



# Accura<sup>®</sup> AMX<sup>™</sup> Rigid Black

Production Rigid

Production-grade Stereolithography resin featuring long-term environmental stability for large-scale plastic parts with demanding mechanical performance requirements and exceptional surface finish

Stereolithography

## PRODUCTION-GRADE INDUSTRIAL RESIN WITH LONG-TERM ENVIRONMENTAL STABILITY FOR LARGE SCALE PLASTIC PARTS

Accura AMX Rigid Black is a game-changing resin that combines long-term environmental stability and high performing mechanical properties with the proven advantages of Stereolithography, including superior surface finish, accuracy, and repeatability.

Engineered for plastic parts requiring a good balance of heat deflection temperature, flexural modulus and elongation at break, this production-grade resin delivers similar stress-strain toughness to standard thermoplastics, making it ideal for parts that require long-term durability and strength in indoor and outdoor conditions.

Printed parts exhibit comparable surface quality to injection-molded plastics while the high isotropic mechanical properties enable superior part performance repeatability.

Accura AMX Rigid Black is ideal for cost-efficiently delivering structural load-bearing custom end-use components, large manufacturing aids, jigs and fixtures, and for direct production to replace injection molding or soft tooling processes. With its exceptional surface finish and mechanical properties, it is well suited for manufacturing and engineering applications across a range of industries, including automotive and motorsports, and consumer goods.

## HANDLING AND POST-PROCESSING GUIDELINES

Proper cleaning, drying and curing is required for this material. Post-processing information can be found at the end of this document.

Note: all properties are based on using the documented post-processing method. Any deviation from this method could yield a different result.

More details can be found at <https://infocenter.3dsystems.com/bestpractices/sla-best-practices/accura-amx-rigid-black>

*Note: Not all products and materials are available in all countries — please consult your local sales representative for availability.*

## APPLICATIONS

- Direct production of plastic parts such as housing, bracket, snap-fits, automotive interior and peripheral parts, and other general-use parts
- Manufacturing aids, jigs and fixtures
- Structural, load-bearing levers, arms, couplings, cranks
- Large size panels, frames, housings and trim
- Functional guides, holders and diverters for production line inspection/sorting/holding equipment
- Direct digital production to replace injection molding or soft tooling processes

## BENEFITS

- Strong, durable parts
- Long-term use parts with high stability of mechanical properties that are significantly better than traditional resins
- Thermoplastic behavior with necking at break enables high performing snaps and clips
- Surface quality, accuracy and repeatability with Stereolithography printing
- Similar stress/strain toughness performance to standard thermoplastics

## FEATURES

- Long-term indoor and outdoor environmental stability of mechanical properties and color; tested out to 8 and 1.5 years (respectively) per ASTM methods
- 64°C HDT @ 0.455MPa
- 24% elongation at break
- UL94 HB Flammability
- Insulative dielectric properties
- Biocompatible capable per ISO 10993-5
- High gloss black color out of the printer or finished to matte black
- Large size parts (650 x 750 x 550 mm, 25.6 x 29.5 x 21.65 in) on the ProX 800 3D printer

## MATERIAL PROPERTIES

The full suite of mechanical properties is given per ASTM and ISO standards where applicable. Properties like flammability, dielectric properties, and 24-hour water absorption are also provided for better understanding of material capabilities to help design decisions using the material. All parts are conditioned per ASTM recommended standards for a minimum of 40 hrs at 23°C, 50% RH.

Solid material properties reported were printed along the vertical axis (ZX-orientation). As detailed in the Isotropic Properties section, stereolithography material properties are relatively uniform across print orientations. Parts do not need to be oriented in a particular direction to exhibit these properties.

