FLEX - BLK 20

Flexible, Durable

Flexible black resin with the strength and finish of production-grade polypropylene

FATIGUE RESISTANT BLACK PLASTIC, WITH LOOK AND FEEL OF PRODUCTION POLYPROPYLENE

FLEX-BLK 20 is a flexible, impact-resistant resin engineered for producing durable black parts that closely resemble production-grade polypropylene. It's ideal for functional prototypes, enclosures, assemblies, and short-run production where both flexibility and accuracy are essential. This fatigue-resistant material provides reliable performance, strong dimensional stability, and a smooth surface finish suitable for a wide range of applications.

HANDLING & POST-PROCESSING GUIDELINES

For optimal part performance, proper mixing, cleaning, drying, and curing are essential when working with this material. Follow the recommended post-processing sequence to ensure consistent appearance and mechanical properties.

All data provided in this sheet is based on the documented post-processing procedure. Any deviation from the recommended process may lead to variations in mechanical properties or final part performance.

APPLICATIONS

- Functional assemblies and prototypes
  - Automotive styling and trim components
  - Consumer goods and electronic housings
  - Containers and customized enclosures
  - Product design validation
- Master patterns for RTV/silicone molding
- Concept and marketing models

BENEFITS

- Produces reliable, robust functional prototypes
- Excellent mechanical accuracy and fine detail definition
- Smooth, aesthetic black finish similar to molded polypropylene
- Stable mechanical and environmental performance over time

FEATURES

- High elongation at break with superior impact resistance
- Lower tensile modulus for better flexibility
- Engineered for long-term environmental and mechanical stability
- Easy cleaning and handling for repeatable results

MATERIAL PROPERTIES

All mechanical properties are tested as per ASTM and ISO standards where applicable. Additional characteristics such as flammability, dielectric strength, and water absorption are included to provide a complete understanding of the material's overall performance. This data supports informed design and material selection decisions.

All printed samples are conditioned for at least 40 hours at 23°C and 50% relative humidity, per ASTM recommendations.

Figure 4® materials exhibit near-isotropic behavior, meaning they provide consistent properties across different print orientations. As a result, part orientation during printing does not significantly influence mechanical performance.

LIQUID MATERIAL			
Property	**Test Method / Condition**	**Metric**	**Imperial**
Viscosity	Brookfield Viscometer @ 25 °C (77 °F)	2250 cps	5440 lb/ft·hr
Color		Black	
Liquid Density	Kruss K11 Force Tensiometer @ 25 °C (77 °F)	1.11 g/cm^3	0.040 lb/in3
Default Print Layer Thickness (Standard Mode)		0.05 mm	0.002 in
Speed - Standard Mode		25 mm/hr	1 in/hr
Speed - Draft Mode		29 mm/hr	1.1 in/hr
Package Volume		1 kg bottle 2.5 kg cartridge 9 kg container	

