RTP Co.

Imagineering Plastics®

Flame Retardant Thermoplastics

Compliant, Cost-Effective Custom Engineered FR Solutions from RTP Company

Your **Global** Compounder of **Custom Engineered Flame Retardant** Thermoplastics

Helping You Deliver

As a manufacturer, you face a host of challenges when it comes to specifying the optimum materials for your products. You need to deliver consistent quality and keep on top of changing global flame retardant (FR) regulations. Also, you must maintain cost-effectiveness and make sure you deliver everything your customers demand – with each and every product.

As your global compounder of custom engineered flame retardant thermoplastic compounds, RTP Company can help. Our engineers are experts on constantly-changing FR regulations that impact your product sales in the global marketplace. And they have the experience, and the approved materials solutions, to help you meet them.

The Bottom Line

RTP Company has the breadth and depth of plastics expertise to help you readily meet every demand of the marketplace while supporting you every step of the way. From meeting regulatory approvals, to achieving optimum moldability, to timely delivery and beyond, we make your entire materials sourcing process simpler, successful, and more effective.

RTP at a Glance

- Privately-owned custom compounder
- Independent, unbiased product development
- Worldwide representation and distribution
- Short standard product lead times
- Global manufacturing sites
- ISO 9001 Registered facilities

Engineering
Expert Solutions

Independent and Unbiased

Our portfolio of more than 60 resins and hundreds of modifiers allows us to custom engineer the most effective flame retardant solution for your needs. We can effectively include every property your application demands, including strength, wear resistance, flexibility and more. Our tailored solutions offer superior value to off-the-shelf "one size fits all" commodity materials.

Unmatched Experience

RTP Company produces thousands of different custom engineered flame retardant thermoplastic compounds every year. Our customers comprise a veritable who's who of global manufacturers and OEMs in industries including electronics, automotive, appliances, electrical products, solar energy, military, aerospace, and more.

Our experience includes over 30 years of successfully producing flame retardant compounds. And, while other companies might work in "only nylon" or "only polypropylene," RTP Company's extensive portfolio and expertise ensures you receive the right solution to meet your needs.

Case Study

Telecom Wiring Harness

Obtaining multiple properties in a single material is why custom compounds are often chosen. Marconi Communications needed flame retardance, UV stability, and antimicrobial properties in a material that was flexible yet provided structural integrity to protect wires fed into outdoor connection boxes. They were able to obtain all the properties they required in a **RTP 2000 Series** custom alloyed compound.

Flame Retardants
Increase Product Safety

Slowing the Combustion Process

Using flame retardant technologies to reduce fire hazards is a basic element of product safety. Fire retardance is achieved in plastics through chemical reactions that moderate one or more of the elements (fuel, heat, or oxygen) necessary for burning to take place.

There are a number of ambiguous terms used to describe plastics incorporating flame retardant systems, all of which have similar intent: fire retardant, ignition resistant, and self-extinguishing materials. Even with flame retardant treatment, no plastic can be rendered entirely fire proof. Flame retardant systems are meant to moderate, but not eliminate, eventual combustion.

Flame Retardants Mitigate Fire Danger

- Increase plastics ignition resistance
- Reduce the speed of flame spread
- Reduce heat release
- Reduce smoke generation

