VisiJet® Armor M2G-CL

Clear Plastic

ProJet MJP 2500

ABS-like, rigid engineering prototyping plastic with translucent clear finish delivering good strength and stiffness with high elongation and toughness

With the strength and stiffness needed to simulate many injection-molded thermoplastics, VisiJet Armor M2G-CL also achieves high elongation and notched Izod impact strength. VisiJet Armor M2G-CL is a rigid material that is good for the most mechanically demanding and geometrically complex functional prototypes. It is optically clear and has high feature fidelity, sharp corners and edges and smooth surface finish.

It was specifically designed to be used as an engineering prototype material and has the same high accuracy and smooth surfaces as the other MJP VisiJet materials. It is suitable for functional prototypes and printed assemblies and can also make extremely small and complex internal structures for microfluidics and flow visualization.

APPLICATIONS

- Strength/stiffness and elongation optimized for demanding engineering applications including injection molded parts and complex functional snap fits
- Translucent functional prototypes and some end-use parts
- Rapid prototyping of plastic injection molded thermoplastic parts
- Exceptional ability to be drilled, tapped and machined, and can create aggressive functional snap fits
- Functional printed assemblies and injection molded screw bosses
- Functional printed screw-threads and thin walls
- Translucent flow visualization and dye-tinted applications
- Optically clear sight windows in fixtures
- Excellent for microfluidics, capillary fluidics and lab-on-a-chip

FEATURES

- Good strength and stiffness, 55-65% elongation, 40-50 notched Izod impact strength
- Excellent for mechanically demanding and geometrically complex functional prototypes
- Able to make extremely small and complex internal structures
- High accuracy and watertight
- Biocompatible USP Class VI

BENEFITS

- High fidelity fine features, sharp edges and high accuracy
- Exceptional smooth and consistent surface finish
- Excellent optical clarity
- No surface cure inhibition of paints or silicones
- Smooth surface and tack-free curing allows for easy molding or painting
- Excellent for complex engineering plastic prototypes

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

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.

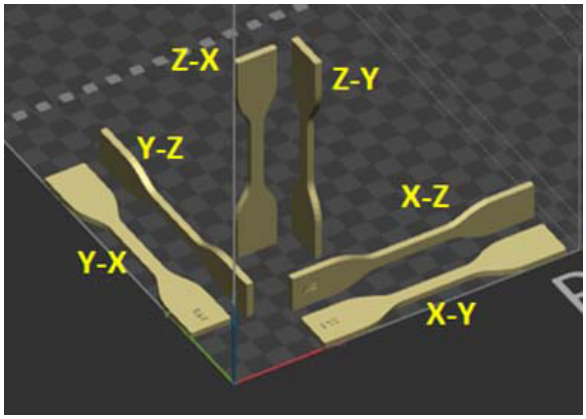
Solid material properties reported were printed along the vertical axis (ZX-orientation). As detailed in the Isotropic Properties section, VisiJet material properties are relatively uniform across print orientations. Parts do not need to be oriented in a particular direction to exhibit these properties.

