



# ResinFormulators

INNOVATIVE MATTERS

**PRODUCT  
SELECTOR  
GUIDE**

## SOLVING UNIQUE CHALLENGES THROUGH CUSTOM ENGINEERING

**Resin Formulators** – exclusively engineered by the manufacturing division of GracoRoberts– is the time-tested and trusted brand of epoxy, urethane, and silicone specialty materials that can be uniquely customized, tested and certified on-demand. Whether you need a proprietary formulation for a specialty material, are looking to improve cure rates, or simply modify color or viscosity, Resin Formulators can help. Our innovative solutions serve many of the biggest names in engineering, and have solved complex challenges in nearly every manufacturing industry for over 60 years. Complete with an on-staff Chemist, a formulation and packaging team, and an innovation lab designed for state-of-the-art product development, Resin Formulators delivers high-quality and cost-effective solutions that are distinctively tailored to meet your advanced engineering needs.

## BEYOND CUSTOM FORMULATION: SPECIALTY PACKAGING AND DISPENSING

Resin Formulators doesn't stop at custom formulation. As part of our customer-focused and service-first approach, every deliverable can be enhanced with specialty packaging and dispensing. Our custom packaging and labelling capabilities help brand and optimize your business. Our dispensing technology ensures precision and safety with every application, eliminating waste and ensuring accuracy at the point-of-use. Tailor the amounts, choose the format, and modify the packaging to work as a complete solution for you and your team of engineers and project managers.

A wide range of services and options are available:

- » **Re-packing into smaller containers (gallons, quarts, pints)**
- » **Barrier kits**
- » **Single component cartridges**
- » **Side-by-side cartridges**
- » **Bi-packs**
- » **Pudding cups**
- » **Totes**
- » **Touch-up kits**
- » **Syringes**
- » **Pre-mixed and frozen**
- » **Degassing**

A dedicated Technical Account Manager will work with you to develop the right solution for your business.

## AEROSPACE FOUNDATION. BROAD APPLICATION.

Resin Formulators was developed decades ago to serve the highly technical aerospace industry. Through evolution and a quest for continuous improvement, we have diversified and formalized our portfolio of solutions for aerospace and other high-quality advanced engineering industries including automotive, composites, construction, electronics, marine, medical, sporting goods, solar, electric vehicles, and more. As part of that growth, Resin Formulators has amassed hundreds of custom and off-the-shelf boutique solutions including adhesives, sealants, potting and encapsulation compounds, resin systems, syntactics, and other specialty materials.

Resin Formulators is ISO9001:2015, AS9100, and AS9120-certified, and tests and certifies each of our products according to the highest industry standards. As part of the product development experience, you will receive a TDS with full specifications to verify that what we have formulated meets your requirements. Tests can include lap shear, tensile strength, hardness, pot life, slump, and much more.

We are pleased to offer in-house advanced testing services which enable us to test over 25 unique physical and mechanical properties to support your product engineering and quality control efforts.

In the pages that follow, you will find a sampling of our more popular formulations. The specifications listed for each product are general purpose, and can always be adapted to your needs. If you don't see your solution in the scope shown, our team of experts will work with you every step of the way to listen, develop, refine, and deliver specialty materials that meet or exceed your expectations.

Let us help you solve your advanced engineering problems.

**CALL: 1-800-374-3872**

**EMAIL: [info@resinformulators.com](mailto:info@resinformulators.com)**

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AEROSPACE OEM



AEROSPACE MRO



AUTOMOTIVE



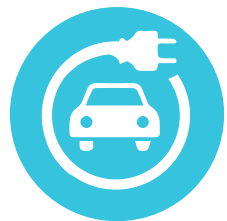
COMPOSITES



EVTOL



ELECTRONICS



ELECTRIC VEHICLE



MEDICAL DEVICE



SPORTING GOODS



MARINE

## POTTING AND ENCAPSULANTS

### RF 1158

RF 1158 is a filled, pourable epoxy resin which was formulated for potting, encapsulating or casting applications. RF 1158 is slightly thixotropic and will resist slumping. The cured properties can be tailored to a wide variety of applications by the choice of appropriate curing agents.

### RF 1319-2

RF 1319-2 A/B replaces RF 1319-1 A/B. Like RF 1319-1 A/B, it is a two-part, Shore A60, optically clear, urethane casting system. It does not contain TDI, MDI, or MOCA, and is easily mixed into pourable material. This system produces a flexible elastomer with excellent toughness, high elongation, good tensile and tear strength.

### RF 1366

RF 1366 is a medium viscosity standard epoxy resin designed for potting, encapsulating and filament winding. It can be used with a wide variety of curing agents to generate products with a broad range of work lives, cure conditions and mechanical properties. This system can be cured in high humidity and low temperatures and produces a hard, glossy surface. RF 1366 offers very good wet out and can produce a high strength laminate. In addition, this resin can be used for coating, potting and encapsulating small electronic components and exhibits good electrical properties.

### RFC 2296

RFC 2296 is a two part silicone RTV that has been modified to reduce density.

### RF 3000

RF 3000 is a low viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 4010

RF 4010 is a medium viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 4407

RF 4407 is a filled, thermally conductive, self-extinguishing epoxy resin designed for potting or casting in electrical applications. It is 100% reactive and produces no VOC. RF 4407 will pass the UL 94V-0 flame spread test using a casting as thin as 1/8 inch.

### RF 4010

RF 4010 is a medium viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 5000

RF 5000 is a standard viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 5020

RF 5020 is a medium-low viscosity unfilled potting epoxy, typically for environmental protection of electronic components.

### RF 5407

RF 5407 is an easy-to-use, alumina-filled, liquid epoxy resin with excellent electrical insulation properties and high thermal conductivity. When used in conjunction with a recommended curing agent, the cured product will have low shrinkage, excellent thermal stability and conductivity, and be a strong and durable casting.

### RF 6002

RF 6002 is a flowable, high temperature and excellent chemical-resistant epoxy resin which can be used for laminating, bonding and/or encapsulating a wide variety of materials. When used with the appropriate curing agent, this product has excellent adhesion to metal and plastic substrates, as well as excellent water soak and environmental resistance.