Elements of Successful Material Selection

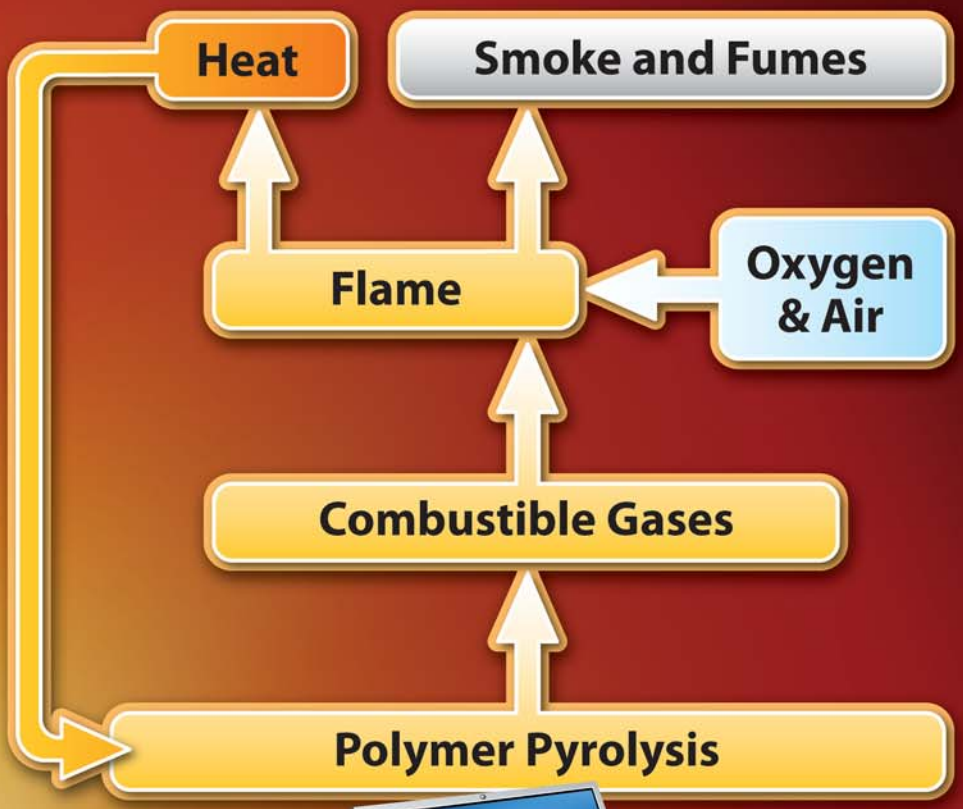
- Meet appropriate flammability specification
- Perform in end-use environment for temperature and chemical exposure
- Resin system with appropriate physical properties at practical cost

Why Flame Retardants?

The objective of flame retardant systems is to delay ignition and fire spread to increase escape time

How Plastics Burn

When exposed to heat or flame, plastics undergo pyrolysis, which results in degradation of the resin, releasing gases that become the fuel source for the propagation of combustion.



Burning behavior of plastics is not just a material characteristic. Part design and nominal wall thickness are key factors in flammability certification.

The Right Choice

Materials and Systems

Given enough heat and the right conditions, anything has the potential to be a combustible fuel source. Plastics used in computers, printers, dryers, vehicles, and many other common products, may need to be protected by incorporating a flame retardant system.

Some polymers, such as fluoropolymers and polysulfones, are inherently flame retardant. Other polymers – including nylons, polyesters, polypropylenes and many other useful and cost-effective materials – are not. They must be modified to achieve the proper level of fire resistance through the use of flame retardant additives.

Each year, billions of pounds of flame retardant additives are used throughout the world. Different flame retardant chemistries, packages, or systems can be strategically deployed in polymers depending on the requirements of individual end-use applications and impacting regulations.

RTP Company is well versed in both halogenated and halogen-free flame retardant technologies (see pages 10 and 11) and can use our expertise to apply the appropriate one to your application.

The goal of flame retardant technology is to disrupt one or more of the fire triangle elements necessary for combustion

How Flame Retardants Function

Vapor Phase Inhibition Mechanism

During combustion, flame retardant additives react with the burning polymer in the vapor phase disrupting, at a molecular level, the production of free radicals and thus shut down the combustion process. This mechanism is commonly used with halogenated flame retardant systems.

Solid Phase Char-Formation Mechanism

Char-forming flame retardant additives react to form a carbonaceous layer on the material's surface. This layer insulates the polymer, slowing pyrolysis, and creates a barrier that hinders the release of additional gases that would otherwise fuel combustion. This method is commonly deployed by non-halogen systems using phosphorous and nitrogen chemistries.

Quench and Cool Mechanism

Hydrated minerals make up a class of halogen-free flame retardant systems commonly used for extruded applications like wire and cable. These systems use an endothermic reaction in the presence of fire to release water molecules that cool the polymer and dilute the combustion process.