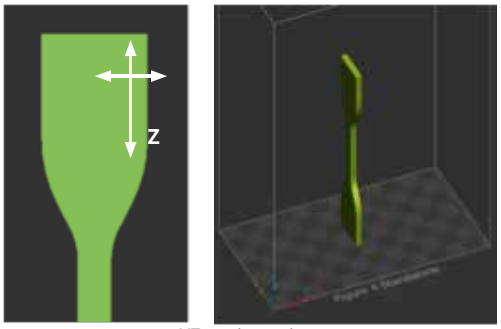
SOLID MATERIAL						
Property	**ASTM Method**	**Metric**	**Imperial**	**ISO Method**	**Metric**	**Imperial**
	PHYSICAL				**PHYSICAL**	
Solid Density 24 Hour	ASTM D792	1.18 g/cm3	0.043 lb/in3	ISO 1183	1.18 g/cm3	0.043 lb/in3
Water Absorption	ASTM D570	0.64%	0.64%	ISO 62	0.64%	0.64%
	MECHANICAL				**MECHANICAL**	
Tensile Strength Ultimate	ASTM D638 *	36 MPa	5220 psi	ISO 527 -1/2	28 MPa	3112 psi
Tensile Strength at Yield	ASTM D638	24 MPa	3480 psi	ISO 527 -1/2	21 MPa	3112 psi
Tensile Modulus	ASTM D638	1150 MPa	122 ksi	ISO 527 -1/2	877 MPa	127 ksi
Elongation at Break	ASTM D638	76%	76%	ISO 527 -1/2	67%	67%
Elongation at Yield	ASTM D638	7.5%	7.5%	ISO 527 -1/2	8.3%	8.3%
Flex Strength	ASTM D790	22 MPa	3190 psi	ISO 178	23 MPa	3265 psi
Flex Modulus	ASTM D790	680 MPa	99 ksi	ISO 178	1088 MPa	158 ksi
Izod Notched Impact	ASTM D256	91 J/m	1.7 ft-lb/in	ISO 180-A	10.8 J/m^2	0.0051 ft-lb/in^2
Izod Unnotched Impact	ASTM D4812	Does not break		ISO 180-U		
Shore Hardness	ASTM D2240	68D	68D	ISO 7619	68D	68D
	THERMAL				**THERMAL**	
Tg (DMA, E")	ASTM E1640 (E"at 1C/min)	11 °C	52 °F	ISO 6721-1/1 (E"at 1C/min)	11 °C	52 °F
HDT @ 0.455 MPa/66 PSI	ASTM D648	41 °C	106 °F	ISO 75- 1/2 B	46 °C	115 °F
HDT @ 1.82 MPa/264 PSI	ASTM D648	<25 °C	<77 °F	ISO 75-1/2 A	27 °C	81 °F
CTE below Tg	ASTM E831	69 ppm/°C	38 ppm/°F	ISO 11359-2	69 ppm/°C	38 ppm/°F
CTE above Tg	ASTM E831	188 ppm/°C	104 ppm/°F	ISO 11359-2	188 ppm/°C	104 ppm/°F
UL Flammability	UL94	HB	HB			
	ELECTRICAL				**ELECTRICAL**	
Dielectric Strength (V/mil) @ 3.0 mm thickness	ASTM D149	14.6				
Dielectric Constant @ 1 MHz	ASTM D150	3.7				
Dissipation Factor @ 1 MHz	ASTM D150	0.035				
Volume Resistivity (ohm-cm)	ASTM D257	1.3x10^{15}				

ISOTROPIC PROPERTIES

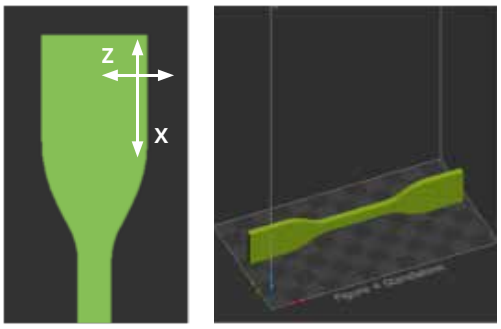
Figure 4 technology produces parts with near-isotropic mechanical behavior, ensuring consistent performance across all print orientations (X, Y, and Z axes).

This uniformity removes the need for specific orientation strategies to achieve optimal mechanical strength, allowing greater flexibility in part orientation during printing and design.

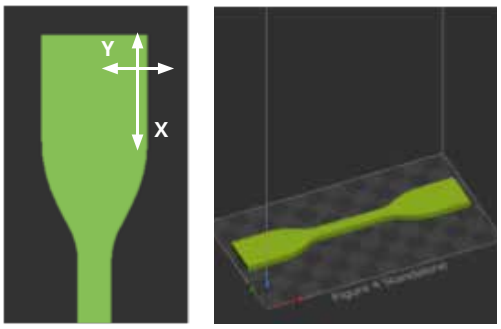
SOLID MATERIAL					
METRIC	METHOD	METRIC			
MECHANICAL					
		ZY	XZ	XY	Z45
Tensile Strength Ultimate	ASTM D638	36 MPa	35 MPa	31 MPa	31 MPa
Tensile Strength at Yield	ASTM D639	24 MPa	26 MPa	26 MPa	25 MPa
Tensile Modulus	ASTM D640	1151 MPa	1229 MPa	1102 MPa	1035 MPa
Elongation at Break	ASTM D641	76%	71%	70%	68%
Elongation at Yield	ASTM D642	7.50%	8.10%	7.50%	9.10%
Flex Strength	ASTM D790	22 MPa	34 MPa	21 MPa	21 MPa
Flex Modulus	ASTM D790	680 MPa	1037 MPa	592 MPa	632 MPa
Izod Notched Impact	ASTM D256	91 J/m	105 J/m	108 J/m	109 J/m
Shore Hardness	ASTM D2240	68D	68D	67D	72D



