

## 21. Glossary

### **Abrasion**

Progressive wearing away of material by mechanical action.

### **Abrasion Resistance**

The ability of a rubber compound to resist mechanical wear.

### **Absorption**

The physical mechanism by which one substance attracts and takes up another substance.

### **Accelerated Life Test**

Any set of conditions designed to reproduce in a short time the deteriorating effect obtained under normal service conditions.

### **Accelerated Service Test**

A service or bench test in which some service condition, such as speed, temperature, or continuity of operation, is exaggerated in order to obtain a result in shorter time.

### **Accelerator**

A substance which hastens the vulcanization of an elastomer causing it to take place in a shorter time or at a lower temperature.

### **Acid Resistant**

Withstands the action of acids.

### **Adhere**

To cling or stick together.

### **Adhesion**

Susceptibility of rubber to stick to a contact surface.

### **Aflas**

Trade name of Asahi Glass for TFE Propylene.

### **After Cure**

Continuation of vulcanization after the desired cure is effected and the heat source removed.

### **Aging**

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

### **Aging, Air Oven**

A means of accelerating the change in physical properties of rubber compounds by exposing them to the action of air at an elevated temperature.

### **Aging, Air Pressure Heat**

A means of accelerating the change in physical properties of rubber compounds by exposing them to the action of air under pressure at an elevated temperature.

### **Aging, Oxygen Bomb**

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

### **Air Bomb**

Similar to an oxygen bomb but used with air. Used for accelerated aging test.

### **Air Checks**

Surface marking or depressions due to trapping air between the materials being cured and the mold or press surface.

### **Air Curing**

The vulcanization of a rubber product in air as distinguished from vulcanizing in a press or steam vulcanizer.

### **Ambient Temperature**

The environment temperature surrounding the object under consideration.

### **Aniline Point of Oil**

The lowest temperature at which equal volumes of pure aniline and a particular oil will completely dissolve in one another. The aniline point generally affects the swell.

### **Antioxidant**

An organic substance which inhibits or retards oxidation.

### **Atmospheric Cracking**

Cracks produced in surface of rubber articles by exposure to atmospheric conditions.

### **Automotive fuels**

Fuels used for automobile engines.

### **Average Modulus**

Total change of stress divided by total change of strain, i.e., the average slope of the stress-strain curve. Employed when modulus varies from point to point.

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### **Back Rind**

A burn-back into the part at a mold line separation caused by too soft a rubber stock, excessive acceleration, or too low a plasticity.

### **Back-up ring**

Washer-like device installed next to O-ring to prevent extrusion.

### **Bench Test**

A modified service test in which the service conditions are approximated, but the equipment is conventional laboratory equipment and not necessarily identical with that in which the product will be employed.

### **Bending Modulus**

Force required to induce bending around a given radius, and hence a measure of stiffness.

### **Bleeding**

Migration to the surface of plasticizers, waxes, or similar materials to form a film or beads.

### **Blemish**

A mark, deformity, or injury which impairs the appearance.

### **Blisters**

A raised spot on the surface or a separation between layers usually forming a void or air-filled space in the vulcanized article.

### **Bloom**

A discoloration or change in appearance of the surface of a rubber product caused by the 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.

### **Break**

A separation or discontinuity in any part of an article.

### **Breakout**

Force to inaugurate sliding. Expressed in same terms as friction. An excessive breakout value is taken as an indication of the development of adhesion.

### **Brittleness**

Tendency to crack when subjected to deformation.

### **Buna N**

A general term for the copolymers of butadiene and acrylonitrile. Typical commercial polymers are Hycar and Paracril.

### **Buna S**

A general term for the copolymers of butadiene and styrene.

### **Butt Joint**

Joining two ends of material whereby the junction is perpendicular to the plane of an O-ring.

### **Butyl**

A synthetic rubber of the polybutene type exhibiting very low permeability to gases.

### **Coefficient of Thermal Expansion**

Average expansion per degree over a stated temperature range, expressed in a fraction of initial dimension. May be linear or volumetric.

### **Cold Flexibility**

Flexibility following exposure to a predetermined low temperature for a predetermined time.