## LAMINATING

### RF 3000

RF 3000 is a low viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 4010

RF 4010 is a medium viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 5000

RF 5000 is a standard viscosity, unfilled, clear general purpose epoxy resin for potting, laminating, and casting applications.

### RF 6002

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### RF 6004

RF 6004 is a low viscosity, poly functional resin for filament winding and laminating. It is formulated to give high Tg's when cured with anhydrides or cycloaliphatic amines.

## FILAMENT WINDING

### RF 1366

RF 1366 is a medium viscosity standard epoxy resin designed for potting, encapsulating and filament winding. It can be used with a wide variety of curing agents to generate products with a broad range of work lives, cure conditions and mechanical properties. This system can be cured in high humidity and low temperatures and produces a hard, glossy surface. RF 1366 offers very good wet out and can produce a high strength laminate. In addition, this resin can be used for coating, potting and encapsulating small electronic components and exhibits good electrical properties.

### RF 3000

RF 3000 is a low viscosity, unfilled, clear general purpose epoxy resin for filament winding applications.

### RF 4010

RF 4010 is a medium viscosity, unfilled, clear general purpose epoxy resin for filament winding applications.

### RF 5000

RF 5000 is a standard viscosity, unfilled, clear general purpose epoxy resin for filament winding applications.

### RF 6002

RF 6002 is a flowable, high temperature and excellent chemical-resistant epoxy resin which can be used for laminating, bonding and/or encapsulating a wide variety of materials. When used with the appropriate curing agent this product has excellent adhesion to metal and plastic substrates, as well as excellent water soak and environmental resistance.

### RF 6004

RF 6004 is a low viscosity, poly functional resin for filament winding and laminating. It is formulated to give high Tg's when cured with anhydrides or cycloaliphatic amines.

## HIGH TEMPERATURE

### RF 713 A/B KIT

RF 713 is a thixotropic epoxy adhesive system with good physical strength and high electrical conductivity. This material is designed to be used where hot solder applications are impractical or on parts which cannot be subjected to heat. RF 713 is also effective as a shielding material.

### RF 2869 (MOD 2) PRE-MIXED AND FROZEN

RF 2869 (Mod 2) is a one-part, silver-filled, electrically conductive epoxy adhesive. It does not require mixing or vacuum degassing, resulting in a casting free of voids. Cure is achieved at temperatures as low as 180°F for one hour. When cured, this adhesive will have very high thermal and electrical conductive properties and bonds well to a variety of substrates.

### RF 2969 (MOD 4) A/B KIT

RF 2969 (Mod 4) is a thixotropic, high strength epoxy adhesive system with good physical strength and high electrical conductivity. This material is designed where hot solder applications are impractical or on parts which cannot be subjected to heat. RF 2969 (Mod 4) is also effective as a shielding material. Open working time is 45 minutes and full cure is achieved in 24 hours at room temperature.

### RF 2969 (MOD 7) A/B KIT

RF 2969 (Mod 7) is a thixotropic, high strength epoxy adhesive with good physical strength and high electrical conductivity. Mod 7 has a higher viscosity and a shorter thin film set time than mod 4. This material is designed where hot solder applications are impractical or on parts which cannot be subjected to heat. RF-2969 (Mod 7) is also effective as a shielding material.

### RF 6002

RF 6002 is a flowable, high temperature and excellent chemical-resistant epoxy resin which can be used for laminating, bonding and/or encapsulating a wide variety of materials. When used with the appropriate curing agent this product has excellent adhesion to metal and plastic substrates, as well as excellent water soak and environmental resistance.

### RF 6004

RF 6004 is a low viscosity, poly functional resin for filament winding and laminating. It is formulated to give high Tg's when cured with anhydrides or cycloaliphatic amines.

### RF 6100 A/B KIT

RF 6100 A/B Kit RF 6100 is a medium viscosity, high temperature epoxy adhesive system for bonding metal and composite structures. RF 6100 has an open pot life of four hours and cures in one hour at 200°F.

## GENERAL PURPOSE

### EC 2216 GRAY B/A W/2% CAB-O-SIL

3M Scotch-Weld Epoxy Adhesive EC-2216 B/A is a flexible, two-part, room temperature curing epoxy with high peel and shear strength. Scotch-Weld EC-2216 Adhesive has been tested and certified for aircraft and aerospace application. \*test data available upon request

### RF 912 A/B KIT

RF 912 is a high strength epoxy adhesive system for bonding a wide variety of substrates, including plastics. This product is thixotropic and can be used on vertical surfaces without excessive run out from the bond line. RF 912 has an open working time of 30 to 45 minutes and will cure at room temperature.

### RF 913 A/B KIT

RF 913 is a toughened epoxy adhesive system for bonding a wide variety of substrates. This product is semi-thixotropic and can be used on vertical surfaces without excessive bleed from the bond line. RF 913 has excellent adhesion to metal and plastic substrates as well as excellent water soak and environmental resistance. RF 913 has an open working time of 30 to 45 minutes and should be heat cured at 150°F to 180°F to achieve the best results.

### RF 1120 A/B KIT

RF 1120 is an excellent general purpose two-part epoxy adhesive system for bonding a wide variety of substrates. RF 1120 has a typical open working time of two hours and will room temperature cure. This product is thixotropic and can be used on vertical surfaces without excessive run out from the bond line.

### RF 1392 (MOD 1)/1393 (MOD 1) A/B KIT

RF 1392 (Mod 1) and RF 1393 (Mod 1) are medium fast curing toughened epoxy adhesive systems for bonding a wide variety of substrates. These products are slightly thixotropic, and can be used on vertical surfaces without excessive run out from the bond line. The products have excellent adhesion to metal and plastic substrates as well as excellent water soak and environmental resistance.

### RF 2070 A/B KIT

RF 2070 is a two-component toughened paste adhesive, which combines high peel strength at room temperature with lap shear strength retention to 225°F (107°C). Glass beads are added for bond line control.

### RF 5061 A/B KIT

RF 5061 is a two-part, semi-thixotropic epoxy paste designed for bonding soft, semi-porous materials such as wood, ceramic or composites. RF 5061 (Mod 1) and (Mod 2) are accelerated versions of RF 5061 that reduce fixturing time. When heated to 150°F, RF 5061 (Mod 1) can be handled and machined after 15-20 minutes.