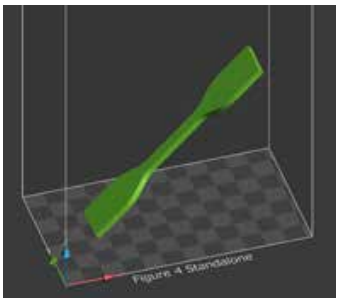
YZ - orientation



XZ - orientation



XY - orientation



Z45-Degree - orientation

LONG TERM ENVIRONMENTAL STABILITY

FLEX-BLK 20 is designed for long-term stability under UV exposure and humid environmental conditions. The material has been tested to ensure it retains a high percentage of its mechanical properties over extended periods, providing reliable performance in real-world applications.

This data represents the retention of mechanical strength over time, where the Y-axis represents the measured property values and each point corresponds to the percentage of the initial measured value.

INDOOR STABILITY

INDOOR STABILITY: Tested per ASTM D4329 standard method.

FIGURE 4 FLEX-BLK 20

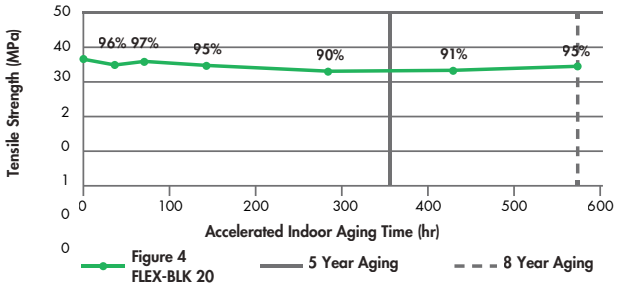
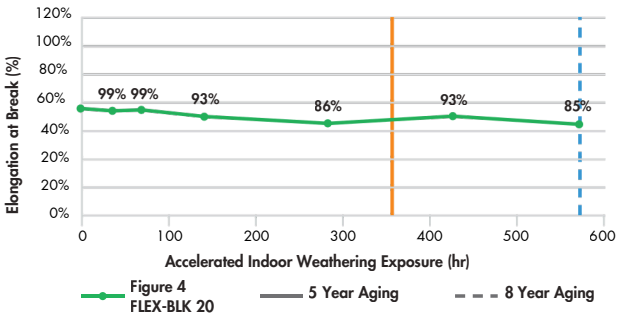


FIGURE 4 FLEX-BLK 20



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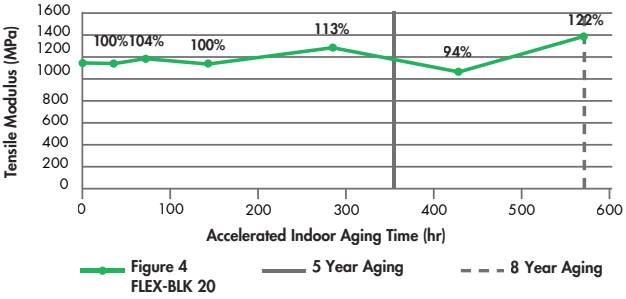

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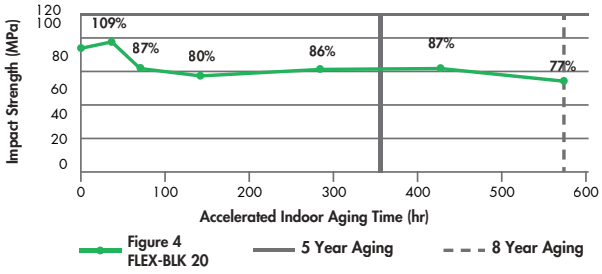


OUTDOOR STABILITY

OUTDOOR STABILITY: Tested per ASTM G154 standard method.

