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MATERIAL GUIDE
Digital Light Projection

RUBBER-65A BLK
(Matrix RB65)

Manufacture rubber parts with production performance properties

RUBBER-65A BLK material is specially formulated to address key customer needs for rubber parts featuring production performance properties and production mechanical properties tested according to industry standards. RUBBER-65A BLK is a mid-tear strength, high elongation at break, Shore 65A material for the production of medium hard rubber parts with slow rebound, for applications such as grips, handles, gaskets, bumpers, seals, vibration dampening components and more.

Applications

- Air/dust gaskets
- Seals and housings
- Vibration dampener and pipe spacers
- Bumpers
- Grips and handles

Benefits

- Production performance properties
  - Long-term stability
  - UL94 HB flammability test standards
- Low cost and low hazard cleaning
- Engineered for long term environmental stability

Features

- Biocompatible* capable per ISO 10993-5 and ISO 10993-10
- High elongation at break
- Shore-A of 65 (medium hard rubber)
- Mid-tear strength
- Easy to clean

Biocompatibility statement

RUBBER-65A BLK 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, and ISO 10993-10, Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization (GPMT). The test results indicate that RUBBER-65A BLK has passed the requirements for biocompatibility according to the above tests.

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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 are given. 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	**CONDITION**	**METRIC**	**ENGLISH**
Viscocity	Brookfield Viscometer @ 25 °C (77 °F)	242 cPs	585 lb/ft h
Colour		Black	
Liquid Density	Kruss K11 Force Tensiometer @ 25 °C (77 °F)	1.03 g/cm^3	0.036 lb/in^3

SOLID MATERIAL			
METRIC	**METHOD**	**METRIC**	**ENGLISH**
PHYSICAL			
Solid Density	ASTM D792	1.12 g/cm^3	0.04 lb/in^3
24 Hour Water Absorption	ASTM D570	2.6%	2.6%
MECHANICAL			
Tensile Strength Ultimate	ASTM D412 Die C	5 MPa	725 psi
Tensile Modulus	ASTM D412 Die C	23 MPa	3.3 ksi
Elongation at Break	ASTM D412 Die C	126%	126%
Stress at 50% Elongation	ASTM D412 Die C	1.3 MPa	145 psi
Stress at 100% Elongation	ASTM D412 Die C	2.9 MPa	290 psi
Tear Strength	ASTM D624 Type C	8.5 kN/m	46 lbf/in
Tear Strength	ASTM D624 Type T	1.8 kN/m	6 lbf/in
Shore Hardness	ASTM D2240	65 A	65 A
Compression Set (%) 23C	ASTM D395	0.6%	0.6%
Compression Set (%) 50C	ASTM D395	1.3%	1.3%
Bayshore Rebound	ASTM D2632	11%	11%
THERMAL			
Tg (DMA, E")	ASTM E1640 (E"Peak)	-10 °C	14 °F
CTE below Tg	ASTM E831	84 ppm/°C	47 ppm/°F
CTE above Tg	ASTM E831	184 ppm/°C	102 ppm/°F
UL Flammability	UL94	HB	
ELECTRICAL			
Dielectric Strength (kV/mm) @ 3.0 mm thickness	ASTM D149	13.9	
Dielectric Constant @ 1 MHz	ASTM D150	5.39	
Dissipation Factor @ 1 MHz	ASTM D150	0.057	
Volume Resistivity (ohm-cm)	ASTM D257	1.27 x 1011	

