

Tubing, Extruded Insulating - Component

[See General Information for Tubing, Polymeric - Component](#)

The products covered under this category are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. THE FINAL ACCEPTANCE OF THE COMPONENT IS DEPENDENT UPON ITS INSTALLATION AND USE IN COMPLETE EQUIPMENT SUBMITTED TO UL

GENERAL

This category covers extruded insulating tubing intended for use as part of the internal wiring of electrical devices and appliances in air, dry and damp locations, in accordance with NFPA 70, National Electric Code (NEC). Tubing may be used for insulating one or more inadequately insulated conductors, bus bars, motor leads, transformer lugs, or small assemblies of electronic components.

Tubing is usually round in cross-section and consists entirely of extruded compounds whose characteristic constituents are thermosetting, elastomeric, or thermoplastic polymers. Tubing may be heat shrinkable or crosslinked with an optional meltable inner liner.

Extruded insulating tubing is comprised of the following materials and ratings:

Material	Form	Temperature Rating, °C	Voltage Rating(s), V
PVC	Not heat-shrinkable	90	300 and 600
		105	300 and 600
	Heat-shrinkable	90	300 and 600
		105	300 and 600
Polyolefin	Flexible and not heat-shrinkable	105	300 and 600
		125	300 and 600
	Semi-rigid and not heat-shrinkable	125	300 and 600
	Flexible and heat-shrinkable	105	150, 300, and 600
	Flexible and heat-shrinkable (with or without meltable liner)	125	150, 300, and 600
	Semi-rigid and heat-shrinkable (with or without meltable liner)	125	150, 300, and 600
PTFE	Not heat-shrinkable	200	150, 300, and 600
	Heat-shrinkable	200	150, 300, and 600
FEP	Not heat-shrinkable	200	150, 300, and 600
	Heat-shrinkable	200	150, 300, and 600
PVF ₂	Rigid and heat-shrinkable (with or without meltable liner)	150	600

Modified fluoropolymer	Flexible and heat-shrinkable	150	600
Chlorinated polyolefin	Flexible and heat-shrinkable	75	600
		90	600
Silicone rubber	Not heat-shrinkable (at least 0.711 mm (0.028 in) thick)	150	300 and 600
		200	300 and 600
	Heat-shrinkable (at least 0.711 mm (0.028 in) thick)	150	300 and 600
		200	300 and 600
	Not Heat-shrinkable (less than 0.711 mm (0.028 in) thick)	150	300
		200	300
	Heat-shrinkable (less than 0.711 mm (0.028 in) thick)	150	300 and 600
		200	300 and 600

A product used for temperatures greater than indicated above or made from a different material may be acceptable thereafter a long term heat aging evaluation.

CONDITIONS OF ACCEPTABILITY

Acceptability of tubing in any particular device or appliance depends upon its acceptability for continued use under the conditions that prevail in actual service. For some applications, it may be necessary to employ tubing having features other than or in addition to those specified in these requirements. For example, tubing may be required to have a heavier wall thickness or a flat rather than a round cross-section; it may be required to have inherent resistance to the effects of immersion in water, oil, solvents, or other liquids (or their vapors); it may be required to be used in an environment conducive to the development of fungi and similar organisms.

Consideration is to be given to the following Conditions of Acceptability when these components are employed in the end-use equipment:

1. A standard insulating conductor intended specifically for the purpose shall be employed prior to using extruded insulating tubing as insulation where it is feasible (e.g., appliance wiring material).
2. Tubing is intended to be used in dry and damp locations only as defined in ANSI/NFPA 70, "National Electrical Code."
3. Minimum wall thickness and the published ratings of the tubing shall be considered in the end-product investigation and standard.
4. Tubing marked "VW-1" has been investigated for resistance to ignition and propagation of flame using a vertical fine wire flame test.
5. Tubing marked with an Oil Resistance Class "01", "02", or "03" is suitable for intermittent or occasional contact with oil.
6. In case of heat shrinkable tubing, proper size selection is dependent on the specific application and the fully recovered diameter that the material will mold around the shape of the cable or wire connection point.
7. Tubing may not be relied upon in applications where it will be subjected to ultraviolet light radiation.
8. Tubing may not be relied upon in applications where it will be in contact with sharp edges, corners, projections or burrs, or where subject to tension, compression, abrasion, repeated flexing.
9. Tubing may not be relied upon in applications with respect to its resistance to ignition from electrical sources.
10. Tubing has not been investigated for surface printing intended to provide warnings, instructions and other information subject to permanence of marking requirements.

