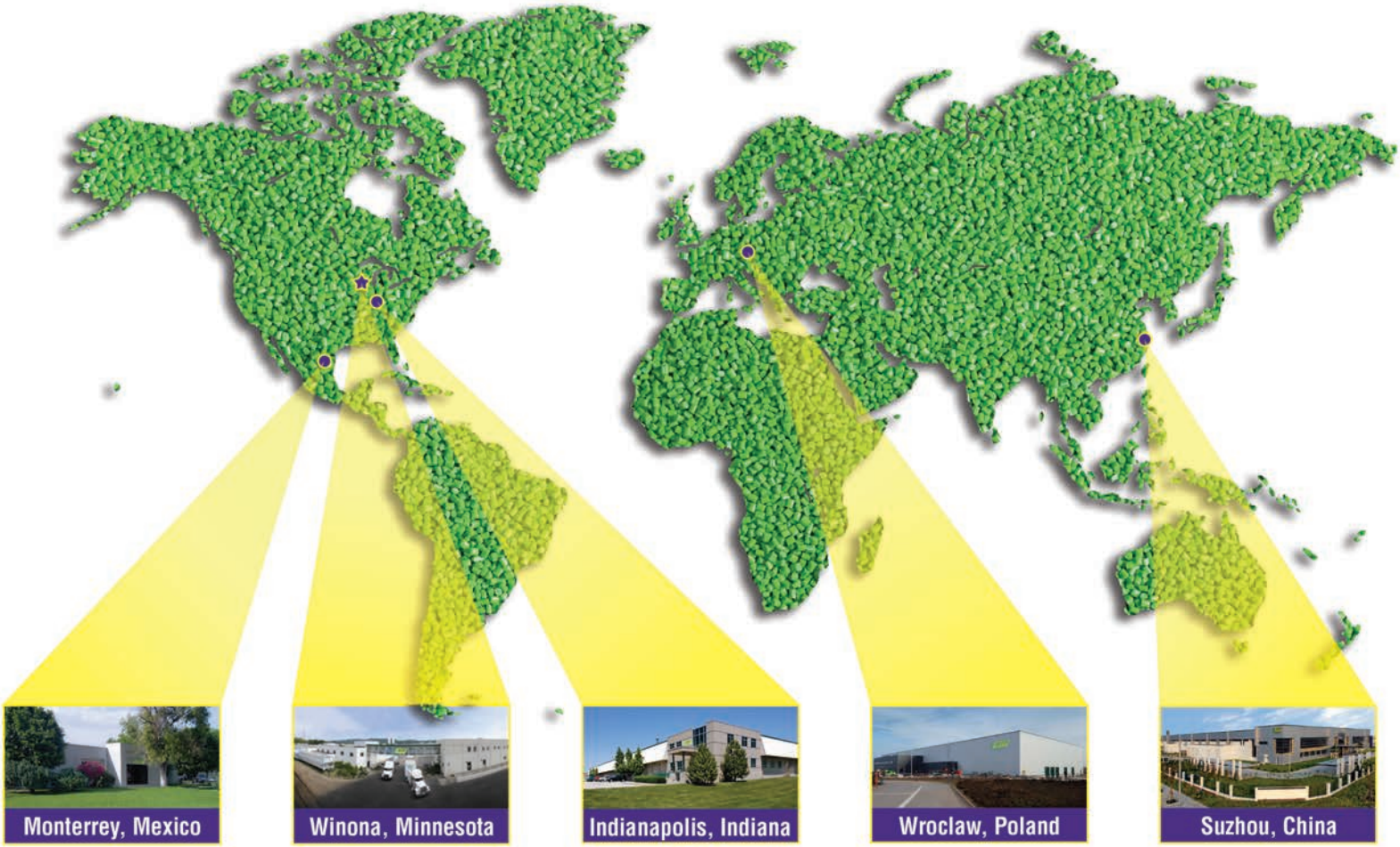
RTP Company CAE Engineers can provide assistance with injection molding analysis or structural FEA analysis on complex parts like this automotive door carrier module.