Case Study

Float Switch

A **RTP 100 Series** flame retardant polypropylene compound successfully fulfilled the float switch's flame retardant requirement. The compound's excellent impact resistance, along with its resistance to common chemicals, protects the float switch from damage and ensures consistent functionality.

Global Standards for Flammability

UL94

The UL94 standard, popularized by Underwriters Laboratories (UL) as an element to obtain a UL Listing for end devices, classifies plastics by how different thicknesses of material burn in various orientations.

For example, to achieve the minimum standard UL94 HB, a horizontal specimen less than 3 mm thick must burn at a rate of less than 76 mm/min.

The more typical V-0, V-1, and V-2 classification use samples of varying thicknesses, which is an element of the classification. They require a vertical specimen stop burning within a period ranging from 10-30 seconds. The effect of dripped particles is also monitored.

Glow Wire

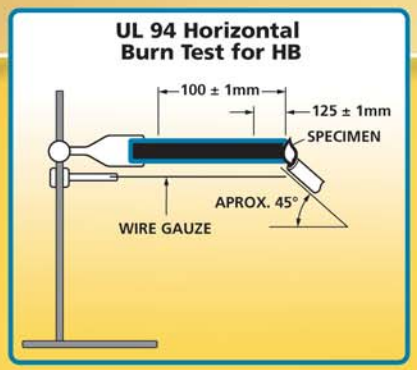
In Europe, the flammability of plastics is often measured using the glow wire test according to IEC 60695-2-10 following the Glow Wire Flammability Index (GWFI) or Glow Wire Ignition Temperature (GWIT) methods.

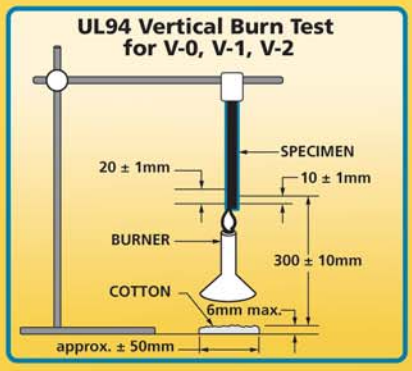
To pass glow wire tests, a specimen must either have no flame or glowing for more than 5 seconds while the glow wire is applied for GWIT, or have flame or glowing that extinguish within 30 seconds after removal of the glow wire for GWFI.

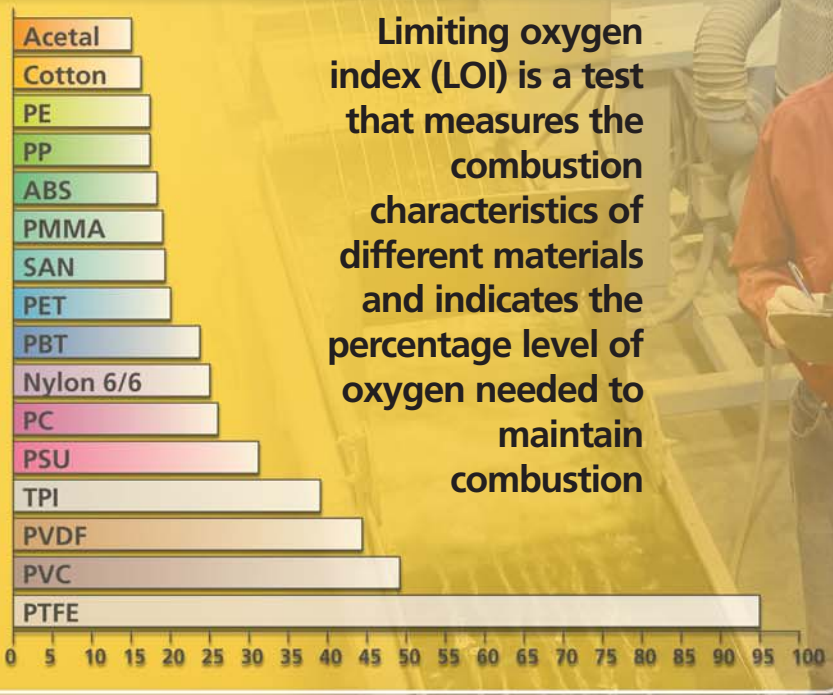
Other Standards

There are numerous other flammability ratings and testing methods specific to certain countries, industries, or applications.