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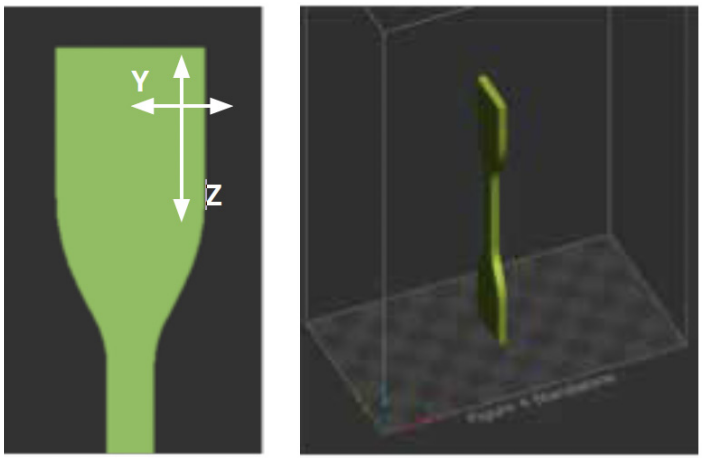
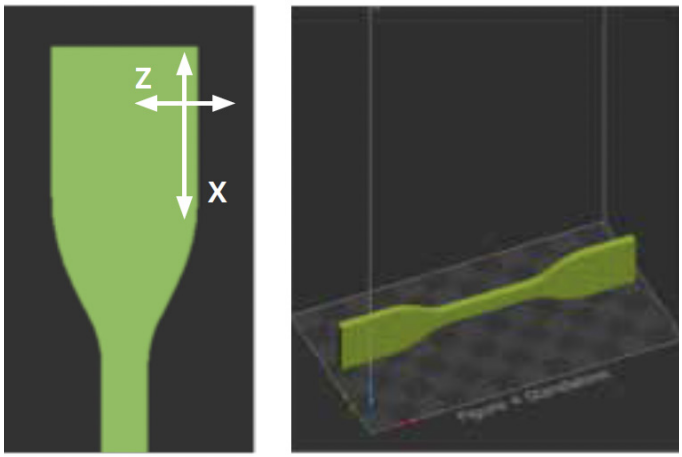
Isotropic properties

DLP prints parts that are 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.

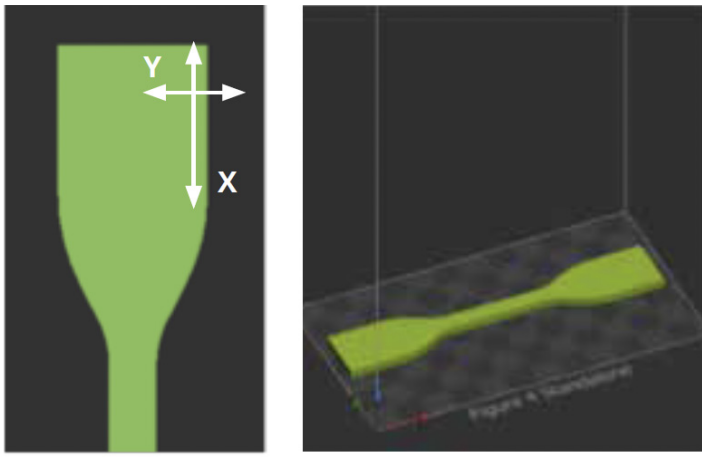
SOLID MATERIAL					
METRIC	METHOD	ZY	XZ	XY	Z45
Tensile Strength Ultimate	ASTM D412 Die C	5 MPa	4 MPa	5 MPa	5 MPa
Tensile Modulus	ASTM D412 Die C	23 MPa	22 MPa	22 MPa	23 MPa
Elongation at Break	ASTM D412 Die C	126%	125%	128%	126%
Stress at 50% Elongation	ASTM D412 Die C	1.3 MPa	1.3 MPa	1.4 MPa	1.3 MPa
Stress at 100% Elongation	ASTM D412 Die C	2.9 MPa	2.7 MPa	3 MPa	2.9 MPa
Tear Strength	ASTM D624 Type C	8.5 kN/m	10 kN/m	14 kN/m	9.4 kN/m
Tear Strength	ASTM D624 Type T	1.8 kN/m	2.1 kN/m	2 kN/m	8.5 kN/m
Shore Hardness	ASTM D2240	65 A	64 A	63 A	60 A



