GALLAGHER
PRECISION POLYURETHANE MOLDING

3908 Morrison Drive ▪ Gurnee, IL 60031-1284
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Polyurethane Glossary

Abraded
Worn away by friction.

Abrasion
Wear due to friction.

Abrasion Resistance Index (ARI)
A measure of abrasion resistance of a urethane elastomer relative to a standard urethane elastomer under the identical conditions. ARI is expressed as a percentage.

Abrasion Tester
A machine for determining relative abrasion resistance.

Accelerated Life Test
A method designed to approximate in a short time the deteriorating effects obtained under normal service conditions.

Accelerator
A substance used to increase the rate of a chemical reaction; synonymous with the term catalyst.

Acid Number
The value given to trace residues of acids in the finished polyol.

Acid Resistance
The ability to resist the action of identified acids within specified limits of concentration, temperature and time.

Activator
Seldom used term nowadays for *Curative* or *Chain Extender*. Sometimes mistakenly used to mean catalyst.

Additive
A material which does not affect the chemical reaction but is included to alter the final product such as pigments, fillers, flame retardants, plasticizers. May be liquids or solids.

Adhesion
The adhering, cling, bonding or sticking of two material surfaces to one another, such as polyurethane to polyurethane, polyurethane to metal, polyurethane to rubber.

Adhesion Failure
The separation of two bonded surfaces in the adhesive layer due to service conditions.

Adhesive
A material which, when applied, will cause two surfaces in contact with each other to stick together.

Adhesive Coating
A coating applied to a surface to increase its bond to an adjoining surface.

Aftercure
A continuation of the stabilization process after the cure has been carried to the desired degree for a predetermined length of time. May be conducted at room or elevated temperatures.

Aging
To undergo changes in physical properties with age or elapse of time.

Aging, Shelf
Aging during storage. Temperature is assumed to be room temperature -- humidity is not controlled.

Air Bomb Aging
A means of accelerating changes in the physical properties of the materials by exposing them to the action of air at elevated temperatures and pressure.

Air Checks
The surface markings or depressions which occur due to air trapped between the material and the mold or pouring surface. See *Bubble*.

Air Oven Aging
A means of accelerating a change in the physical properties of polyurethane compounds by exposing them to the action of air at an elevated temperature at atmospheric pressure. Generally done in a temperature controlled, forced air oven.

Aliphatic
A chain-like molecule comprised of carbon and hydrogen without the presence of a benzene ring.

Alloy
A composite material produced by blending polymers or copolymers with other polymers under controlled conditions to achieve enhanced physical properties.

Ambient Temperature
The environment temperature surrounding the object under consideration.

Amine
A group of organic compounds containing N, NH, or NH2 group.

Amine Catalyst
A group of amine containing organic compounds that cause specific beneficial urethane-related chemical reactions. May be reactive or non-reactive (to isocyanates).

Amine Equivalent
An analysis value determined for isocyanate materials to express their reactive strength, used in some methods for calculating the *stoichiometric balance* of a formula. The value secured has an inverse relationship to the strength of the chemical as the larger the value, the weaker is the reactive strength of the isocyanate per unit of weight. The method of analysis may be obtained by request to one of the major chemical companies supplying the isocyanate.

Aniline
A key starting material used to make MDI, MOCA, a few specialty crosslinkers.

ANSI
American National Standards Institute.

Anti-Static
See *static conductive.*

Antidegradant
An additive used to retard – delay – deterioration caused by oxidation, ozone, light, radiation, in any combination. The additive may reactive or non-reactive.

Antiflex Cracking Agent
An additive used to retard cracking caused by cyclic deformation.

Antioxidant
A compounding ingredient used to retard deterioration caused by oxygen.

Antiozonant
A compounding ingredient used to retard deterioration caused by ozone.

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Antislip Surface
A specially treated surface to obtain greater than normal traction.

Aperture
The clear opening size as in length, width or diameter of an opening. Apertures may also involve special shapes such as rectangular, oblong, or triangular configurations.

Aromatic
Molecules that include at least one benzene ring.

Artificial Weathering
Exposure to cyclic laboratory conditions involving changes in temperature, relative humidity, and radiant energy – with or without direct water spray. Attempting to produce changes in the material as would be observed after long-term, continuous, outdoor exposure.

ASME
American Society of Mechanical Engineers.

ASTM
American Society for Testing and Materials.

You will note that we refer to ASTM tests and test results frequently. We use ASTM tests to classify properties, but the limitations on the usefulness of the standard tests are well stated in ASTM D 394 and D 1630: “No relation between this test and service performance is given or implied…” Never by-pass the all-important prototype and field test steps. However, once the performance has been proven, relevant ASTM test data serves well in specification writing.

Average Modulus
The total change of stress divided by the total strain.

Backrind
A molding defect in which the urethane elastomer adjacent to a parting line shrinks below the surface of the molded product, leaving the part with an irregular parting line.

Banbury Mixer
A specific type of internal mixer used to incorporate filler and other ingredients in polyurethane or plastic matrix.

Batch
The product of one mixing or blending operation -- no size limit.

Batch Mixing
The process of simultaneously mixing the entire amount of the formula required in one container.

Batcher
A person who prepares mixtures of urethane chemicals before they are cast.

Bench Marks
Two marks of a known separation applied to a tensile test specimen to measure the strain of the specimen during extension.

Bench Test
A modified service test in which the service conditions are approximated in the laboratory.

Bending Force
The force required to bend a given cross-section under prescribed conditions.

Bending Modulus
That force required to induce bending around a specified radius and -- a measure of stiffness.

Bleeding
Migration to the surface of plasticizer, waxes or similar materials to form a film or beads. See also, *Bloom*.

Blemish
A mark, deformity or injury which impairs appearance but not to the degree where the urethane component would not otherwise perform its intended function.

Bloom
A discoloration or change in the appearance of the surface of a polyurethane product caused by migration of a liquid or solid to the surface. Examples: *sulfur bloom*, *wax bloom*. Not to be confused with dust on the surface from external sources.

Blow-up
A blister between plies of a dual durometer article.

Bond, Bonding
See *Adhesion*

Boss
A protuberance designed to add strength, facilitate alignment, or provide fastenings.

Brand
A mark or symbol identifying or describing a product and/or manufacturer: may be embossed, inlaid or pad printed.

Breaking strength
The tensile strength at which polyurethane first ruptures.

Brittle Point
The highest temperature at which a urethane elastomer will fracture under a shock load.

BTU
British Thermal Unit -- the amount of energy required to heat one pound of water one degree Fahrenheit.

Buffer Catalyst
A catalyst -- usually a very alkaline amine -- that has been partially or wholly neutralized with acid so that the reaction would not be affected by the extreme alkalinity of the catalyst.

Buffing
The grinding of a vulcanizate – urethane -- producing a roughened textured surface.

Buffing Marks
The characteristic surface condition after a secondary buffing operation.