These include FMVSS 302 for automotive applications, FAR 25.853 in aerospace uses, ASTM E162 flame spread index for solar energy devices, and the limiting oxygen index (LOI) among many others.







Limiting oxygen index (LOI) is a test that measures the combustion characteristics of different materials and indicates the percentage level of oxygen needed to maintain combustion

Testing and Approvals

In-house Lab Expedites Development

RTP Company has in-house laboratory testing expertise, with the ability to perform tests including UL94-HB, V-0, V-1, V-2, 5-V, and VTM; glow wire ignition; FMVSS 302; and FAR 25.853.

Our test facilities are audited and have been qualified by UL under their Client Test Data Program for more than a decade. RTP Company has a long-standing working relationship with UL, receiving our first recognition in 1977. Our engineers are well versed in managing UL projects and adapting material technologies to evolving UL standards, such as UL1703 for photovoltaic connectors.

Using independent labs, RTP Company can obtain data for LOI, smoke density, smoke toxicity, flame spread, and heat release when needed.

UL Yellow Cards

RTP Company has over 500 compounds in 30+ polymers with "yellow cards" that are already UL-Recognized. UL certification of new materials can be expedited with in-house testing as part of UL's Client Test Data Program.

View RTP Company compounds with UL yellow cards at: www.rtpcompany.com/info/ul

Compliance with Environmental Regulations

RoHS and Halogen Restrictions

There are two general regulatory challenges when it comes to developing flame resistant products. One is avoidance of materials banned or being phased out for environmental reasons. The other is meeting flammability specifications by undergoing and passing specific testing requirements (see pages 8 and 9).

On the environmental side, the key regulation significantly impacting flame retardants is the European Union's Restriction of Hazardous Substances (RoHS) Directive. It bans, along with heavy metals, chemicals containing PBDE (including DecaBDE or decabrom) used in some brominated flame retardant additives.

Many other countries are following the EU's lead. China, Korea, and Japan have their own versions of RoHS, and in the U.S., the Environmental Protection Agency has negotiated an agreement with producers of the chemical DBDE (decabromodiphenyl ether) to end its sale in 2012.

Formulating for Compliance

RTP Company has experience in formulating materials to meet the requirements of RoHS, without compromising FR protection or other desired properties. Likewise, we can assist in meeting the demand of other regulations that may impact products incorporating flame retardant protection, including:

- **REACH** – Registration, Evaluation, Authorization and Restriction of Chemicals
- **WEEE** – Waste of Electrical and Electronic Equipment
- **EPEAT** – Electronic Product Environmental Assessment Tool
- **LEED** – Leadership in Energy and Environmental Design

RTP Company has the knowledge, experience, and the approved and proven material solutions to meet regulatory requirements

Halogen-Free

Halogenated systems using bromine or chlorine have long been the "go to" chemistries because they are an effective solution that can easily be incorporated into thermoplastic at relatively low cost.

Because of increased targeting of halogens by environmental campaigns, RTP Company has developed halogen-free flame retardant compounds for most major resin systems. These offer comparable flammability performance at similar cost.

Certifications

We can provide certification for RoHS and REACH compliance, as well as for other regulations and organizations. For example, Letters of Compliance can be supplied (along with supporting data such as chemical analysis, spectrography results, or other evidence) to document that regulated substances are not present in your compound.

Case Study

Airline Appliance

RTP Company formulated a precolored **RTP 2500 Series** PC/ABS alloy compound with high impact properties, chemical resistance, flame retardancy, and UL recognition.

To ensure worldwide acceptance RTP Company proposed a bromine/chlorine/heavy metal-free compound, which complies with stringent Human and Environmental Safety regulations in the global marketplace.

