

FLEX-BLK 20 (Matrix FX-BLK 20)

FLEX-BLK 20 is a flexible, high impact-resistant material for extremely durable black parts with look and feel of production polypropylene.

Great for functional prototypes, enclosures and assemblies, as well as short-run production parts, this fatigue resistant material provides outstanding flexibility and accuracy, enabling many applications.



Applications

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

Features

- ▶ High elongation at break and notched impact strength
- ▶ Lower tensile modulus
- ▶ Engineered for long term environmental stability
- ▶ Easy to clean

Benefits

- ▶ Reliable and robust functional prototypes
- ▶ Excellent mechanical properties and accuracy
- ▶ Beautiful black parts with look and feel of molded black polypropylene
- ▶ Improved environmental stability of mechanical and performance properties over time



MATERIAL PROPERTIES

The full suite of mechanical properties are given per ASTM and ISO standards where applicable. In addition, properties such as flammability, dielectric properties, and 24 hour water absorption. This allows for better understanding of the material capability to aid in design decisions for the material. All parts are conditioned per ASTM recommended standards for a minimum of 40 hours at 23 °C, 50% RH.

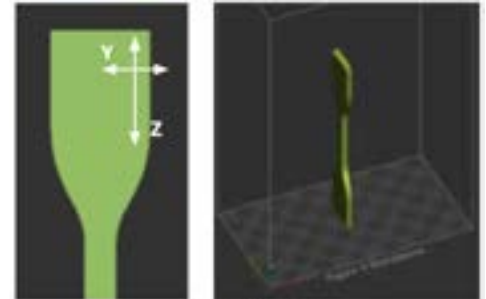
Solid material properties reported were printed along the vertical axis (ZY-orientation). DLP material properties are relatively uniform across print orientations, as detailed in the following section on Isotropic Properties. Because of this, parts do not need to be oriented in a particular direction to exhibit these properties.

LIQUID MATERIAL						
MEASUREMENT	METHOD		METRIC	ENGLISH		
Viscosity	Brookfield viscometer @ 25°C (77°F)		2250 cps	5440 lb/ft-hr		
Colour			Black			
Liquid Density	Kruss K11 Force Tensiometer @ 25°C (77°F)		1.11 g/cm ³	0.040 lb/in ³		
SOLID MATERIAL						
MEASUREMENT	ASTM METHOD	METRIC	ENGLISH	ISO METHOD	METRIC	ENGLISH
PHYSICAL				PHYSICAL		
Solid Density	ASTM D792	1.18 g/cm ³	0.043 lb/in ³	ISO 1183	1.18 g/cm ³	0.043 lb/in ³
24 hour 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%
Flexural Strength	ASTM D790	22 MPa	3190 psi	ISO 178	23 MPa	3265 PSI
Flexural Modulus	ASTM D790	680 MPa	99 ksi	ISO 178	1088 MPa	158 ksi
Notched Izod Impact	ASTM D256	91 J/m	1.7 ft-lb/in	ISO 180-A	10.8 kJ/m ²	0.0051 ft-lb/in ²
Unnotched Izod Impact	ASTM D4812	Does not break		ISO 180-U		
Shore Hardness	ASTM D2240	68 D	68 D	ISO 7619	68 D	68 D
THERMAL				THERMAL		
Tg (DMA E'')	ASTM E1640 (E'' at 1C/min)	11°C	52°F	ISO 6721-1/11 (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 76- 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 (kV/mm) @ 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				

