

ELTEK International Laboratories

TEST LIST

Relative Thermal Index (RTI) & Thermal Index (TI) for Materials

Relative Thermal Index & Thermal Index Tests

ELTEK Labs conducts a wide range of thermal index tests to various industry standards.

- Relative Thermal Index (RTI) refers to thermal classification of a material by comparing the performance of a new (candidate) material against the performance of a known or reference material. Two materials are involved.
- Thermal Index (TI) refers to thermal classification of a material by projecting the pattern (thermal aging curve) to a pre-selected time coordinate; not a known or reference material. Only the candidate material is involved.
- Thermal Index testing, RTI or TI, is intended to evaluate thermal decomposition as the only, or main, cause of loss of performance property.

General Information

This general category must be separated into specific type of materials as each sub-group has different performance properties and requirements.

The industry has identified three essential properties which can result in establishing thermal classifications for various types of materials. Not all three properties are related to all sub-categories. The pattern of properties and the sub-categories is as follows:

	Electrical	Mechanical Tensile or Flexural	Impact
Polymeric Materials / Plastics / Engineering Polymers			
Injection Molding Resins	X	X	X
Film / Paper / Tape	X	X	
Laminated / Composite Sheet	X	X	
Powder Coatings	X		
Photovoltaic Back Sheets	X	X	Tear Resistance
Photovoltaic Top Sheet	Under industry review to determine the correct test methods		
Magnet Wire Coatings	X (TP)		
Magnet Wire	X (TP)		
Insulating Varnishes/ Impregnating Resins	X (TP)	X (HC)	
Single and Multi-layered Wire	X		
Sleevings and Tubings	X		

Special Note: Flammability Rating may be necessary for some categories of RTI or TI evaluations.

ELTEK Labs tests all types of polymeric materials such as films, papers, tapes, laminated sheets, composite sheets, rigid sheets and many others types.

ELTEK Labs conducts Relative Thermal Index [RTI] and Thermal Index [TI] tests using the Fixed Time Frame Method or the Fixed Temperature Method in accordance with:

National Electrical Manufacturers Association [NEMA]

NEMA MW 1000: Magnet Wire; section 3.58: Thermal Endurance

(This test method is structured for Thermal Index)

(Key Words: Thermal Aging, LTTA, Long Term Thermal Aging, Twisted Pairs, ASTM method D-2307)

American Society for Testing of Materials [ASTM]

ASTM method D-2304: Standard Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

(Key words: 20,000-h, 20,000-hours, UL 746-B, Long Term Thermal Aging, LTTA, breakdown voltage, AC, flexural strength, rigid plates, rigid sheets, thermal setting laminates, water absorption)

ASTM method D-149: Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-A, UL 746-B, LTTA, Long term Thermal Aging, heat aging, IEC 60243)

ASTM method D-256: Standard test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-A, UL 746-B, LTTA, Long term Thermal Aging, Injection or Extruded Molding Resins, heat aging, ISO 180)

ASTM method D-638: Standard Test Method for Tensile Properties of Plastics

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-A, UL 746-B, LTTA, Long term Thermal Aging, Injection Molding Resins, Sheet and Plate molded plastics, heat aging, ISO 527-2)

ASTM method D-790: Standard Test Methods for Flexural Properties of Unreinforced and reinforced Plastics and Electrical Insulating Materials

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-A, UL 746-B, LTTA, Long term Thermal Aging, Injection Molding Resins, Sheet and Plate molded plastics, heat aging, ISO 178)

ASTM method D-882: Standard Test Method for Tensile Properties for Thin Plastic Sheeting

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-A, UL 746-B, LTTA, Long term Thermal Aging, heat aging, ISO 527-3)

ASTM method D-1822: Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-B, LTTA, Long term Thermal Aging, Injection Molding Resins, heat aging, ISO 8256)

ASTM method D-3801: Standard Test Method for Measuring the Comparative Burning Characteristics of Solid Plastics in a Vertical Position
(This test method is structured for both Relative Thermal Index and Thermal Index)
(Key words: UL 94, UL 746-A, UL 746-B, LTТА, Long term Thermal Aging, Injection Molding Resins, heat aging)

ASTM method D-6272: Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials from Four-Point Bending
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: UL 746-A, UL 746-B, LTТА, Long term Thermal Aging, Injection Molding Resins, Sheet and Plate molded plastics, heat aging]

ASTM method D-2307: Standard Test Method for the Thermal Endurance of Round Magnet Wire
(This test method is structured for Thermal Index)
[Key words: UL 1446, Twisted Pair, TP, thermal decomposition, LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-3251: Standard Test Method for the Thermal Endurance Characteristics of Electrical Insulating Varnish Applied Over Film-Insulated Magnet Wire
(This test method is structured for Thermal Index)
[Key words: UL 1446, Twisted Pair, TP, LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-4881: Standard test Method for Thermal Endurance of Varnished Fibrous- or Film-Wrapped Magnet Wire
[Key words: LTТА, Long Term Thermal Aging, ski specimens, shaped wire, Electrical Insulating Material, EIM, ASTM method D-2307]