LIQUID MATERIAL						
MEASUREMENT	CONDITION/METHOD	METRIC	ENGLISH			
Viscosity	Brookfield Viscometer @ 25 °C (77 °F)	300 cPs	726 lb/ft-h			
Color			Black			
Liquid Density	Kruss K11 Force Tensiometer @ 25 °C (77 °F)	1.07 g/cm <sup>3</sup>	0.036 lb/in <sup>3</sup>			
Default Print Layer Thickness	Internal	102 um	0.004 in			

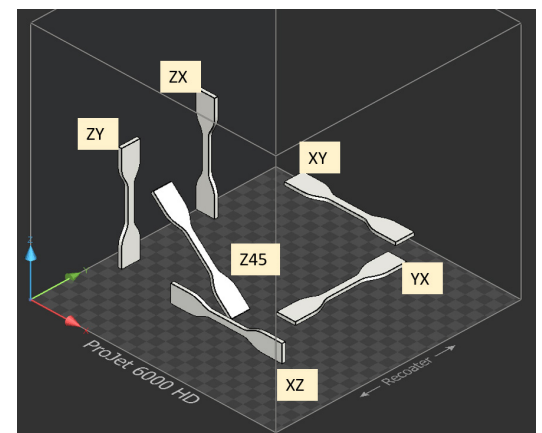
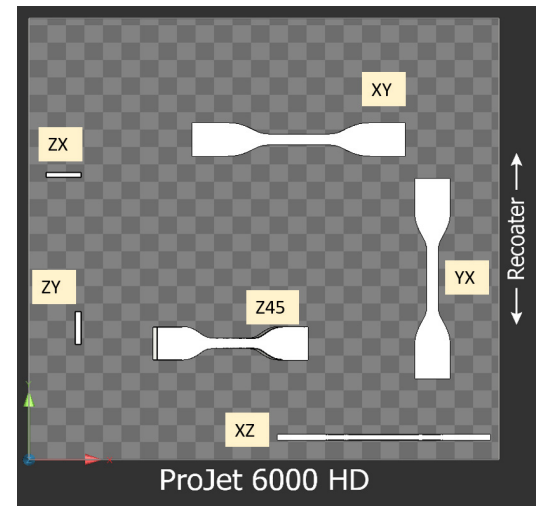
SOLID MATERIAL						
METRIC	ASTM METHOD	METRIC	ENGLISH	ISO METHOD	METRIC	ENGLISH
<b>PHYSICAL</b>				<b>PHYSICAL</b>		
Solid Density	ASTM D792	1.15 g/cm <sup>3</sup>	0.041 lb/in <sup>3</sup>	ISO 1183	1.15 g/cm <sup>3</sup>	0.041 lb/in <sup>3</sup>
24 Hour Water Absorption	ASTM D570	1.16 %	1.16 %	ISO 62	1.16 %	1.16 %
<b>MECHANICAL</b>				<b>MECHANICAL</b>		
Tensile Strength Ultimate	ASTM D638 Type IV	52 MPa	7600 psi	ISO 527 -1/2	56 MPa	8100 psi
Tensile Strength at Yield	ASTM D638 Type IV	52 MPa	7600 psi	ISO 527 -1/2	56 MPa	8100 psi
Tensile Modulus	ASTM D638 Type IV	2100 MPa	310 ksi	ISO 527 -1/2	2500 MPa	365 ksi
Elongation at Break	ASTM D638 Type IV	24 %	24 %	ISO 527 -1/2	21 %	21 %
Elongation at Yield	ASTM D638 Type IV	4.5 %	4.5 %	ISO 527 -1/2	4.4 %	4.4 %
Flex Strength	ASTM D790	88 MPa	12800 psi	ISO 178	70 MPa	9800 psi
Flex Modulus	ASTM D790	2300 MPa	340 ksi	ISO 178	1900 MPa	274 ksi
Izod Notched Impact	ASTM D256	23 J/m	0.4 ft-lb/in	ISO 180-A	3.6 kJ/m <sup>2</sup>	1.7 ft-lb/in <sup>2</sup>
Izod Unnotched Impact	ASTM D4812	170 J/m	3 ft-lb/in	ISO 180-U	15.5 kJ/m <sup>2</sup>	7.4 ft-lb/in <sup>2</sup>
Shore Hardness	ASTM D2240	80 D	80 D	ISO 7619	80 D	80 D
<b>THERMAL</b>				<b>THERMAL</b>		
Tg (DMA, E'')	ASTM E1640 (E''at 1C/min)	50 °C	125 °F	ISO 6721-1/11 (E''at 1C/min)	50 °C	125 °F
HDT @ 0.455 MPa/66 PSI	ASTM D648	64 °C	146 °F	ISO 75- 1/2 B	62 °C	144 °F
HDT @ 1.82 MPa/264 PSI	ASTM D648	52 °C	125 °F	ISO 75-1/2 A	50 °C	122 °F
CTE below Tg	ASTM E831	84 ppm/°C	46 ppm/°F	ISO 11359-2	84 ppm/°K	46 ppm/°F
CTE above Tg	ASTM E831	168 ppm/°C	93 ppm/°F	ISO 11359-2	168 ppm/°K	93 ppm/°F
UL Flammability	UL94	HB				
<b>ELECTRICAL</b>				<b>ELECTRICAL</b>		
Dielectric Strength (kV/mm) @ 3.0 mm thickness	ASTM D149	15			0.547619048	
Dielectric Constant @ 1 MHz	ASTM D150	3.2			92	
Dissipation Factor @ 1 MHz	ASTM D150	0.023			15.88095238	
Volume Resistivity (ohm-cm)	ASTM D257	7.36x10 <sup>15</sup>			42.16666667	

