

Seals—Terminology of Radial Lip

1. Scope—The purpose of this SAE Recommended Practice is to provide a glossary of radial seal terms and nomenclature which are normally encountered in the design, manufacture, installation, testing, inspection, and failure mode analysis of radial seals. The information will aid in the understanding and communication among those people associated with radial seals.

2. Reference

2.1 Applicable Publication—The following publication forms a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J448a—Surface Texture

3. Definitions

3.1 Angle, Contact Approach (2-25)—Synonym: angle, seal outside lip.

3.2 Angle, Helix (1-2)—The projected angle between a helical rib and the lip line of contact.

3.3 Angle, Helix Contact (1-3)—The angle formed by the rib leading edge and the lip line of contact.

3.4 Angle, Helixseal Rib (1-9)¹—The angle formed by the leading edge of the rib and a line perpendicular to a plane tangent to the outside lip surface at the centerline of the rib base.

3.5 Angle, Inside Lip (2-19)—The angle between the inside lip surface and the seal axis.

3.6 Angle, Molded Toe (2-30)—The angle between the toe face of a seal lip and the seal axis.

3.7 Angle, Outside Lip (2-25)—The angle between the outside lip surface and the seal axis.

1. Numbers in parentheses refer to figure and item number in that order.

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SAE WEB ADDRESS:

- 3.8 Angle, Trimming (2-19)—Angle, Trimming (2-19)**—The angle between the trimmed face of a seal lip and the seal axis.
- 3.9 Assembly, Seal**—A group of parts, which includes sealing surfaces, provisions for initial loading, and a secondary sealing mechanism which accommodates the radial and axial movement necessary for installation and operation.
- 3.10 Base, Seal (2-5)**—Synonym: face, outside seal.
- 3.11 Bedding-In**—Synonym: run-in.
- 3.12 Blister**—A *raised* cavity or sack that deforms a surface of the seal material.
- 3.13 Bond**—The adhesion established by vulcanization between two cured elastomer surfaces, or between one cured elastomer surface and one nonelastomer surface.
- 3.14 Bore, Housing (2-10)**—A cylindrical surface which mates with the outside diameter of the outer seal case.
- 3.15 Bore, Seal Case**—Synonym: diameter, outer-case inner.
- 3.16 Buna-N—Buna-N**—See: nitrile.
- 3.17 Cap**—That part of the seal head section which is removed during trimming.
- 3.18 Case, Bonded (3-4)**—A design feature of a type of radial lip seal wherein the heel of the sealing element is attached to the seal case by an adhesive during the molding operation.
- 3.19 Case, Clinched (3-10)**—A design feature of a type of radial lip seal wherein the heel of the sealing element is attached to the seal case by clamping it between two convolutions, or folds, of the case.
- 3.20 Case, Inner (2-4, 3-3)**—A rigid, cup-shaped component of a seal assembly, which is placed inside the outer seal case. It has one or more of the following functions: reinforcing member, shield, spring retainer, lip-clamping device.
- 3.21 Case, Molded (3-5)**—A design feature of a type of radial lip seal wherein the lip and case are made integral in the molding process.
- 3.22 Case, Outer (2-2, 3-2)**—The outer thin-wall rigid structure of the lip-seal assembly which contains the inner case, the primary-seal ring, the spring parts, and the secondary seal.
- 3.23 Case, Seal**—A rigid member to which the seal lip is attached.
- 3.24 Cavity, Mold**—A single unit or assembly of contoured parts in which a material, such as an elastomer, is shaped into a particular configuration.
- 3.25 Cavity, Seal**—The annular area between a housing bore and a shaft, into which a seal is installed.
- 3.26 Checking**—Short axial cracks on the lip contact surface.
- 3.27 Clearance, Axial (2-14)**—The gap between the toe face of the head section and the inside surface of the inner case.