### RF 6110

RF 6110 is a structural adhesive, with a high peel strength and elevated temperature performance.

## SYNTACTICS

### RF 955

RF 955 is an easy-to-mix two-part, high strength epoxy fairing compound. It is designed to hold up to a one inch peak before cure and is easily smoothed to a paintable surface. This high strength material bonds well to a wide variety of substrates, including most metals and rigid plastics.

### RF 1141

RF 1141 is a two-part low-density, fast-set syntactic system. This product is thixotropic and can be used on vertical surfaces without excessive run out from the bond line. RF 1141 has a working life of 20 minutes and cures in six to eight hours at room temperature.

### RF 1143

RF 1143 is a two-part low-density, fast-set syntactic system. This product is thixotropic and can be used on vertical surfaces without excessive run out. RF 1143 has a working life of 40 minutes and cures in six to eight hours at room temperature.

### RF 1144

RF 1144 is a two-part heat cured, low density, high strength, syntactic system that is formulated for continuous service at high temperatures. RF 1144 has excellent mechanical properties up to 350°F.

### RF 1145 1-COMPONENT

RF 1145 is a high strength syntactic putty for structural filling of composite parts. It has long out time coupled with rapid cure above 220°F and can be co-cured with most 250°F pre-pregs.

### RF 1146

RF 1146 is a syntactic potting compound with low density and low viscosity.

### RF 1148 FR

RF 1148 is a high strength, syntactic potting compound formulated to meet UL 94 V0 flammability requirements. It features a rapid set time and non-slump handling characteristics.

### RF 1164

RF 1164 is a syntactic potting compound with low viscosity, fast-set syntactic.

### RF 1710

RF 1710 is an easy-to-use, CFC-free, two-part foam-in-place rigid foam system. The cured foam is effective in operating environments of -40°F to 250°F, with a peak of 300°F for short periods. The system has a cream time of 40 seconds and cures at a density of 6lb/ft<sup>3</sup>. Alternate versions with 2lb/ft<sup>3</sup> and 4lb/ft<sup>3</sup> density are also available.

## SPECIALTY MATERIALS

### RF 825

RF 825 is a two-component, low viscosity epoxy system used for potting electronic packages, generally with vacuum impregnation techniques. It is a highly temperature resistant, low outgassing material designed for high voltage devices in space. As a cured thermoset plastic, it exhibits excellent chemical resistance and electric properties. When cured, this system has good adhesive bond strengths to a variety of metal and non-metal substrates.

## SPECIALTY MATERIALS (CONT'D)

### RF 1386

RF 1386 is a two-part, thixotropic, high strength epoxy adhesive system designed for use in food packaging and water filtration applications and meets the requirements of provision 21 CFR 175.105. The raw materials used in RF 1386 are listed for use in "Food Packaging Adhesive" applications and are classified as FDA Approved under the same provision. It has excellent wet out and can easily penetrate fibrous substrates. RF 1386 has exceptional adhesive strength to a wide variety of substrates, including membranes, separators and other material used in reverse osmosis.

### RF 1591

RF 1591 BK is UL registered to UL 94V-0 as a self-extinguishing potting system. RF 1591 BK is a low viscosity system with good thermal conductivity, chemical, and thermal shock resistance and exhibits excellent adhesion to a variety of substrates.

### RF 1735

RF 1735 (Mod 1) is an easy-to-use, two-part, medium-soft (Shore A 60), high temperature, urethane potting compound. RF 1735 (Mod 1) does not contain TDI or MOCA. The hydrolytic stability of this system is remarkable. Thirty days at 212°F and 95% relative humidity have little effect on the properties. Thermal stability is exceptional, with intermittent temperatures as high as 300°F causing little or no degradation. The material remains thermally stable to temperatures well below -40°F with a brittle point at less than -60°F.

### RF 2500

RF 2500 is a glycerol polyglycidyl ether.

### RF 2388 1-COMPONENT

RF 2388 is a 1-component anti-corrosion paste adhesive system for aluminum substrates with excellent high temperature properties.

### RF 1350 MOD 4

RF 1350 M4 A/B is a two-part, quick curing, natural colored urethane adhesive/potting system. It has a shore A hardness between 60-65. This system was developed for potting connectors; small electronic components where flexibility is needed. RF 1350M4 A/B does not contain TDI or MOCA, and is easily mixed into a pourable material. When cured, this urethane system produces a flexible elastomer with excellent toughness, high elongation, and has very good adhesive strength to a variety of plastics.

## CURING AGENTS

### RF 9

RF 9 is an accelerated polyamide curing agent with a pot life of 30-40 minutes. It has excellent adhesion to a wide range of substrates and a service temperature up to 250°F.

### RF 14

RF 14 is a primary amine curing agent. A mix with RF 14 will have a 20 minute pot life under normal conditions. Cure will take place at room temperature or, in small castings or adhesives, can be accelerated with heat. Some properties are improved with a one hour post cure at 200° F.

### RF 24

RF 24 is a cycloaliphatic amine curing agent used to cure various epoxy resins at elevated temperatures. The properties of RF 24 include light color, low viscosity, long pot life, and rapid cure. Due to its unique composition, RF 24 is often recommended as a replacement for aromatic amines.

### RF 30

RF 30 is a low viscosity polyether diamine with low color and moderate reactivity in epoxy curing blends. The polyether backbone of RF 30 yields cured resins with relatively high elongation, toughness and thermal shock resistance.

### RF 32

RF 35 is a modified aromatic amine. It offers long pot life coupled with rapid cure response. RF 32 is non-staining and has physical properties and chemical resistances equivalent to MDA cured resins.

### RF 35

RF 35 is a modified aromatic amine. It offers long pot life coupled with rapid cure response. RF 32 is non-staining and has physical properties and chemical resistances equivalent to MDA cured resins.

### RF 36

RF 36 is a modified low viscosity amidoamine hardener. It offers improved chemical resistance and better low temperature cure than standard amidoamine hardeners.