Bulk Storage
A series of tanks large enough in capacity that bulk shipments -- tank wagon or railcar -- can be off loaded and stored on the premises. Can be above or below ground.

Bulking Agent
A material or chemical added to another that increases the quality of the mixture without changing the chemical activity of the total mass. Can be solid or liquid.

Bumping
A process used in compression molding consisting applying and releasing pressure to the gelling, urethane elastomer to force air bubbles out of the mold.

Butt Seam
A seam made by placing the pieces to be joined edge to edge.

Castfilm
A film made by depositing a layer of polyurethane in solution, or in a dispersion onto a surface, solidifying and removing the film from the surface.

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Casting
The process of filling – pouring -- open molds with uncured, liquid polyurethane.

Castor Oil
A naturally occurring triol derived from the castor bean used to make low durometer, water resistant urethanes.

Catalyst Balance
The ratio between amine catalysts and organotin catalysts.

Catalyst
The ingredient in a polyurethane formulation which initiates a chemical reaction or increases the rate of chemical reaction. Maybe reactive or nonreactive.

cc
Abbreviation for cubic centimeter, a metric system unit of volume.

CD Curve
Abbreviation for Compression-Deflection Curve.

Cement
A mixture of polymeric compounds or elastomers used as an adhesive or sealant.

Cemented Edge
An application of cement around the edge of a fabricated product with or with or without internal reinforcement for protection or adhesion.

Centipoise (cP)
1/100 of a poise, a unit of viscosity.

Centrifugal Casting
A molding process whereby the mold is spun and the liquid, uncured urethane is poured into the spinning mold through an opening at the center the spinning mold slinging it outwards against the internal cavities of the mold. A useful molding process for complex shapes and thin sections.

CFM
Abbreviation for Cubic Feet per Minute.

Chain Reaction
Lengthening of the main chain (backbone) of polymer molecules by end-to-end attachment.

Charging
A term used to describe the filling of machine or day tanks with various quantities of chemicals.

Chalking
Formation of a powdery surface due to a disintegration of surface binder or elastomer due to weathering or other destructive environments.

Checking
Short, shallow cracks on the surface. Generally due to the destructive action of severe environmental conditions.

Chute Lining
Highly abrasion resistant elastomeric (polyurethane) lining a chute to protect the metal chute from abrasive wear.

Clicker Press
A mechanical press used to die cut test samples for physical testing or articles of commerce from flat sheets of elastomer.

Coefficient of Friction -- Kinetic
The ratio of the force required to maintain movement of an object in motion across a surface to the weight of that object. A dimensionless number.

Coefficient of Friction -- Static
The ratio of the force required to initiate movement of an object at rest across a surface to the weight of that object. A dimensionless number.

Coefficient of Thermal Expansion
The average expansion per degree over a stated temperature range. Expressed as a fraction of the initial dimension.

Cog
A tooth on the rim of a wheel or polyurethane product.

Cohesive
The tendency of a material to stick to itself.

Cold Flex
See *Low-Temperature Flexing*.

Cold Flexibility
The relative ease of bending following exposure to low temperature.

Cold Flow
Continued deformation under stress, See *Creep.*

Cold splice/bond
Usually, the joining of two or more substrates together, using a two-part cement that is chemically cured without using supplemental heat from an external source.

Commercially Smooth
A degree of smoothness of an article which is acceptable in accordance with industry practice.

Component
A separately metered stream of liquid which is introduced directly into the mixing head.

Compound
a mixture of a polymer(s) and other materials to give the desired chemical and physical properties in the elastomeric components of a polyurethane product.

Compound Standard
A control or reference compound prepared to a prescribed formula and mixing procedure.

Compounding in the Head
A procedure whereby two or more prepolymers, curatives and/or other components are metered into the mixing head of a urethane dispensing machine at a predetermined ratio and stoichiometry to achieve the desired polyurethane compound. An efficient method of switching urethane compounds – formulation -- on the fly; requires specialized equipment. May also be applied to quasi or one shot systems.

Compression
Stress on a material tending to cause deflection, since, in many instances, urethane elastomers can be considered incompressible. Because very little volume change occurs, we prefer to use the term *deflection*.

Compression Molding
A molding process whereby liquid, uncured urethane is poured into the bottom half of a mold, allowed to gel, followed by the placement of top half of the mold, and placed under great pressure in a press.

Compression Set
The deformation in a material remaining after it has been subjected to and released from a compressive force.

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Conditioning, Environmental
The storage of a urethane sample, under specified conditions of time, temperature and humidity prior to testing.

Conditioning, Mechanical
The prescribed program of deformation of a urethane sample prior to testing.

Conductive Elastomer
An elastomer capable of conducting -- generally static electricity.

Conductivity
The quality of power of conducting or transmitting heat or electricity.

Control
A material or a product of known characteristics included in a series of tests to provide a basis for evaluation of other products.

Copolymer
A substance consisting of molecules characterized by the repetition of two or more types of monomeric units.

cP
Abbreviation for *Centipoise.*

CPS
Abbreviation for cycles per second.

Crack, Flex
A fissure starting in the surface of a urethane elastomer caused by cyclic deformation -- bending.

Cracking
A sharp break or fissure in the surface generally due to excessive strain.

Crater
A small shallow surface imperfection.

Crazing
Slight break in the surface of a material.

Creep
The deformation occurring with elapsed time in both cured and partially cured polyurethane, in a body under stress in addition to immediate elastic deformation.

Cross Linking
The formation of chemical links between molecular chains.

Crude Isocyanate
Undistilled isocyanate containing several different polymeric isocyanates, generally dark brown in color.

Crystallization
A change in physical properties resulting from the crystalline reorientation caused by temperature.

Curative
See *Curing Agent,*

Cure
The process which completes the chemical reaction. The term also refers to the state of completeness of the chemical reaction,

Cure Date
The date a urethane part was molded. Usually cast into the part.

Cure Temperature
The temperature at which the elastomer product is cured,

Curing Agent
Chemicals with a functionality of two or more that react with isocyanate groups that chain extend the molecule to very large molecular weights,

Cut Resistance
The ability of polyurethane to withstand the cutting action of sharp objects,

Cycle Time
The amount of time required to complete a molding cycle from start to finish,

DABCO®
Is a registered trademark used for triethylenediamine, a very powerful accelerator or catalyst of the tertiary Amine family.

Dam
A device installed within a mold to prevent the flow of material into areas of the mold cavity to reduce, alter, or eliminate a portion of the cast part, of which the mold is intended to produce.

Damping
See *Hysteresis*.

Day Tanks
A slang expression generally meaning either *batch tanks* or *machine tanks* used for one day's production run. The tanks' size may vary significantly from manufacturer to manufacturer.

Deflashing
A variety of process used to remove excess material from the edges of a cured part.

Deformation
Any change of form or shape produced in a body by a stress.

Degradation
A deleterious change in the chemical structure of a material.

Degree of Polymerization (DP)
The number of monomeric units in the *average* polymer molecule in a sample.

Delamination
The separation of layers of material in a multilayer material.