## ISOTROPIC PROPERTIES

Stereolithography technology prints parts that are generally isotropic in mechanical properties meaning the parts printed along either the XYZ axis will give similar results.

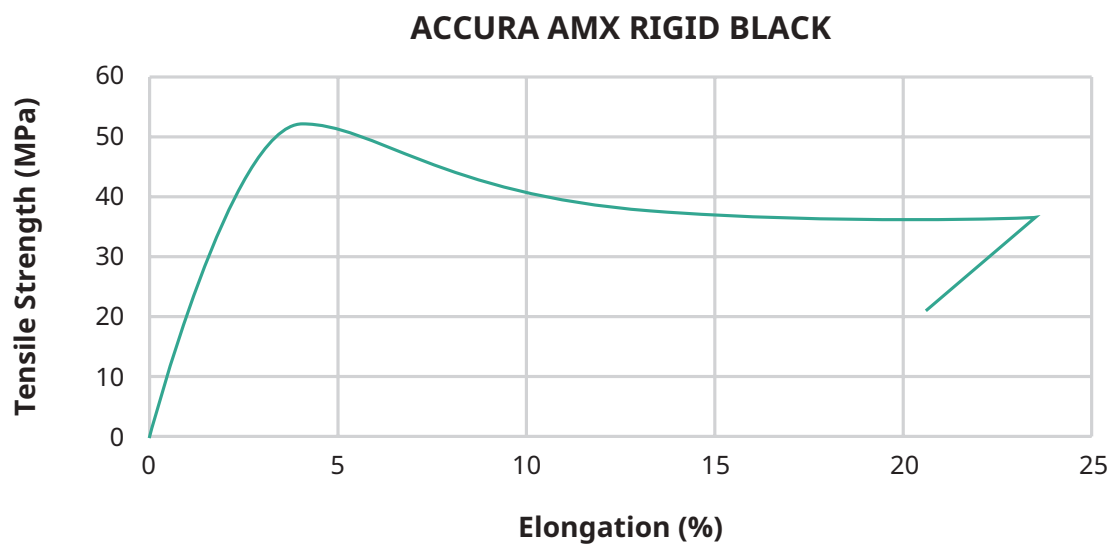
Parts do not need to be oriented to get the highest mechanical properties, further improving the degree of freedom for part orientation for mechanical properties.

SOLID MATERIAL							
METRIC	METHOD	METRIC					
MECHANICAL							
		ZY	ZX	XZ	XY	YX	Z45
Tensile Strength Ultimate	ASTM D638 Type IV	52 MPa	55 MPa	53 MPa	51 MPa	54 MPa	53 MPa
Tensile Strength at Yield	ASTM D638 Type IV	52 MPa	55 MPa	53 MPa	51 MPa	54 MPa	53 MPa
Tensile Modulus	ASTM D638 Type IV	2100 MPa	2200 MPa	2100 MPa	2300 MPa	2000 MPa	2100 MPa
Elongation at Break	ASTM D638 Type IV	24 %	16 %	17 %	26 %	14 %	11 %
Elongation at Yield	ASTM D638 Type IV	4.5 %	4.6 %	4.4 %	4.3 %	4.6 %	4.4 %
Flex Strength	ASTM D790	88 MPa	76 MPa	75 MPa	70 MPa	74 MPa	67 MPa
Flex Modulus	ASTM D790	2300 MPa	2000 MPa	2000 MPa	1500 MPa	1800 MPa	1700 MPa
Izod Notched Impact	ASTM D256	23 J/m	23 J/m	24 J/m	25 J/m	26 J/m	24 J/m
Shore Hardness	ASTM D2240	85 D	N/A	N/A	N/A	N/A	N/A