### RF 47

RF 47 curing agent is a polyamide curing agent. It offers a longer pot/working life than DETA or TETA. When cured with epoxy resins, it produces a high strength thermoset plastic. This curing agent, along with an appropriate epoxy resin, can be used in adhesives, and in potting and encapsulating applications of small electronic components.

### RF 61

RF 61 is a polyamide curing agent for use with various epoxy resins. This specific curing agent is designed to add toughness and flexibility to cured epoxy resins. It has very good adhesive strength characteristics and will bond with most substrates.

### RF 66

RF-66 is an amidoamine curing agent for use with various epoxy resins. This curing agent will cure epoxy resins at ambient temperatures or can be heat cured. A mix with RF-66 will have a very long pot life of nearly 6 hours under normal conditions. This curing agent can be used in compliance with 21 CFR 175.300 and 21 CFR 176.170 as a component of FDA-compliant epoxy systems.

### RF 77

RF 77 is a low viscosity polyamine curing agent exhibiting a rapid cure at room temperature. It produces a high strength clear amber thermoset plastic. This curing agent can be used for adhesives, coatings, and small castings or electrical potting and encapsulation.

### RF 78

RF 78 is an ambient or elevated temperature curing agent for use with liquid epoxy resins. It is designed to minimize the skin irritation potential associated with unmodified aliphatic amines.

### RF 81

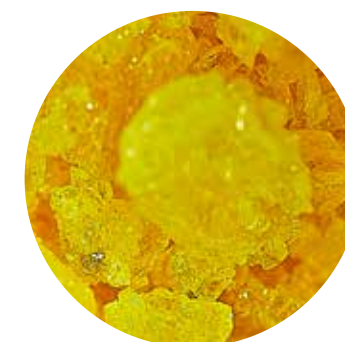
RF 81 is a low viscosity polyamide curing agent developed for curing epoxy resins. It offers a shorter pot/working life than most polyamide curing agents. When cured with epoxy resins, it produces a high strength thermoset plastic with good adhesive and physical properties.

### RF 96

RF 96 is a modified cycloaliphatic amine curing agent for use with various epoxy resins. This curing agent will cure epoxy resins under high humidity and low temperatures to 40°F as well as under water.

### RF 612

RF 612 is polyglycoldiamine (PGDA) which is similar to the polyoxypropylamine types of curing agents. It offers a longer pot/working life than DETA or TETA. When cured with epoxy resins, it produces a high strength flexible thermoset plastic with excellent impact and thermal shock resistance. This curing agent along with an appropriate epoxy resin can be used in potting / encapsulating of small electronic components, adhesive applications and laminates. The cured system has excellent adhesive properties.



Resin Formulators can supply a catalyst with any resin to deliver the desired rate-of-cure and can customize the process and performance properties of the system.

**PRODUCT SELECTOR DATA SHEET**

<b>POTTING &amp; ENCAPSULANTS</b>														
Product	Curing Agent	WPE/AEW	Viscosity (centipoise) 77F	Gel Time (25C)	Tg (C)	Lap Shear (psi)	CTE (below Tg)	Volume Resistivity	Specific Gravity 77F	Shore Hardness	Cure Temperature (C)	Cure Time	Storage Temperature (C)	Mix Ratio by Weight (phr)
RF 1158	RF 47	-	224400	93	73	3478	-	-	1.13	80	25C	3-5 days	N/A	100:64
RF 1319-2 A/B Kit		-	<2000	45 min	N/A	N/A	-	-	1.08	60	25C	24 hr	N/A	100:100
RF 1366		182	8000-11000	-	-	-	-	-	1.16	-	-	-	N/A	-
RF 1366	RF 96	101	150	40 min	48	4478	-	-	1.12	85	25	3-5 days	18-27C	100:57
RF 1366 MOD 3		169	900-1200	-	-	-	-	-	1.15	-	-	-	18-27C	-
RF 1366 MOD 3	RF 14	27	20	30 min	90	3310	-	-	1.12	80	25	3-5 days	18-27C	100:16
RF 2296 A/B Kit		-	NT	120 min	N/A	34	-	-	1.32	40	25	3-5 days	18-27C	100:0.6
RF 3000		187	500-700	-	-	-	-	-	1.13	-	-	-	N/A	-
RF 3000	RF 61	100	11000	120 min	69	5450	-	5.60E+14	1.08	80+	25	3-5 days	18-27C	100:53
RF 3000	RF 66	105	250	8 hr	47	3500	9	5.60E+14	1.06	70+	25	5-7 days	18-27C	100:56
RF 3000	RF 96	101	150	20-30 min	44	4221	96	5.60E+14	1.09	80+	25	3-5 days	18-27C	100:54
RF 4010		182	3500-4500	-	-	-	-	-	1.16	80+	25C	3-5 days	18-27C	-
RF 4010	RF 9	42	300	30-45 min	81	4800	67	5.60E+14	1.12	85+	25C	3-5 days	18-27C	100:23
RF 4010	RF 14	27	20	20-30 min	86	3400	60	5.60E+14	1.13	85+	85C	6 hours	18-27C	100:15
RF 4010	RF 24	60	120	5-6 hr	131	3000	66	5.60E+14	1.12	80+	85C	4 hours	18-27C	100:33
RF 4010	RF 35	81	70	6-8 hr	68	5100	62	5.60E+14	1.1	80+	25C	3-5 days	18-27C	100:44
RF 4010	RF 61	100	1000	60-120 min	52	3400	76	5.60E+14	1.09	80+	25C	3-5 days	18-27C	100:55
RF 4010	RF 96	101	150	30-40 min	55	3200	70	5.60E+14	1.12	80+	25C	3-5 days	18-27C	100:55
RF 4010	RF 612	56	10	60-90 min	55	4300	49	5.60E+14	1.12	-	-	-	18-27C	100:31
RF 4407		-	120000-160000	-	-	-	-	-	1.64-1.79	-	-	-	18-27C	-
RF 4407	RF 14	27	20	20-30 min	100	2400	-	-	1.59	80+	25C	3-5 days	18-27C	100:6
RF 4407	RF 24	60	120	5-6 hr	*	2084	-	-	1.53	80+	85C	6 hours	18-27C	100:13.7
RF 4407	RF 61	100	11000	90-120 min	80	2830	-	-	1.46	80+	25C	3-5 days	18-27C	100:23
RF 4407	RF 612	56	10	60-90 min	115	2659	-	-	1.54	80+	25C	3-5 days	18-27C	100:13
RF 5000		189	11000-15000	-	-	-	-	-	1.16	-	-	-	18-27C	-
RF 5000	RF 612	100	11000	120 min	-	5516	-	-	-	80+	25C	3-5 days	18-27C	100:29
RF 5407		573	110000-150000	-	-	-	-	-	2.15-2.2	-	-	-	18-27C	-
RF 5407	RF 9	42	300	40-60 min	84	2400	42	1.60E+15	1.98	85+	25C	3-5 days	18-27C	100:9
RF 5407	RF 14	27	20	30-40 min	84	2482	38	1.60E+15	2	85+	25C	3-5 days	18-27C	100:5
RF 5407	RF 24	60	120	6 hr	134	2600	44	1.60E+15	1.95	85+	82C, 121C	30 mins plus 2 hours	18-27C	100:10.5
RF 5407	RF 35	81	70	8 hr	73	2400	40	1.60E+15	1.88	80+	82C	4 hours	18-27C	100:14
RF 5407	RF 91	100	11000	120 min	52	2600	44	1.60E+15	N/A	80+	25C	3-5 days	18-27C	100:17
RF 5407	RF 612	56	10	60 min	70	3000	47	1.60E+15	1.97	85+	25C	3-5 days	18-27C	100:10
RF 5407 FR		573	600000-700000	-	-	-	-	-	N/A	-	-	-	18-27C	-
RF 5407 FR	RF 24	60	120	6 hr	134	2600	-	-	N/A	85+	82C/121C	1 hour/1hour	18-27C	100:10.5
RF 6002		147	12000	-	-	-	-	-	1.17	-	-	-	18-27C	-
RF 6002	RF 32	48.5	200	180 min	N/A	N/A	-	-	1.12	85+	82C/121C	2 hours/2 hours	18-27C	100:35

