

## Technical Paper

# Comparative Analysis of Current SLA Resins

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### Overview:

Rapid prototyping service bureaus are often the first to hear the new marketing claims of the resin suppliers, all claiming to offer the latest and greatest resins. They all sound great at the onset, but many resins don't quite live up to the marketing claims. At the same time, you as a customer count on rapid prototyping service bureaus to be experts at Stereolithography, and frequently ask your rapid prototyping provider to make SLA resin recommendations for your applications.

And so it's of vital importance that a real-life, objective test be developed. A test used to learn about the relative performances of the resins, so recommendations based on personal experience, rather than the hearsay of a resin salesman, or numbers on a spec sheet. Following are the results of the test we developed.

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The rapid prototyping service bureau's internal resin requirements have been, and will continue to be:

- high accuracy
- repeatability
- short run time
- compatibility with RTV molding processes

You, the customer have a list of attributes that you require in your SLA's:

- accuracy
- durable
- robust
- not brittle or too rigid (a common complaint of SLA's a couple years ago)

To that end, we developed a test and are happy to share the results with you. This should help you find a balance between what's been marketed as the "best" resin, and what actually works and performs well. This information is a way to further develop your working knowledge of some common SLA resins, so you can make

more informed decisions about what SLA resin you choose to use in future projects.

### Methodology used in testing

#### Step 1 –

- Design a test piece that can be run in the majority of the current available SLA resins, and design a fixture that will flex the test pieces in a controlled and uniform manner. This will allow us to
  - Compare "break points" of each resin, and
  - Compare repeated deflection cycles of each resin.

#### Step 2 –

- Run the SLA samples ("normal" process that is used for all customer SLA's),
  - Compare each resin sample using the test fixture
  - Perform the same test to each sample, recording all results

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Photo A is a picture of the test fixture, and one of the test parts. Photo B is a picture of another SLA test part as tested. You can see the deflection of the center "snap feature." Each stage in the test fixture is another .010" of deflection for the test pieces.



Click to see the .stl file for the test fixture, save target as: ProtoGenic\_testfixture.zip



Click to see the .stl file for the test part, save target as: ProtoGenic\_testpart.zip

### Deflection test 1: Maximum deflection value

In this test, pieces were run through the test fixture, forced in and out of each stage of deflection starting with the lowest deflection amount, then working up incrementally. The 'fail point' of each resin was recorded as the deflection point at which the snap feature broke. Two SLA's from each resin were tested, those results are below:

### Deflection Test Comments:

The 10120 resin surprised us the most, by testing the highest. The 18420 ProtoGen material also did well, which wasn't a surprise since it's this type of test that this resin was engineered for. And we weren't surprised that the Accura 60 did the worst, since our experience has proven time and again that this "polycarbonate-like" SLA resin is our most brittle SLA resin.

Test updated March 2, 2009

	XC 11122		Accura 55		18420		Accura 60		SL-5260		10120		XC 11112	
Deflection	Part 1	Part 2	Part 1	Part 2	Part 1	Part 2	Part 1	Part 2	Part 1	Part 2	Part 1	Part 2	Part 1	Part 2
.100"	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
.110"	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
.120"	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
.130"	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Pass	Pass	Fail
.140"	Pass	Pass	Pass	Pass	Pass	Pass	Fail	-	Pass	Pass	Pass	Pass	Fail	-
.150"	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Fail	Pass	Pass	Pass	-	-
.160"	Fail	Fail	Fail	Pass	Pass	Pass	-	-	-	Fail	Pass	Pass	-	-
.170"	-	-	-	Fail	Pass	Pass	-	-	-	-	Fail	Pass	-	-
.180"	-	-	-	-	Pass	Fail	-	-	-	-	-	Pass	-	-
.190"	-	-	-	-	Fail	-	-	-	-	-	-	Fail	-	-
.200"	-	-	-	-	-	-	-	-	-	-	-	-	-	-

## Deflection test 2: Repeatability

In this test, first determine a deflection amount that each sample is capable of doing, then count how many cycles each resin sample will do before breaking. "Down" and "up" in and out of the test fixture was counted as two cycles, since the snap feature had to deflect two times. The deflection amount chosen was .100", and the cycles of each resin are shown in the table below:

	XC 11122	Accura 55	18420	Accura 60	SL-5260	10120	XC 11112
<b>Deflection</b>	.100"	.100"	.100"	.100"	.100"	.100"	.100"
<b># of Cycles</b>	48	25	111	73	114	118	27

### Repeatability Test Comments:

Again, the resin that surprised us the most is the 10120, since it is not marketed as a 'flex resin.' All of the SLA resins were very similar each other, with the Accura resins being among the soonest to break.

Two resins that were also tested are the **DSM Somos DMX SL-100 and SL-9120.**

Both of these resins exceeded the scope of the tests here, by never breaking in either deflection or repeatability tests. These two resins are engineered to be more flexible, and it really showed in the test samples, however they both do still have their limitations in some applications, and there are other tests that would reveal

them to not be the best. For example, both resins deflect a considerable amount, but the features do not necessarily return to their original position, instead they remain somewhat deformed. Also, it's fair to point out that all SLA resins absorb moisture, and lose their mechanical properties over time.

Thank you for taking the time to read through this study, please let us know if you have any questions. As new resins are available, samples are run through the same test and the tables are updated, so you'll always know how the latest resins compare.

Click here with  
questions  
or comments

*The resin test was performed by Protogenic, A Division of Spectrum Plastics Group. The test was not funded by any resin manufacturer. It was conducted to educate Protogenic staff and customers for the purpose of providing a better finished product.*

*Protogenic, located in Westminster, CO, is a professional service bureau specializing in Additive Manufacturing Technologies. Protogenic manufactures prototypes and conceptual models using stereolithography (SLA) and Laser Sintering (LS) rapid prototyping technology. Protogenic also offers silicone rubber (RTV) molds and cast polyurethane parts for limited quantities.*

*Spectrum Plastics Group, headquartered in Minneapolis, MN, consists of 3 separate manufacturing facilities to better service customers across the US. Spectrum Plastics Group offers injection molding and contract manufacturing facilities in the following locations: Gardena, CA, Minneapolis, MN, and Ansonia, CT.*

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