## STRESS-STRAIN CURVE

Accura AMX Rigid Black exhibits thermoplastic behavior with a long plastic deformation ductile necking before fracturing which gives better snap and clip performance.

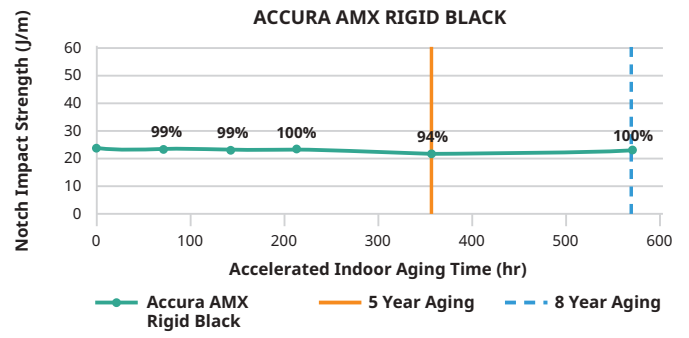
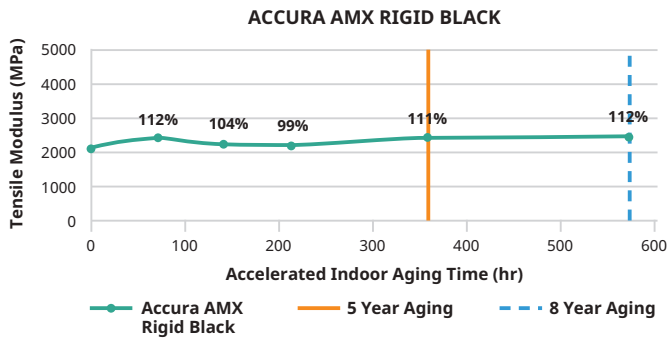
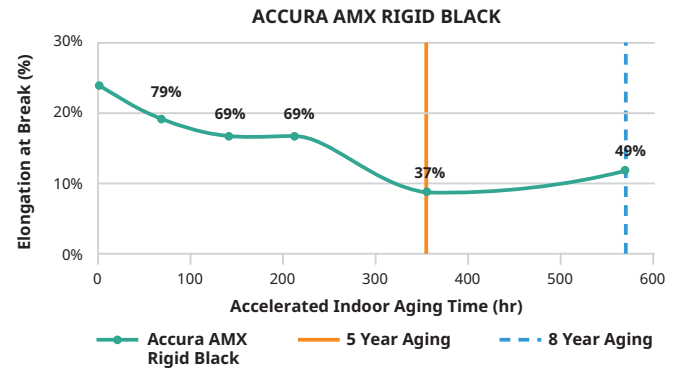
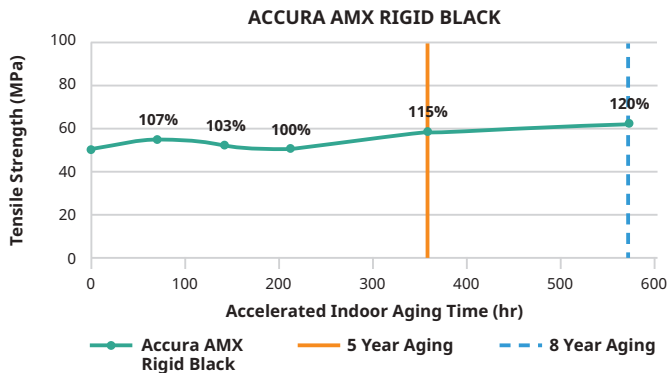


## LONG TERM ENVIRONMENTAL STABILITY

Accura AMX Rigid Black is engineered to give long term environmental UV and humidity stability. This means the material is tested for the ability to retain a high percent of the initial mechanical properties over a given period of time. This provides real design conditions to consider for the application or part. **Actual data value is on Y-axis, and data points are % of initial value.**