**PRODUCT SELECTOR DATA SHEET (CONTINUED)**

**LAMINATING AND FILAMENT WINDING**

Product	Curing Agent	WPE/AEW	Viscosity (centipoise) 77F	Gel Time (25C)	Tg (C)	Lap Shear (psi)	CTE (below Tg)	Volume Resistivity	Specific Gravity	Shore Hardness	Cure Temperature (C)	Cure Time	Storage Temperature (C)	Mix Ratio by Weight (phr)
RF 1366		182	8000-11000	-	-	-	-	-	1.16	-	-	-	18-27C	-
RF 1366 MOD 3		169	900-1200	-	-	-	-	-	1.15	-	-	-	18-27C	-
RF 3000		187	500-700	-	-	-	-	-	1.13	-	-	-	18-27C	-
RF 4010		182	3500-4500	-	-	-	-	-	1.16	-	-	-	18-27C	-
RF 4010	RF 9	42	300	30-40 min	81	4800	67	6.00E+14	-	80+	25C	3-5 Days	18-27C	100:23
RF 5000		189	11000-15000	-	-	-	-	-	1.16	-	-	-	18-27C	-
RF 6002		174	12000	-	-	-	-	-	1.17	-	-	-	18-27C	-
RF 6002	RF 53	178	230	12-18 hr	180	N/A	-	-	1.2	80+	177C	2-4 hr	18-27C	100:80
RF 6002	RF 88	42	350	180 min	172	N/A	-	-	1.14	80+	84C/177C	30m/1 hr	18-27C	100:24
RF 6002	RF 24	60	120	4-5 hr	170	N/A	-	-	1.12	80+	84C/177C	30m/1 hr	18-27C	100:34
RF 6004		139	2100	-	-	-	-	-	1.15	-	-	-	18-27C	-
RF 6004	RF 53	178	230	18 hr	178	N/A	-	-	1.1	80+	177C	2-4 hr	5C	100:110
RF 6004	RF 88	42	350	3-4 hr	208	N/A	-	-	1.13	80+	84/177C	30m/1 hr	18-27C	100:30
RF 6004	RF24	60	120	8-9 hr	206	N/A	-	-	1.12	80+	84/177C	30m/1 hr	18-27C	100:43
RF 6004 MOD 1		177	900	-	-	-	-	-	1.16	-	-	-	18-27C	-
RF 6004 MOD 1	RF53	178	230	18 hr	228	N/A	-	-	1.1	80+	177C	2-4 hr	5C	100:137
RF 6004 MOD 1	RF 88	42	350	4 hr	220	N/A	-	-	1.13	80+	84/177C	30m/1 hr	18-27C	100:36
RF 6004 MOD 1	RF 24	30	120	9-10 hr	220	N/A	-	-	1.11	80+	84/177C	30m/1 hr	18-27C	100:51