ASTM method D-3145: Standard Test Method for Thermal Endurance of Electrical Insulating Varnishes by the Helical Coil Method
(This test method is structured for Thermal Index)
[Key words: UL 1446, HC, LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-1932: Standard Test Method for Thermal Endurance of Flexible Electrical Insulating Varnishes.
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: UL 1446, Curved Electrode, varnished glass cloth, varnish, LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-1830: Standard Test Method for Thermal Endurance of Flexible Sheet Materials used for Electrical Insulation by the Curved Electrode Method
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: UL 746-A, UL 746-B, UL 5703, Curved Electrode, LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-695: Standard Test Method for Compressive Properties of Rigid Plastics
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-1938: Standard Test Method for Tear-propagation of Plastic Film and Thin Sheeting by a Single-Tear Method
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: Plastic film, trouser, LTТА, Long Term Thermal Aging, heat aging]

ASTM method D-2288: Weight Loss of Plasticizers on Heating
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: Plasticizer volatility, LTTA, Long Term Thermal Aging, heat aging]

ASTM practice D-3045: Standard Practice for Heat Aging of Plastics Without Load
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: LTTA, long term Thermal Aging, heat aging]

ASTM method D-1876-01: Standard Test Method for Peel Resistance of Adhesives
(This test method is structured for both Relative Thermal Index and Thermal Index)
[Key words: UL 5703]

UL

UL Standards are more focused on the structure of thermal aging projects while organizations such as ASTM are focused on the test methodologies to evaluate the properties.

UL 746-B: Polymeric Materials – Long Term Properties
Plastics: All sections

- Mechanical without Impact
- Mechanical with Impact
- Electrical

Polypropylene: Section 20.2

Powder Coating: Section 20.3 tested applied over steel

Bus Bar Insulation: Section 20.3 tested applied over copper and/or aluminum

Films are tested in accordance with UL 746-B (section 15)

Papers are tested in accordance with UL 746-B (section 15)

UL 1446: Insulation Systems – General

- Magnet Wire Coating
- Magnet Wire for full thermal aging
- Magnet Wire for 1-temperature aging
- Varnishes / Impregnating Resins
- EIS for full thermal aging (refer to our EIS section of our website)
- EIS 1-temperature and/or 2-temperature (refer to our EIS section of our website)

UL 1441: Sleeving

UL 224: Tubing

UL 5703: Determination of the maximum Operating Temperature Rating of Photovoltaic (PV) Backsheet Materials

[International Electrotechnical Commission \[IEC\]](#)

IEC 60243-1: Electrical Strength of Insulating Material – Test methods – Part 1: Tests at Power Frequencies

(This test method is structured for both Relative Thermal Index and Thermal Index)

(Key words: UL 746-B, LTTA, Long term Thermal Aging, heat aging, ASTM method D-149)

IEC 60216: Electrical Insulating Materials – Thermal Endurance Properties – Part 2

IEC 61857: Part 1 and Part 21 (refer to our EIS section of our website)

IEC 60172 - Test Procedure for the Determination of the Temperature Index of Enameled Winding Wires

International Standards Organization [ISO]

ISO 180: Plastics – Determination of Izod Impact Strength

(This test method is structured for both Relative Thermal Index and Thermal Index)

[Key words: UL 746-B, LTТА, Long term Thermal Aging, Injection or Extruded Molding Resins, heat aging, ASTM method D-256]

ISO 527: Plastics – Determination of Tensile Properties

(This test method is structured for both Relative Thermal Index and Thermal Index)

[Key words: UL 746-B, LTТА, Long term Thermal Aging, Injection Molding Resins, Sheet and Plate molded plastics, heat aging, ASTM method D-638, ASTM method D-882]

ISO 178: Plastics – Determination of Flexural Properties

(This test method is structured for both Relative Thermal Index and Thermal Index)

[Key words: UL 746-B, LTТА, Long term Thermal Aging, Injection Molding Resins, Sheet and Plate molded plastics, heat aging, ASTM method D-790]

ISO 8256: Plastics – Determination of Tensile-Impact Strength

(This test method is structured for both Relative Thermal Index and Thermal Index)

[Key words: UL 746-B, LTТА, Long term Thermal Aging, Injection Molding Resins, heat aging, ASTM method D-1822]

Vr. 10.07.29/RTI

ELTEK International Laboratories

248 Hughes Lane, Saint Charles, MO 63301, U.S.A. – Phone: 636.949.5835 – Fax: 636.723.5835

Email: info@eltek-labs.com – Web: www.ELTEKLabs.com