Case Study

Networking Switch

F5 Network's switch attracts consumer attention with its use of color, translucency, and surface textures. A precolored **RTP 300 Series** high flow and non-halogenated flame retardant polycarbonate compound eliminates secondary painting processes in addition to achieving a UL94 V-0 rating.

Popular Resins for **FR Applications**

RTP Company develops flame retardant compounds in over 40 different engineering resins. These are some of the more popular polymers used for flame retardant applications:

Polypropylene (PP)

RTP 100 FR Series — Excellent fatigue endurance and outstanding chemical resistance. Performs well at operating temperatures up to 225 °F (105 °C).

Nylon or Polyamide (PA)

RTP 200 FR Series — Superb mechanical properties up to 275 °F (135 °C) in continuous use. Molds easily in thin wall sections; good resistance to chemicals.

Polycarbonate (PC)

RTP 300 FR Series — Superior impact strength, high heat resistance, good electrical properties, excellent mechanical properties up to 250 °F (120 °C). Controlled shrinkage, dimensional stability, thermal stability, good flow, and good surface finish.

Acrylonitrile Butadiene Styrene (ABS)

RTP 600 FR Series — Continuous use temperatures up to 175 °F (80 °C). Easy processing, chemical resistance, increased surface hardness, good impact strength, and overall toughness. Good for plating.

Polybutylene Terephthalate (PBT)

RTP 1000 FR Series — Good dimensional stability, high heat resistance, chemical resistance. Good flow in thin-wall sections, rapid crystallization, low mold temperatures, and fast cycle times make this material economical to mold.

Polycarbonate/Acrylonitrile Butadiene Styrene Alloy (PC/ABS)

RTP 2500 FR Series — Higher heat deflection temperature than ABS with better low-temperature impact resistance than PC. Good dimensionally stable, easily colored.

Polycarbonate/Acrylic Alloy (PC/PMMA)

RTP 1800 A FR Series — Higher impact resistance than PC/ABS with the processing ease of acrylic. Excellent flow, ideal for thin wall molding.

Thermoplastic Vulcanizate Elastomers (TPV)

RTP 2800 FR Series – Offers a broad range of elastomeric properties in addition to superior heat resistance. Can incorporate with both RoHS-compliant and halogen-free FR systems.