Demolding Time
The time between pouring the liquid into the mold and the removal of the article from the mold. This is usually kept to the minimum possible time in which the partially cured object can be handled without damage so that the mold may be reused.

Density
The weight of a specified volume of material -- resin, curative, finished part. In some countries, this is expressed as pounds per cubic foot; in others, it is expressed as grams per cubic centimeter or kilograms per cubic meter. For ordinary practical purposes, density and specific gravity may be regarded as equivalent.

Desiccant
A compound used to irreversibly remove moisture from other materials -- typically liquids.

Dew point
The temperature at which a vapor begins to condense.

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Diameter
The length of a straight line passing through the geometric center to the periphery of an object.

Dibutyltin Di-Ethyl Hexoate
Is a powerful catalyst of the organotin group.

Dibutyltin Diacetate
Is a powerful catalyst of the organotin group.

Dibutyltin Dilaurate
Is a powerful catalyst of the organotin group. It is sometimes used for adhesives.

Die Cutting
The process whereby shaped articles are stamped out of a sheet by the impact of a die against the sheet. Polyurethanes frequently form the backing material for *Die Cutting* applications.

Dielectric Strength
The measure of the electric potential strength of a polyurethane product. The measure of its ability as an insulating compound to resist the passage of a disruptive discharge produced by an electric stress. Measured as volts per mil of thickness.

Differential Scanning Calorimetry (DSC)
A thermoanalytical technique where the heat flow is monitored during a steady heating of the sample. DSC is used widely for examining polymeric materials to determine their thermal transitions.

Differential Thermal Analysis -- Also Thermal Gravimetric Analysis (TGA)
Is an examination technique whereby the material may be heated to destruction while a temperature profile recording is being taken. The TGA instrument continuously weighs a sample as it is heated to temperatures of up to 2000 °C.

Diisocyanate
One of the major components of a polyurethane often referred to as the *resin* side. Diisocyanates may be in monomeric form or in prepolymer form and can be characterized as *aromatic* or *aliphatic*. Major diisocyanates used in the polyurethane industry include TDI, MDI, PPDI, NDI as well as the aliphatics H6-MDI, IPDI, and HDI.

Diluent
A liquid used to extend or reduce the viscosity of another material without changing the reactivity of the original material other than by the dilution occurring.

Dimensional Stability
The ability of a plastic part to retain the precise shape in which it was molded, fabricated, or cast.

Dimer
A substance (comprising molecules) formed from two molecules of a monomer.

Diol
A polyol having two reactive hydroxyl (OH) groups attached to each molecule.

Dip Coat
A coating on a surface obtained by dipping the material to be coated into the coating materials.

Discharge Orifice
The port or opening through which the chemicals are discharged. This term is usually restricted to the final discharge of the mixed materials rather than to intermediate points opening into the mixing chamber, which are normally called metering ports or metering tubes.

Discoloration
The gradual darkening of urethane due to a photochemical reaction. It is faster in sunlight than in artificial light -- although it occurs in both. Discoloration without exposure to light can indicate excessive temperature exposure.

Dispersion
The application of high shearing forces to distribute one or more liquids or fine solids into a *mother* liquid in ensure uniformity and stability over time.

Dumbbell
A specimen with lesser width at the middle of its length than at its ends used in testing materials physical properties.

Durometer
An instrument for measuring the hardness of polyurethane. Measures the resistance to the penetration of an indenter point into the surface.

Durometer Hardness
The resistance to indentation under conditions which do not puncture the elastomer surface. The most frequently used device is the spring-loaded *Shore Durometer*. The scale runs from zero hardness for a liquid, to 100 for a hard plane surface, such as glass. Usually reported as a Shore A -- softer scale -- or Shore D -- harder scale.

Dynamic Fatigue
The loss in properties of a material when continually subjected to flexing and or cyclic stress.

Dynamic Properties
Mechanical properties exhibited under repeated cyclic deformations.

Ejector Pins
Internal mold pins that when activated, ejects the part from the mold. Generally used only in complex molds.

Elastic Limit
The point of deformation beyond which a material will permanently deform rather than elastically recover.

Elastic Modulus
A ratio between the force applied to cause the deformation and the resistance to that force by the material being deformed. It can be determined for samples in tension as well as compression.

Elasticity
The property of a material whereby the material tends to return it very nearly to its original dimensions after significant deformation.

Elastomer
The word is generally applied to the man-made rubbers. It's simply the contraction of the words "elastic polymer." Each of the elastomer classes is characterized by its own set of characteristics which make it useful.

Elastomeric Properties
The chemical and physical properties of an elastomer.

Elongation
The percent of its original length to which a specially shaped sample will stretch before breaking.

Embossing
The operation of transferring a design to a polyurethane surface.

Equivalent Weight (eq. wt.)
Is the molecular weight of a chemical divided by the number of reactive – functional -- groups.

For example, the molecular weight of pure TDI is 174, the number of reactive groups is two -- it is a Diisocyanate -- so the equivalent weight is 174/2 or 87. In a formulation, the number of equivalents of isocyanate must be balanced against the number of equivalents of curative to achieve stoichiometric balance. Isocyanate resins typically are provided with a weight percent NCO instead of an equivalent weight. Amines typically have an isocyanate equivalent weight given. Some curatives can be used for both epoxies and polyurethanes with different equivalent weights for each.

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Exotherm
The heat liberated by some of the chemical reactions occurring in the urethane formation. Urethane reactions fall in the general class of exothermic reactions, which have heat as a by-product.

Extender
See *Plasticizer* and *Fillers*.

Extensometer
A device for determining elongation of a specimen as it is elongated (strained) in a testing machine.

Extraction test
A test in which certain components are separated from a solid by immersing the solid in a liquid solvent under suitable conditions, then analyzing the solvent for foreign components -- i.e. plasticizers.

Extruded
Forced through a die in either solid or hollow cross section (i.e., hollow tubing or solid rod).

Extrusion
A process whereby heated or unheated plastic forced through a shaping orifice, becomes a continuously formed piece.

Fatigue
The weakening or deterioration of a material caused by a repetition of stress or strain.

Filler
An inert material added to the formulation to change the final physical properties. Fillers can be used to increase the density of the product without significantly adding to the cost, or they are used to assist in a cost reduction. The solid fillers often result in higher load-bearing properties but lower tensile and tear strengths. Fillers are usually solid, particulate materials, such as glass, silica, or clays.

Film
A thin sheet of polyurethane.

Filter
A device to remove unwanted particles of material from the liquid streams of chemicals. For trouble-free operation, all lines should be properly filtered.

Fire Resistant
Retards the burning action of fire or flame.

Fisheye
A small globule that has not blended completely into the surrounding material.

Fixed Calibration Time
The practice of metering the various fluid streams during a fixed time interval (such as 6 seconds or 1 minute) to calibrate and set the liquid streams to a desired total flow rate per minute as well as to the desired ratio with each other.

Fixed Ratio
The condition of having all components with a fixed throughput so that ratio variations are not possible.