- 3.28 Cocked Assembly**—An installation in which the plane of the outside seal face is not perpendicular to the shaft axis.
- 3.29 Coil**—One turn of the coiled wire garter spring.
- 3.30 Composite**—Term used to describe a seal element comprised of two or more compounds bonded together to enhance seal performance and/or reduce cost.
- 3.31 Crack**—A sharp break or fissure in the sealing element.
- 3.32 Creep**—The time dependent part of a strain resulting from stress.
- 3.33 Cure Time**—The time required to produce vulcanization at a given temperature.
- 3.34 Curing Temperature**—The temperature at which the elastomeric product is vulcanized.
- 3.35 Cut**—A deep discontinuity in the seal material whereby no material is removed.
- 3.36 Cut, Trim**—Damage to the elastomeric portion of the seal during trimming.
- 3.37 Deformation**—A stress induced change of form or shape.
- 3.38 Diameter, Assembled Spring Inside**—The inner diameter of the garter spring, with the ends securely joined.
- 3.39 Diameter, Free-Lip**—See: diameter, unsprung lip.
- 3.40 Diameter, Functional Lip**—The apparent inner diameter of the seal lip when the seal case is concentric with the outer diameter of the sizing mandrel in an air gage, light box, or similar inspection equipment.
- 3.41 Diameter, Inside Face Inner (2-21)**—The inner diameter of the inner case of a radial lip seal.
- 3.42 Diameter, Lip (2-31)**—The inner diameter of the seal lip, measured with the spring installed.
- 3.43 Diameter, Lip-Inner**—See: diameter, seal lip.
- 3.44 Diameter, Molded Lip**—The lip diameter in the free state (no spring) formed by the molding operation of the sealing element to generate the contact line.
- 3.45 Diameter, Outer Case Inner (2-22)**—The inside, or smallest diameter of the outer case on a lip-seal assembly.
- 3.46 Diameter, Seal Outer (2-9)**—The external diameter of a lip-seal assembly, which normally corresponds to the outer diameter of the outer seal case.
- 3.47 Diameter, Spring Mean Coil**—The spring coil diameter minus one wire diameter.
- 3.48 Diameter, Spring Outside Coil**—The outer diameter of an individual helical coil of a garter spring.
- 3.49 Diameter, Trimmed Lip**—The lip diameter in the free state (no spring) resulting from knife trimming the molded portion of the sealing element to generate the contact line.
- 3.50 Diameter, Unsprung Lip (2-32)**—The inner diameter of the seal lip, measured without the spring installed.

- 3.51 Dimension, Radial Wall (2-8)**—The distance between the seal lip contact line and the seal outside diameter measured in a radial direction on a finished seal in the free state.
- 3.52 Dry Running**—Operation of a seal without lubrication at the seal-shaft interface.
- 3.53 Durometer**—An instrument which measures the hardness of rubber by the penetration (without puncturing) of an indenter point into the surface of rubber.
- 3.54 Eccentricity, Lip ID to OD**—See: variation, radial wall.
- 3.55 Eccentricity, Shaft**—The radial distance which the geometric center of a shaft is displaced from the axis of shaft rotation.
- 3.56 Elasticity**—The property of a material which causes it to return to its original shape after deformation.
- 3.57 Elastomer**—An elastic rubberlike substance, such as natural or synthetic rubber.
- 3.58 Element, Sealing (3-1)**—See: lip, seal.
- 3.59 Elongation**—The increase in length of a specimen due to a tensile force expressed as a percentage of the original specimen length.
- 3.60 End Play**—A measure of axial movement encountered or allowed, usually in reference to the shaft on which the seal lip contacts.
- 3.61 Extrusion**—Permanent displacement of part of a seal into a gap, under the action of fluid pressure.
- 3.62 Face, Inside (2-7)**—That surface of the inner case which faces, and is usually in contact with, the fluid being sealed.
- 3.63 Face, Molded Toe**—Synonym: face, toe.
- 3.64 Face, Outside (2-5)**—The surface of the seal case, perpendicular to the shaft axis, which is not in contact with the fluid being sealed.
- 3.65 Face, Rib Leading (1-11)**—The face of the helix seal rib which is closest to the fluid side of the seal.
- 3.66 Face, Toe (2-20)**—The annular surface of the spring-retaining lip.
- 3.67 Face, Trim (2-29)**—The seal inside lip surface when formed by a trimming operation.
- 3.68 Factor, p_v** —An arbitrary term which is the product of face pressure and relative sliding velocity. The term is normally considered to provide some measure of severity of service or seal life.
- 3.69 Filler**—A solid compounding ingredient which may be added, usually in finely divided form, in relatively large proportions, to a polymer.
- 3.70 Finish, Shaft Surface**—See: texture, shaft surface.
- 3.71 Flash**—Thin extensions of the elastomer formed by extrusion at the parting lines in the mold cavity or vent points.

