

# Polymeric Materials



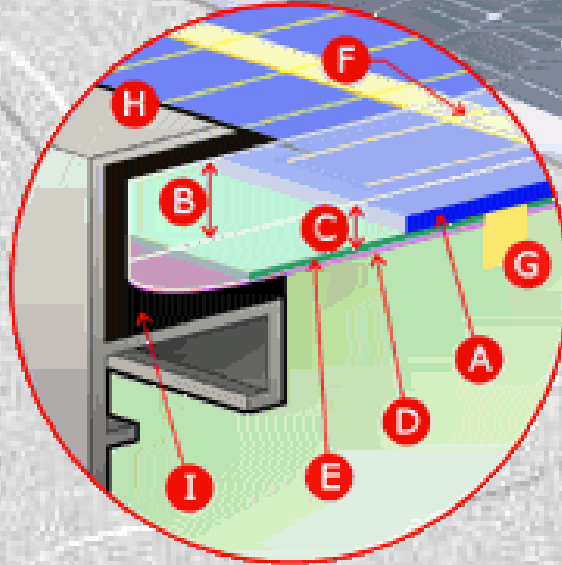
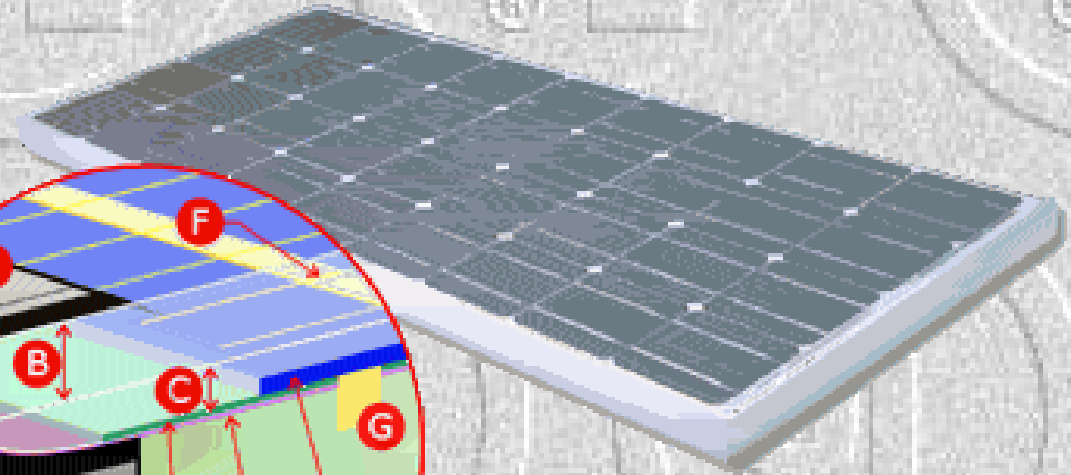
**Underwriters Laboratories Inc.®**

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# UL Principal Designated Engineer - Renewable Energy

- Photovoltaic Modules and Panels
- Concentrated Photovoltaics
- Thermal Solar Systems
- Wind Turbine Generating Systems
- Inverters and Converters for Use in Independent Power Systems
- Energy Systems
- Engine Generators

# The Standards - UL 1703, IEC 61730, IEC 61215, IEC 61646



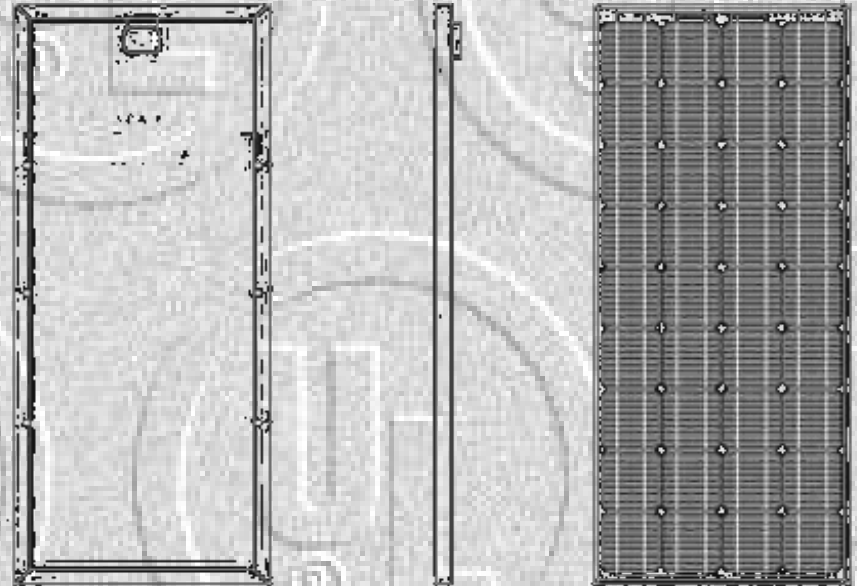
A. Solar Cell	F. Interconnect Ribbon
B. Glass	G. Bus Ribbon
C. Encapsulant	H. Frame
D. Back Cover	I. Edge Seal
E. Fiberglass	

- Electrical shock hazards
- Fire resistance
- Reliability

- Verify evaluation through testing
- Provide descriptive information for subsequent “Follow-Up” inspection of manufacturing locations

# Polymeric Material Considerations

- Plastic materials
  - Flammability
  - HWI - Hot Wire Ignition
  - HAI – High Arc Ignition
  - CTI - Comparative Tracking Index
  - RTI - Relative Thermal Index
  - UV resistance
  - Creep
  - Adhesion



# PV Polymeric Requirements

- **Past** – The PV industry developed polymeric materials requirements that evaluate the PV module end product through UL1703, IEC 61215, IEC 61646 and IEC 61730 in place of more traditional component materials evaluations
- **Today** – Recent field issues are indicating that the UL1703 or IEC 61730 tests do not cover the open circuit arcing fault failure mode and that the materials requirements need to be more stringent.

