

Accessory Seal: A seal which is used for sealing accessory equipment. On various engines, the term 'accessory seal' pertains to a seal which is employed for sealing an accessory shaft in the gear box, such as a shaft for operating an oil pump, a fuel pump, a generator, a starter, or a de-oiler.

Anti-Extrusion Ring: A ring which is installed on the low-pressure side of a seal or packing, in order to prevent extrusion of the sealing material.

Anti-Rotation Device: A device, such as a key, used to prevent rotation of one component relative to an adjacent component in a seal assembly. Ref ***Shear Nitch and Torque Pin***.

Asperities: Minute imperfections on the seal face or surface of the mating ring which are the result of normal surface-finishing processes.

Assembly Lock: The element of the seal which retains the several components in the assembly installation.

Automatic Seal: Seal which are activated by the pressure of the fluid which they are to seal.

Axial Seal: See ***Face Seal***.

Back Ring: A split or multi-segment ring in a circumferential seal assembly. It is used for restricting axial leakage flow and accomplished this by covering the gaps between segments of the primary-seal ring.

Back-to-Back Ring Seal: An adaptation of the simple ring seal, which employs two identical elements loaded axially by a spring placed between the rings. The spring forces the elements against mating rings on either side.

Back-Up Ring: See ***Anti Extrusion Ring***.

Balance Diameter: That diameter of a face seal at which the resultant force is considered to be acting. This force is obtained from area integration of the pressure profile which exists on the fore-and-aft surfaces of the axially movable portion of the seal assembly. For a balanced seal, the secondary-seal land diameter and the balance diameter are the same.

Balanced Piston Ring: A piston ring, the geometric design of which includes face, bore, and/or relief grooves or cuts which are employed to minimize pressure forces and thus to reduce friction forces.

Balanced Seal: A term which is applied to a mechanical seal constructed so that the net hydraulic or pneumatic force acting to open or close the seal is essentially zero. In this device, the spring provides the only significant face load acting to close the seal.

Bedding-In: See *Run-In*.

Belleville Spring: A washer which has a slightly conical shape and acts as a spring when compressed axially.

Bellows Convolution: In a welded bellows, an assembly of two single-ply or multiple-ply formed plates or diaphragms, welded at either the inner diameter or the outer diameters. In a formed bellows, a one-piece, thin-walled, single-ply or multiple-ply, ring-like member having a deep fold or corrugation, generally of "U" shaped section.

Bellows Damper: A device used for damping-out vibrations which can be shorten bellows life. One type consists of a simple metal member which is spring-loaded against some exterior portion of the bellows, or against the attached primary seal or its carrier.

Bellows Diaphragm: See *Bellows Plate*.

Bellows Effective Span: That portion of the bellows span which actively enters into the deflection and pressure response.

Bellows Pitch: The number of bellows convolutions per inch.

Bellows Plate: A single, thin, metallic disc. When adjacent disc are welded together at their inner and outer edges, they form the bellows assembly.

Bellows Seal: A type of mechanical seal which utilizes a bellows for providing secondary sealing.

Bellows Span: The total radial section of a bellows: One-half the difference between the inner and outer diameter of the bellows.

Bi-Directional Seal: A seal which is designed for applications in which shaft rotation is in either direction. Ref **Uni-rotational Seal**

Bonded Washer: A flat, metal, washer-type ring which has been molded in place in the elastomeric material forming one of the sealing elements.

Boot Seal: A seal the primary component of which is an accordion or bellows-type member. It is attached solidly to the two members between which sealing is desired. This type of seal is useful only for sealing where there is oscillatory reciprocating, or angular motion involved.

Bore Seal: A device the outside-diameter surface of which mates with a bore surface. It provides sealing between these two surfaces.

Bounded Seal Case: A design feature of a type of radial lip seal wherein the heel of the lip seal is attached to the seal case by an adhesive during the molding operation.

Breakaway Torque: See **Starting Torque**.

Buffer Zone: A chamber or cavity which is adjacent to the mechanical seal and is filled with the buffer fluid. Ref **Face Seal; Buffer Fluid**.

Buffered Seal: See **Pressurized Seal**.

Burner Flow: A fluid which is introduced between two seal elements, quite often at a pressure which is higher than the pressure of the fluids on either side of the seal assembly.

Bushing Seal: See **Seal Bushing**.

Carbonization: A reduction of hydrocarbons, resulting in the formation of carbonaceous residue.

Carry-Over Block: An abrupt, step-like protrusion from the land of a labyrinth seal. The blocks are positioned between the knife-edges to produce additional turbulence in the leakage fluid and to increase sealing efficiency.

Cascade: A term applied to hydrostatic-seal orifices when such orifices are in series.

Cascaded Seals: Seals which are arranged in series and which have a regulated pressure between adjacent pairs.

Cavitation: A condition in which vapor or gas bubbles occur locally in liquids, normally in an area where pressure decrease abruptly. The subsequent collapse of the bubbles causes high local impact pressure which can contribute to seal wear.

Circulation Connections: The inlet and outlet ports of the seal cavity, which receive the piping or tubing for circulating liquid in close proximity to the mechanical seal.

Circumferential Seal: A seal composed of a continuous ring or of one or more split or segmented rings. When the rings are keyed to the rotating member, their out-diameter surfaces mate with the stationary housing by means of a controlled annular clearance between the two.

Clearance Seal: A seal which limits the leakage between a rotating or reciprocating shaft and a stationary housing by mean of a controlled annular clearance between the two.