Common FR Compounds

RTP Product	RoHS Compliant	Specific Gravity ASTM D 792	Notched Impact ASTM D 256	Tensile Strength ASTM D 638	Flexural Strength ASTM D 790	Flexural Modulus ASTM D 790	Flammability UL94	Glow Wire GWFI IEC 60695-2-12
Polypropylene (PP)								
RTP 104 CC FR A 25% Glass Fiber – Homopolymer	Yes	1.47	2.0 ft-lbs/in 107 J/m	10,000 psi 69 MPa	16,500 psi 114 MPa	0.90 x 10^6 psi 6,206 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 150 A Homopolymer	Yes	1.24	0.8 ft-lbs/in 43 J/m	3,300 psi 23 MPa	5,700 psi 39 MPa	0.23 x 10^6 psi 1,586 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 151 Halogen-Free – Homopolymer	Yes	1.05	0.5 ft-lbs/in 27 J/m	3,000 psi 21 MPa	5,500 psi 38 MPa	0.32 x 10^6 psi 2,206 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 152 Homopolymer – Low Density	Yes	0.93	0.7 ft-lbs/in 37 J/m	4,400 psi 30 MPa	5,400 psi 37 MPa	0.19 x 10^6 psi 1,310 MPa	V-2 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 154 Homopolymer – Low Density	Yes	1.03	0.5 ft-lbs/in 27 J/m	4,100 psi 28 MPa	5,600 psi 39 MPa	0.19 x 10^6 psi 1,310 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 155 A Mineral Reinforced – Copolymer	Yes	1.37	1.0 ft-lbs/in 53 J/m	3,000 psi 21 MPa	4,500 psi 31 MPa	0.38 x 10^6 psi 2,620 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 156 A Copolymer	Yes	1.26	4.0 ft-lbs/in 214 J/m	2,200 psi 15 MPa	3,600 psi 25 MPa	0.17 x 10^6 psi 1,172 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 199 X 127145 F Glass Fiber – Halogen-Free – Homopolymer	Yes	1.32	2.0 ft-lbs/in 107 J/m	8,000 psi 55 MPa	14,500 psi 100 MPa	0.90 x 10^6 psi 6,206 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
Nylon 6/6 (PA)								
RTP 200 FR NH Unreinforced – Halogen-Free	Yes	1.18	0.8 ft-lbs/in 43 J/m	11,000 psi 76 MPa	18,000 psi 124 MPa	0.55 x 10^6 psi 3,792 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 205 FR 30% Glass Fiber	Yes	1.66	2.0 ft-lbs/in 107 J/m	21,000 psi 145 MPa	33,000 psi 228 MPa	1.55 x 10^6 psi 10,687 MPa	V-0 @ 0.020 in 0.5 mm	960 °C @ 1/32 in 0.8 mm
RTP 205 FR XB 30% Glass Fiber (Black Only)	Yes	1.48	1.3 ft-lbs/in 69 J/m	20,000 psi 138 MPa	31,000 psi 214 MPa	1.50 x 10^6 psi 10,342 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 205 FR XC 30% Glass Fiber (Colors)	Yes	1.54	1.5 ft-lbs/in 80 J/m	22,000 psi 152 MPa	32,000 psi 221 MPa	1.60 x 10^6 psi 11,032 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 299 X 119106 H 30% Glass Fiber – Halogen-Free	Yes	1.41	1.8 ft-lbs/in 96 J/m	17,500 psi 121 MPa	27,500 psi 190 MPa	1.40 x 10^6 psi 9,653 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
Nylon 6 (PA)								
RTP 205 A FR 30% Glass Fiber	Yes	1.65	2.0 ft-lbs/in 107 J/m	20,000 psi 138 MPa	32,000 psi 221 MPa	1.20 x 10^6 psi 8,274 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 299 A X 117575 30% Glass Fiber – Halogen-Free	Yes	1.44	2.3 ft-lbs/in 123 J/m	16,000 psi 110 MPa	30,500 psi 210 MPa	1.57 x 10^6 psi 10,825 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
Polycarbonate (PC)								
RTP 300 FR A Unreinforced	Yes	1.21	12.0 ft-lbs/in 641 J/m	8,400 psi 58 MPa	12,000 psi 83 MPa	0.33 x 10^6 psi 2,275 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 305 FR 30% Glass Fiber	Yes	1.43	3.0 ft-lbs/in 160 J/m	18,000 psi 124 MPa	27,000 psi 186 MPa	1.20 x 10^6 psi 8,274 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
Polybutylene Terephthalate (PBT)								
RTP 1000 FR A Unreinforced	Yes	1.43	0.6 ft-lbs/in 32 J/m	9,000 psi 62 MPa	15,000 psi 103 MPa	0.43 x 10^6 psi 2,965 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 1005 FR A 30% Glass Fiber	Yes	1.63	1.5 ft-lbs/in 80 J/m	19,000 psi 131 MPa	30,000 psi 207 MPa	1.40 x 10^6 psi 9,653 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
RTP 1099 X 117578 A 30% Glass Fiber – Halogen-Free	Yes	1.56	1.8 ft-lbs/in 96 J/m	16,000 psi 110 MPa	24,000 psi 165 MPa	1.50 x 10^6 psi 10,342 MPa	V-0 @ 1/32 in 0.8 mm	960 °C @ 1/32 in 0.8 mm
Polycarbonate/Acrylic (PC/PMMA)								
RTP 1800 A FR A Unreinforced	Yes	1.25	20.0 ft-lbs/in 1,068 J/m	7,500 psi 52 MPa	12,000 psi 83 MPa	0.33 x 10^6 psi 2,275 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
Polycarbonate/ABS (PC/ABS)								
RTP 2500 FR A Unreinforced	Yes	1.21	10.0 ft-lbs/in 534 J/m	9,000 psi 62 MPa	14,000 psi 97 MPa	0.40 x 10^6 psi 2,758 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 1/16 in 1.5 mm
RTP 2500 FR-3010 Unreinforced – Halogen Free	Yes	1.2	13.0 ft-lbs/in 694 J/m	8,500 psi 59 MPa	15,000 psi 103 MPa	0.42 x 10^6 psi 2,896 MPa	V-0 @ 1/16 in 1.5 mm	960 °C @ 0.040 in 1.0 mm

View product data sheets for additional RTP Company flame retardant compounds at: www.rtpcompany.com/info/data

All the **Properties You Need** in **One Material**

FR + ???