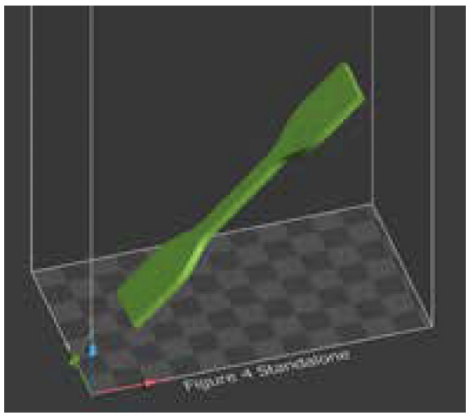
ZY - orientation



XZ - orientation



XY - orientation



Z45-Degree - orientation

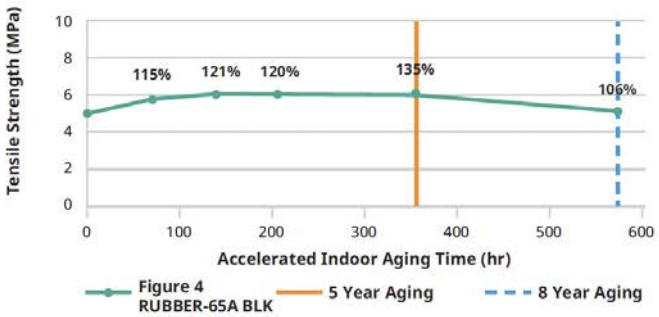
Long term environmental stability

RUBBER-65A BLK 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.

FIGURE 4 RUBBER-65A BLK



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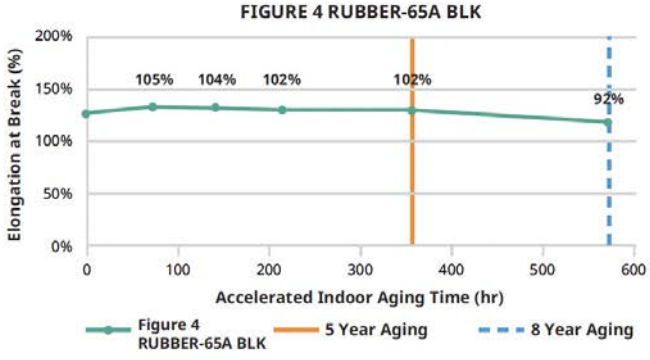

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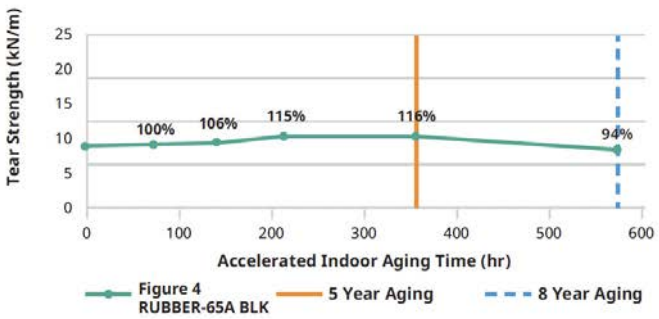

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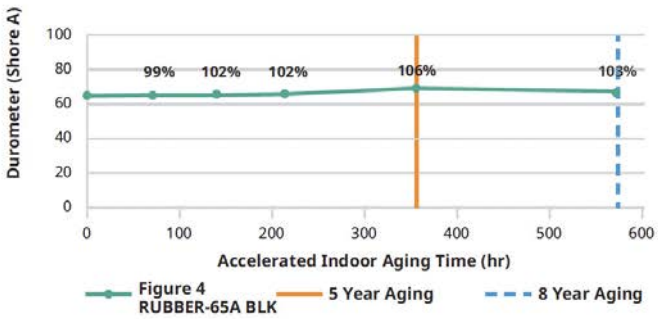
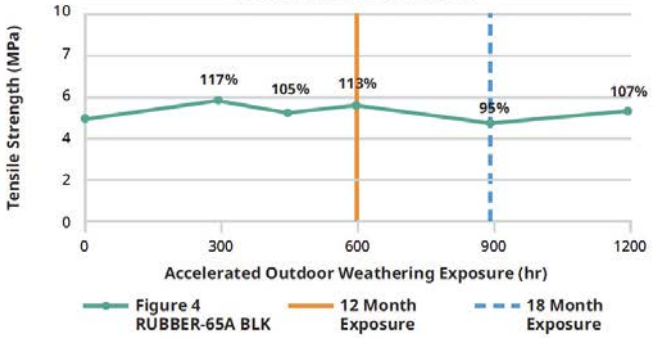


OUTDOOR STABILITY

Tested per ASTM G154 standard method.