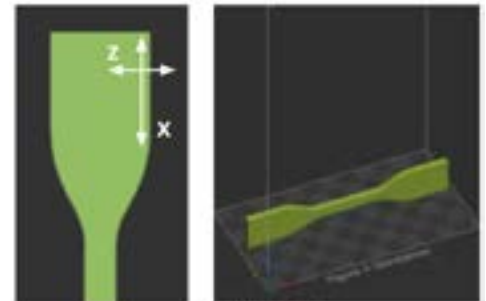
ISOTROPIC PROPERTIES

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

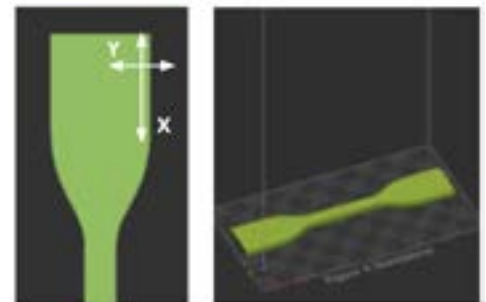
Parts do not need to be oriented to get the highest mechanical properties, further improving the degree of freedom for part orientation for mechanical properties.



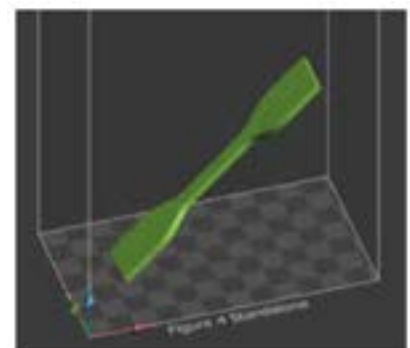
YZ - orientation



XZ - orientation



XY - orientation



Z45-Degree - orientation

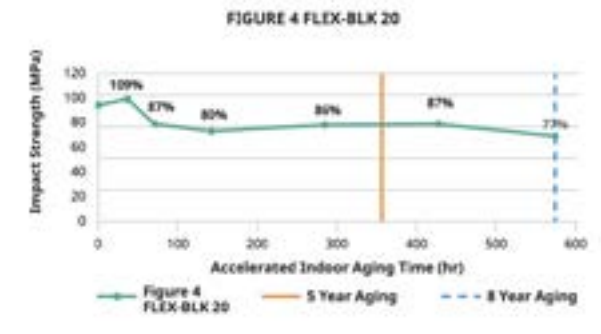
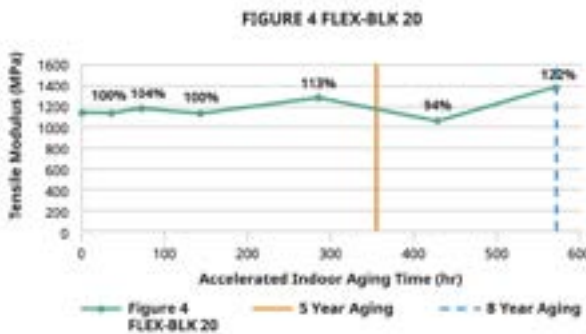
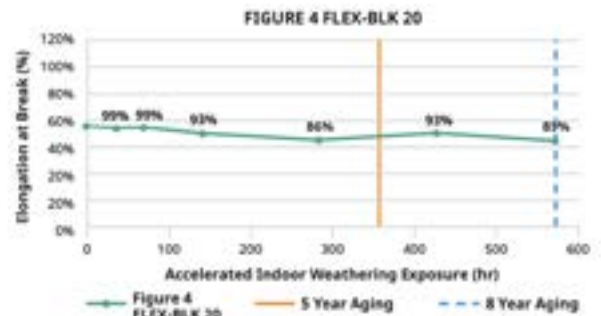
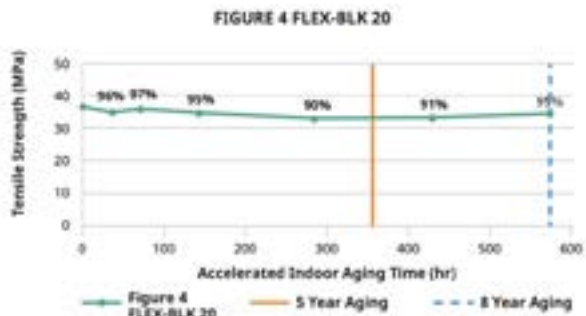
SOLID MATERIAL					
METRIC	METHOD	METRIC			
MECHANICAL					
		ZY	XZ	XY	Z45
Tensile Strength Ultimate	ASTM D638	36 MPa	35 MPa	31 MPa	31 MPa
Tensile Strength at Yield	ASTM D639	24 MPa	26 MPa	26 MPa	25 MPa
Tensile Modulus	ASTM D640	1151 MPa	1229 MPa	1102 MPa	1035 MPa
Elongation at Break	ASTM D641	76%	71%	70%	68%
Elongation at Yield	ASTM D642	7.5%	8.1%	7.5%	9.1%
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	68 D	68 D	67 D	72 D