- 3.72 Flashing**—A rapid change in fluid state, from liquid to gaseous. In a dynamic seal, this can occur when frictional energy is added to the fluid as the latter passes between the primary sealing faces, or when fluid pressure is reduced below the fluid's vapor pressure because of a pressure drop across the sealing faces.
- 3.73 Flexibility, Cold**—Flexibility of a material during exposure to a predetermined low temperature for a specific length of time.
- 3.74 Flinger**—Synonym: slinger.
- 3.75 Fluid Side**—That side of the seal which in normal use faces toward the fluid being sealed.
- 3.76 Fluorelastomer**—A saturated polymer in which hydrogen atoms have been replaced with fluorine. It is characterized by excellent chemical and heat resistance.
- 3.77 Force, Lip**—The radial force exerted by an extension spring and/or lip of a seal on the mating shaft. Lip force is expressed as force per unit of shaft circumference.
- 3.78 Groove, Spring (2-12)**—A depression formed in the head section of the seal. It is generally semicircular in form and serves to accommodate and locate the garter spring.
- 3.79 Hardness**—The resistance to indentation. Measured by the relative resistance of the material to an indenter point of any one of a number of standard hardness testing instruments.
- 3.80 Hardness, Durometer**—An arbitrary numerical value which indicates the resistance to penetration of the indenter point into the rubber surface. Value may be taken immediately or after a very short specified time.
- 3.81 Hardness, Shore**—The relative hardness of an elastomer obtained by use of a Shore durometer instrument.
- 3.82 Head (2-18)**—Synonym: section, head.
- 3.83 Heel**—Synonym: section, heel.
- 3.84 Height, Contact Line (2-34)**—The axial distance from the outside seal face to the lip contact line.
- 3.85 Height, Helix Seal Rib (1-10)**—The height of the helical ribs, measured perpendicular to the outside lip surface.
- 3.86 Height, Lip (2-35)**—The axial distance from the outside seal face to the toe face.
- 3.87 Housing (2-3)**—A rigid structure which supports and locates the seal assembly with respect to the shaft.
- 3.88 Hydroseal**—A sealing system having helically disposed elements formed on the shaft surface.
- 3.89 Inclusion**—Foreign matter included in the seal material.
- 3.90 Incomplete Trim**—A trimmed surface which does not have all designated material removed.
- 3.91 Index, Spring**—The ratio of the mean coil diameter to the wire diameter of a garter spring.
- 3.92 Insert, Lip (3-11)**—A material such as PTFE bonded onto a lip of an elastomeric seal to provide improved sealing and/or exclusion performance not attainable with the elastomeric material alone.

- 3.93 Interface, Sealing**—The region between the static and dynamic sealing surfaces in which there is contact, or which experiences the closest approach and effects the primary seal.
- 3.94 Interference, Lip**—See: interference, seal.
- 3.95 Interference, Seal**—The difference between the seal lip and shaft diameters.
- 3.96 International Rubber Hardness Degrees (IRHD)**—A standard unit used to indicate the relative hardness of elastomeric materials, where zero represents a material having a Young's modulus of zero, and 100 represents a material of infinite Young's modulus.
- 3.97 Knit Line**—A blemish of the sealing element created during the molding operation.
- 3.98 Lead, Shaft**—Spiral structures on a shaft surface caused by the machining operation, (e.g., the relative axial movement of grinding wheel to shaft).
- 3.99 Leakage**—Synonym: rate, leakage.
- 3.100 Length, Deflected**—Refers to the working circumferential length (measured on spring centerline) of the garter spring with the seal lip assembled on a normal (designed) shaft diameter.
- 3.101 Length, Lip (2-6)**—The axial distance between the thinnest part of the flex section and the contact line.
- 3.102 Length, Spring Free**—The total unconfined length of a spring. For a garter spring, it would not include the nib length.
- 3.103 Life, Flex**—The length of time to failure which indicates the relative ability of a material to withstand dynamic bending or flexing under specific test conditions.
- 3.104 Line, Contact (2-27)**—The line of intersection between the outside and inside lip surfaces of a radial lip seal. In a cross-sectional view, this intersection is illustrated as a point.
- 3.105 Lip, Auxiliary**—See: lip, secondary seal.
- 3.106 Lip, Dirt**—See: lip, secondary seal.
- 3.107 Lip, Dust**—See: lip, secondary seal.
- 3.108 Lip, Molded**—A type of seal lip which requires no trimming to form the contact line.
- 3.109 Lip, Primary**—The normally flexible elastomeric component of a lip seal assembly, which rides against the rotating surface and effects the seal.
- 3.110 Lip, Static (2-28)**—That section of the helix seal lip incorporating the contact line.
- 3.111 Lip, Secondary (2-23)**—A short lip, normally without a spring, located at the outside seal face of a radial lip seal to prevent ingress of atmospheric contaminants. Synonyms: lip, dirt; lip, auxiliary; lip, dust.
- 3.112 Lip, Spring Retaining (2-17)**—The portion of the primary lip that restricts the axial movement of the garter spring from a predetermined position.
- 3.113 Load, Radial**—The total static force (load) that the seal lip exerts on the shaft. It is the sum of the forces resulting from the lip interference and the garter spring.