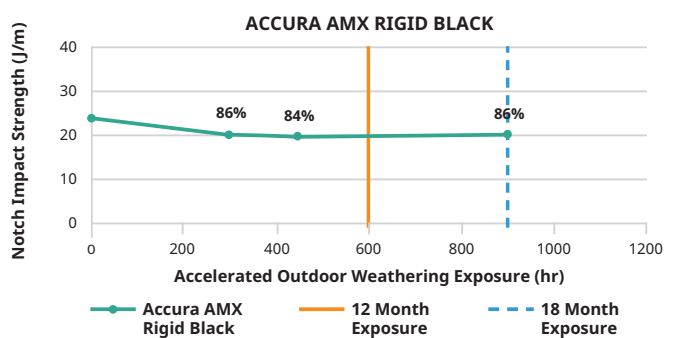
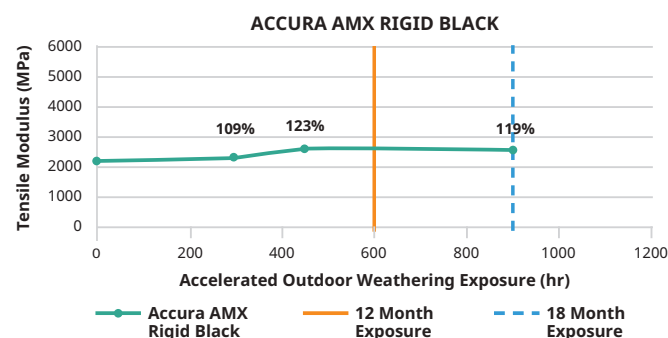
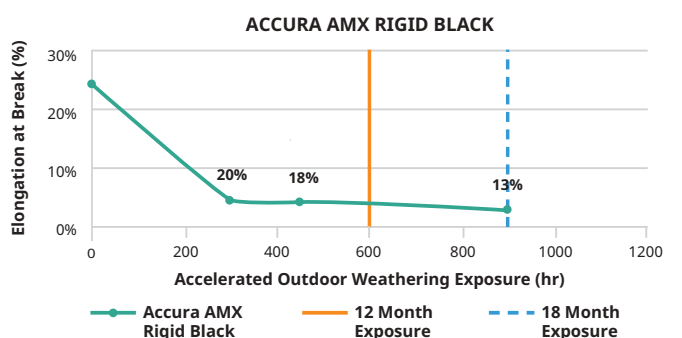
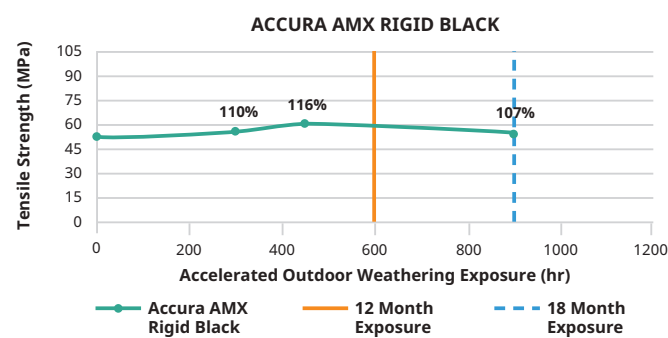
**INDOOR STABILITY:** Tested per ASTM D4329 standard method.