FIGURE 4 RUBBER-65A BLK



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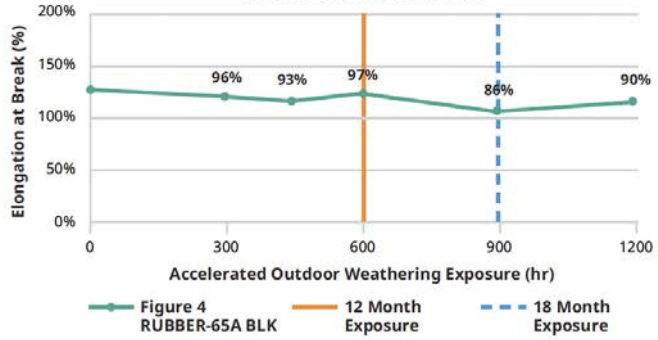

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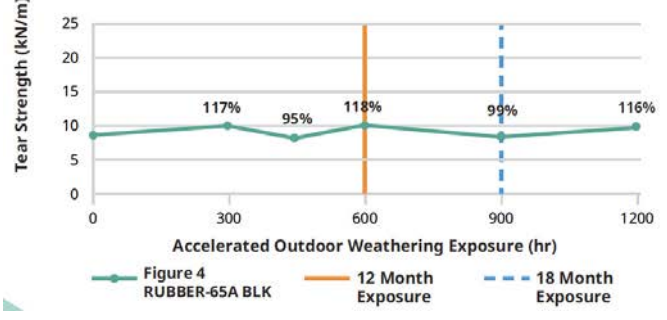

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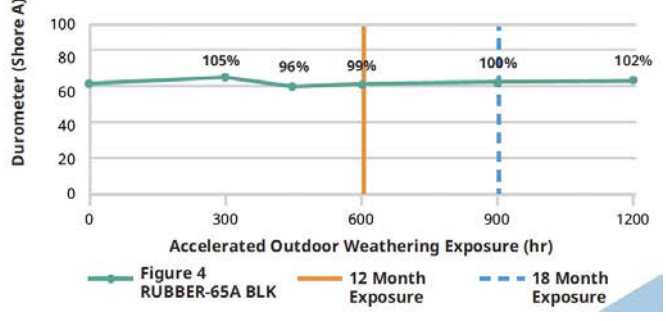

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Automotive fluid compatibility

The compatibility of a material with hydrocarbons and cleaning chemicals is critical to part application. RUBBER-65A BLK 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.

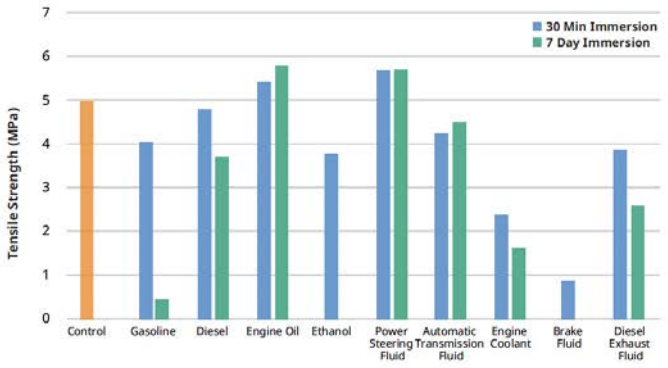
- Immerse for 7-days, then take mechanical property data for comparison
- Immerse for 30-minutes, remove, and take mechanical property data for comparison in 7-days

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
Automative 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

FIGURE 4 RUBBER-65A BLK



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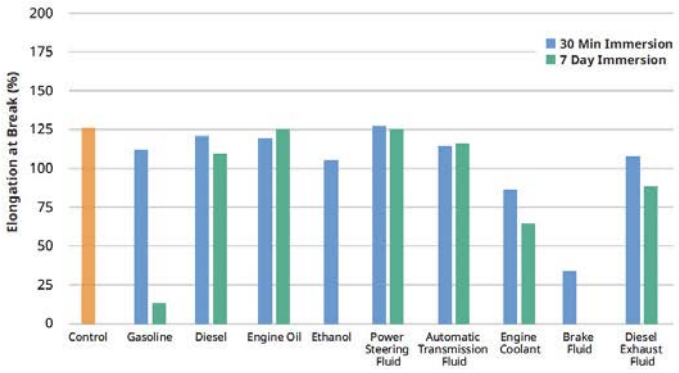