- 3.114 LOP**—See: pressure, lip opening.
- 3.115 Lubricant, Mold**—The substance used to coat the surfaces of a mold to prevent the elastomer from adhering to the mold cavity surface during vulcanization.
- 3.116 Lubricant Starvation**—Lack of proper lubrication at the seal interface which may cause premature wear and early failure.
- 3.117 Modulus, Rubber**—The tensile stress at a specified elongation. A measure of resistance to deformation.
- 3.118 Modulus, Young's**—The ratio of the stress to the resulting strain (the latter expressed as a fraction of the original height or thickness in the direction of the force).
- 3.119 Mold Impression**—A molded imperfection on the surface of the seal.
- 3.120 Monomer**—A single organic molecule usually containing carbon and capable of additional polymerization.
- 3.121 Nib, Spring**—A short end section of an extension spring formed by a reduction in the coil diameter used to join the two ends in forming a garter spring.
- 3.122 Nick**—A void created in the seal material after molding.
- 3.123 Nitrile**—A general term for the copolymers of butadiene and acrylonitrile.
- 3.124 Nonfill**—A void in the seal material.
- 3.125 Offset**—The radial distance between the axis of the seal bore and axis of shaft rotation. (Synonym: shaft-to-bore misalignment.)
- 3.126 Oil Resistance**—The measure of an elastomer's ability to withstand the deteriorating effect of oil on the mechanical properties.
- 3.127 Oil Seal**—A seal designed primarily for the retention of oil.
- 3.128 Oil Swell**—The change in volume of a rubber material due to absorption of oil.
- 3.129 O-Ring**—A toroidal shaped seal.
- 3.130 Out-of-Round, Shaft**—The deviation of the shaft cross section from a true circle. Out-of-round is measured as the radial distance, on a polar chart recording, between concentric, circumscribed, and inscribed circles which just contain the trace and are so centered that the radial distance is minimized.
- 3.131 Packing, Mechanical**—A deformable material used to prevent or control the passage of matter between surfaces which move in relation to each other.
- 3.132 Pitch, Helix Seal Rib (1-12)**—The circumferential displacement between adjacent helical ribs of a lip seal.
- 3.133 Plasticity**—The degree of rate at which unvulcanized elastomer and elastomeric compounds will flow when subjected to forces of compression, shear, or extrusion.
- 3.134 Plasticizer**—A material which, when incorporated in elastomer or a polymer, will change its hardness, flexibility, processability, and/or plasticity.