LIQUID MATERIAL						
Color	Clear					
Package Volume	1.5 kg bottle					
SOLID MATERIAL						
METRIC	**ASTM METHOD**	**METRIC**	**ENGLISH**	**ISO METHOD**	**METRIC**	**ENGLISH**
	PHYSICAL				**PHYSICAL**	
Solid Density	ASTM D792	1.14 g/cm³	0.041 lb/in³	ISO 1183	1.14 g/cm³	0.041 lb/in³
24 Hour Water Absorption	ASTM D570	0.11 %	0.11 %	ISO 62	0.11 %	0.11 %
	MECHANICAL				**MECHANICAL**	
Tensile Strength Ultimate	ASTM D638 Type IV	35 MPa	5100 psi	ISO 527 -1/2	33 MPa	4800 psi
Tensile Strength at Yield	ASTM D638 Type IV	35 MPa	5100 psi	ISO 527 -1/2	32.9 MPa	4800 psi
Tensile Modulus	ASTM D638 Type IV	1600 MPa	240 ksi	ISO 527 -1/2	1300 MPa	195 ksi
Elongation at Break	ASTM D638 Type IV	58 %	58 %	ISO 527 -1/2	60 %	60 %
Elongation at Yield	ASTM D638 Type IV	4.1 %	4.1 %	ISO 527 -1/2	3.9 %	3.9 %
Flex Strength	ASTM D790	46 MPa	6600 psi	ISO 178	43 MPa	6200 psi
Flex Modulus	ASTM D790	1300 MPa	190 ksi	ISO 178	2000 MPa	284 ksi
Izod Notched Impact	ASTM D256	49 J/m	0.9 ft-lb/in	ISO 180-A	6.1 kJ/m²	2.9 ft-lb/in²
Izod Unnotched impact	ASTM D4812	840 J/m	16 ft-lb/in	ISO 180-U		
Shore Hardness	ASTM D2240	77 D	77 D	ISO 7619	77 D	77 D
	THERMAL				**THERMAL**	
Tg (DMA E")	ASTM E1640 (E"Peak)	45 °C	112 °F	ISO 6721-1/11 (E" Peak)	45 °C	112 °F
HDT 0.455MPa/66PSI	ASTM D648	46 °C	114 °F	ISO 75- 1/2 B	40 °C	106 °F
HDT 1.82MPa/264 PSI	ASTM D648	41 °C	106 °F	ISO 75-1/2 A	37 °C	99 °F
CTE -20 to 70C	ASTM E831	110 ppm/°C		ISO 11359-2	110 ppm/K	61 ppm/°F
CTE 95 to 180C	ASTM E831	183 ppm/°C		ISO 11359-2	183 ppm/K	102 ppm/°F
UL Flammability Rating		HB				
	ELECTRICAL				**ELECTRICAL**	
Dielectric Strength (kV/mm) @ 3.0 mm thickness	ASTM D149	365				
Dielectric Constant @ 1 MHz	ASTM D150	3.37				
Dissipation Factor @ 1 MHz	ASTM D150	0.017				
Volume Resistivity (ohm-cm)	ASTM D257	5.98E+15				

ISOTROPIC PROPERTIES

MultiJet Printing (MJP) technology prints parts that are generally isotropic in mechanical properties meaning the parts printed along either the XYZ axis will give similar results.

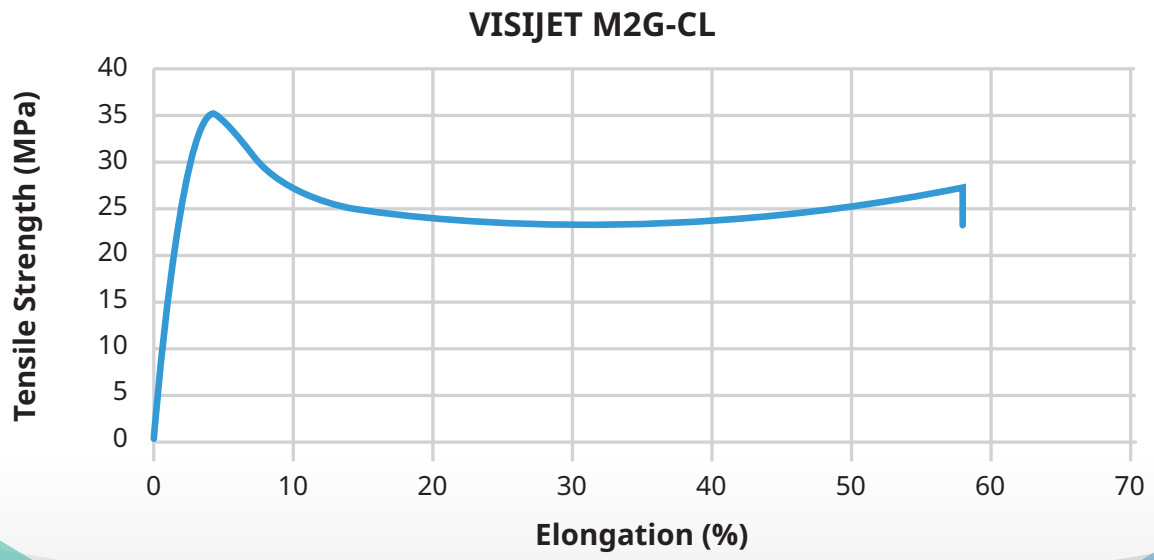
Parts do not need to be oriented to get the highest mechanical properties, further improving the degree of freedom for part orientation for mechanical properties.