Additional Conditions of Acceptability may be included in the Report available from the manufacturer.

Minimum Wall Thickness

Wall thickness of tubing is critical to maintain the performance of the tubing and shall not be less than that referred to in the respective tables within UL 224 "Extruded Insulating Tubing". This applies to being fully recovered in the case of heat shrinkable tubing.

Heat Shrinkable

Tubing that is heat shrinkable may reduce in diameter upon the controlled application of heat while maintaining the minimum wall thickness. Some applications may include an inner liner to assist in bonding the tubing to the underlying connectors or cables.

Temperature Rating

Temperature rating of the tubing shall be equivalent to the normal operating conditions of the appliance wiring for which it is providing insulation. The rated temperature is determined through thermal endurance tests for critical properties dependent on the material and form of the tubing.

Voltage Rating

Voltage rating of the tubing shall be equivalent to the normal operating conditions of the appliance wiring for which it is providing insulation. The rated temperature is determined through thermal endurance tests for critical properties dependent on the material and form of the tubing.

Flammability

Extruded insulating tubing has been investigated to a minimum of the All Tubing flame test. Tubing may additionally be investigated to the VW-1 (vertical wire) flame test described in UL 224 "Extruded Insulating Tubing".

Oil Resistance

Extruded insulating tubing may be investigated for intermediate or occasional contact with oil and reference a specific Oil Resistance Class dependent on the tensile strength and elongation following immersion in IRM 902 oil.

- Class 01 – Immersed for 4 hours at 70°C
- Class 02 – Immersed for 96 hours at 100°C
- Class 03 – Immersed for 60 days at 80°C

PRODUCT MARKINGS

All extruded insulating tubing shall be marked with the following or equivalent information on tags attached to both ends of the tubing, on the shipping spool label, or on the smallest unit container:

1. Company name, company ID, trade name, trademark, or private labeller's name (if applicable),
2. Manufacturer's name or ID (if different from Item 1),
3. Catalog number or equivalent,
4. Temperature rating in °C,
5. Voltage rating,
6. Date of manufacture (or a lot number, if the date of manufacture can be traced from this number),
7. Flammability rating (if VW-1),
8. "Oil Resistant" or "Oil Res" and Oil Resistance Class, (if applicable),
9. Inside diameter (before and after recovery, for heat-shrinkable tubing)

RELATED PRODUCTS

See:

Tubing, Flame Retardant ([YDQS2](#))

Miscellaneous Tubing, Polymeric ([YDTU2](#))

Tubing, Sealable Channel, Insulating ([YDSW2](#))

Sleeving, Coated Electrical ([UZFT2](#))

Sleeving, Flame Retardant ([UZIQ2](#))

Sleeving, Miscellaneous ([UZKX2](#))

Tubing, Mechanical Protection and Fittings ([YDRQ2](#))

Insulating Tape ([OANZ](#) and [OANZ2](#))

Miscellaneous Tape ([OARC2](#))

REQUIREMENTS

The basic standard used to investigate products in this category is [UL 224](#), "Extruded Insulating Tubing."

UL MARKING

Components Recognized under UL's Component Recognition Program are identified by significant markings consisting of the Recognized company's identification and catalog, model or other product designation printed on the central paper core or outer package that correspond with the marking specified in UL's published records. Only those components that actually bear the "Marking" shown in the individual Recognitions should be considered as being covered under the Component Recognition Program.

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