### **Cold Flow**

Continued deformation under stress.

### **Cold Resistant**

Withstands the effect of cold or low temperatures without loss of serviceability.

### **Commercially Smooth**

Degree of smoothness of the surface of an article which is acceptable for use.

### **Compound**

A term applied to either vulcanized or unvulcanized mixtures of elastomers and other ingredients necessary to make a useful rubber-like material.

### **Compression Modulus**

The ratio of the compressive stress to the resulting compressive strain (the latter expressed as a fraction of the original height or thickness in the direction of the force). Compression Modulus may be either static or dynamic.

### **Compression Set**

The decrease in thickness of a rubber specimen which has been deformed under specific conditions of load, time, and temperature. It is usual expressed as a percentage of the initial compression of the test sample.

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### **Conductive rubber**

A rubber having qualities of conduction or transmitting heat or electricity. Most generally applied to rubber products used to conduct static electricity.

### **Conductivity**

Quality or power of conducting or transmitting heat or electricity.

### **Copolymer**

A polymer consisting of two different monomers chemically combined.

### **Corrosion (Packing)**

Corrosion of rigid member (usually metal) where it contacts packing. The actual corroding agent is fluid medium trapped in the interface.

### **Corrosive (Packing)**

A property of packing whereby it is assumed, often incorrectly, to promote corrosion of the rigid member by the trapped fluid.

### **Cracking**

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

### **Creep**

The relaxation of a rubber material while under stress.

### **Cross section**

An O-ring viewed as it were if cut at right angles to the axis showing internal structure.

### **Curing Date**

O-ring molding date.

### **Curing Temperature**

The temperature at which the rubber product is vulcanized.

### **Cylinder**

Chamber in which piston, plunger, ram, rod, or shaft is driven by or against the pressure medium.

### **Degassing**

The intentional but controlled outgassing of a rubber substance.

### **Durometer**

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

### **Dynamic**

O-ring application in which the O-ring is subject to movement or moving parts.

### **Dynamic Packing**

A packing employed in a joint whose members are in relative motion.

### **Dynamic Seal**

A seal required to prevent leakage past parts which are in relative motion.

### **Elasticity**

The property of an article which tends to return to its original shape after deformation.

### **Elastic Limit**

The greatest stress which a material is capable of developing without a permanent deformation remaining upon complete release of the stress. In rubber, the elastic limit as above defined is very low and sometimes practically non-existent. Usually this term is replaced by various load limits for specific cases in which the resulting permanent deformations are not zero but are negligible.

### **Elastomer**

A general term for an elastic, rubber-like substance. A polymeric material which may be compressed or otherwise deformed, and by virtue of its molecular structure, will recover almost completely to its original form.

### **EMI Electromagnetic Interference**

An electromagnetic emission, which has a disturbing effect on devices exposed to it.

### **EMI Gasket**

A component, usually incorporating a formed resilient elastomer, which will allow a seam or enclosure panel interface to be reliably interconnected (electrical bonded) along the entire joint.

### **Elongation**

Increase in length expressed numerically as a fraction or percentage of initial length.

**21. Glossary****Ethylene Propylene**

Elastomer prepared from ethylene and propylene monomers.

**Explosive Decompression**

Expanding of gas (or volatile liquid) in case of a sudden pressure drop.

**Extrusion**

Distortion, under pressure, of portion of seal into clearance between mating metal parts.

**Fam**

Test fluid for extraction of softeners out of the rubber compound.

**Filler**

Chemically inert, finely divided material added to the polymer to aid in processing and improving properties of abrasion resistance and strength - gives it varying degrees of hardness.

**Flash**

Excess rubber left around rubber part after molding due to space between mating mold surfaces; removed by trimming.

**Flex Cracking**

A surface cracking induced by repeated bending or flexing.

**Flex Life**

The relative ability of a rubber article to withstand dynamic bending stresses.

**Flock**

Fibers added to rubber compounds.

**Flow Cracks**

Surface imperfections due to improper flow and failure of stock to knit or blend with itself during the molding operation.