SOLID MATERIAL								
METRIC	METHOD	METRIC						
MECHANICAL								
		XY	XZ	YX	YZ	Z45	ZX	ZY
Tensile Strength Ultimate	ASTM D638 Type IV	35 MPa	30 MPa	31 MPa	32 MPa	35 MPa	29 MPa	30 MPa
Tensile Strength at Yield	ASTM D638 Type IV	35 MPa	30 MPa	31 MPa	31 MPa	35 MPa	29 MPa	30 MPa
Tensile Modulus	ASTM D638 Type IV	1600 MPa	1400 MPa	1400 MPa	1500 MPa	1700 MPa	1400 MPa	1400 MPa
Elongation at Break	ASTM D638 Type IV	58 %	63 %	63 %	65 %	51 %	38 %	23 %
Elongation at Yield	ASTM D638 Type IV	4.1 %	4.1 %	4.1 %	3.9 %	3.9 %	4.1 %	4 %
Flex Strength	ASTM D790	46 MPa	39 MPa	47 MPa	37 MPa	47 MPa	34 MPa	36 MPa
Flex Modulus	ASTM D790	1300 MPa	1000 MPa	1300 MPa	1000 MPa	1500 MPa	900 MPa	900 MPa
Izod Notched Impact	ASTM D256	49 J/m	46 J/m	48 J/m	48 J/m	54 J/m	42 J/m	44 J/m
Izod unnotched impact	ASTM D4812	840 J/m	N/A	N/A	N/A	N/A	N/A	N/A
Shore Hardness	ASTM D2240	77 D	74 D	74 D	73 D	74 D	74 D	73 D

STRESS-STRAIN CURVE

The graph represents the stress-strain curve for VisiJet M2E-BK per ASTM D638 testing.

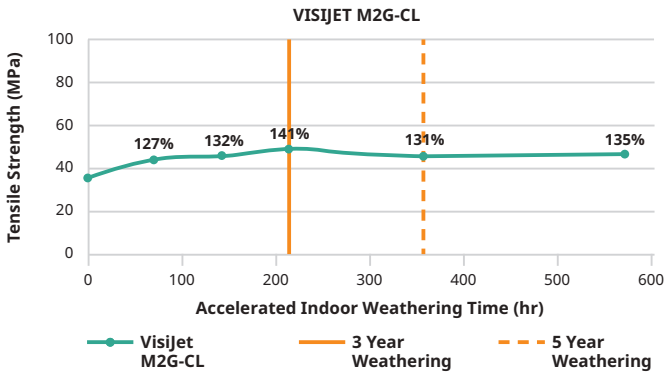


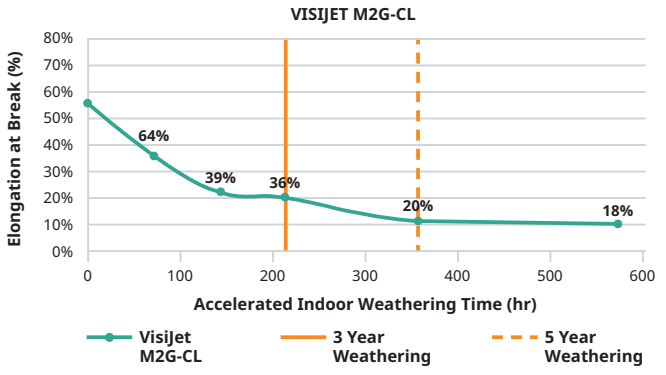
LONG TERM ENVIRONMENTAL STABILITY

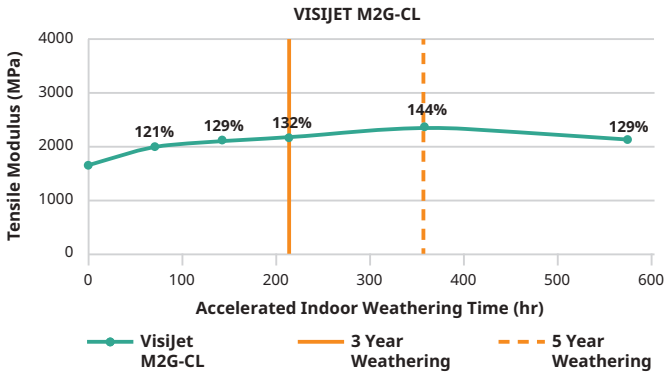
VisiJet Armor M2G-CL is engineered to give long-term environmental UV and humidity stability. This means the material is tested for the ability to retain a high percent of the initial mechanical properties over a given period of time. This provides real design conditions to consider for the application or part. **Actual data value is on Y-axis, and data points are % of initial value.**