- 3.135 Plunge Ground**—The surface texture of shaft or wear sleeve produced by presenting the grinding wheel perpendicular to the rotating shaft without axial motion.
- 3.136 Polyacrylate**—A type of elastomer characterized by an unsaturated chain and being a copolymer of alkyl acrylate and some other monomer such as chloroethyl vinyl ether or vinyl chloroacetate.
- 3.137 Polymer**—Generic term for an organic compound of high molecular weight and consisting of recurrent structural groups.
- 3.138 Polymerization**—The ability of certain organic compounds to react together to form a single molecule of higher atomic weight.
- 3.139 Polytetrafluoroethylene (PTFE)**—PTFE is a fluoropolymer with excellent thermal and chemical resistance and a low coefficient of friction. PTFE is usually compounded with fillers such as molybdenum disulfide, graphite, pigments, and glass fibers to improve wear characteristics and other properties.
- 3.140 Porosity**—A multitude of minute cavities in the seal material.
- 3.141 Position, Spring (2-11)**—The axial distance between the "seal contact line" and the centerline of the spring groove of a radial lip seal; commonly referred to as the "R" value.
- 3.142 Precure**—Partial cure. A term frequently used to designate the first cure of a material that is given more than one cure in its manufacture.
- 3.143 Pressure, Contact**—The average pressure exerted by a seal on a shaft. This pressure is computed by dividing the total lip force by the total lip contact area. Sometimes referred to as radial pressure.
- 3.144 Pressure, Lip Opening**—The pressure necessary for flowing air at 10 000 cm³/m between the contact surface of a radial lip seal and a shaft-size mandrel under the following conditions: the seal case outer diameter clamped to be concentric with the mandrel and the pressurized air applied to the outside lip surface.
- 3.145 Pressure, Radial**—See: pressure, contact.
- 3.146 Pressure, Seal Cavity**—The pressure of a fluid being sealed.
- 3.147 Pressure, Spring**—The contact pressure which results from the spring load.
- 3.148 PTFE Seal, Lay Down Lip**—Term used to describe a PTFE sealing element with a wide contact pattern on shaft. Often used with hydrodynamic features.
- 3.149 PTFE Seal, Line Contact Lip**—A seal utilizing an insert of PTFE bonded to an elastomeric back-up material. Shaft contact is over a narrow area similar to most radial lip seals.
- 3.150 Rate, Leakage**—The quantity of fluid passing through a seal in a given length of time.
- 3.151 Rate, Spring**—The force, independent of initial tension, which is required for extending the working length of a spring a unit distance.
- 3.152 Rate, Wear**—The amount of seal contact surface wear per unit of time.
- 3.153 Relaxation, Stress**—A characteristic of an elastomer wherein a gradual decrease in stress is experienced under a constant deformation, after initial deformation.