Fixed Throughput -- Fixed Flow Rate
A term used to describe a machine with one or more pumps directly connected to the drive motors so that no variation in flow rate is possible.

Flame Performance
How cured polyurethane, after being ignited, will burn and/or self-extinguish.

Flame Retardance
The intensity of flame diminished by fire-retardant ingredient(s) in the polymer compound.

Flame Retardant
Generally, a flame-retardant material is an additive that imparts a certain degree of flame retardancy to a finished article – i.e., they will burn less rapidly or lose less weight on burning -- see *Fire Retardant.*

Flame Test
A means, under a specific condition, for establishing the standardized flame performance of a polyurethane product.

Flammability
Describes the relative burnability of the material in a specified situation. Meanings will vary based on the test method used.

Flange
A raised edge on a polyurethane article.

Flash
Material protruding from the surface of a molded part, appearing at the mold parting line or mold vent points. Usually very thin, and removed by some method from the finished part.

Flat Blade Impeller
A mixing blade that is characterized by a generally single plane shape or flat appearance. It may be solid, perforated with various patterns, or may be irregular in contour.

Flex cracking
A surface cracking induced by repeated bending or flexing.

Flex Fatigue
The loss of physical properties of a sample undergoing continuous flexing of a specified magnitude, duration, and rate.

Flex Life
The relative ability of a polyurethane article to withstand dynamic bending stresses.

Flex Life Test
A laboratory method used to determine the life of a plastic product when subjected to dynamic bending stresses.

Flexibility
The ability to be bent repeatedly without cracking.

Flexible Mold Material
The rubber like material used for molding very intricate shapes and contours. These materials can be any elastomers but are more usually urethane or silicone based. The usual compounds are liquids which are poured over the *master*, allowed to gel, then removed and oven cured to maximum tensile strength before use to provide flexible molds.

Flexometer
A laboratory testing apparatus that subjects test specimens to repeated deformation in tension, compression shear or bending or any combination thereof.

Flow Marks
Visible flow lines on molded products caused by an imperfect flow of the gelling liquid urethane elastomer as it is being cast. Can occur in compression molded urethane elastomers.

Flow-Rate
A term which refers to the quantities of chemicals delivered to the discharge nozzle or metering port in a specified time interval. In the USA, it is usually expressed in pounds per minute per component.

Formula/Formulation
The list of ingredients and their proportions to each other which are used to make a specific product.

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Free Monomer
The weight percent of monomeric isocyanate, usually in a prepolymer resin.

Friction
The resistance to motion of an object due to the contact between two surfaces.

Friction, Coefficient of
The ratio between the force pressing the surfaces together and the force required to move it.

Full Recirculation
A term applied to a urethane machine designed to permit all fluid components to be circulated between the tank and the mixing head during the *idle* or non-production time. For *full recirculation,* the valve that diverts the flow to the mixing chamber should be immediately adjacent to the chamber so that stagnant areas are eliminated.

Fully Automatic Solvent Flush
The solvent flush cycle initiated automatically by the machine.

Functionality
The number of reactive groups attached to a single molecule. An amine or polyol with a functionality of 2 would be a diamine or a diol. An amine or polyol with a functionality of three would be a triamine or a triol.

Fungicide
An agent that destroys fungi or inhibits their growth.

Gel
The initial semi-solid stage that develops during the solvation of a (solid) resin by a plasticizer.

Gel point (or Gel time)
The stage at which a liquid begins to exhibit pseudo-elastic properties. The gel time of a polyurethane is dependent on both the temperature and the mass. Gel times are usually reported on a 100g mass at an indicated temperature

Glass Transition Temperature
The temperature at which a polymer changes from having rubbery characteristics to glassy ones. Physical properties often change rapidly with small temperature changes in proximity to the glass transition temperature.

Glycol
Is the generic terms for polyols having a functionality of 2. Also termed *idols*.

Ground Finish
The surface produced by grinding or buffing.

Guard Thermostat
An extra thermostat in the electrical circuit of a heating system, used as a safety control over the maximum temperature of the heating source.

Handbatching
The mixing together pre-measured components in a urethane formula by means of a spatula then pouring into a mold. Sometimes a mechanical mixer is used such as a drill motor/mixer blade.

Hardening
An Increase in resistance to indentation.

Hardness
Property or extent of being hard; usually expressed in Shore A or D units. See also *Durometer Hardness.*

Haze
The cloudy appearance of a transparent casting.

Hazing
A dull finish.

Heat Build-Up
This term, peculiar to the rubber industry, means the temperature rise within an elastomer body due to hysteresis and the low thermal conductivity of elastomers. Since the physical properties of urethanes are reduced as the temperature rises above 160°F (70°C). Heat build-up is to be avoided. The amount of heat liberated per deformation cycle is proportional to the amplitude of the strain, the frequency of application and the duration of the condition. Designers can avoid heat build-up by constructive use of shape factor.

Heat Degradation
Change in chemical and/ or physical properties due to excessive exposure to heat.

Heat History
A combination of time and temperature to which a urethane prepolymer has been subjected.

Heat Of Reaction
See *Exotherm.*

High Shear Mixing
The mixing together of urethane components in a high-speed close tolerance mixing chamber.

Homogenous
Uniform composition.

Humid Aging
An accelerated laboratory test under conditions of high humidity and temperature to determine the suitability of a material to specific end use.

Hydroxyl Equivalent Weight
The number of grams of sample required so that one gram equivalent weight of hydroxyl (17.008) will be present in the sample.

Hydrolytic Stability
The ability to resist the deterioration by the effects of water.

Hydrophilic
Tending to mix with, dissolve in, or be wetted by water.

Hydrophobic
Tending to repel or fail to mix with water.

Hydroxyl Number
A number that indicates the number of hydroxyl groups available for reaction in a polyol.

Hysteresis Loop
The area under the stress-strain curve.

Hysteresis Loss
A loss of mechanical energy due to successive deformation and relaxation.

Hysteresis
Refers to the percent energy lost per cycle of deformation or 100% minus the resilience percent. Hysteresis is the result of intermolecular friction and is manifested by conversion of mechanical energy to heat.

Immediate Set
The amount of deformation measured immediately after removal of the load causing the deformation.

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Impact
The single instantaneous stroke or contact of a moving body with another either moving or at rest, such as a large mass of heavy material dropping on a polyurethane product.

Impact Energy
The effective combination of force (mass of the body and height) when one body falls on another.

Impact Force
The energy power of impact.

Impact Resistance
The relative ability to withstand mechanical or physical blows without loss of protective properties.

Impulse
An application of force in a manner to produce sudden strain or motion.

Indentation
(1) The extent of deformation by the indenter point of standard hardness testing instruments;
(2) A recess in the surface of a polyurethane component.

Inhibitor
A material used to delay a chemical reaction.

Injection Molding
A method frequently utilized in the manufacturing of polyurethane products. While this method is extremely cost effective when producing huge quantities, the properties of injection molded polymers – thermoplastics -- do not offer the superior characteristics of open cast -- thermoset polyurethane.

