UL PERFORMANCE MATERIALS

UL BLUE CARD

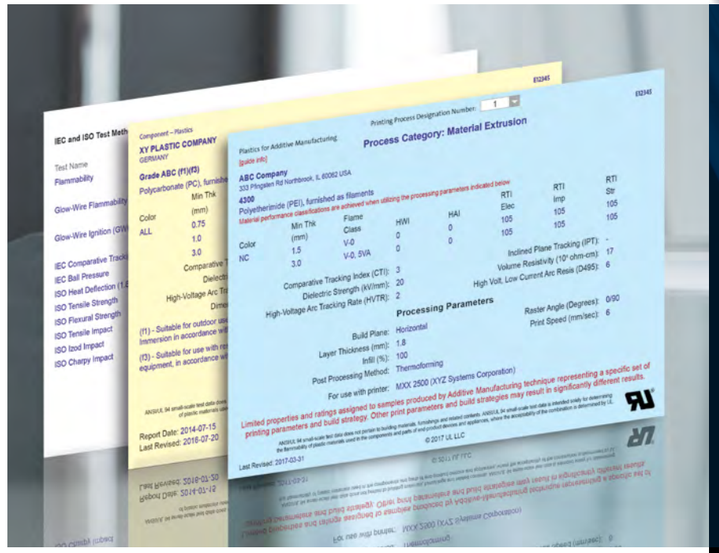
PLASTICS FOR ADDITIVE MANUFACTURING

PLAY YOUR CARDS RIGHT.
WITH THE NEW UL BLUE CARD.

3D printing, or Additive Manufacturing (AM), is a fast-growing segment of the plastics market. UL helps manufacturers navigate and win in the challenging AM space and bring their innovative products to market.

The Plastics for Additive Manufacturing Program offers solutions for safety and compliance for the growing needs of this exciting new business area.

That's where the UL Blue Card comes into play – as a safety and quality guarantee, and a low-maintenance marketing tool.



Plastics for Additive Manufacturing Program (Blue Card Program)

Unlike traditional manufacturing such as injection molding, the 3D printing process introduces a variability which significantly impacts material properties based on how test specimens are printed.

Serving as an extension of the Plastics Recognition Program (Yellow Card Program), the Plastics for Additive Manufacturing Program (Blue Card Program) defines the additional requirements necessary to recognize plastics intended for 3D printing and 3D printed components and products. The Blue Card, a digital product information card, presents the data necessary to prove the safety, integrity and usefulness of materials intended for 3D printing.

It is the ideal recognition for manufacturers of materials or components to promote products and their properties to global markets and potential customers.

The Blue Card provides verification that a material is appropriate for a specific 3D printing technology – in a very compact, simple and easy-to-read format. It helps ensure that the component or end-product manufacturer is using a tested and certified material, as well as being monitored at regular intervals by an independent test laboratory.

A Blue Card is automatically issued when a material intended for 3D printing receives a UL Recognized Component Mark.

Certified materials are added to the UL iQ™ and Prospector® databases, which are used by end product manufacturers to find providers of verified materials and components.

Give Value to End Product Manufacturers

The Blue, Yellow and White Cards help shorten the path for manufacturers seeking certification for their end-products or systems. Using UL tested and certified components, identifiable through the UL Recognized Components Mark on the card, can save time and money by eliminating the need for further material testing.

UL Recognized Component Mark

The UL Recognized Component Mark is a mark consumers rarely see because it is specifically used on component parts that are part of a larger product or system. The component recognition marking is found on a wide range of products, including some switches, power supplies, printed wiring boards, some kinds of industrial control equipment – and now also on 3D printed components. Recognized products and materials are permitted to claim compliance with the standards to which they were tested, within conditions of acceptability in the end application.

Who benefits from the UL Blue Card?

Material Manufacturers producing materials for use in 3D printed components

Component Manufacturers interested in using tested and certified materials to be able to offer certified 3D printed components

End-product Manufacturers interested in using tested and certified 3D printed parts and components in their applications

PROMOTE YOUR PRODUCTS.
WITH THE UL DECK OF CARDS.

Blue Card

- The Blue Card is to be used when the material has been processed using one of the following 3D Printing technologies:
  - Material Extrusion
  - Powder Bed Fusion Systems
  - VAT Polymerization
  - Material Jetting
  - Binder Jetting
  - Sheet Lamination
  - Directed Energy Deposition

The Blue Card lists:

- Material safety performance property ratings
- 3D printer model designation and test specimen build parameters specific to the technology (e.g. build plane, raster angle, air gap, etc. for material extrusion technology)
- Additional information about processing may be included that has a demonstrated influence on the properties and performance of the printed test specimens

Yellow Card

- The UL Yellow Card is typically applied when one of the following traditional manufacturing technologies is employed:
  - Blow molding
  - Extrusion
  - Injection molding
  - Rotational molding
  - Vacuum forming
- The UL Plastics Recognition Program (UL Yellow Card) is a digital product information card for polymeric materials certified by UL
- It lists multiple safety and performance-related properties of tested materials to appropriate standards and is automatically issued when polymeric materials receive a UL Recognized Component Mark

White Card

- The White Card is an extension at the bottom of a Blue or Yellow Card and allows manufacturers to promote their product's performance credentials to global markets
- Manufacturers can add value by increasing coverage, beyond safety certification parameters, and include the performance properties customers are looking for
- It relates to international standards, while the information on the Blue or Yellow Card is typically relevant to North America

Advantages for Material Manufacturers

As certified materials are added to the UL iQ™ and UL's Prospector® databases, your Blue Cards, Yellow Cards and White Cards are immediately visible to thousands of designers, engineers, and suppliers searching for a material or component provider who meets certain safety and performance requirements.