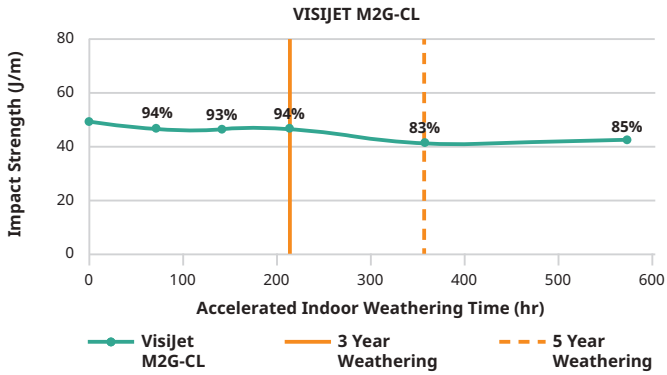
INDOOR STABILITY

INDOOR STABILITY: Tested per ASTM D4329 standard method.



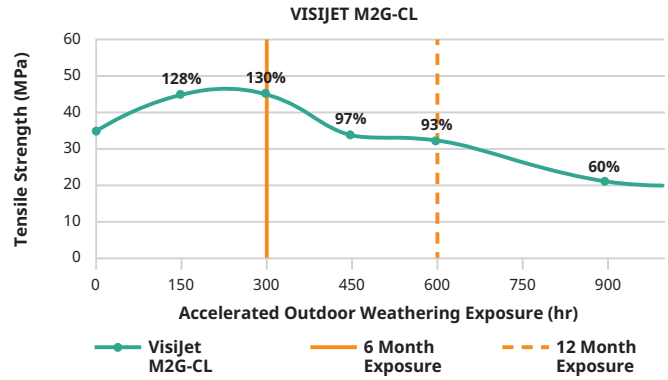


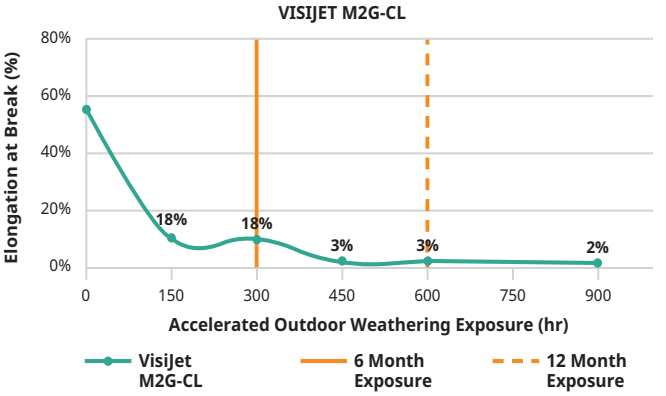


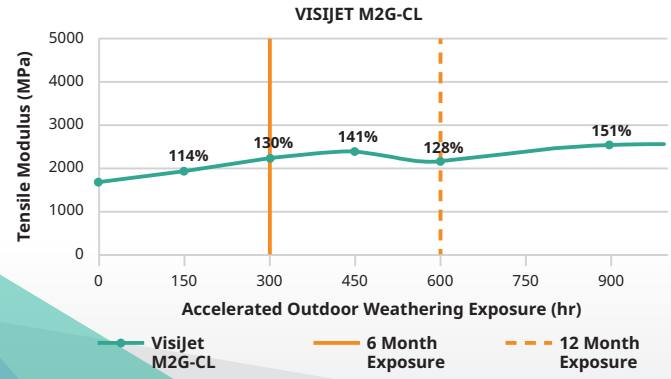


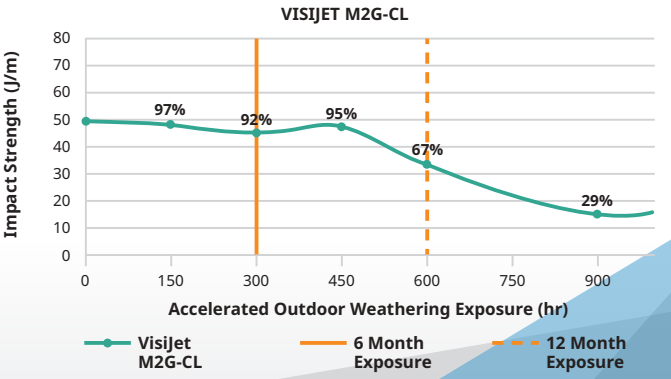
OUTDOOR STABILITY

OUTDOOR STABILITY: Tested per ASTM G154 standard method.