**CONDUCTIVE, HIGH TEMPERATURE, AND GENERAL PURPOSE ADHESIVES**

Product	Viscosity A (centipoise)	Viscosity B (centipoise)	Mixed Viscosity (centipoise)	Gel Time (25C)	Tg (C)	Lap Shear (psi)	CTE	Volume Resistivity	NASA Outgassing	Specific Gravity	Shore Hardness	Cure Temperature (C)	Cure Time	Storage Temperature (C)	Mix Ratio by Weight (phr)
RF 713 A/B Kit	Thixotropic	3900	Thixotropic	20 min	-	1840	-	3E-3	-	2.7	-	60C	2 hours	5C	100:8
RF 912 A/B Kit	Thixotropic	180000	Thixotropic	90 min	-	2100	-	-	-	-	75+	25C	3-5 days	18-27C	100:96
RF 913 A/B Kit	220000	75000	Thixotropic	40-45 min	-	2700	-	-	2.93/0.01/0.33	1.35	75+	25C	3-5 days	18-27C	100:100
RF 1120 A/B Kit	Thixotropic	11000	Thixotropic	120 min	46C	3000	91	-	-	-	75	75C	2 hours	18-27C	100:74
RF 1393 (MOD 1) A/B Kit	70000	60000	Thixotropic	40 min	-	2000	-	-	-	-	-	25C	16 hours	18-27C	100:85
RF 2070 A/B Kit	-	-	120000	50 min	107C	-	-	-	-	-	-	25C	5-7 days	-	100:43
RF 2869 (Mod 2) 1-Component	300000	-	Thixotropic	3 days	68C	-	50	2.0E-4	-	-	80+	121C	15 minutes	-18C	N/A
RF 2969 (MOD 4) A/B	70000	300000	280000	90 min	50C	1700	52	2E-3	0.21/0.00/0.05	4.4	70+	60C	4 hours	5C	100:50
RF 2969 (MOD 7) A/B	880000 (thixo)	-	Thixotropic	60 min	68C	1800	43	4.5E-3	-	4.3	80+	25C	16 hours	5C	100:50
RF 5061 A/B Kit	135000	14000 (thixotropic)	-	80 min	-	4000	-	-	-	part A - 1.16, part B - 1.04	80+	65C	2 hours	18-27C	100:45
RF 6100 A/B Kit	-	-	-	4-5 h	180C	3800	-	-	-	-	-	93C	1 hour	5C	100:26.6
RF 6110	170,000	270,000	-	50 min	108C	4800	-	-	-	-	85	25C	7 days	5C	100:58

**PRODUCT SELECTOR DATA SHEET (CONTINUED)**







<b>SYNTACTICS</b>												
Product	Viscosity A	Viscosity B	Mixed Viscosity	Gel Time	Tg (C)	Lap Shear (psi)	Compressive Strength	Specific Gravity	Cure Temperature (C)	Cure Time	Storage Temperature (C)	Mix Ratio by Weight (phr)
RF 955 A/B Kit	-	-	Thixotropic	60 min	-	2100	6600	1.12	65C	2 days	18-27C	100:50
RF 1131 A/B	-	-	-	701 min	122	-	-	.56	60	-	-	-
RF 1133 A/B	-	-	-	1335 min	110	-	-	.55	60	-	-	-
RF 1141 A/B Kit	Thixotropic	-	Thixotropic	30 min	-	1200	3800	.48	25C	3-5 days	18-27C	100:10.5
RF 1141 FR A/B	-	-	-	-	-	-	-	.54	55	-	-	-
RF 1143-1 A/B Kit	Thixotropic	-	Thixotropic	30 min	-	-	-	.70	25C	3-5 days	18-27C	100:8.6
RF 1144 A/B Kit	-	-	80,000	3-4 hours	120	-	-	.68	25C	3-5 days	18-27C	100:21
RF 1163 A/B	-	-	-	75 min	146	-	-	.63	25C	3-5 days	Part A 40F Part B Ambient	100:42
RF 1710 A/B Kit	-	-	N/A	N/A	-	-	43/22	.1	25C	24 hours	5C	100:92
RF 1148 FR	-	-	Thixotropic paste	20 min	-	1800	12000	.9	25C	24 hours	18-27C	100:33
RF 1145 1-Component	Thixotropic	-	Thixotropic	5-8 min	-	-	16000	1.18	121C	1 hour	5C	-
RF 1164 A/B Kit	Thixotropic	-	20,000	75 min	187	2200	9000	.56	25C	5-7 days	5C	100:28.8







<b>SPECIALTY MATERIALS</b>												
Product	Viscosity A (centipoise)	Viscosity B (centipoise)	Mixed Viscosity (centipoise)	Gel Time (25C)	Lap Shear (psi)	Volume Resistivity	Specific Gravity	Shore Hardness	Cure Time Temperature (C)	Cure Time	Storage Temperature (C)	Mix Ratio by Weight (phr)
RF 825 A/B Kit	6000	-	1000	30 min	-	-	-	85+	75C	12 hours	18-27C	100:18
RF 1386 A/B Kit	9000	78000	Thixotropic	2 h	1700	-	1.2/0.96	70+	25C	3-7 days	18-27C	100:45
RF 1591 BK A/B Kit	UL-94 V-0	35000	4500	20000	35 min	1000	-	80	25C	3-5 days	18-27C	100:17
RF 1735 A/B Kit	Thixotropic	Thixotropic	1700-2000	90 min	2000	1.0E15	1.2/1.3	60	25C	24 hours	18-27C	37:63
RF 2388 1-Component	600000	-	550000	<30 days	2500	-	-	85+	135C	90 minutes	5C	-
RF 1350 Mod 4	2400	3000	<2000	5-7 min	-	8.2E10	1.15/1.04	50A	25C	24 hours	18-27C	55:100

<b>CURING AGENTS</b>				
Product	WPE/AEW	Viscosity (centipoise)	Gel Time (POT LIFE mins)	Storage
RF 9	42	300	60	18-27C
RF 14	27	20	30	18-27C
RF 24	60	120	400	18-27C
RF 30	60	10	400	18-27C
RF 32	48.5	200	270	18-27C
RF 35	81	70	360	18-27C
RF 36	93	680	100	18-27C
RF 47	120	40000	120	18-27C
RF 61	100	11000	200	18-27C
RF 66	105	250	385	18-27C
RF 77	41	60	8	18-27C
RF 78	36	300	18	18-27C
RF 81	95	1600	65	18-27C
RF 96	101	150	30	18-27C
RF 612	56	10	60	18-27C



# PRODUCT CLASSIFICATIONS

	 Aerospace	 Electronics	 Composites	 Medical Device	 Automotive	 Electric Vehicles
EC 2216 Gray B/A w/2% Cab-O-Sil	X	X	X			
RF 1120 A/B Kit	X		X		X	
RF 1141 A/B Kit	X		X			
RF 1143-1 A/B Kit	X		X			
RF 1144 A/B Kit		X			X	X
RF 1145 1-Component	X					
RF 1146 A/B Kit		X				
RF 1146 (Mod 1)		X				
RF 1148 FR	X					
RF 1158				X		
RF 1164 A/B Kit	X		X			
RF 1319-2 (Slow) Urethane Casting A/B Kit				X		
RF 1350 (Mod 4)		X				
RF 1366	X	X	X	X	X	
RF 1366 (Mod 3)	X	X	X	X	X	
RF 1386 A/B Kit	X			X		
RF 1393 (Mod 1) A/B Kit	X					
RF 1591 BK A/B Kit	X	X				
RF 1710 A/B Kit	X	X	X			
RF 1735 A/B Kit		X				
RF 2070 A/B Kit	X		X			
RF 2388 1-Component	X	X	X			
RF 2500	X		X			
RF 2869 (Mod 2) 1-Component		X				
RF 2969 (Mod 4) A/B	X	X				X
RF 2969 (Mod 7) A/B	X	X				X
RF 3000	X	X	X	X		
RF 4010	X	X	X			
RF 4407		X		X		X
RF 5000	X	X	X	X	X	X