FIGURE 4 FLEX-BLK 20

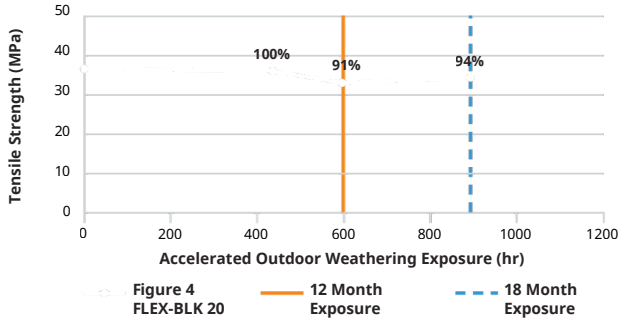
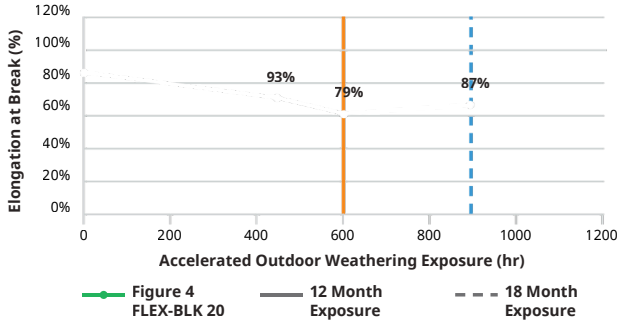


FIGURE 4 FLEX-BLK 20



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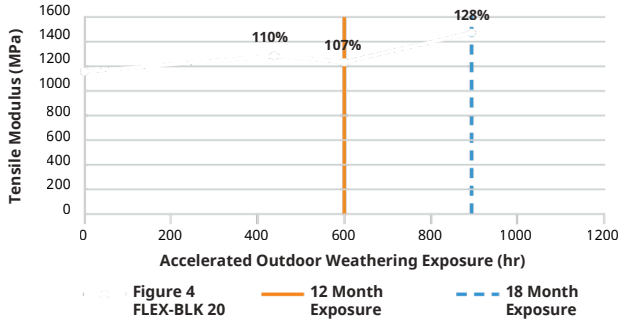

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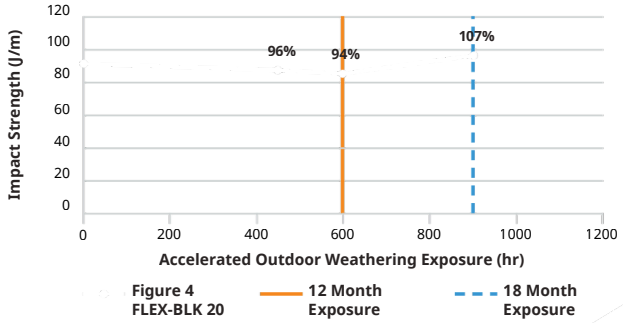


AUTOMOTIVE FLUID COMPATIBILITY

Compatibility with hydrocarbons and cleaning chemicals is an important factor for automotive and industrial applications. Figure 4® FLEX-BLK 20 parts were evaluated for both sealed and surface contact compatibility under USCAR2 test conditions.

The following fluids were tested using two standard exposure methods:

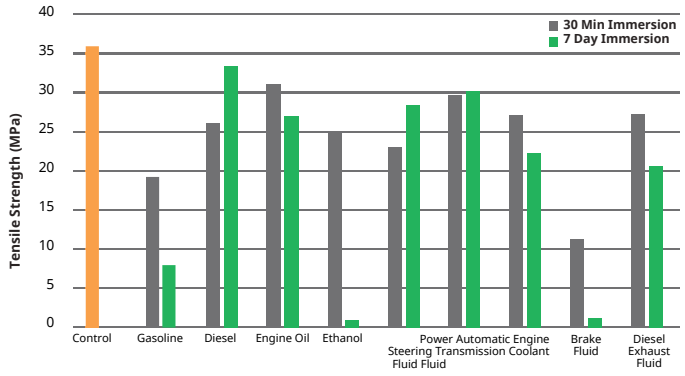
- 7-day immersion: Parts were submerged for seven days, before mechanical property testing for performance comparison.
- Short-term exposure: Parts were immersed for 30 minutes, then allowed to rest for seven days before testing.

All data represents the measured mechanical property values after each test duration, indicating the material's performance stability under fluid exposure.