LONG TERM ENVIRONMENTAL STABILITY

FLEX-BLK 20 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.

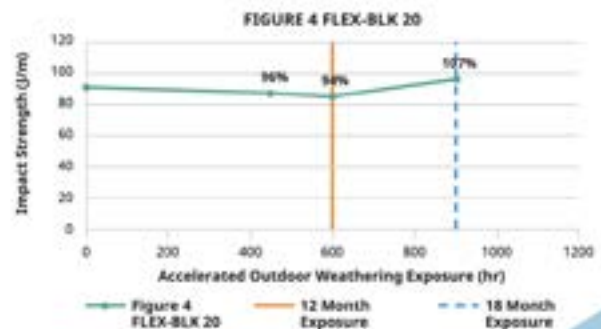
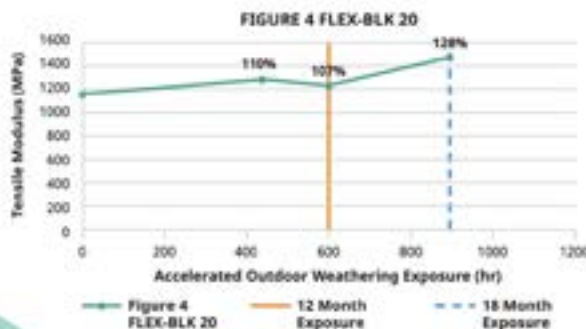
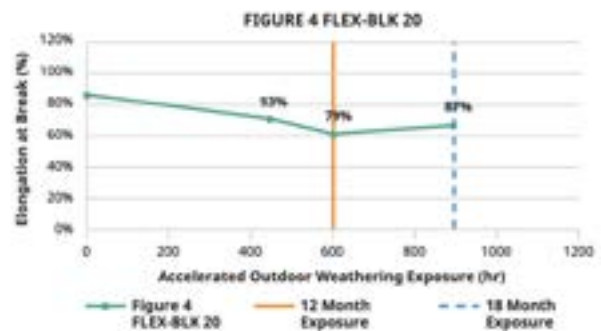
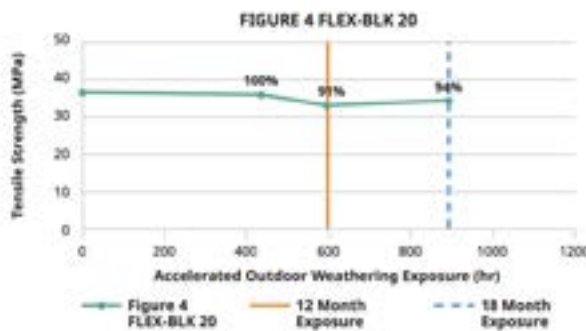
INDOOR STABILITY: Tested per ASTM D4329 standard method.

INDOOR STABILITY



OUTDOOR STABILITY: Tested per ASTM G154 standard method.

