

Glossary of Terms

Abrasion Resistance: The ability a material has to withstand rubbing and scraping. Our LedaFlex tubing is a product that has a high level of abrasion resistance.

ABS (Acrylonitrile-Butadiene-Styrene): A rigid thermoplastic polymer common in piping applications. ABS is very durable but breaks down when exposed to acetone.

Antifungal: Additive used to retard fungal growth in tubing, especially for applications in which tubing is exposed to damp environments.

Antioxidant: Additive used to prevent yellowing of tubing or loss of strength when exposed to oxygen in the atmosphere.

Annealing: A term used to describe the heating of a polymer to just below melting point. The process reconfigures the plastic molecules, re-setting the plastic's "memory."

Brittleness Temperature: The temperature below which a flexible material exhibits brittle failure when subjected to a specified impact during testing.

Bend Radius: The minimum radius you can bend a tube or pipe without kinking it. It is measured to the inside curvature of the tube.

Bloom: The residue that, in time, comes out of plastics that contain plasticisers, stabilisers or lubricants such as Vinyl (PVC). It is sometimes called a "haze."

Burst Pressure: The pressure level required to burst a tube.

Butt Weld: A joint in a plastic tube or tether that is created by melting two ends and then joining them together, end-to-end. The result is a bond as strong as the original material.

Coefficient of Thermal Expansion: The unit change in length or volume resulting from a unit change in temperature

Co-extrusion: A process of extruding two materials simultaneously through the same die.

Colourant: Pigment additives used to introduce colour to tubing. Both natural coloured opaque polymers and clear polymers can be coloured. Addition of colourant to clear polymers results in a tinted transparent polymer.

Compound: A chemical blend of base resin and desired additives, which becomes the raw material from which tubing is extruded.

Concentricity: Used to describe the uniformity of the wall thickness of tubing, it is a measure of the offset of the centre of the inside diameter from the centre of the outside diameter.

Creep: Measured at constant stress and temperature, creep is a measure of deformation over time. Creep always increases with temperature.

Destructive Testing: Any of the mechanical tests performed on an expendable sample of tubing to check physical properties. These tests include: tensile, yield, elongation, hardness, flare, flattening, bend and burst.

Die: The metal nozzle that the polymer is pressed through to create the tubing. The characteristics of size, wall thickness and shape are dictated by the die that is used.

Durometer: A measurement of the hardness of a polymer. It is usually measured using Shore or Rockwell scales. Higher numbers represent harder materials.

Elasticity: The tendency of a material to return to its original shape after being bent or stretched.

Elongation: The maximum amount, expressed as a percentage, that tubing can be stretched in length before it breaks.

Extender: A material added to a polymer base that is designed to replace a portion of the polymer compound. Also known as "filler." Note Leda does not use extenders.

Extrusion: The thermal and mechanical process by which a polymer compound is conveyed through a heating chamber, forming dies, cooling tanks and vacuum tanks to form tubing.

FEP: Fluorinated ethylene propylene, or FEP, is an alternative to Teflon tubing. (Teflon® is a registered trademark of DuPont.) FEP tubing is known for chemical resistance and ability to withstand a large range of temperatures.

Flame Retardant: An additive that is included in tubing compounds to improve resistance to burning.

Flexural Modulus: The ratio of stress to strain that occurs while a stress is acting to bend an object. Materials with lower flexural moduli tend to be more flexible.

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Flexural Strength: The ability of a material to resist deformation under a load.

Fluoropolymer: A polymer compound containing fluorine. These compounds are typically chemically resistant and can withstand extreme elevated temperatures.

Gamma Stable: The ability to resist a change in physical properties under gamma irradiation. Typically gamma irradiation is used in the plastics industry to sterilize tubing or process components in an aseptic container. Commonly acceptable doses range between 25 kGy and 45 kGy

Halogen Free: A compound that does not contain Fluorine, Chlorine, Bromine, Iodine or Astatine. Halogenated compounds are often used to improve flame resistance of tubing, but when burned these compounds emit smoke which is toxic to humans and corrosive to electronic equipment.

Hardness: A measurement of resistance to surface penetration that correlates well with mechanical strength and rigidity. Usually measured using Shore or Rockwell scales.

HDPE: High Density Polyethylene.

Heat Deflection Temperature: a test in which a horizontal bar of a polymer is heated uniformly in a closed chamber while a load of 66psi or 264psi is placed at the center of the bar. The HDT is the temperature where a deflection of 0.25mm is reached at the center. The HDT is an indicator of how much mass an object must be constructed of to maintain desired structural integrity. Also, it provides a measure of rigidity of a material under a load at a certain temperature.