Insert
Generally, a metal or plastic component to which a urethane elastomer is chemically and/or physically bonded during the molding process.

International Rubber Hardness Degrees (IRHD)
An alternate method to Shore Hardness of measuring the hardness of rubber or urethane elastomer articles.

ISO
The abbreviation for the International Organization for Standardization.

Isocyanate
The group name of chemical compounds having one or more NCO groups attached to the main chemical chain.

Isomer
Any one of two or more chemical compounds having the same kind of atoms in their structure, but arranged in a different way.

Isomer Ratio
The ratio of two or more isomers. I.e., 80/20 TDI (80% 2,4 isomer; 20% 2,6 isomer of TDI).

Jaws
Clamps to hold a specimen when applying stress to a specimen on a Universal Testing Machine (e.g., Instron).

Jig
A fixture used to accurately position parts during the manufacturing process (e.g., welding jig, hole positioning jig).

Joint
The area where two ends of a component are fastened together by chemical and/ or mechanical means. See also *Splice*.

Ketone
Compounds in which a carbonyl group is bound to two alkyl or two aryl groups, or to one alkyl and one aryl group.

Kinetic Energy
Energy that matter possesses by virtue of its motion.

Knit Line
A line where two or more streams of curing, liquid urethane come together in complex and/or large molds to form a visible boundary.

Know How
Technical background information required in order to properly operate a specific process.

Laminate
A product made by bonding together two or more layers of material.

Laminated
Build up from thinner layers.

Lap
A part that extends over itself or a like part.

Lap seam
A seam made by placing the edge of one piece of material extending flat over the edge of the second piece of material.

Lateral
Coming from the side.

Life Test
A laboratory procedure used to determine the resistance of a polymer article to a specific set of destructive forces or conditions.

Light Resistance
The ability of polyurethane elastomer to resist changing color when exposed to sunlight or UV light. Related to the type of isocyanate -- aromatic or aliphatic -- used in the system.

Linear Molecule
A long chain molecule as contrasted by one having many side chains or branches. In castable urethanes, can be controlled, within limits, by isocyanate index.

Logy
Very slow recovery of an extended elastomer.

Longitudinal
A lengthwise direction.

Longitudinal Seam
A seam joining two materials in the length of the finished product.

Low-Temperature Flexibility
The ability of a polyurethane to be bent or flexed at low temperatures without loss of serviceability.

Low-Temperature Flexing
The act of bending a product under low-temperature conditions.

Machine Tanks
Component tanks mounted on a urethane dispensing machine frame with metering pumps either inside or outside said tanks.

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Mass Effect
The influence of the size of the pour to the maximum exotherm. Larger the mass results in heat being retained in the casting which may cause degradation of the polymer.

Masterbatch
A preliminary mixture of two or more compound ingredients for purposes of more through dispersion or better processing, and which later become part of the final compound in subsequent mixing operations.

MDI
The abbreviated term for Diphenylmethane Diisocyanate.

Memory
The tendency of an elastomer to return to its original shape after the deformation force has been removed.

Mer
The repeating structural unit of any high polymer.

Mil
One thousandth of one inch, 0.001"

Mirror Finish
A bright, polished surface appearance.

Mismatch
A part defect caused by misaligned, mating mold cavities.

Mix
A urethane compound.

ml
The abbreviation for milliliter.

Mn -- Average Molecular Weight
The average molecular weight is the total weight of all the polymer molecules in a sample, divided by the total number of polymer molecules in a sample.

Modulus of Elasticity
In elastomers, as in steel, this term refers to the ratio of stress to the strain, produced by that stress. Within the region of low strain (up to 15%), an elastomer's stress-strain curve is almost linear and design calculations which assume stress proportional to strain may be made with a tolerable error. Strains greater than 15% are far from proportional to stress. Modulus of elasticity in this engineering sense should not be confused with "modulus" which is rubber industry jargon for tensile stress and is applied when strains are much greater than 15%. Elastomers, in general, have two moduli of elasticity; static and dynamic, in as much as they have the peculiar property of behaving stiffer when vibrated or impacted. The term *modulus*, when applied to steel, is defined as the slope of the straight-line portion of the stress-strain curve. In the case of elastomers, the modulus is defined as the stress required to produce a given strain of say 300%, would be called the 300% modulus, and is not useful in calculations.

Modulus
A coefficient or numerical measure of some property.

Mold Mark
An indentation or embossment on the surface of a molded product caused by irregularities in the mold surface.

Mold Release Agent
One of many chemical compounds which, when applied to a mold surface prevents the cured urethane part from sticking to the mold.

Mold Shrinkage
The dimensional difference between the part and its mold when measured at normal room temperature.

Molding
The practice of pouring liquid urethane into a mold, curing, then demolding the part from its mold.

Monomer
A relatively simple compound which can react to form a polymer.

MSHA
Abbreviation for Mine Safety and Health Administration.

Mw -- Average Molecular Weight
The sum of the total weights and molecules of each size multiplied by their respective weights divided by the total weight of all molecules.

NCO
Abbreviation for the isocyanate chemical group, contains nitrogen double bonded to carbon which is double bonded to oxygen.

NDI
Abbreviation for 1,5-napthalene Diisocyanate.

Naphthenic Oil
A hydrocarbon processing oil containing more 30% by mass of naphthenic hydrocarbons. Commonly used as a low-cost plasticizer in polyether cast urethane elastomers.

Natural Frequency
The characteristic frequency of vibration for a particular spring-mass system after a force or displacement is applied and removed.

Nitrogen
An inert, anhydrous gas commonly used to blanket urethane chemicals to prevent harmful moisture absorption.

Nominal
An approximate amount -- normal or expected value of a parameter.

Non-Fill
A defect resulting from the lack of material completely filling the entire mold cavity.

Nozzle
The discharge opening or tip of a mixing head.

Number of Components
Ambiguous term to describe the number of reactive fluid streams that enter the final mixing zone in a urethane dispensing machine. Usually excludes air, solvent flush, and color streams.

Off-Register
See *Mismatch*

OH Groups
See *Hydroxyl Group*.

OH number -- Hydroxyl Number
Is the number of milligrams of potassium hydroxide (KOH) that is chemically equivalent to the activity of a specified weight -- in grams -- of the polyol.

Oil Proof
Not adversely affected by exposure to oil.

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Oil Resistant
Withstands the deteriorating effects of oil -- generally, refers to petroleum -- on the physical properties.

Oligomer
A polymer consisting of only a few monomer units such as in dimer, a trimer, a tetramer, etc. and their mixtures.

Open Cast
The method of manufacture utilized to obtain maximum wear characteristics in polyurethane modules.

Open Molding
A term which refers to the practice of pouring into a cavity having a closed bottom and sides but an open top. The mold may be shallow or deep. It is generally not the most economical way to mold a product but may have an Application where minimum internal mold pressures are required.