With all the technical and regulatory challenges it entails, flame retardance is perhaps the most challenging property to achieve in thermoplastic materials. However, it is often only one of a host of properties necessary to make your application successful.

At RTP Company, our materials' expertise extends from achieving vital flame retardant characteristics to including the precise combination of engineering properties you need in a single material.

Compounding Enhancements

- Increased stiffness/toughness
- Wear resistance
- Tunable elastomeric hardness
- Static charge control
- Visually appealing color
- Bondable TPE

Don't Forget Color

Matching color in materials built for FR properties is especially challenging, since many additives can impact the appearance of pigments and dyes in thermoplastics. Over the years, we have earned a reputation for having an outstanding color organization, achieving successful color matches that others cannot.

More Than Formulations

After specification, RTP Company continues to work closely with you ensuring you get the best results from your custom compound. We can provide on-site trouble-shooting during molding or help optimize your design with computer-aided engineering services where we model how our material flows through your mold.

Application Checklist

Our Engineers Are Your Engineers

As your compounding partner, we are by your side every step of the way. Every formulation starts with our detailed and unique **Application Checklist** that makes sure every possible requirement is communicated and taken into account as we develop your custom compound.

What is the application's purpose, form, and function?

Resin Considerations

Cost Limitations
- Per pound/kilogram
- Per part (cubic volume)

Usage Environment
- Typical operating temperature
- Operating temperature range
  - ❑ Indoor
  - ❑ Outdoor
- Time length at temperature extremes
- UV exposure

Chemical Resistance
- Types of chemical exposure
  - ❑ Acids
  - ❑ Bases
  - ❑ Oils
- Time length of chemical exposure
- Temperature during chemical exposure

Physical Properties
- Strength
- Stiffness
- Flexibility
- Impact absorption
- Density
- Hardness
- Shrinkage

Material Replacement
- Old material
- Replacement reason

Processing Method
- Injection molding
- Profile extrusion
- Sheet/film/thermoforming

Value-Added Properties

Flammability Requirements
- Standard/rating
- Wall thickness
- Restrictions
  - ❑ RoHS
  - ❑ Halogen-Free

Electrical Requirements
- Anti-static
- Static dissipative
- Conductive
- EMI shielding

Wear Requirements
- Abrasion resistance
- Friction reduction

Color and Appearance
  - ❑ Custom color
  - ❑ Identification color
- Coloring method
- Surface finish

Other Requirements

Compliance
- Regulatory requirements
- Agency approvals
- Particular specifications
- Qualification method

Secondary Operations
- Painting
- Marking/labeling
- Bonding/welding
- Assembly method

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

Your Global Compounder of Custom Engineered Thermoplastics

If you're facing an FR material challenge, expert help is available

Global flame retardant (FR) regulations are moving quickly, as are the technologies that can ensure you meet them. If you are developing a new product, entering a new market, or need to reformulate in light of evolving regulations, RTP Company can help. We bring 40 years of FR expertise with leading OEMs, unmatched regulatory and testing knowledge, global reach, outstanding technical support and customer service, the ability to custom engineer an FR material with the exact combination of properties you require, and much more.

RTP Company is your global compounder of custom engineered flame retardant thermoplastics. Contact us today to discuss how we can help.

www.rtpcompany.com

Visit our website to view product data sheets for flame retardant compounds, along with technical information on RTP Company's complete portfolio of thermoplastic compounds.

Color • Conductive • Elastomer
Flame Retardant • Structural
Wear Resistant

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