Hydrostatic Testing: A non-destructive test procedure that checks for holes, cracks or porosity. Tubing is pressurised internally with water to a high pressure, but does not exceed material yield strength.

ID: The inside diameter of a tubular product. It is also known as the opening or bore of a tube or pipe.

Kynar: A trade mark of Arkema Chemical Corp. Kynar tubing is an economic alternative to Teflon when heat resistance is not needed.

LDPE: Low Density Polyethylene, typical density range of 0.910-0.940 g/cm³

LLDPE: Linear Low Density Polyethylene. LLDPE has very short chain branching form the polymer backbone

compared to LLPE which has long chain branching. LLDPE typically has higher tensile and elongation.

Longitudinal Shrinkage: The change in length, as opposed to the change in diameter, of heat shrinkable tubing during the recovery process initiated by the application of heat.

MDPE: Medium Density Polyethylene, typical density range of 0.926-0.940 g/cm³

Megapascal (MPa): A metric pressure unit and equals to 1,000,000 force of Newton per square meter which is known as a Pascal. 1 MPa equals to 10 Bar. Because of its high pressure ratings is often used in hydraulic and similar systems.

Memory: The tendency a particular plastic has to go back to its original shape after being stretched or bent. Polyurethane is described as having excellent memory.

Modulus of Elasticity: The ratio of stress to strain that occurs when a stress is applied to a material. While a stress is acting on a material a material, initially the relationship between the applied force (stress) and the disturbance (strain) is linear (it is directly proportional), but after the material is strained to a certain point, the relationship is no longer linear (this phenomenon is known as Hooke's Law) .

Nominal: The theoretical or stated value of a dimension

Normal Stress: A stress acting perpendicular to a surface including compression and tension (pulling)

Nylon: A class of polymers known as polyamides. Nylon is a tough, abrasion resistant, semi-rigid material with good high temperature properties. Leda manufacture tubing using Nylon 12 and Nylon 11.

OD: The outside diameter of a tubular product.

Operating Temperature: The maximum recommended temperature which tubing may operate in continuous service.

Ovality: A quantitative measurement of how 'round' a tube is by comparing width to height.

Pascal: The unit of pressure or stress equal to one Newton per square metre.

Permeability: The capability a tube has for passing pressurized liquid or gas through its walls.

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Phthalate: Esters of phthalic acid that are commonly used as plasticisers to soften and increase the flexibility of PVC compounds. DOP/DEHP and DINP are two commonly used phthalate plasticisers. It doesn't bond with the plastic so over time it may be released into the environment. There are studies linking phthalates to a variety of ailments, particularly in children.

Phthalate Free: A compound that contains no intentionally added phthalates. Trace amounts of phthalates may still be present.

Plasticiser: A chemical additive that is included in polymer compounds to provide flexibility. It is what is added to PVC to change it from a rigid plastic used in pipe to a super flexible material for tubing. Plasticisers serve to fill and increase the spacing between polymer chains, allowing them to slip past each other more readily. Types of plasticisers include phthalates; trimellitates; adipates; epoxidized vegetable oils, and polymeric.

Polycarbonate: A high impact thermoplastic resin used in making "bulletproof glass" and microwave cookware.

Polyester: A large classification of resins that are used for making textile fibres. Not a tubing compound.

Polyethylene (PE): A tough, flexible low cost plastic. Common applications are tubing, bags, film, and squeeze bottles. Low-density polyethylene (LDPE) is the most flexible. Linear low-density polyethylene (LLDPE) is the toughest and cheapest. High-density polyethylene (HDPE) is less transparent, but stiffer and more heat resistant.

Polymer: The generic word used to describe many plastics. Specifically, a polymer can be natural or synthetic. The compounds are formed from many low molecular weight monomers that are combined into long molecular chains.

Polypropylene (PP): Similar to high-density polyethylene, but more heat resistant (it can handle boiling water) and having high tensile strength and clarity. It is noted for its rigidity and resistance to chemicals. Common applications are plastic rope and drinking straws.

Polytetrafluoroethylene (PTFE): A highly resistant plastic that does not react to chemical influences. It is most commonly known by its brand name, Teflon®.

Polyurethane: A tough, abrasion resistant polymer having excellent low temperature properties and high clarity. It is highly flexible and kink resistant. It is chemically resistant to fuels, oils and solvents and is commonly used for fuel lines

and wire abrasion protection. It is available in both an ether and ester base. The ester-based PUR is less desirable due to how it degrades in moisture. The ether-based polymer is much more durable.