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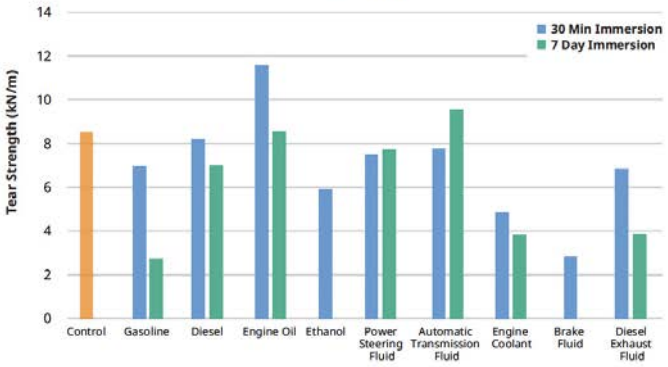

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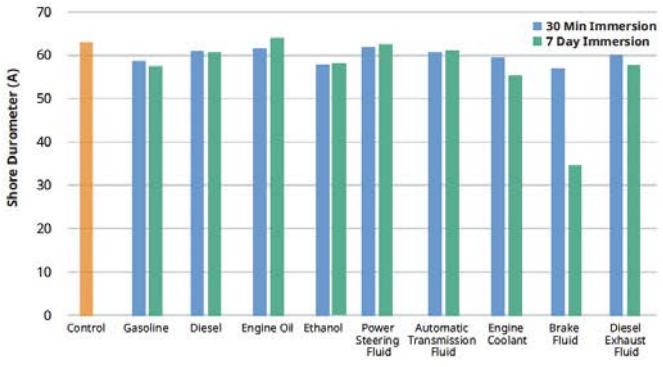

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Chemical compatibility

The compatibility of a material with cleaning chemicals is critical to part application. RUBBER-65A BLK 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

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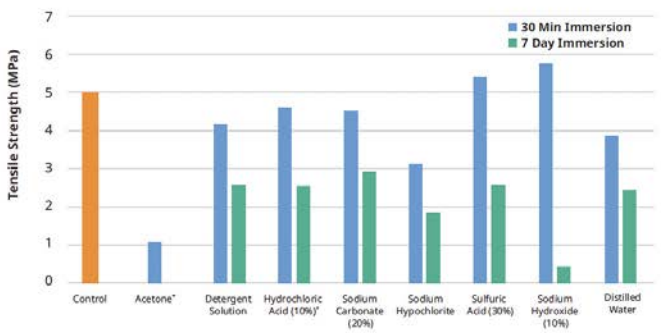

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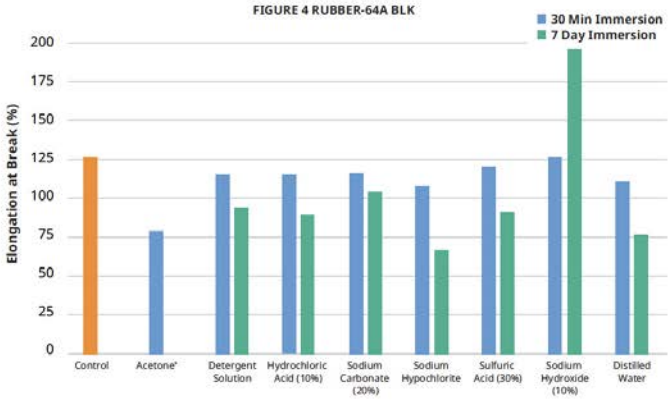

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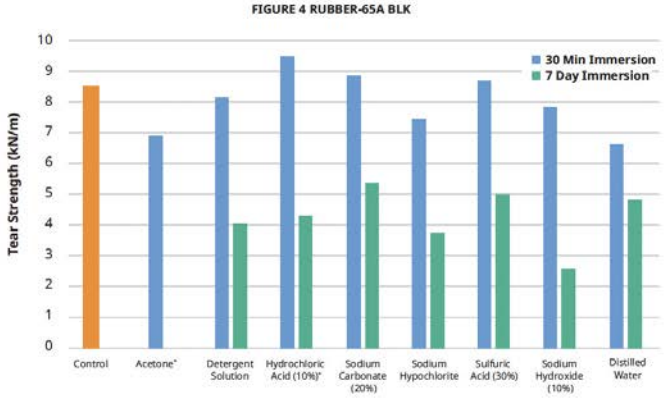

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