INDOOR STABILITY



**OUTDOOR STABILITY:** Tested per ASTM G154 standard method.

OUTDOOR STABILITY



## AUTOMOTIVE FLUID COMPATIBILITY

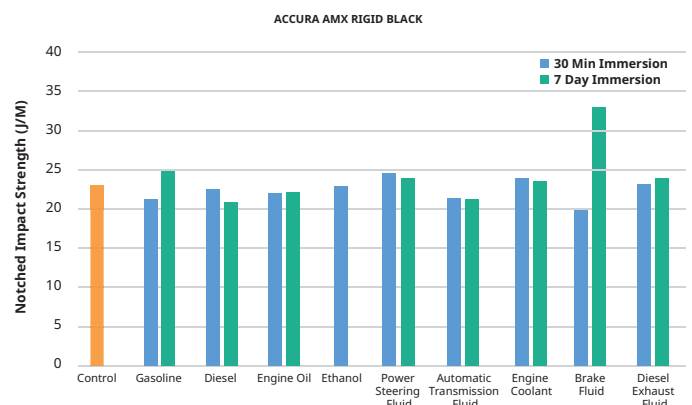
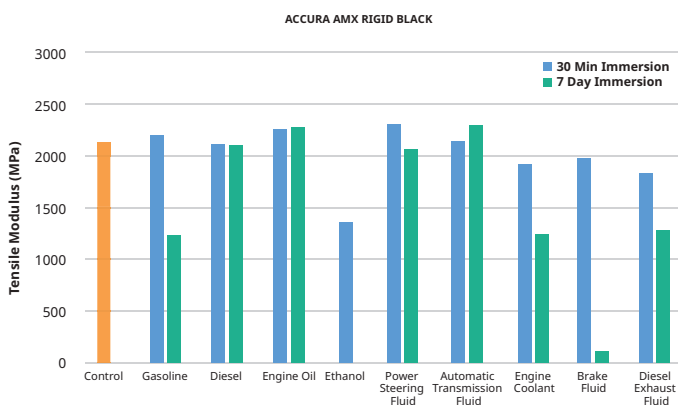
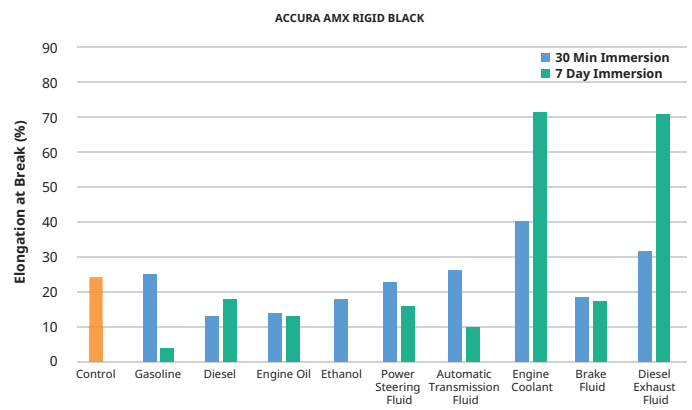
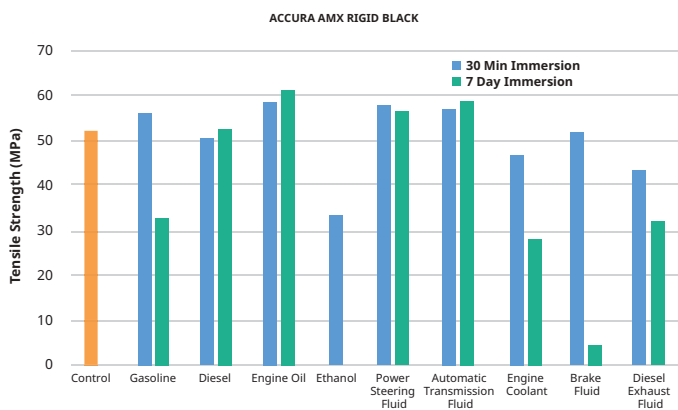
The compatibility of a material with hydrocarbons and cleaning chemicals is critical to part application. Accura AMX Rigid Black parts were tested for sealed and surface contact compatibility per USCAR2 test conditions. The fluids below were tested in two different ways per the specs.

- Immerse for 7-days, then take mechanical property data for comparison
- Immerse for 30-minutes, remove, and take mechanical property data for comparison in 7-days

**Data reflects the measured value of properties over that period of time.**

AUTOMOTIVE FLUIDS		
FLUID	SPECIFICATION	TEST TEMP °C
Gasoline	ISO 1817, liquid C	23 ± 5
Diesel Fuel	905 ISO 1817, Oil No. 3 + 10% p-xylene*	23 ± 5
Engine Oil	ISO 1817, Oil No. 2	50 ± 3
Ethanol	85% Ethanol + 15% ISO 1817 liquid C*	23 ± 5
Power Steering Fluid	ISO 1917, Oil No. 3	50 ± 3
Automotive Transmission Fluid	Dexron VI (North American specific material)	50 ± 3
Engine Coolant	50% ethylene glycol + 50% distilled water*	50 ± 3
Brake Fluid	SAE RM66xx (Use latest available fluid for xx)	50 ± 3
Diesel Exhaust Fluid (DEF)	API certified per ISO 22241	23 ± 5