Polyvinyl Chloride (PVC): PVC tubing is made from a polymer that is tasteless, odourless and will not degrade in most organic solvents. When a plasticiser is introduced, the compound becomes highly flexible with good abrasion resistance. Does not break down the way rubber does. Common flexible PVC applications are tubing and shower curtains. Common rigid or semi-rigid PVC applications are drainpipe and house siding.

Polymer: A compound consisting of long molecular chains formed from monomers occurring as repetitive "building blocks".

Polyolefin: A generic term for a group of polymers produced from olefin (or alkene) monomers. Olefins are hydrocarbon substances having a single carbon-to-carbon double bond. Polyolefin heat shrink tubing is typically made from polyethylene and is usually cross-linked.

PSI: Common engineering abbreviation for pounds per square inch. It is a measurement of stress in a material. 1 pound per square inch (psi) equals to 6,894.75729 Pascal.

Recovery: The degree to which a plastic returns to its original shape after a load is removed.

Resin: The base raw material in a polymer compound. It is the term is used for the un-coloured plastic pellets that we receive from our suppliers.

Retracted Length: The length of a recoil tube when it is not in use. Also referred to as Closed Length.

Rockwell Hardness: A durometer measuring scale developed by the Rockwell Corporation. Hardness is measured by testing the resistance that a material has to being punctured. See "Durometer" and "Shore Hardness."

Shear: The stress acting parallel to a surface

Shore Hardness: A series of scales used to indicate hardness (Shore A and Shore D). The Shore A scale is most commonly used to measure the hardness of plastic tubing. Within a given scale, a higher number indicates a harder material.

Silicone: A plastic with high thermal stability, water resistance, flexibility and low toxicity. Commonly used in medical tubing and cooking applications.

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Specific Gravity: The ratio of the density (mass per unit volume) of a material to the density of water.

Sterilisation: Any process that eliminates or kills all forms of microbial life, including transmissible agents (such as fungi, bacteria, viruses, spore forms, etc.) present on a surface, contained in a fluid, in medication, or in a compound such as biological culture media. Sterilisation can be achieved by applying combinations of heat, chemicals, irradiation, high pressure, and filtration.

Strain Relief: A type of fitting that prevents a kink to form at the point where the fitting and tube or hose meet. Particularly useful in situations where the maximum working length of the tube is frequently met.

Stress Relaxation: A measurable decrease in stress exerted by a material over time at a constant temperature.

Teflon® Tubing: A product of the DuPont Company, Teflon is a chemical and temperature resistant plastic.

Tensile Strain: The resulting deformation of a material due to tensile stress.

Tensile Strength: A measure of the ability a tube has to sustain tension (pulling).

Tensile Strength at Break (Ultimate Tensile Strength): The force per unit area (psi or MPa) required to break a material by applying a pulling force. It is a considerable factor in calculating burst pressure.

Thermoplastic: A plastic that can be reshaped by heating and then sets when cooled.

Thermoset: A polymer that cannot be melted and reformed (commonly due to cross linking or additives). In other words, thermosets thermally degrade before their melting temperature. Thermoplastics can be melted and reformed.

Thermal Conductivity: The ability of a material to conduct heat energy. Thermal conductivity is a physical constant for a measurement of heat energy that passes through a cube of a material in a unit of time when the temperature of the two faces differs by 1°C.

TPE (Thermoplastic Elastomer): Thermoplastics that have characteristics similar to rubber. Unlike rubber though, they can be repeatedly reshaped.

TPU: Thermo-Plastic-Urethane: also called polyurethane. A tough, abrasion resistant polymer having excellent low temperature properties and high clarity. Chemically resistant to fuels, oils and solvents.

TPV: Thermal Plastic Vulcanite.

Thermoset: A polymer, such as polyolefin, in which irreversible chemical "curing" or "set" takes place as the molecule chains are cross-linked in three dimensions through covalent bonding. Once set, the polymer cannot be melted.

Tolerance (In Engineering): The permissible limit of variation in units of measure

Total Organic Carbon (TOC): A measure of bound carbon within an organic compound such as a plastic

Ultraviolet Degradation: The loss of strength or discoloration caused by long-term exposure of tubing to sunlight or other ultraviolet rays.

Ultraviolet (UV) Stabilizer: An additive to tubing compounds that protects against loss of strength or discoloration when it is exposed to the outdoors.

Urethane: See Polyurethane.

Viscosity: The resistance of a material to flow. Fluids that are highly viscous, are thick and "goosey." Water has a low viscosity.

Vulcanisation: A chemical reaction in plastic that occurs when exposed to sulphur, making soft plastic harder.

Working Length: The length of a recoil tube when it is stretched to its maximum reach.

Working Pressure: The maximum pressure at a given temperature, that tubing can be expected to perform without sacrificing performance.