OUTDOOR STABILITY



AUTOMOTIVE FLUID COMPATIBILITY

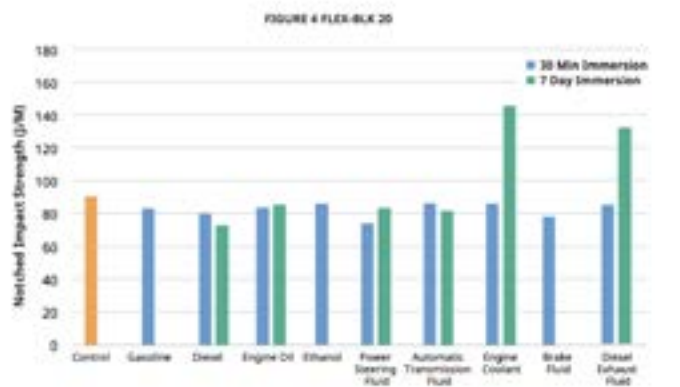
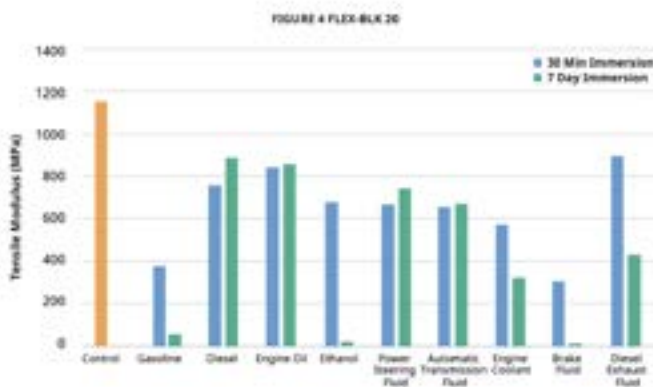
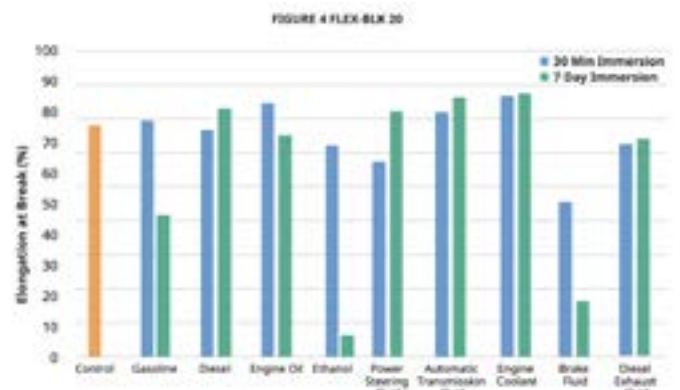
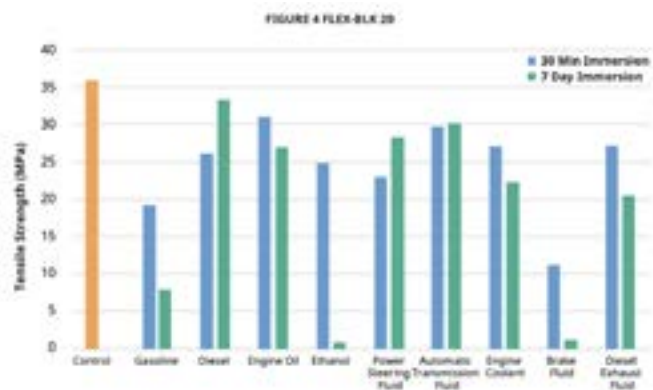
The compatibility of a material with hydrocarbons and cleaning chemicals is critical to part application. FLEX-BLK 20 parts were tested for sealed and surface contact compatibility per USCAR2 test conditions. The fluids below were tested in two different ways per the specs.