\*Solutions are determined as percent by volume



## CHEMICAL COMPATIBILITY

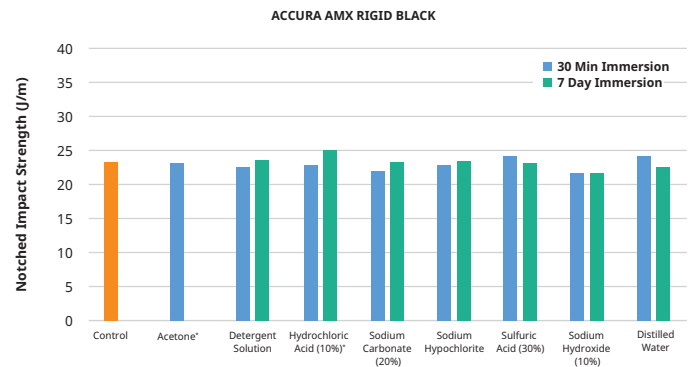
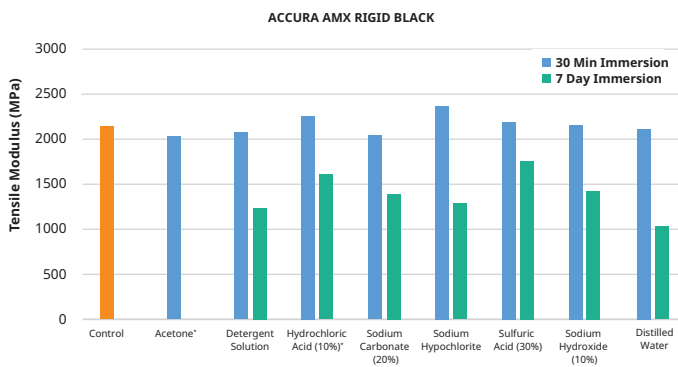
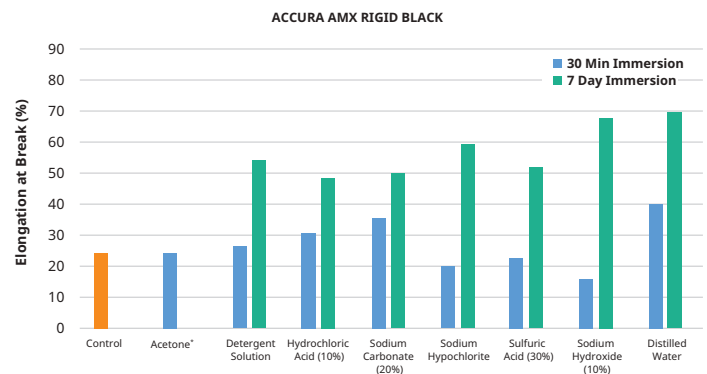
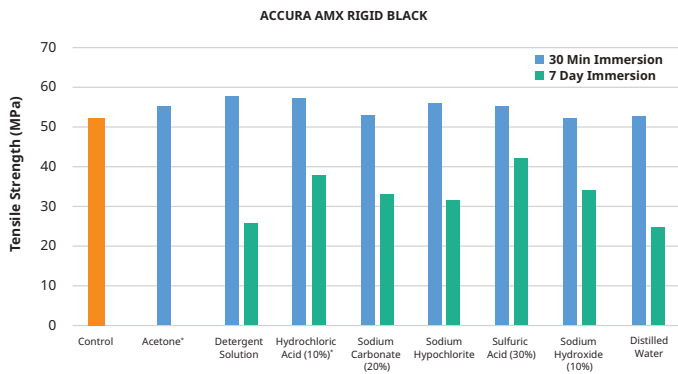
The compatibility of a material with cleaning chemicals is critical to part application. Accura AMX Rigid Black parts were tested for sealed and surface contact compatibility per ASTM D543 test conditions. The fluids below were tested in two different ways per the specs.