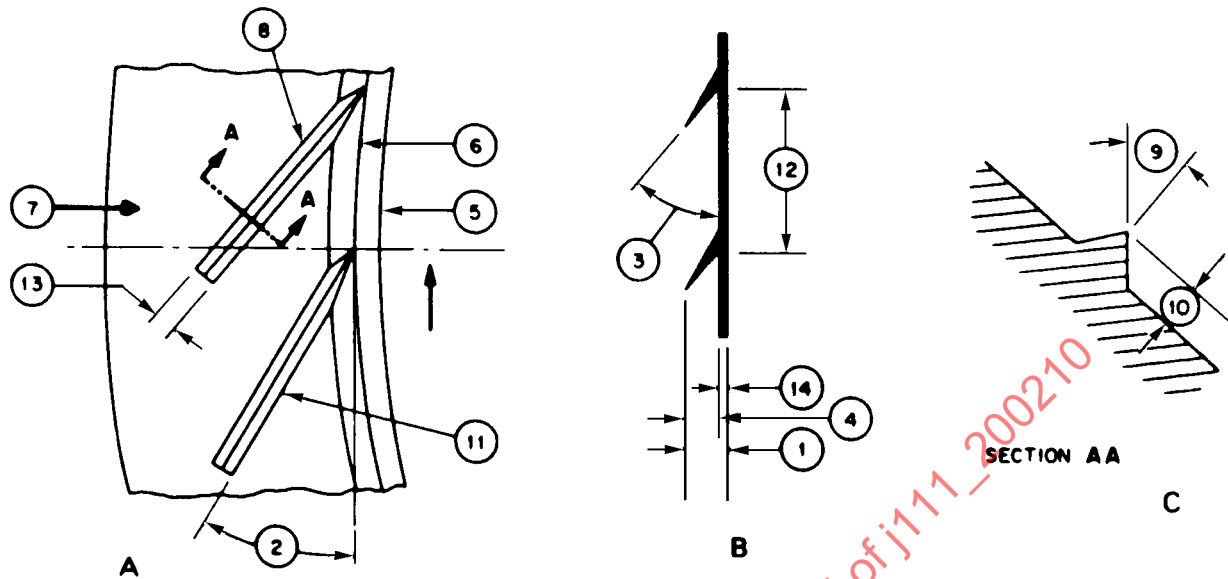
- 3.154 Resilience**—In elastomer or rubberlike materials subjected to and relieved of stress, resilience is the ratio of energy given up on recovery from the deformation to the energy required to produce the deformation. Resilience for an elastomer is usually expressed in percent.
- 3.155 Resistance, Cold**—The ability of a seal or sealing material to withstand the effects of a low temperature environment without loss of serviceability.
- 3.156 Resistance, Heat**—The ability of a seal or sealing material to resist the deteriorating effects of elevated temperatures.
- 3.157 Resistance, Ozone**—The ability of a material to withstand the deteriorating effects of ozone (surface cracking).
- 3.158 Rib (1-8, 2-26)**—A long, narrow projection which is normally triangular in cross-section and which is molded into the outside lip surface of a helix seal. It is oriented at an angle to the shaft axis. One end of the rib forms part of the seal-lip contact surface.
- 3.159 Rough Trim**—A trimmed surface with irregularities on the outside and inside lip surfaces in the immediate vicinity of the contact line.
- 3.160 Roughness**—A measure of the shaft surface texture which results from the finishing process. (See SAE J448a.)
- 3.161 Roughness, Axial Surface**—Surface roughness of a shaft measured in a direction parallel to the centerline axis.
- 3.162 Roughness, Circumferential Surface**—Surface roughness of a shaft measured in a direction (plane) normal to the centerline axis.
- 3.163 Run-In**—The period of initial operation during which the seal-lip wear rate is greatest and the contact surface is developed. Synonym: bedding-in.
- 3.164 Runout, Dynamic**—Twice the distance the center of the shaft is displaced from the center of rotation and expressed in TIR. That runout to which the seal lip is subjected due to the outside diameter of the shaft not rotating in a true circle. Synonym: runout, shaft.
- 3.165 Runout, Shaft**—See: runout, dynamic.
- 3.166 RWV**—See: variation, radial wall.
- 3.167 Scoop Trim**—A trimmed surface which is concave.
- 3.168 Scratch**—A shallow discontinuity in the seal material whereby no material is removed.
- 3.169 Scuffing**—Metal surface degradation resulting from adhesive wear.
- 3.170 Seal, Birotational**—A rotary shaft seal which will seal fluid regardless of direction of shaft rotation.
- 3.171 Seal, Dynamic**—A seal which has rotating, oscillating, or reciprocating motion between it and its mating surface, in contrast to stationary-type seal, such as a gasket.
- 3.172 Seal, Helix**—An elastomeric hydrodynamic lip seal having helical ribs on the outside lip surface.

- 3.173 Seal, Hydrodynamic**—A dynamic sealing device which utilizes the viscous shear and inertia forces of the fluid; their effect can be increased by design features such as a helically grooved or ribbed seal lip, to generate a pressure differential that opposes fluid flow.
- 3.174 Seal, Lip**—An elastomeric seal which prevents leakage in dynamic and static applications by reason of controlled interference between the seal lip and the mating surface.
- 3.175 Seal, Mechanical**—Any material or device that prevents or controls the passage of matter across the separable members of a mechanical assembly.
- 3.176 Seal, Radial**—A seal which exerts radial sealing pressure in order to retain fluids and/or exclude foreign matter.
- 3.177 Seal, Radial Lip**—A type of seal which features a flexible sealing member referred to as a lip. The lip is usually of an elastomeric material. It exerts radial sealing pressure on a mating shaft in order to retain fluids and/or exclude foreign matter.
- 3.178 Seal, Split**—A seal which has its primary sealing element split, approximately parallel to the shaft axial centerline. Typically used where conventional installation methods are impractical or impossible.
- 3.179 Seal, Unirotational**—A seal designed for applications having a single direction of shaft rotation.
- 3.180 Seal, Unitized**—A seal assembly in which all components necessary for accomplishing the dynamic sealing function are retained in a single package.
- 3.181 Sealer, Case OD**—A coating applied to the case OD to prevent leakage between the seal case and the housing bore.
- 3.182 Section, Flex (2-16)**—The portion of a seal lip which is bounded by the head and heel section of a lip seal. Its primary function is to permit relative motion between the seal lip and the case.
- 3.183 Section, Head (2-18)**—The portion of a lip seal which is generally defined by the inside and outside lip surfaces and the spring groove.
- 3.184 Section, Heel (2-15)**—The portion of a lip seal which is attached to the seal case and bounded by the flex section and the outside face.
- 3.185 Set, Compression**—The deformation which remains in rubber after it has been subjected to and released from a specific percent compression for a definite period of time at a prescribed temperature. Compression set measurements are for the purpose of evaluating creep and stress relaxation properties of rubber.
- 3.186 Set, Permanent**—The residual unrecoverable deformation in an elastomeric part after the load causing the deformation has been removed.
- 3.187 Side, Air**—That side of a seal which in normal use faces away from the fluid being sealed.
- 3.188 Silicone**—A type of elastomer having a basic polymer of dimethyl polysiloxane, with various attached vinyl or phenyl groups.
- 3.189 Slant, Seal**—The difference between the maximum and minimum axial dimensions from the seal-lip contact line to the outside face of the case.