AUTOMOTIVE FLUID COMPATIBILITY

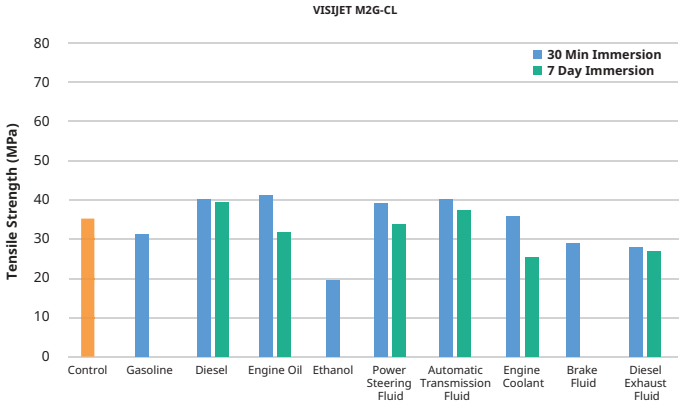
The compatibility of a material with hydrocarbons and cleaning chemicals is critical to part application. VisiJet Armor M2G-CL parts were tested for sealed and surface contact compatibility per USCAR2 test conditions. The fluids below were tested in two different ways per the specs.

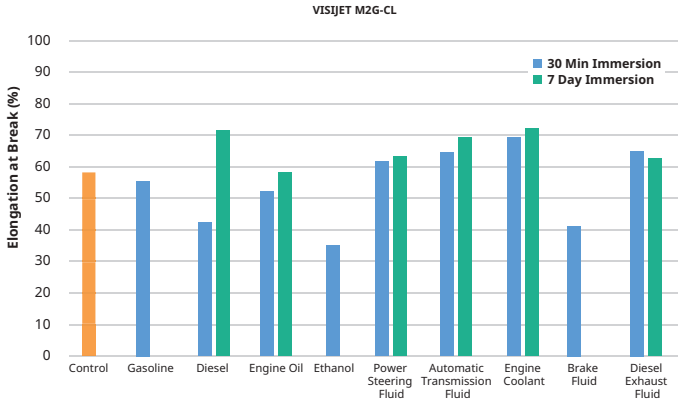
- Immerse for 7-days, then take mechanical property data for comparison.
- Immerse for 30-minutes, remove and take mechanical property data for comparison in 7-days.

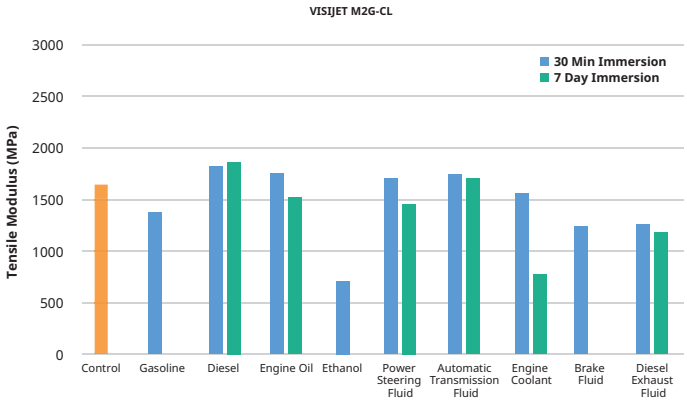
Data reflects the measured value of properties over that period of time.

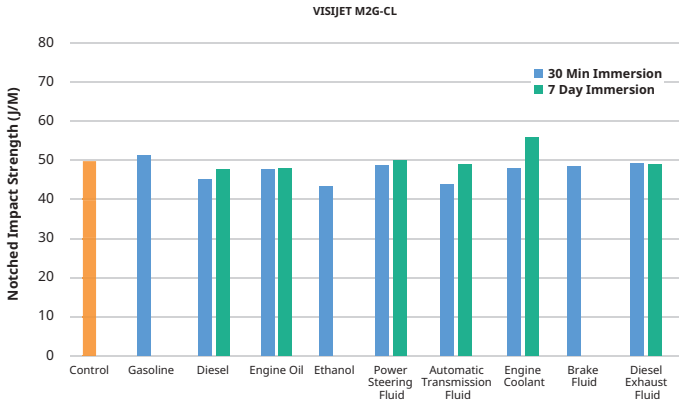
AUTOMOTIVE FLUIDS		
FLUID	**SPECIFICATION**	**TEST TEMP °C**
Gasoline	ISO 1817, liquid C	23 ± 5
Diesel Fuel	905 ISO 1817, Oil No. 3 + 10% p-xylene*	23 ± 5
Engine Oil	ISO 1817, Oil No. 2	50 ± 3
Ethanol	85% Ethanol + 15% ISO 1817 liquid C*	23 ± 5
Power Steering Fluid	ISO 1917, Oil No. 3	50 ± 3
Automative 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