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 1817, 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 (latest available fluid)	50 ± 3
Diesel Exhaust Fluid (DEF)	API certified per ISO 22241	23 ± 5

*Solutions are determined as percent by volume

FIGURE 4 FLEX-BLK 20



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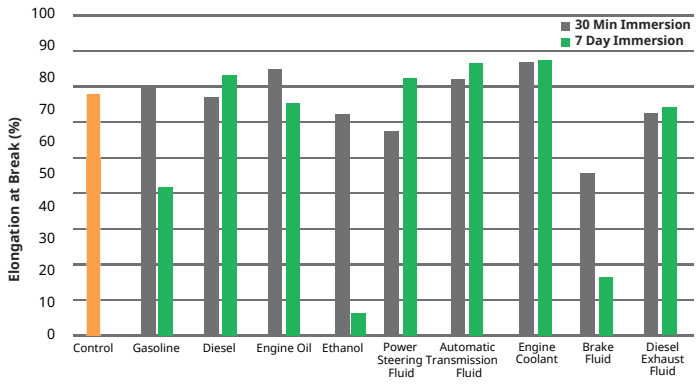

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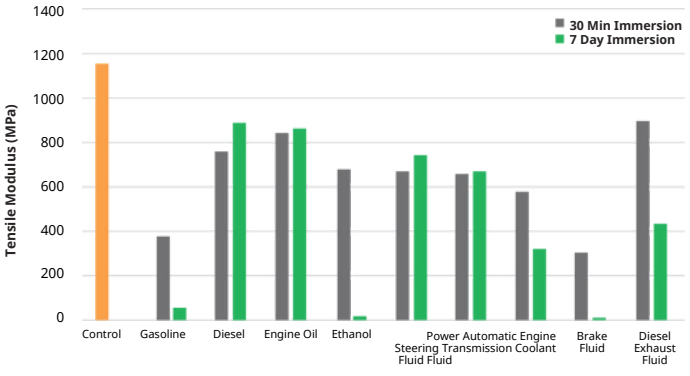

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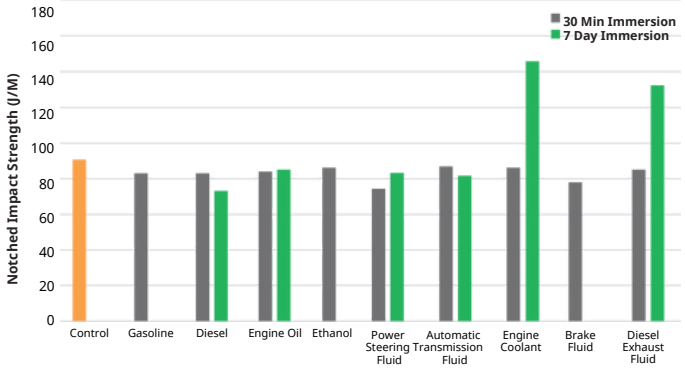


CHEMICAL COMPATIBILITY

Compatibility with cleaning chemicals is essential for maintaining part durability and long-term performance in operational environments. Figure 4® FLEX-BLK 20 samples were evaluated for sealed and surface contact compatibility under ASTM D543 test conditions.

The following fluids were tested using two exposure methods:

- 7-day immersion: Parts were submerged for seven days before mechanical property testing.
- Short-term exposure: Parts were immersed for 30 minutes, and then conditioned for seven days before testing.

All results represent the measured mechanical property values after each exposure period.
*Fluids marked with an asterisk were not subjected to the 7-day soak conditioning.

Chemical	Specification / Reference	Test Type
Acetone	ASTM D543, Section 6.3.3	Tensile
Detergent Solution, Heavy Duty	ASTM D543, Section 6.3.12	Tensile
Hydrochloric Acid (10%)	ASTM D543, Section 6.3.23	Tensile
Sodium Carbonate Solution (20%)	ASTM D543, Section 6.3.38	Tensile
Sodium Hypochlorite Solution	ASTM D543, Section 6.3.44	Tensile
Sulfuric Acid (30%)	ASTM D543, Section 6.3.46	Tensile
Sodium Hydroxide Solution (10%)	ASTM D543, Section 6.3.42	Tensile
Distilled Water	ASTM D543	Tensile