- 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

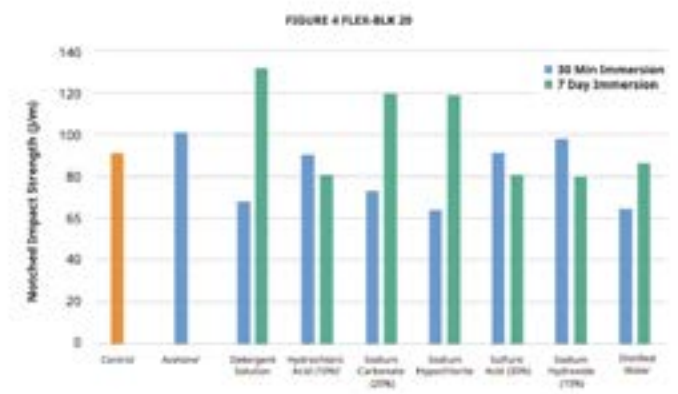
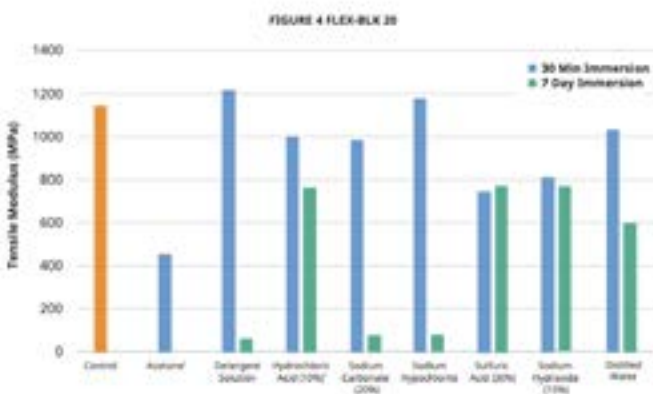
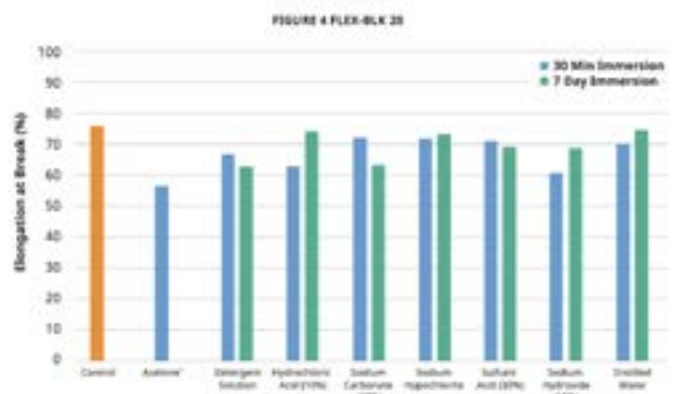
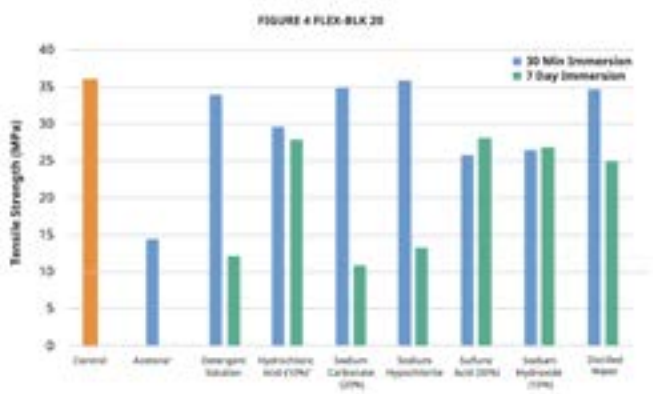
The compatibility of a material with cleaning chemicals is critical to part application. FLEX-BLK 20 parts were tested for sealed and surface contact compatibility per ASTM D543 test conditions. The fluids below were tested in two different ways per the specs.

- 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 through 7-day soak conditioning.

CHEMICAL COMPATIBILITY
6.33 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 Hydrochloric Solution
6.3.46 Sulfuric Acid (30%)
6.3.42 Sodium Hydroxide Soln (10%)
6.3.15 Distilled Water



Warranty/Disclaimer: The performance characteristics of these products may vary according to product application, operating conditions, material combined with, or with end use. Prototype Projects makes no warranties of any type, express or implied, including, but not limited to, the warranties of merchantability or fitness for a particular use.