- 3.190 Sleeve, Wear**—A replaceable metal ring, generally used in assemblies to eliminate expensive shaft replacement caused by grooving that may occur at the seal-shaft interface.
- 3.191 Slinger**—A washer-like device used for imparting radial momentum to a liquid in order to keep the latter away from the sealing interface. Often incorporated into a wear sleeve.
- 3.192 Spiral Trim**—A trimmed surface which has a spiral pattern.
- 3.193 Spring Axial Position (2-11)**—The axial distance between the projected intersection of the inside and outside lip surfaces and the centerline of the spring coil diameter (center plane of the spring) with the spring in position and the seal located on shaft.
- 3.194 Spring, Finger**—A spring consisting of a multiple number of cantilevered elements located circumferentially on a ring. It can be designed to produce either a radial or an axial force.
- 3.195 Spring, Garter (2-13, 3-6)**—A helically coiled wire with its ends connected to form a ring. It is normally used in tension for maintaining a radial sealing force between the sealing element of a radial lip seal and a shaft.
- 3.196 Stability, Dimensional**—The ability to retain manufactured shape and size after having experienced the combination of operating stresses and temperatures.
- 3.197 Step Trim**—A trimmed surface having a discontinuity perpendicular to the contact line.
- 3.198 Stick, Slip**—A friction related phenomenon in which the sealing element tends to adhere and rotate with the shaft surface momentarily until the elastic characteristics of the sealing element overcome the adhesive force, causing the seal lip to lose contact with the rotating shaft. This cycle repeats itself continuously and is normally associated with nonlubricated and boundary-lubricated conditions.
- 3.199 Surface, Contact (1B)**—The portion of the seal lip which circumferentially contacts the shaft to form the seal-shaft interface.
- 3.200 Surface Contamination**—Foreign matter on the seal surface.
- 3.201 Surface, Inside Lip (1-5, 2-29)**—The inside truncated conical surface of the lip, the minor diameter of which terminates at the contact point.
- 3.202 Surface, Outside Lip (1-7, 2-24)**—The outside truncated conical surface of the lip, the minor diameter of which terminates at the contact point.
- 3.203 Surface, Shaft (2-33)**—A cylindrical surface which mates with the inside diameter of the seal lips.
- 3.204 Surface Speed**—The linear velocity calculated from the shaft rotational speed, using the nominal shaft diameter.
- 3.205 Surface, Trim**—Synonym: surface, trimmed seal.
- 3.206 Surface, Trimmed Seal**—The lip surface formed by a knife cutting operation to develop the contact line.
- 3.207 Synthetic Rubber**—Synthetic elastomers made by polymerization of one or more monomers.
- 3.208 Tear**—The removal or separation of a portion of the sealing element.
- 3.209 Tear Resistance**—The property of an elastomeric material to resist tearing forces.