Optimum Cure
The time and temperature of fusion at which a desired combination of properties is attained in an elastomer.

Organosol
A suspension of a finely divided plastic in a plasticizer with a volatile organic solvent.

Outgassing
The release of volatile constituents -- usually under high vacuum -- in the form of vapor or noncondensable gasses from cured urethane or liquid urethane components such as prepolymers, polyols, plasticizers or color dispersions.

Oven
A low-pressure hot air chamber equipped with precise temperature controls. Used for post-curing, open cast polyurethane products.

Overcure
An excess of curing time/temperature leading to the loss of optimal physical properties.

Oxidation
The addition of oxygen to a compound or the reduction of hydrogen.

Oxygen Bomb
A chamber capable of holding oxygen at an elevated pressure which can be heated to an elevated temperature. Used for an accelerated aging test.

Oxygen Bomb Aging
A means of accelerating change in the physical properties of polymer compounds by exposing them to the action of oxygen at an elevated temperature and pressure.

Ozone Resistant
Withstands the deteriorating effects of ozone -- generally cracking.

Paraffinic Oil
A hydrocarbon oil composed mainly of alkanes.

Parting Line
A ridge on the part where mold plates meet.

Permanent Set
The amount by which an elastic material fails to return to its original form after deformation.

Permeability
The quality or condition of allowing passage of liquids or gases through a material layer.

Permeation Rate
The flow rate of a gas, under specified conditions, through a predetermined area divided by that area.

pH
An expression of the degree of acidity or alkalinity of a substance. Neutrality is pH7 -- acid solutions being under 7 and alkaline solutions over 7.

PHR or phr
Abbreviation for parts per hundred and is used to indicate proportions of components in a system. Commonly used for purposes of compounding prepolymers, curing systems, and to ratio urethane dispensing machines.

Pimple
A small crater on the surface of a molded product with a width about the same as its depth.

Pin Impeller
A rotating mixing blade. Generally characterized as having a straight, relatively sturdy, central shaft parallel to the direction of liquid flow; and a series of smaller, round, square, or hexagonal shaped *pins* mounted on the central shaft at right angles, and generally perpendicular to the liquid flow. There are many variations of this involving pin mounting angles other than 90 degrees -- different diameter pins, different quantity of pins, different spacing between pins, etc. It is usually classed as a low shear mixing device.

Pin Mixer
A mixing head utilizing a pin impeller.

Plastic
A material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state, can be shaped by flow.

Plasticity
(1) A measure of the resistance to shear of an uncured elastomer;
(2) a measurement of resistance to shear with heat history.

Plasticizer
A compounding ingredient which can change the physical and chemical properties and processability of a polymeric compound.

Plastisol
A dispersion of a powderous polymer in a plasticizer.

Plate Finish
A finish resulting from contact with commercially smooth but not polished heated pouring table.

Poise
A measure of the specific viscosity of a fluid. It is measured by the force required to move one plate in relation to another plate when space between is filled with the fluid. A material with a viscosity of 1 poise requires 1 gram of force to move the plate 1 centimeter in 1 second.

Poly Isocyanates
Isocyanate compounds having more than one isocyanate (NCO) group attached to the molecule.

Polyester
A polymeric compound, with the reactive hydroxyl groups containing ester linkages. One of the families of compounds that can be prepared with reactive hydroxyl groups. As a family, these compounds are characterized by the presence of -C-O-groups in the molecule. This type of bond is more susceptible to attack by water – hydrolysis -- than is the single oxygen present in the polyether type.

Polyether
A polymeric compound, with the reactive hydroxyl groups containing ether linkages. As a family, these compounds are characterized as having ether groups -C-O-C-in the molecule. This type of molecular joint is less susceptible to hydrolysis than the type characteristic of polyesters.

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Polymer
A macromolecular material formed by the chemical combination of monomers having either the same or different chemical composition. A high-molecular-weight organic compound, natural or synthetic, whose structure can be represented by a repeated small unit, the mer; e.g., polyethylene, rubber, cellulose. Synthetic polymers are formed by addition or condensation polymerization of monomers. If two or more monomers are involved, a copolymer is obtained. Some polymers are elastomers, some plastics.

Polymeric Isocyanates
Is generally used to refer to those isocyanates containing products that consist of a mixture of isocyanate compounds containing more than two isocyanate groups in the molecule. This type of isocyanate reacts with a polyol with less heat generation than with *pure* diisocyanates.

Polymerization
The process that converts monomers into polymers.

Polyol
A chemical compound with more than one reactive hydroxyl group attached to the molecule.

Polyol Mix
The product resulting from premixing many of the compatible minor ingredients into the polyol component. This is usually done to reduce the final number of components required to be metered and introduced into the mixing head and to improve the accuracy of the compounding when some of the minor ingredients would be difficult to meter individually because of very small quantities or very high viscosity. This also allows time to mix some materials that are difficult to mix in the short length of time available in the final mixer. This product is also called *masterbatch* and *premix*.

Polyurethanes
Are a family of chemical compounds that can be prepared by the reaction of an isocyanate containing material with a hydroxyl containing material. An alternative term for urethane.

Porosity
The presence of numerous small holes or cavities in an elastomer. Typically caused by moisture in cast urethane elastomer systems.

Positive Displacement
A term which refers to those pumps that are so designed that the bulk of the material displaced from the suction side of the pump is delivered to the outlet side of the pump. In other words, internal recirculation is at a minimum and -- what little there is -- is constant over a wide range of conditions.

In normal practice, some limitation in use is necessary. Under some conditions, a pump that is positive metering with a 1000 cps material may slip rather badly with 100 cps material. Under other conditions, a pump that is designed to be positive metering with a 1 cps material may transfer enormous quantities of energy, in the form of heat, to a material of 1000 cps.

Positive Metering
The ability to control the flow rate of a fluid to an accuracy of approximately 1% of the total flow regardless of temperature or pressure fluctuations downstream from the metering device.

This is difficult to achieve in normal practice, every time and under any conditions. It can be achieved economically if certain design rules and limitations of use are practiced. There is a certain amount of ambiguity in the term since many piston pumps can be classified as positive metering for the total quantity delivered -- while the amount delivered per second may vary. Many gears or vane pumps can be positive metering both for the total quantity delivered and for quantity per second delivered.

Positive Proportioning
A term which refers to the condition in which two or more fluid streams are positively metered with respect to an absolute standard and are maintained in an exact ratio with each other continuously.

Positive Tracking
A term used to describe the condition existing when the flow rate is changed in two or more fluid circuits simultaneously while still maintaining positive proportioning. For accuracy, positive tracking is normally stated as a plus or minus variation from a standard flow level and for a specific viscosity material.

Post Cure
The period of cure after the product has been removed from the mold. In many cases, accelerated curing at elevated temperatures is utilized.

Pot Life
The time during which a reacting polymeric compound remains suitable for its intended use after having been mixed with a reaction-initiating agent.