CHEMICAL COMPATIBILITY

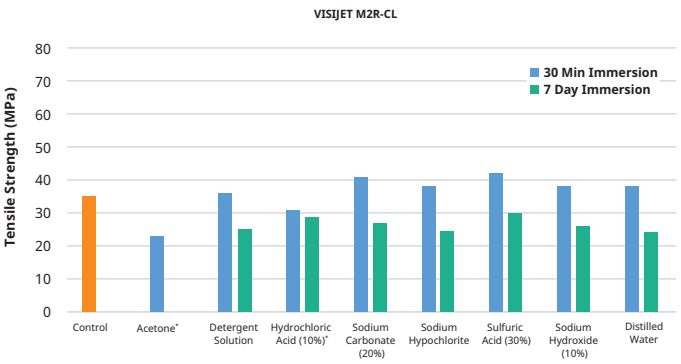
The compatibility of a material with cleaning chemicals is critical to part application. VisiJet Armor M2G-CL parts were tested for sealed and surface contact compatibility per ASTM D543 test conditions. The fluids below were tested in two different ways per the specs.

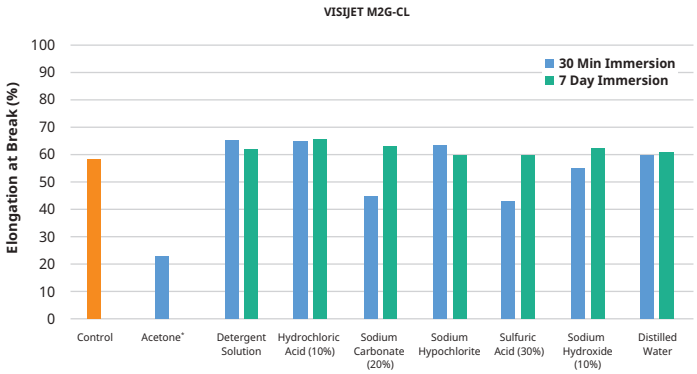
- Immerse for 7-days, then take mechanical property data for comparison.
- Immerse for 30-minutes, remove, and take mechanical property data for comparison in 7-days.

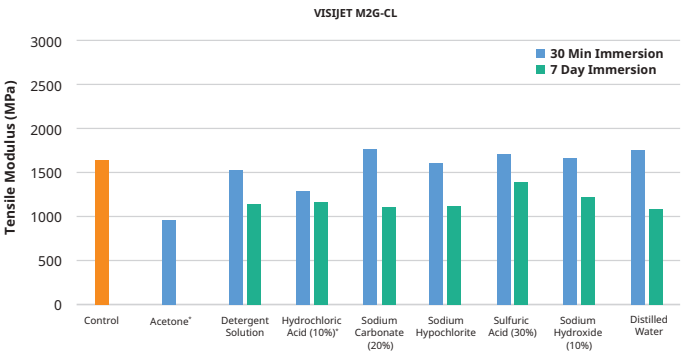
Data reflects the measured value of properties over that period of time.

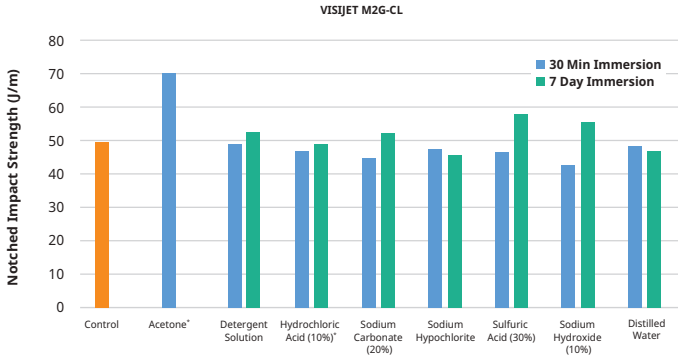
*Denotes materials did not go through 7-day soak conditioning.

CHEMICAL COMPATIBILITY
6.3.3 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 Solution (10%)
6.3.15 Distilled Water









BIOCOMPATIBILITY POST-PROCESS

Outline of MJP biocompatible cleaning procedure. More detail is available in the Post-Processing section of the User Guide:

- Remove wax support in an oven
- Clean with EZ Rinse-C or mineral oil
- Ethyl alcohol (ethanol) rinse with sonication
- Second fresh high purity ethanol rinse with sonication
- Air dry