- 3.210 Tensile Strength, Ultimate**—The force per unit of original cross-sectional area at the moment of a specimen rupture.
- 3.211 Tension, Initial Spring**—The "preload" that has been wound into the coils of a spring during the coiling operation.
- 3.212 Test, Accelerated Life**—Any set of test conditions designed to reproduce in a short time the effects obtained under service conditions.
- 3.213 Test, Bench**—A laboratory test in which the functional operating conditions are approximated, but the equipment is conventional laboratory equipment and not necessarily identical to that in which the product will be used.
- 3.214 Test, Field**—A test performed in the actual environment in which the product will be used.
- 3.215 Test, Flex**—A laboratory method used to evaluate the resistance of a material to repeated bending.
- 3.216 Test, Life**—A laboratory procedure used to determine that period of operation which a component or assembly will operate until it no longer performs its intended function.
- 3.217 Texture, Shaft Surface**—A term used to describe the quality, appearance, or characteristic of the shaft surface resulting from operations, such as grinding, polishing, burnishing, etc. See SAE J448a for additional information.
- 3.218 Thickness, Film**—In a dynamic seal, the distance separating the two surfaces which form the primary seal.
- 3.219 Trim**—The removal of the superfluous parts from a molded product, usually removal of parting line flash or feed sprues.
- 3.220 Trim, Crooked**—Synonym: slant, seal.
- 3.221 Trim, Rough**—Irregularities on the outside and inside lip surfaces in the immediate vicinity of the contact line.
- 3.222 Unbonded Flash**—Flash which does not properly adhere to the mating material to which it is intended to be bonded.
- 3.223 Under-Cure**—A degree of cure less than desired.
- 3.224 Value, "R" (2-11)**—Synonym: position, spring.
- 3.225 Variation, Contact Line Height**—The difference in the contact line height as measured at any two points on the contact line. Maximum contact line height variation is defined as seal slant.
- 3.226 Variation, Radial Wall**—The difference between the minimum and maximum radial wall dimensions when measured around 360 degrees of the seal lip, preferably without a spring.
- 3.227 Vibration, Torsional**—A vibration which has a circumferential or angular direction. It is often generated by a stick-slip action between mating seal faces.
- 3.228 Volume Swell**—Increase in physical size caused by the swelling action of a liquid, generally expressed as a percent of the original volume.

- 3.229 Vulcanization**—An irreversible process during which a rubber compound, through a change in its chemical structure, for example, cross-linking, becomes less plastic and more resistant to swelling by organic liquids and the elastic properties are confined, improved, or extended over a greater range of temperature.
- 3.230 Washer, Bonded (3-8)**—A flat, metal, washer-type ring which has been molded in place in the elastomeric material forming one of the sealing elements.
- 3.231 Weepage**—A minute amount of liquid leakage by a seal.
- 3.232 Wetting**—A formation of a continuous film of a liquid on a surface.
- 3.233 Width, Case (2-1)**—The total axial width of the seal case.
- 3.234 Width, Contact (1-1)**—The width of the lip contact area of a radial lip seal, measured in the axial direction.
- 3.235 Width, Helix Contact (1-4)**—The axial width of that portion of the contact surface of a helix seal which is formed by the helical ribs. It is equal to the total axial width of the contact surface minus the width of the static lip. See: seal, helix.
- 3.236 Width, Helix Seal Rib (1-13)**—The maximum width of a helical rib measured perpendicular to the rib's longitudinal axis.
- 3.237 Width, Static Lip Contact (1-14)**—The axial width of the contact surface developed by a static lip. See: seal, helix.
- 3.238 Wind-up, Spring**—The tendency of a garter spring with its ends assembled together to deform from a flat surface. Excessive spring wind-up results in the spring forming a "figure 8" configuration.



1. CONTACT WIDTH
2. HELIX ANGLE (PROJECTED)
3. HELIX CONTACT ANGLE
4. HELIX CONTACT WIDTH
5. INSIDE LIP SURFACE
6. CONTACT LINE
7. OUTSIDE LIP SURFACE
8. RIB
9. RIB ANGLE
10. RIB HEIGHT
11. RIB LEADING FACE
12. RIB PITCH
13. RIB WIDTH
14. STATIC LIP CONTACT WIDTH

FIGURE 1—NOMENCLATURE FOR OUTER LIP SURFACE AND CONTACT SURFACE. DETAILS OF RADIAL LIP SEAL (HELIX SEAL TYPE): (A) VIEW IN PLANE OF OUTSIDE LIP SURFACE, (B) VIEW OF CONTACT SURFACE, (C) CROSS SECTION OF RIB.