**Fluorocarbon, Perfluorocarbon**

Highly fluorinated carbon backbone polymers.

**Food service**

Compound ingredients for contact with food products.

**Friction**

Resistance to motion due to the contact of surfaces.

**Friction, Breakout**

Initial or starting friction developed of a dynamic seal.

**Friction, Running**

Friction developed during operation of a dynamic seal.

**Fuel, Aromatic**

Fuel which contains benzene or aromatic hydrocarbons.

**Fuel, Non-Aromatic**

Fuel which is composed of straight chain hydrocarbons.

**Gland**

Seal assembly, including the O-ring; groove which holds the O-ring and the contacting surfaces.

**Gow-Joule effect**

Elastomers under stretch give higher tension when the temperatures rises.

**Hardness**

Property or extent of being hard. Measured in degrees and based on the penetration into the rubber of a defined indenter under a set load.

**Hardness Shore A**

Durometer reading in degrees of the hardness of the rubber based on a shore durometer.

**Homogeneous**

General - a material of uniform composition throughout.

**Hycar**

Commercial name of B.F. Goodrich for polyacrylate rubber, ACM polymer of acrylic acid ester.

**Hypalon**

Commercial name for a chlorosulphonated derivative of polyethylene.

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### **Immediate Set**

The deformation found by measurement immediately after removal of the load causing the deformation.

### **Immersion**

Placing an article into a fluid, generally so it is completely covered.

### **Impact**

The single instantaneous stroke or contact of a moving body with another either moving or at rest, such as a large lump of material dropping on a conveyor belt.

### **Internal Lubrication**

The incorporation of friction reducing ingredients (graphite, molybdenum disulfide, powdered Teflon®, or organic lubricants) in the rubber compound.

### **Labsfree**

The absence of any trace of ingredient on the surface of the O-ring which can cause adhesion problems (i.a. paint industry).

### **Leakage Rate**

The rate at which either a gas or liquid passes a barrier.

### **Life Test**

A laboratory procedure used to determine the amount and duration of resistance of a rubber article to a specific set of destructive forces or conditions.

### **Linear Expansion**

Expansion in any one linear dimension or the average of all linear dimensions.

### **Logy**

Sluggish, low snap or recovery of a material.

### **Low Temperature Flexibility**

The ability of a rubber product to be flexed, bent or bowed at low temperatures.

### **Low Temperature Flexing**

Act or instance of repeated bending or bowing a rubber product under conditions of low temperature.

### **Media**

A liquid, a gas, or a mixture of both.

### **Memory**

Tendency of a material to return to original shape after deformation.

### **Micro O-rings**

Any O-ring that measures less than .4 inch (1 mm) in either inside diameter or cross section.

### **Mirror Finish**

A bright, polished surface.

### **Misalignment**

Departure from alignment.

### **Mismatch**

Poor matching or meeting in splice.

### **Modulus**

Tensile stress at a specified elongation (generally 100%).

### **Modulus of Elasticity**

One of the several measurements of stiffness or resistance to deformation, but often incorrectly used to indicate specifically static tension modulus.

### **Mold Cavity**

Hollow space or cavity in the mold which is used to impart the desired form to the product being molded.

### **Mold Finish**

The uninterrupted surface produced by intimate contact of rubber with the surface of the mold at vulcanization.

### **Mold Lubricant**

A material usually sprayed onto the mold cavity surface, to facilitate the easy removal of the molded rubber parts.

### **Mold Marks**

Indentations or ridges embossed into the skin of the molded product by irregularities in the mold cavity surface.

### **Mold Register**

Means used to align the parts of a mold.

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### **Mooney Scorch**

The measurement of the rate at which a rubber compound will precure or set up by means of the Mooney Viscometer.

### **Mooney Viscosity**

The measurement of the plasticity or viscosity of a not compounded or compounded but not vulcanized rubber and rubber-like material by means of the Mooney Shearing Disk Viscometer.

### **Natural Rubber**

Raw or crude rubber obtained from vegetable sources, basically the unsaturated polymer of isoprene.

### **Neoprene**

Homopolymers of chloroprene. DuPont's name for chloroprene rubber.