Potting
The process of encapsulating or embedding a device by pouring a casting compound into a cavity in which the device has been fixed and curing the compound in place. Resulting in the device being embedded completely in a plastic polymer. The compounds are usually thermosetting and vacuum may be used with the solid polymers to avoid entrapped gases.

Pouring Head
A mixing head designed only to dispense liquid mixtures.

Pre-Heat
A term normally applied to the technique of bringing molds or cavities to the desired temperature level prior to pouring. This is a critical factor and must be accomplished with reasonable accuracy and reproducibility for best quality control.

Premix
A term often used synonymously with masterbatch or polyol mix to indicate the mixture resulting from blending many of the minor ingredients in with the polyol to reduce the final number of components or to allow more time for mixing or blending those chemicals that may not be readily mixable in the short period of exposure to the final mixing. See polyol mix.

Premix Tank
A term used to indicate tanks that are used for making batches of premix separately from the machine. Also, refers to those tanks on the machine that are used in the premix flow circuit.

Prepolymer
A chemical intermediate, manufactured by reacting all the isocyanate with a portion -- or all -- of the polyol.

Pressure Balance
A term used to describe the condition existing in an *on-off* fluid metering circuit when the pressure during the *on* cycle is equal to the pressure during the *off* cycle.

Pressure Balance Valve
A valve located somewhere in the return line -- between the mixer and the tank -- used to help in balancing pressures.

In some cases, this valve is built into the mixing head, while in others it is separate and located on the tank. For some materials, particularly isocyanates, the construction of the valve is important, and it should be of a type that does not accumulate small particles. In most cases, a filter is installed just prior to the valve to ensure more trouble-free performance. The closer the valve is to the mixing head, the better the performance. Regulators are sometimes used for pressure balance instead of valves.

Pressure Cut-Off Switch
A switch actuated by movement of a diaphragm or Bourdon-tube located near the pump in the flow circuit and arranged to cut off the power to the pump drive motor. This device protects the fluid circuit against damage from over press.

Pressure Developing
A technique used to gain more positive control of metering when a water-thin viscosity liquid (1 cP) must be metered at extremely small flow rates.

This situation is encountered often when total prepolymer systems are used for filling small cavities. With this technique, a special needle valve or pressure regulator is installed in the flow circuit of the catalyst system between the metering pump and the mixing head and as close to the mixing head as possible. A back-pressure -- between the valve and the pump -- of at least 5 psi is maintained. Small inner diameter metering tubes must be used in the mixing head to keep the system liquid full but they must not be so small as to cause the pressure to rise during the *on* cycle

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Pressure Gauge
A device for measuring and indicating pressure.

Primary Alcohol Groups
Are reactive groups present in certain polyol molecules. Primary alcohol groups react faster than secondary alcohol groups. Usually, the higher the percentage of primary alcohol groups in the formulation, the less catalyst is required for curing. The term *primary hydroxyl groups* is often used interchangeably.

Process Oil
A hydrocarbon oil used as a plasticizer in elastomers and classified as aliphatic, aromatic or naphthenic -- per its chemical structure.

PTMEG
Poly Tetra Methylene Glycol.

PU
abbreviation for Polyurethane.

Pumper
A term occasionally used to describe a metering unit.

Pumping Impeller
A mixing blade designed to positively move the liquids being mixed through the mixing zone and through the discharge orifice by means of the force exerted by the pumping action designed into the mixing blade itself.

Qualification Conformance Inspection
The examination of samples from a production run to determine conformance to a given specification.

Qualification Inspection Test
The examination of samples from a typical production run to determine conformance to a given specification for approval to become a supplier.

Quasi-Prepolymer -- Quasi-System
Quasi-prepolymers are defined as NCO-terminated products prepared from diisocyanates and polyols with NCO contents between 16 and 25 percent. These products can be processed like one-shot elastomers and yield elastomers.

Ratio Control
The ability to change and regulate the ratio or proportion between 2 or more fluid components. This introduces versatility to a machine, enabling it to be used in several different formulations. A fixed ratio machine can be built that will work with only one formula under precise operating conditions, but these are rarely requested.

Raw Materials
A term often used to describe the chemical ingredients used in manufacturing urethanes. The term is generally applied to the chemicals as received from the chemical manufacturers prior to any premixing.

Rebound Test
The method of determining the resilient properties of a cured elastomer by measuring the rebound of a steel ball or pendulum from a defined height. Expressed as a percent.

Recipe
A written document detailing the composition, amount, and process procedure for the making an elastomer.

Recovery
The degree an elastomeric material returns to its original dimensions after being stressed.

Register
The accurate matching of mold sections.

Regulator
A fluid control device usually consisting of a housing, a spring-loaded diaphragm, and a means for adjusting the spring tension. This can be used to control either the upstream or downstream pressure.

Reinforcement
The strengthening member of a polyurethane component.

Reinforcement Agent
An ingredient in a polymeric compound used to increase its chemical and physical properties.

Reinforcing Element
The strengthening members of polyurethane component or product.

Reproducibility
The ability to produce the same result at repeated intervals. This is a very important consideration in buying chemicals or machinery since lack of reproducible control over any production variable can result in the production of poor quality products.

Resilience
The resilience of elastomers subjected to and relieved of stress has been defined by the ASTM as the ratio of energy given up on recovery from deformation to the energy required to produce the deformation, expressed as a percent.

Resilience Value
A measure of the *rubberiness* or elasticity of the product, in compression. One of the methods for measuring this is the *Ball Rebound Test.*

Resin
Certain materials produced by chemical synthesis.

Resistance
The property or ability of matter to withstand the effects of force, pressure, heat, or chemical action.

Rheology
Is the study of flow and deformation of matter

Ribbon blender
A type of internal mixer used to mix powders and liquids into a dry, powderous, viscous, or liquid mass.

Rotor
A term sometimes used to describe a mixing blade or impeller.

Rubber
The term embraces a large group of materials which have the ability, under certain conditions, to undergo large deformations and recover almost completely and instantaneously on the release of the deforming force. This elasticity is due to the repetition of long molecular chains and cross links of the base polymer. The *first* rubber came from the tree *Hevea Brasiliensis* and was called Indian or natural rubber. Its use can be traced to the Mayan Indian culture. Since the 1930's, at least 16 different man-made rubbers with different, improved and controlled molecular structures have been developed. Familiar types are neoprene, nitrile, butyl, silicone, and urethane.

Run Tanks
A term sometimes used to describe the machine tanks that form part of the metering system to distinguish them from bulk storage or premix tanks.

Sample
A piece of material removed for evaluation or testing.

Seam
The place where two edges of fabric or elastomer are adjacent to each other to form a single ply or layer.

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Semi-Cure
A partial or incomplete cure.

Service Test
A test in which the product is made to operate under expected field conditions. See *Bench Test.*

Set
The amount of deformation remaining after complete release of the load producing the deformation. Can be tensile or compression.