	 Aerospace	 Electronics	 Composites	 Medical Device	 Automotive	 Electric Vehicles
RF 5020		X	x	X		
RF 5061 A/B Kit			X			
RF 5407	X	X			X	X
RF 5407 FR	X	X			X	X
RF 6002	X		X			
RF 6004	X		X			
RF 6004 (Mod 1)			X			
RF 6100 A/B Kit	X	X	X			
RF 6110	X		X			
RF 713 A/B Kit		X				X
RF 825 A/B Kit	X	X	X			
RF 912 A/B Kit		X	X		X	X
RF 913 A/B Kit			X		X	
RF 955 A/B Kit	X					
RFC 2296 A/B Kit	X		X			
RF 2869 (Mod 2) Pre-Mixed & Frozen	x	x			x	x
RF 14	X	X	X	X	X	
RF 24		X				X
RF 30	X	X	X	X		
RF 32		X	X			
RF 35	X	X	X			
RF 36	X					
RF 47	X	X	X	X		
RF 61	X	X				
RF 612	X	X	X			
RF 66	X	X	X	X		
RF 77	X	X	X	X		
RF 78	X					
RF 81	X	X	X	X		
RF 9	X	X	X		X	
RF 96	X			X		

## FULL-SERVICE LABORATORY AND TESTING SERVICES

The in-house chemical testing services performed by Resin Formulators' team of highly experienced chemists and technicians cover a wide-range of physical and mechanical techniques to ensure the quality and desired performance of your specialty chemical products. Our testing capabilities speed up the product development timeline by fifty percent, and increases our ability to test for customer specifications, batch requirements, and assist with expedite delivery needs.

We are pleased to offer the following advanced testing services which enable us to test a wide range of unique physical and mechanical properties to support your product engineering and quality control efforts.

To discuss test method details or ASTM-specific options, please contact us at [info@resinformulators.com](mailto:info@resinformulators.com).



## LAB TESTING SERVICES

### COMPRESSION STRENGTH | \$450

Compression Strength is the stress required to cause plastic deformation. Plastic deformation is the permanent change in the shape or size of a solid body without fracture, resulting from sustained stress beyond the elastic limit. Cylinder shaped specimens are placed in a test machine that applies an increasing compressive force until plastic deformation weakens the sample. The highest force recorded prior to deformation is the Compression Strength.

### DEGREE OF CURE | \$450

The Degree of Cure is one of the key state variables in that it can describe the physical state of the thermoset as it transitions from a flowing resin into a solid matrix material. The degree of cure value can provide insight as to whether the polymer is still a flowing resin, has become a gelled semi-solid, or has become a physical solid with some insight into the potential mechanical strength of that solid.

### DENSITY (SPECIFIC GRAVITY) | \$100

Density is mass divided by volume. We conduct these tests after conditioning the material to 75°F (24°C) to eliminate variation in density assessment due to temperature variation. Density will be provided in either pounds per gallon, or grams per cubic centimeter (also referred to as specific gravity).

### DIFFERENTIAL SCANNING CALORIMETRY (DSC) | \$350

DSC is a thermal analysis apparatus measuring how physical properties of a sample change, along with temperature against time. In other words, the device is a thermal analysis instrument that determines the temperature and heat flow associated with material transitions as a function of time and temperature.

### DYNAMIC MECHANICAL ANALYSIS (DMA) | \$450

A Dynamic Mechanical Analysis, otherwise known as DMA, is a technique where a small deformation is applied to a sample in a cyclic manner. This allows the materials' response to stress, temperature, frequency, and other values to be studied. It is extremely useful for defining engineering limitations for a materials' capacity to withstand specific temperature exposure.

### FOURIER TRANSFORM INFRARED SPECTROSCOPY (IR OR FTIR) | \$250

Fourier Transform Infrared Spectroscopy (FTIR) is a technique used to obtain infrared spectrum of absorption, emission, and photoconductivity of a solid, liquid, or gas. It is used to detect different functional groups in PHB. FTIR spectrum is recorded between 4000 and 400 cm<sup>-1</sup>. The resulting image is a chemical fingerprint of the material in question.

### GEL TIME | \$150

Gel Time is the time it takes for a mixed resin system to gel or become so highly viscous that it can no longer be considered workable or able to be handled. These tests are run using a 100-gram mass in our gel time test device.

### GLASS TRANSITION (TG) | \$350

Glass Transition Temperature (T<sub>g</sub>) is a very useful property for understanding the thermal characteristics of an epoxy resin system. The T<sub>g</sub> is the temperature at which the epoxy changes from a glassy (solid) state to a soft, rubbery state. It can be considered the point at which a measurable reduction in physical properties occurs resulting from exposure to elevated temperatures. Please note that T<sub>g</sub> values can be reported after a second heat. The second heat is the process of testing the sample after it has been exposed to an initial first heat which results in an elevated temperature, 392°F (200°C), post-cured sample. The second scan test is useful to understand the outcome of a post cure exposure to the resin system, which, in many cases can boost the defined temperature resistance.

### HEAT CAPACITY | \$350

Heat capacity describes how much heat must be added to a substance to raise its temperature by 1 degree Celsius.

### HEAT OF REACTION/CURE KINETICS | \$350

This test method determines the exothermic heat of reaction of thermally reactive chemicals or chemical mixtures, using milligram specimen sizes, by differential scanning calorimetry. This test method is useful in determining the extrapolated onset temperature, the peak heat flow temperature and the heat of reaction of a material via ASTM E2160.