### **Nick**

A small notch, slit, or cut.

### **Nitrile (Buna N)**

Copolymer of butadiene and acrylonitrile; known commercially as Butaprene, Chemigum, Hycar OR, Perbunan and Paracril. (See Buna N)

### **Nominal Length**

The desired length from which tolerances are set.

### **Non-Blooming**

The absence of bloom.

### **Off-Register**

Misalignment of mold halves causing an out-of-round O-ring cross section.

### **Oil Resistant**

Ability of a vulcanized rubber to resist the swelling and deteriorating effects of various type oils.

### **Oil Swell**

The change in volume of a rubber article due to absorption of oil.

### **O-ring**

An elastomeric seal of homogeneous composition molded in one piece to the configuration of a torus with circular cross section (doughnut). The O-ring is used as a dynamic or static seal usually installed in a machined groove.

### **Optimum Cure**

State of vulcanization at which maximum desired property is attained.

### **Over Cure**

A degree of cure greater than the optimum.

### **Outgassing**

A vacuum phenomenon where a substance spontaneously releases volatile constituents in the form of vapors or gases.

### **Oxidation**

The reaction of oxygen on a rubber product, usually detected by a change in the appearance or feel of the surface or by a change in physical properties.

### **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 (See Aging).

### **Ozone Resistant**

Withstands the deteriorating effects of ozone (generally cracking).

### **Packing**

A flexible device used to retain fluids under pressure or seal out foreign matter.

### **Packing Groove**

A groove carved in a flange, or in one member of a concentric joint, to accommodate a packing.

### **Perbunan**

Standard Oil of New Jersey's name for chloroprene rubber.

### **Permanent Set**

Permanent set is the deformation remaining after a specimen has been stressed in tension a prescribed amount of time and released for a definite period.

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### **Permeability**

Property of rubber or other materials which permits passage of gas through the molecular structure of the material.

### **Pit or Pock Mark**

A circular depression, usually small.

### **Plasticizer**

A substance, usually a liquid, added to an elastomer to decrease stiffness, improve low temperature properties, and improve processing.

### **Polymer**

A material formed by the joining together of many (poly) individual units (mer) of a monomer.

### **Porosity**

Quality of state of being porous due to presence of globular structural voids.

### **Post Cure**

The second step in the vulcanization process for some elastomers. Provides stabilization of parts and drives off decomposition products resulting from the vulcanization process.

### **Radiation**

Emission of alpha particles, beta particles, or electromagnetic energy (gamma radiation).

### **Register, Off or Uneven**

Nonconformity of finished article with design dimensions due to mold misalignment during cure.

### **Relative Humidity**

The ratio of the quantity of water vapor actually present in the atmosphere to the greatest amount possible at the given temperature.

### **Resilience**

Capable of returning to original size and shape after deformation.

### **RMS and Ra**

Root Mean Square - The measure of surface roughness, obtained as the square root of the sum of the squares of micro-inch deviation from true flat. 1 RMS micro-inch = 0,025 µRA micro-meter.

### **Rough Trim**

Removal of superfluous parts by pulling or picking. Usually a small portion of the flash or sprue remains attached to the product.

### **Rubber, Chloroprene**

Homopolymer of chloroprene.

### **Runout (Shaft)**

Same as Gyration. When expressed in inches or mm alone or accompanied by abbreviation "TIR" (total indicator reading), it refers to twice the radial distance between shaft axis and axis of rotation.

### **Seal**

Any device used to prevent the passage of a gas or liquid.

### **Service**

Operating conditions to be met.

### **Shaft**

Rotating member within cylinder; not in contact with the walls.

### **Shelf-aging**

The change in a material's properties which occurs in storage with time.

### **Shield, EMI**

Electrically conductive materials placed around a circuit, component or cable, to suppress the effect of electromagnetic field.

### **Shore A Hardness**

See Hardness and Durometer.

### **Shrinkage**

Decreased volume of unit caused by air drying after immersion in fluid.

### **Silicone fluids**

Oils and greases based on silicones.

### **Silicone, Fluorosilicone**

Semi-organic elastomer, containing silicone.