Shape Factor
The ratio of the load area of an elastomer body subjected to a compressive load to the sum of the areas which are free to bulge. As the shape factor increases, the strain produced by given stress decreases. This is a critical consideration in avoiding heat build-up in dynamic applications. It is also important in static load bearing applications such as structural bearing pads where compressive stress relaxation versus time is to be avoided.

Sheeting
A form (shape) of plastic or elastomer in which the thickness is very small in proportion to the length and width and in which the material is a continuous phase. Sometimes called *Sheet Stock*.

Shelf Storage Life
The period prior to use during which the product retains its intended performance parameters,

Shock Load
The sudden application of an external force.

Shore Hardness
A measure of the resistance a material has to indentation. See also *Durometer Hardness.*

Shrinkage
The dimensional difference between a molded part cooled to room temperature and its actual mold dimensions.

Sink
A collapsed blister or bubble leaving a depression in the product.

Specification
A detailed description of specific requirements.

Specimen
A piece cut from a sample to test.

Specimen, Test
A piece of an elastomer appropriately shaped and prepared so that it is ready for testing.

Spread
To apply a thin coat of a liquid material over a surface determined by means of a knife, bar, or doctor blade

Static Conductive
Capability to conduct static electricity.

Static Electricity
The electrical potential between two objects.

Static Friction
The resistance which must be overcome to start a body in motion.

Stiffness
Resistance to flexing.

Stoichiometry
The chemical relationship between the amount of reactive elastomer polymer to the amount of curing agent used.

Strain
Deformation resulting from a force applied to a body.

Stress-Strain
The relationship of force and deformation in a body during compression, extension, or shear.

Stretch
An increase in length.

String Time
The time between pouring mixed urethane liquid into a container and the time it begins to form string when touched with an object such as a spatula. Closely related to gel time.

Sun Check
Fine cracks and crazing of an elastomeric surface primarily due to the sun's ultraviolet rays.

Swelling
The increase in the volume of an elastomer immersed in a liquid or exposed to a vapor over a set of defined conditions such as time, temperature, concentration, and pressure.

Tack
Temporary adhesion.

TDI
Abbreviation for Toluene Diisocyanate.

Tangent Delta (Tan Delta)
A ratio of the loss modulus -- the viscous component of the elastomer -- to the elastic modulus -- storage component of the elastomer. A low Tan Delta means higher resilience and less hysteresis.

Tear Propagation
Continuation of a tear.

Tear Strength
The load to tear apart an elastomer expressed in pounds per linear inch.

Tensile Set
The extension remaining after a specimen has been stretched and then allowed to relax in a specified manner. Expressed as a percentage of the original length.

Tensile Stress
The force applied to stretch a test piece -- specimen.

Tensile Strength
The maximum force – stress -- applied to a specimen at rupture.

Tension
Stress on a material tending to cause elongation.

Tension Fatigue
A fracture, caused by crack growth, of a component or test specimen subjected to repeated tensile deformation.

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Terathane®
DuPont trademark for Polytetramethlene Glycol (PTMEG).

Thermoplastic
Capable of being repeatedly softened by heating and cooling and in the softened state can be shaped by flow.

Thermoset
A material that can undergo a chemical reaction by the action of heat or catalyst, leading to a relatively infusible and cross-linked state. Thermoset polyurethane is not altered by elevated temperatures until reaching the decomposition point.

TODI
Abbreviation for O-Tolidine Diisocyanate.

Tolerances
The limiting values for a dimension.

Trapped Air
Air which is enclosed in a product or between a product and a mold surface during cure.

Ultimate Elongation
Elongation at rupture.

Ultimate Strength
The force required to rupture a specimen.

Ultimate Tensile
Tensile stress at rupture.

Undercure
A less than optimal state of cure which may be evidenced by tackiness or inferior physical properties.

Ultraviolet (UV) Stabilizer
Any chemical compound which, when admixed with a resin, selectively absorbs UV rays -- ultraviolet-zone of invisible radiations beyond the violet end of the spectrum of visible radiations.

Urethane
The name given to a class of NCO (isocyanate) terminated resins with cross linking or chain extension intermediates called curing agents. Urethane is often used as an alternative term for Polyurethane. There are ten major groups of urethanes:

- MDI-Polyesters: produce FDA dry and wet food grade urethanes in the normal hardness range from 85 Durometer A to 45 Durometer D. They are tough, abrasion resistant and tear resistant.
- TDI-Polyester: produces urethanes from 50 Durometer A to 75 Durometer D which are tough, abrasion resistant, and with excellent oil and aliphatic solvent resistance.
- MDI-Polyethers: produce urethanes with higher resilience, better impingement type abrasion resistance, good dynamic performance, improved hydrolysis resistance and excellent low-temperature properties. Some are adaptable to FDA and USDA application for wet and dry food contact.
- TDI-Polyethers: have excellent low temperature and dynamic properties, microbial resistance and long term water resistance.
- TODI Polycaprolactone: Excellent heat resistance, hydrolysis resistance and superior mechanical properties/
- PPDI: Terminated polyesters and polyethers offer superior performance at higher temperatures.
- MDI: Diphenylmethane Diisocyanate
- TDI: Toluene Diisocyante
- PPDI: Paraphenylene Diisocyanate
- TODI: Toluidine Diisocyanate

Taken together, urethanes possess:

- Oil, water and weather resistance, ozone and oxidation resistance, and resistance to many chemicals. Some are radiation, fungus, and bacteria resistant.
- High tensile and tear strength compared to other elastomers.
- Outstanding abrasion resistance compared to metals, plastics, and other elastomers.
- Higher load bearing capacity than other elastomers.
- Higher impact resistance and resilience than plastics.Excellent retention of properties at very low temperatures and at temperatures up to 220°F (104°C). (Bonded to metal to 160°F (71°C).

Viscoelasticity
A combination of viscous and elastic properties in an elastomer, with the relative contribution of each being dependent on time, temperature, stress, and strain rate.

Viscosity
The resistance of a fluid to flowing readily. For example, a low viscosity material would flow readily from a container when poured, while a high viscosity material would only pour slowly from a tipped container. The lower the number, the thinner the liquid.

Void
The absence of material or an area devoid of materials where not intended. See also *Blister* and *Sink*.

Vulcanizate
The product of molecular chain extension – growth -- and crosslinking of a urethane elastomer.

Warpage
Dimensional distortion in a molded product.

Water Absorption
The amount of water absorbed by an elastomer under a set of specified test conditions. Expressed as a percent of the original dry weight of the test specimen or article.

Weathering
Surface deterioration, evidenced by cracks and crazing of an elastomer during outdoor exposure.

Yield Point
The stress in a material at which a substantial increase in strain occurs with a minimum increase in stress.

Yield Strength
The stress at which a material exhibits a specified limiting, permanent set. Determined by a measurable value of plastic yielding of the material above which the material is damaged and below which the damaging effects are considered negligible.

Young's Modulus
Alternative term for modulus of elasticity. It is the slope of the linear portion of the stress-strain curve of the elastomer in tension or compression.

Zero Load
A reference load applied in taking an initial reading and prior to determining compressibility or extensibility.