## LAB TESTING SERVICES (CONT'D)

### LAP SHEAR (ASTM D1002) | \$350

Lap Shear measures the strength of an epoxy bonded joint when loaded in shear. The test is performed by bonding two metal coupons together with a 1/2" overlap and then pulling them apart with tension in a test machine. The tensile force creates a shear force in the bond line and the resulting stress is reported as the Lap Shear strength.

### MELTING POINT | \$350

Determining the melting point of a compound is one way to test if the substance is pure.

### MIXED VISCOSITY | \$250

Mixed Viscosity is the measurement of a materials resistance to flow for an A/B material system. Viscosity is taken at 75° F for the catalyzed resin system and is designed to assist with manufacturing process development.

### POT LIFE | \$200

Pot Life is the amount of time a mixture of resin and hardener has a workable viscosity while in the mixing container. Pot life is determined using 100-gram sample mass in a standardized container at 75° F. Both mass and ambient temperature affect the rate at which an epoxy system will cure. Pot life should be used only for comparative purposes when evaluating a resin system's cure time. Working Time is the amount of time the viscosity of the epoxy remains low enough to be processed. By measuring the starting viscosity of a material and identifying the point at which the viscosity has doubled, we can determine the effective pot life of a mixed resin system. A potted curve of viscosity resistance over time will be provided in addition to the calculated time at which the viscosity doubled.

### SHORE HARDNESS (OO, A, D) | \$100

Hardness is a measure of how hard the surface of a substance is. The harder the surface of a coating is, the more abrasion resistant it is. We test for this with a durometer which accurately measures the hardness of the surface of a cured resin. We use a Shore OO/A/D testing devices to assess a wide range of material hardnesses. Because hardness increases with degree of cure, the test is conducted after 5 days of cure at room temperature or following an appropriate oven curing profile for the material in question. The results of a hardness test can also be important for comparative purposes or determining the degree of cure.

### TENSILE STRENGTH | \$450

Tensile Strength is the stress that is required to fracture the epoxy and cause a failure. During this test, dog bone-shaped specimens are placed in a test machine that applies an increasing tensile force until failure. The highest stress recorded prior to failure is the Tensile Strength.

### T-PEEL STRENGTH | \$475

The primary purpose of this test method is to determine the relative peel resistance of adhesive bonds between flexible adherends by means of a T-type specimen. The term flexible refers to the ability of the adherend to bend through 90° without breaking or cracking.

### VISCOSITY: BROOKFIELD, ELEVATED TEMPERATURE ASSESSMENT | \$250

This test provides the materials' resistance to flow when tested at elevated temperature. The testing temperature ranges from 75° F to 400° F. Material resistance to flow will decrease as temperature increases. This test is designed to assist with manufacturing process development.

### VISCOSITY: BROOKFIELD, AMBIENT | \$200

This test measures the materials' resistance to flow. Testing is conducted after conditioning the sample to 75° F to standardize outcomes relevant to a set temperature as the material flow will change as a product is heated or cooled.

### VISCOSITY: PARALLEL PLATE | \$1,000

Viscosity testing using a parallel plate rheometer is determined when a small sample is placed between two oscillating parallel plates and then heated. During curing, the resin is converted from a liquid (not cross-linked) or semi-solid into a rigid cross-linked solid.

### WATER ABSORPTION | \$150

The Water Absorption test is used for the calculation of the relative water absorption rate by plastics during immersion in specified conditions.

## CASE STUDIES

Resin Formulators has been solving unique challenges across a wide variety of advanced manufacturing industries for over 60 years. Below are just a few examples of how we can put our custom solutions to work for you.

### EDGE CLOSE OUT AND INSERT POTTING FOR HIGH PRODUCTION THROUGHPUT DEMAND



#### CHALLENGE:

An aerospace OEM customer needed a material which would be extremely lightweight while providing sufficient adhesion, compression and non-slumping properties for edge close out, insert potting, and densification of honeycomb structures. A product that would meet high production throughput demand and a room temperature cure profile was required.

#### SOLUTION:

RF 1141 was created as a low-density syntactic epoxy system, with a 30-40 minute work life, 3000+ psi compression strength and .46-.48 specific gravity. The product is now qualified on satellite and commercial aviation programs.

### EDGE FILLING WITH HIGH TEMPERATURE STABILITY



#### CHALLENGE:

A satellite OEM had two materials approved for their satellite panel edge filling, and needed a custom modification to combine the favorable properties of each product into one solution. The first product provided high-temperature performance but production processing was very difficult. The second product provided low viscosity for easier production use, but lacked the desired temperature performance.

#### SOLUTION:

After a thorough design and development process, RF 1164 A/B was created as a low density syntactic epoxy system to provide the flow required while maintaining a very high temperature stability. The solution solved the customer process and performance solution for their satellite panel applications.

### COST-EFFECTIVE EPOXY SYSTEMS FOR MODERN ELECTRICAL COMPONENT DESIGN



#### CHALLENGE:

Various aerospace and defense customers were looking for a silver filled epoxy system that would fit new and improved electrical component designs - specifically a product that would wick into extremely small places to complete an electrical connection. The application would require high electrical conductivity, have an ambient or elevated cure formula, and be suitable for electrical circuitry, EMI shielding, or grounding of composites.

#### SOLUTION:

Resin Formulators began a design and development process where it was decided that multiple versions were needed, including a heat cure and room temperature curing version. The resulting product, RF 2969, met the technical needs for new design requirements, and was also recognized as a cost-effective solution for scalability. The product has now been a successful aerospace solution for over 20 years and is qualified to military aircraft, commercial satellite, rocket, and automotive programs.

### IMPROVED PRODUCTION PROCESSING FOR A BROAD RANGE OF APPLICATIONS



#### CHALLENGE:

The Resin Formulators team anticipated a major market delivery issue when there was a disruption in the supply of a raw material that was used in the production of certain structural adhesives.

#### SOLUTION:

The resulting product, RF 6110, was created as a two-part structural epoxy with high peel and elevated temperature performance. It proved economically efficient and improved production processing due to its versatility across a broad range of applications. The product is now qualified to commercial aircraft programs.

## ASK THE EXPERTS

### Have a question or need help getting started?

Let our Senior Research Chemist and Technical Account team assist you today.



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