### **Silicone free**

O-rings which are produced with a silicone free mold lubricant.

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**Size, Actual**

Actual dimensions of the O-ring, including tolerance limits.

**Size, Nominal**

Approximate size of O-ring in fractional dimensions.

**Size number**

Number assigned to indicate inside and cross section diameters of an O-ring. Sizes established in SAE standard AS 568 have been adopted by the military and industry.

**Specific Gravity**

The ratio of the weight of a given substance to the weight of an equal volume of water at a specified temperature.

**Specimens**

Product parts used for testing.

**Sprue Marks**

Marks left on the surface of a rubber part, usually elevated, after removal of the flash.

**Squeeze**

cross section diametrical compression of O-ring between bottom surface of the groove and surface of other mating metal part in the gland assembly.

**Static**

Stationary application such as a gasket.

**Static Seal**

Seal designed to work between parts having no relative motions.

**Stress**

Force per unit of original cross sectional area required to stretch a specimen to a stated elongation.

**Stress Relaxation**

This is the phenomenon exhibited by an elastomer under constant compression, whereby the opposing force exerted by the elastomer decreases with time.

**Sun Checking**

Surface cracks, checks or crazing caused by exposure to direct or indirect sunlight.

**Swell**

Increased volume of unit caused by immersion in a fluid.

**Synthetic Rubber**

Manufactured elastomers.

**Tear Resistance**

Strength of a compound as resistance to growth of a cut or nick when tension is applied to the cut specimen.

**Temperature Range**

Lowest temperature at which rubber remains flexible and highest temperature at which it will function.

**Tensile Strength**

Force in pounds per square inch or in kilograms per square centimeter required to cause the rupture of a specimen of a rubber material.

**Terpolymer**

A polymer consisting of at least three different monomers chemically combined.

**Thermal Effects**

Deterioration at higher temperatures.

**Thermal Expansion**

Expansion caused by increase in temperature. May be linear and volumetric.

**Thiokol**

A synthetic rubber of the polysulfide type.

**Torque**

The turning power of a shaft.

**Torr**

Comes from the tube of Torricelli. The unit of pressure used in vacuum measurement. It is equal to 1/760 of a standard atmosphere, and for all practical purposes is equivalent to one millimeter of mercury (mm HG).

**Trim**

The process involving removal of mold flash.

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### **Trim Cut**

Damage to mold skin or finish by too close trimming.

### **TR-10**

The warming up temperature at which a frozen O-ring regains 10% of its elasticity.

### **Under-Cure**

Degree of cure less than optimum. May be evidenced by inferior physical properties.

### **Vacuum**

Situation in a given space that is occupied by a gas at less than atmospheric pressure.

### **Vacuum Level**

The term used to denote the degree of Rough, Medium, High, Hard, or Ultra Hard vacuum evidenced by its pressure in torr (mm HG).

### **Vamac**

DuPont-Dow Elastomers' name for Ethylene Acrylate.

### **Vapor Pressure**

The maximum pressure exerted by a liquid (or solid) heated to a given temperature in a closed container.

### **Viscosity**

A manifestation of internal friction opposed to mobility. The property of fluids and plastic solids by which they resist an instantaneous change of shape, i.e., resistance to flow.

### **Voids**

The absence of material or an area devoid of materials where not intended.

### **Volume Change**

Change in volume of a specimen which has been immersed in a designated fluid under specified condition of time and temperature. Expressed as a percentage of the original volume.

### **Volume Swell**

Increase in physical size caused by the swelling action of a liquid.

### **Vulcanization**

A thermo-setting involving the use of heat and pressure and which results in greatly increased strength and elasticity of rubber-like materials.

### **Vulcanizing Agent**

A material which produces vulcanization of an elastomer.

### **Vulc-O-ring**

An O-ring manufactured from O-ring cord by splicing and bonding or vulcanizing.

### **Width**

Radial dimension. For packing rings or sets the term "packing space" is preferred.

### **Wiper ring**

A ring employed to remove excess fluid, mud, etc., from a reciprocating member before it reaches the seal.