- Immerse for 7-days, then take mechanical property data for comparison
- Immerse for 30-minutes, remove, and take mechanical property data for comparison in 7-days

Data reflects the measured value of properties over that period of time.

\*Denotes materials did not go thru 7-day soak conditioning.

CHEMICAL COMPATIBILITY
6.3.3 Acetone
6.3.12 Detergent Solution, Heavy Duty
6.3.23 Hydrochloric Acid (10%)
6.3.38 Sodium Carbonate Solution (20%)
6.3.44 Sodium Hypochlorite Solution
6.3.46 Sulfuric Acid (30%)
6.3.42 Sodium Hydroxide Soln (10%)
6.3.15 Distilled Water



## BIOCOMPATIBILITY STATEMENT

Accura AMX Rigid Black test coupons printed and processed according to the post processing instructions below were provided to an external biological testing laboratory for evaluation in accordance with *ISO 10993-5, Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity*. The test results indicate that Accura AMX Rigid Black has passed the requirements for biocompatibility according to the above test.

It is the responsibility of each customer to determine that its use of Accura AMX Rigid Black material is safe, lawful and technically suitable to the customer's intended applications. Customers should conduct their own testing to ensure that this is the case. Because of possible changes in the law and in regulations, as well as possible changes in these materials, 3D Systems cannot guarantee that the status of these materials will remain unchanged or that it will qualify as biocompatible in any particular use. Therefore, 3D Systems recommends that customers continuing to use these materials verify their status on a periodic basis.

## POST-PROCESSING INSTRUCTIONS REQUIRED TO PASS ISO 10993-5

### CLEANING INSTRUCTIONS

- Clean with 2 solvents of 1-TPM,1-IPA (wash and rinse)
- Agitate parts in 'wash' TPM for 20 minutes manually or in automated cleaning system
- Manually rinse in 'clean' IPA using squirt bottle to remove TPM solvent
- Submerge, and manually rinse in 'clean' IPA for 10 minutes while agitating part
  - DO NOT EXCEED more than 10 minutes submerged exposure to IPA to preserve mechanical properties
- Using a soft brush can be used to aid cleaning on down facing surfaces. Use care when handling parts to prevent marking the surfaces
- Refresh IPA when cleaning becomes ineffective

### DRYING INSTRUCTIONS

- Oven dry at 35 °C for 25 minutes

### UV CURE TIME

- 3D Systems LC-3DPrint Box UV Post-Curing Unit: 180 minutes

## POST CURE SYSTEMS

3D Systems LC-3DPrint Box UV Post-Curing Unit was used to get data sheet properties. There are other existing post cure systems for SLA that allow for larger parts such as the Procure 350 and Procure 750. the table below compares mechanical property output.

- Optimal post cure temperature is at 60 °C
- The times for each post cure system is 180 minutes for the data in the table below:

PROPERTY	ASTM METHOD	LC-3DPRINT BOX	PROCURE 350	PROCURE 750
Max. part size	L x W x H	ø 260 x 195 mm	350 x 350 x 350 mm	630 x 1050 x 1050 mm
Tensile Strength Ultimate	ASTM D638 Type IV	52 MPa	42 MPa	50 MPa
Tensile Strength at Yeild	ASTM D638 Type IV	52 MPa	42 MPa	50 MPa
Tensile Modulus	ASTM D638 Type IV	2100 MPa	1900 MPa	2100 MPa
Elongation at Break	ASTM D638 Type IV	24 %	41 %	34 %
Elongation at Yield	ASTM D638 Type IV	4.5 %	4.4 %	4.5 %
Flexural Strength	ASTM D790	88 MPa	39 MPa	66 MPa
Flexural Modulus (MPa)	ASTM D790	2300 MPa	1600 MPa	1800 MPa
Izod Notched Impact	ASTM D256	23 J/m	34 J/m	24 J/m
Izod Unnotched Impact	ASTM D4812	170 J/m	205 J/m	198 J/m
Shore Hardness	ASTM D2240	80 D	79 D	80 D
HDT@0.455 MPa/66 PSI	ASTM D648	64 °C	56 °C	58 °C
HDT@1.82 MPa/264 PSI	ASTM D648	52 °C	48 °C	49 °C