FIGURE 4 FLEX-BLK 20

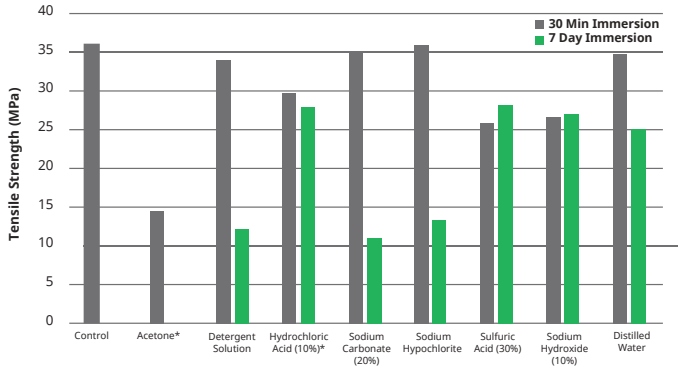
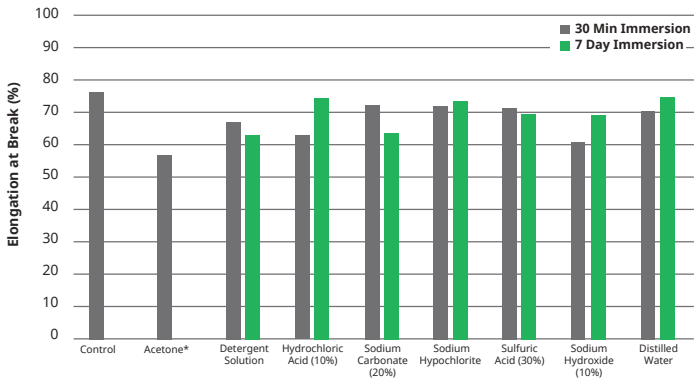


FIGURE 4 FLEX-BLK 20



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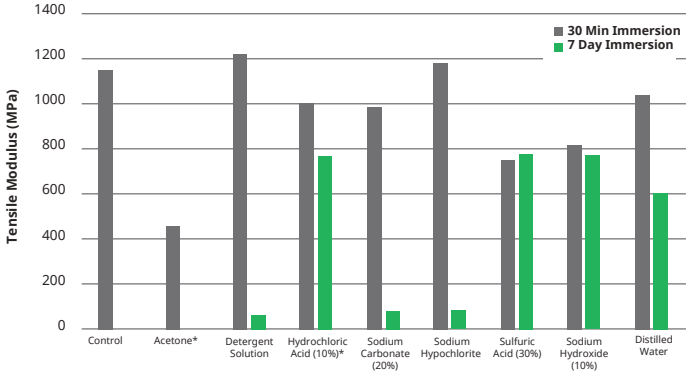
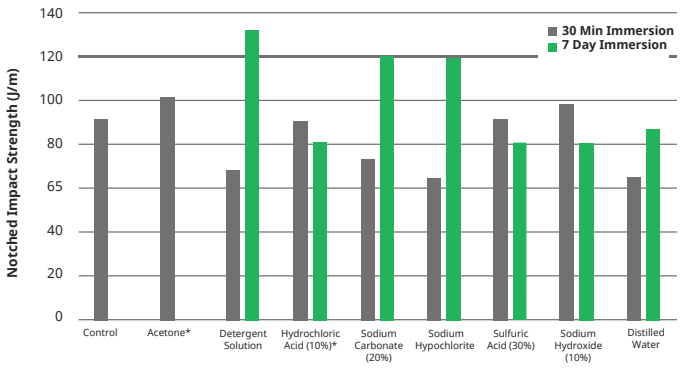


FIGURE 4 FLEX-BLK 20



POST-PROCESSING INSTRUCTIONS

MIXING INSTRUCTIONS

This material contains a pigment that may settle slowly over time. Proper mixing before printing ensures consistent color and mechanical properties.

For 1 kg bottle (Figure 4 Standalone):

- Roll the bottle for 1 hour on the 3D Systems LC-3D Mixer before first use.
- Roll for 10 minutes before each subsequent use.

For 2.5 kg cartridge (Figure 4 Modular):

- Shake the bottle vigorously for 2 minutes before installing the cartridge.

Use the Resin Mixer to stir the material in the tray for 30 seconds between print jobs to maintain uniform consistency.

MANUAL CLEANING INSTRUCTIONS

- Clean parts using two containers of IPA (wash and rinse).
- Immerse parts in "wash" IPA for 2.5 minutes, agitating gently.
- Rinse in "clean" IPA for another 2.5 minutes with agitation.
- Do not exceed 5 minutes total IPA exposure to preserve mechanical properties.
- Gentle manual agitation or a soft brush may be used to support effective cleaning.
- Replace IPA once cleaning effectiveness decreases.

DRYING INSTRUCTIONS

- Allow parts to air dry at ambient temperature for at least 1 hour before post-curing.

UV CURE TIME

- Cure parts for 90 minutes under a suitable UV post-curing system to achieve optimal mechanical properties.