# IEC 61730 Polymerics

Polymers are classified into four operational categories:

- - polymers serving as an enclosure for live conductive parts (such as a junction box);
- - polymers serving as a support of live metal parts (such as integrated terminals);
- - polymers serving as the outer surface for the module (such as the superstrate or substrate);
- - barriers.

# IEC 61730 Polymerics

- All polymeric materials shall have a minimum relative thermal index (RTE) (electrical and mechanical as defined by IEC 60216-5) of 20 C above the maximum measured operating temperature of said material in application, as measured during the temperature test (IEC 61730-2, MST 21).

# Encapsulants

- **Past** – One EVA used by the industry, UL1703 and IEC end product testing no component testing.
- **Present** - >30 Encapsulants used by industry, tracking ID, material chemical makeup.
- **Present** – IEC61730 requires All polymeric materials shall have a minimum relative thermal index RTI (electrical and mechanical as defined by IEC 60216-5) of 20°C above the maximum measured operating temperature...
- **Future** – UL61730 May include direct contact /direct support requirements similar to other UL categories and UL746C; Flame Rating, HAI, CTI, tracking and UV/water.

# Backskins / Substrates and Superstrates

- **Past** - Tedlar or laminate including Tedlar providing the construction passes the UL1703 test program. Tedlar is a UL Recognized Component.
- **Future** – RTI (min 90°C) on all laminate components. Individual layer evaluations and/or laminate evaluation. UV & water immersion (F1) , Flame spread index.
- Likely to be in contact with live parts and meet direct support requirements; Flame Rating, HAI, CTI and tracking.

# Pottants

- **Present** – Min 90°C RTI, Note most silicones have a generic RTI of 105°C, Flame rating or end product flame test and other direct contact / support requirements; CTI, HWI.
- **Future** – Same as above plus UV/water, tracking and minimum flame ratings will be V-1 to eliminate the possibility of flaming droplets.

# UL iQ For Plastics

- Searchable database that may be used by UL clients and the general public

[http://data.ul.com/ULiQ\\_Link/index.asp](http://data.ul.com/ULiQ_Link/index.asp)

- Contains all published information for a polymeric material
- There is no fee for this service



# UL iQ For Plastics

SEARCH:

Parameters

Grade

Tradename

Company

File number

Description

## Select Parametric Search Criteria

Generic Family: Any	Relative Temperature Index (R.T.I.)
Minimum thickness (mm): 3	Electrical Strength: n/a
Ultraviolet and/or water immersion considerations: n/a	Mechanical Impact: n/a
	Mechanical Strength: n/a
<small>(f1) = Suitable for outdoor use with respect to exposure to Ultraviolet Light, Water Exposure and Immersion in accordance with UL 746C. (f2) = Subjected to one or more of the following tests: Ultraviolet Light, Water Exposure or Immersion in accordance with UL 746C, where the acceptability for outdoor use is to be determined by UL Inc.</small>	
Flame Class: n/a	Hot Wire Ignition (HWI): n/a
Comparative Tracking Index (CTI): n/a	High Amp Arc Ignition (HAI): n/a
High Volt Tracking Rate (HVTR): n/a	ASTM D495 Tracking (D495): n/a
Maximum Number of Matching Grades: 500 (selecting over 1000 will significantly increase querying time)	

Search by Parameter

# UL iQ For Plastics

QMFZ2 Component - Plastics

Monday, January 01, 2001

E987654

## ANY PLASTICS CO LTD

PO Box 1, Polymer Way Pkwy, Northbrook IL USA

Material Designation: **PA-123FR**

Product Description: Polyamide 66 (PA 66), glass reinforced, flame retarded designated "Akulon" furnished as pellets.

Color	Min. Thick. (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str	IEC GWIT	IEC GWFI
ALL	0.75	HB	4	0	65	65	65	-	-
	1.5	V-2	4	0	65	65	65	-	-
	3.0	V-0	3	0	65	65	65	-	-

CTI: 1      IEC CTI (V): -      HVTR: 1      D495: 6      IEC Ball Pressure (°C): -

Dielectric Strength (kV/mm): 23

Volume Resistivity ( $10^9$  ohm-cm): 13

Dimensional Stability (%): 0

ISO Tensile Strength (MPa): -

ISO Flexural Strength (MPa): -

ISO Heat Deflection (°C): -

ISO Tensile Impact (kJ/m<sup>2</sup>): -

ISO Izod Impact (kJ/m<sup>2</sup>): -

ISO Charpy Impact (kJ/m<sup>2</sup>): -

Report Date: 01/01/2000

Underwriters Laboratories Inc®

ASTM Tens. Str: 44

ASTM Tens Imp: -

ASTM Flex Str: -

ASTM Izod Imp: 154

ASTM Heat Deflection: 84

Thank you for your time.

For more information, please contact:

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