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

Worldwide Manufacturing of VLF Compounds

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



We manufacture VLF 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.

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

Property Comparison

Formula	Description	Specific Gravity	Tensile Strength (MPa)	Tensile Modulus (MPa)	Flexural Strength (MPa)	Flexural Modulus (MPa)	IZOD Notched Impact (kJ/m²)	IZOD Unnotched Impact (kJ/m²)
Polypropylene (PP)								
RTP 199 X 151100 A	20% VLF	1.05	90	4800	125	4100	16	48
RTP 199 X 151100 B	30% VLF	1.13	110	7100	170	6500	21	60
RTP 199 X 151100 C	40% VLF	1.20	130	8500	200	8500	25	63
RTP 199 X 151100 D	50% VLF	1.33	140	11900	220	10500	23	75
RTP 199 X 136017 H	30% VLF High Impact	1.12	95	6850	140	5400	18	55
RTP 199 X 123127 A	30% VLF UV	1.12	110	7100	170	6500	18	60
RTP 199 X 123127 B	40% VLF UV	1.21	130	8500	200	8500	25	63
RTP 199 X 123150 A	30% VLF Low VOC	1.13	110	7100	170	6500	21	60
RTP 199 X 123150 B	40% VLF Low VOC	1.21	120	8900	180	8500	21	68
RTP 199 X 123150 C	50% VLF Low VOC	1.33	130	11800	205	11700	23	75
Nylon 6 (PA 6)								
RTP 80207 A	40% VLF	1.45	210	12900	320	12300	25	80
RTP 80209 A	50% VLF	1.56	230	17900	330	16500	30	94
Nylon 6/6 (PA 6/6)								
RTP 80207 EM HS	40% VLF	1.46	225	13500	345	12000	27	90
RTP 80209 EM HS	50% VLF	1.57	250	16000	370	15200	29	100
RTP 299 X 98619 C	60% VLF	1.71	250	21500	400	18500	32	250
Polyphenylene Sulfide (PPS)								
RTP 1399 X 68907 A	40% VLF	1.69	165	15500	235	15000	23	40
RTP 1399 X 68907 B	50% VLF	1.73	185	17500	275	17900	25	42
Polyetheretherketone (PEEK)								
RTP 2299 X 108578 A	30% VLF	1.52	185	11700	275	11000	17	60
RTP 2299 X 108578 B	40% VLF	1.61	205	13800	310	15200	18	80
Rigid Thermoplastic Polyurethane (RTPU)								
VLF 82307 A	40% VLF	1.51	230	10000	325	10000	30	120
VLF 82309 A	50% VLF	1.60	235	12400	345	12400	40	140
Polyphthalamide (PPA)								
VLF 84007	40% VLF	1.57	230	15200	325	14500	22	75
VLF 84009	50% VLF	1.64	265	18300	400	18000	25	85

For additional data, such as temperature, flow, and crossflow, contact your local RTP Company representative.

STRUCTURAL • ELASTOMERS • WEAR • COLOR
CONDUCTIVE • FLAME RETARDANT • FILM/SHEET

Your Global Compounder of Custom Engineered Thermoplastics

RTP COMPANY is committed to providing you with solutions, customization, and service for all of your thermoplastic needs. We offer a wide range of technologies available in pellet, sheet, and film that are designed to meet even your most challenging application requirements.

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.

STRUCTURAL

Our reinforced structural compounds can increase strength, stiffness, and provide resistance to impact, creep, and fatigue. Ideal for metal or other material replacement, our formulas can be customized to meet cost and performance targets.

TPE

Our thermoplastic elastomers provide rubber-like performance with the processing benefits of thermoplastic resin. We offer a wide range of options, 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.

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

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ISO 9001 REGISTERED FACILITIES

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