The UL iQ™ family of free databases is a suite of relational databases that allow users to search for UL Certified Components and review relevant safety certification and material performance data. **iq.ul.com**

UL's Prospector® is the premier database for manufacturers to quickly find the precise materials they need. Bringing together thousands of suppliers, Prospector offers an online service to sort and search materials by properties, applications, safety data, performance characteristics and more. **ULProspector.com**

...and End-Product Manufacturers

Save time and money in the process of seeking certification for end products or systems by using the UL Certified plastics. UL Certified plastics are also covered under UL's Follow-Up Services – a product's ongoing certification assessment that helps ensure that products continue to meet UL standards of safety and performance.

HOW TO READ A BLUE CARD.

Example Blue Card and White Card, other information and ratings may be shown

Printing Process Designation Number: 1

Plastics for Additive Manufacturing
[guide info]

Process Category: Material Extrusion

E12345

ABC Company
333 Pfingsten Rd Northbrook, IL 60062 USA

4300
Polyetherimide (PEI), furnished as filaments
Material performance classifications are achieved when utilizing the processing parameters indicated below

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
NC	1.5	V-0	0	0	105	105	105
	3.0	V-0, 5VA	0	0	105	105	105

Comparative Tracking Index (CTI):	3	Inclined Plane Tracking (IPT):	-
Dielectric Strength (kV/mm):	20	Volume Resistivity (10^x ohm-cm):	17
High-Voltage Arc Tracking Rate (HVTR):	2	High Volt, Low Current Arc Resis (D495):	6

Processing Parameters

Build Plane:	Horizontal	Raster Angle (Degrees):	0/90
Layer Thickness (mm):	1.8	Print Speed (mm/sec):	6
Infill (%):	100		
Post Processing Method:	Thermoforming		
For use with printer:	MXX 2500 (XYZ Systems Corporation)		

Limited properties and ratings assigned to samples produced by Additive Manufacturing technique representing a specific set of printing parameters and build strategy. Other print parameters and build strategies may result in significantly different results.

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10, IEC 60695-11-20	Class (color)	1.5	V-0 (NC)
			3.0	V-0, 5VA (NC)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	1.5	960
			3.0	960
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	1.5	875
			3.0	875
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m^2	-	-
ISO Izod Impact	ISO 180	kJ/m^2	-	-
ISO Charpy Impact	ISO 179-2	kJ/m^2		

Flame Class – UL94
Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, now harmonized with IEC 60695-11-10, 60695-11-20, ISO 9772 and ISO 9773. There are twelve UL 94 specified flame classifications assigned to materials based on the results of these small-scale flame tests.

HWI – Hot Wire Ignition
The test method for the determination of resistance to ignition of plastic materials from an electrically heated wire is described in the Standard ASTM D 3874.

HAI – High Arc Ignition
The HAI test determines a material's ability to withstand electrical arcing either directly on or just above the surface of the plastic material. This can occur in the presence of open switch contacts or in the event of the failure of an electrical connection.

RTI – Relative Thermal Index
The maximum service temperature for a material where a class of critical property will not be unacceptably compromised through chemical thermal degradation over the reasonable product lifetime. Electrical RTI is associated with critical electrical insulating properties. Mechanical impact RTI is associated with critical impact resistance, resilience and flexibility properties. Mechanical strength RTI or mechanical without impact is associated with critical mechanical strength where impact resistance, resilience, and flexibility are not essential.

CTI – Comparative Tracking Index
ASTM D 3638 (IEC 60112) Method: This test is used as a measure of the susceptibility of the material to tracking.

Dielectric Strength
The test method for the determination of the dielectric breakdown and strength of insulating materials, described in the Standard ASTM D 149 (IEC 60243).

HVTR – High Voltage Arc Tracking Rate
Test method to determine the susceptibility of the test material to track or form a visible carbonized conducting path over the surface when subjected to high-voltage, low-current arcing.

IPT – Inclined Plane Tracking
Described in the Standard ASTM D 2303, used as a measure of the susceptibility of a material to track.

Volume Resistivity
Testing according to ASTM D 257 (IEC 60167), procedures for the determination of d-c volume resistance, volume resistivity, surface resistance, and surface resistivity of electrical insulating materials.

High Voltage, Low Current Arc Resistance
Testing to ASTM D495, based on the number of seconds that a material resists the formation of a surface-conducting path when subjected to an intermittently occurring arc of high-voltage, low-current characteristics.

Note: For some tests a Performance Level Category (PLC) may be assigned. This is typically a numeric rating from 0 – 5, where each number represents a range of property values,and 0 represents the best rating available.

Process Category
Definition of the 3D Printing technology:
– Material Extrusion
– Powder Bed Fusion Systems
– VAT Polymerization
– Material Jetting
– Binder Jetting
– Sheet Lamination
– Directed Energy Deposition

Build plane
The plane in which the samples are built, either horizontal or vertical.

Layer thickness
The thickness of one printed layer (in mm or microns).

Post processing method
Processing applied to the printed part after printing (eg. blasting, coating, electro-plating, etc.).

Specific to Material Extrusion:

Air gap
Shortest distance between two adjacent beads of the material (in mm or microns).

Print speed
The speed of printing (in mm/sec).

Raster angle
The angle of a printed layer relative to x-axis of the part (in degrees).

Specific to Powder Bed Fusion:

Hatch spacing
Distance between the adjacent hatch lines (in mm or microns).

Scan strategy
Scan strategy refers to the laser scan pattern used for performing the fusion. (Ex., Parallel Scans, Alternate Scans, etc.,).

Scan Speed
Speed of the laser beam on the heated powder bed (in mm/sec).

Laser Power
Power value of the laser beam (in Watts).

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