Clinched Seal Case: A design feature of a type of radial lip seal wherein the heel of the lip seal is attached to the seal case by clamping it between two convolutions, or folds, of the case.

Closing Bias: See ***Overbalanced Seal.***

Coil Spring: A type of spring which is formed from wire wrapped in a helix. The spring so formed encloses a volume in the shape of a right cylinder. It is normally used in multiples, with the individual springs oriented about the circumference of a seal assembly. Thus placed, the springs transmit a uniform closing force on the sealing face.

Collar: A rod seal having a lip around its inner circumference and a radially extending clamping flange. It is referred to as "mating ring" in a mechanical face-seal assembly.

Composite Seal: A seal which is composed of two or more materials of differing flexibility. The seal has overlapping joints for blocking leakage at the gaps. An axial spring load seat the ring against the wall of its containing cartridge.

Compression Set: The difference between the thickness of a gasket or static seal before the seal is compressed and after it is released from compression. Compression set is normally expressed as a percentage of the total compression.

Contact Load: See *Face Pressure*.

Contact Pressure: The average pressure exerted by the lip of a radial lip seal on a shaft. This pressure is computed by dividing the total radial lip force by the total contact area.

Contact Width: The width of the lip contact area of a radial lip seal, measured in the axial direction.

Contracting-Ring Seal: A type of circumferential seal which utilizes a ring which is spring-loaded radially inward against a shaft. The ring is either gapped or segmented, in order to have radial flexibility. The seal has overlapping joints for clocking leakage at the gaps. An axial spring load seats the ring against the wall of its containing cartridge.

Controlled Gap Seal: A seal which is designed to maintain a constant clearance with a shaft.

Cover Ring: A ring which is mounted on the outside diameter of the primary seal ring to cover the gap in the latter. It can be a piston-ring type, or it can be made of several separate sections.

Crooked Trim: See *Seal Slant*.

Cup Seal: A seal which attaches to a piston head and has an outer lip which extends axially from a flat clamping area.

Cup: A rigid, circular-shaped, thin-walled member which forms the external structure of a package type face seal.

Diametric Tension: A term which is used to describe the load necessary for closing a piston ring to a specified diameter. It is applied through the diameter of the ring at points which are equidistant from the gap. The diametric tension has a value which is 2.27 times the tangential tension.

Diaphragm Seal: A face seal or a bore seal, or a combination of the two, the secondary seal of which consists of a flexible.

Differential Pressure: A difference in pressure between two points in a system, such as one point immediately upstream of a seal and the other immediately downstream.

Dimensional Stability: The ability to retain manufactured shape and size after having experienced the combination of operating stresses and temperatures.

Double Acting Seal: See *Bi-Directional Seal*.

Dry-running: Running without liquid present at the seal surface.

Durometer Reading: An index which is used for ranking the relative hardnesses of elastomers.

Dynamic Seal: A seal which has rotating, oscillating, or reciprocating motion between its components, in contrast with a stationary-type seal, such as a gasket.

Effective Diameter: See *Balance Diameter*.

Effective Leakage Area: The orifice-flow area which will result in the same calculated flow for a given pressure drop as is measured for the seal in question. This concept is useful when comparing the leakage performance of seals of different sizes and designs and of seals operating under different conditions.

End Gap: The distance between the ends of a piston ring at the gage diameter.

End Plate: A plate which holds the non-rotating assembly of a mechanical seal and connects it to the seal chamber.

End Seal: See *Face Seal*.

Extended Length: The total axial length of the seal assembly, with no compression load on the springs.

Extension Spring: An open or close wound, helically coiled wire spring which resists extension when a tensile force is applied to it.

External and Outboard Seal: See *Outside Mounted Seal*.

Externally Pressurized Seal: A seal which operates on a thin film at the interface with the mating surface. The film is formed by high-pressure fluid which is brought to the interface at some mid-dam location and which is at a pressure equal to or higher than, the upstream seal pressure. Ref *Hydrostatic Seal*.

Extrusion Gap: The clearance on the low-pressure side between components which confine the seal.

Extrusion Ring: See *Anti-Extrusion Ring*.

Extrusion: Permanent displacement of part of a seal into a gap provided for such displacement, under the action of fluid power.

Face Pressure: the face load, computed as the sum of the pneumatic or hydraulic force and the spring force, divided by the contacting area of the sealing lip. For lip seals and packing, the face load also includes the interference load.

Face Seal: A device which prevents leakage of fluids along rotating shafts. Sealing is accomplished by a stationary primary-seal ring bearing against the face of a mating ring mounted on a shaft. Axial pressure maintains the contact between seal ring and mating ring.

Face-Seal Hysteresis: The difference in load for the same deflection as read from two load deflection curves obtained when compressing and decompressing a face seal.

Filler Ring: A ring generally of "U" or "V" shaped cross-section, which fills the recess of a packing.

Film Thickness: In a dynamic seal, the distance separating the two surfaces which form the primary seal.

Finger Spring: A spring which has flexible fingers. The latter can be designed to produce either a radial or an axial sealing force.

Flash: Thin imperfections on the elastomeric portion of a seal, formed by extrusion of the elastomer at the parting lines in the mold cavity.

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.

Flinger: See *Slinger*.

Floating Labyrinth Seal: A labyrinth-type seal the non-rotating member of which is capable of radial self-adjustment. Ref *Labyrinth Seal*.

Floating Ring Seal: A ring-type seal which is free to float radially and axially and is not restrained from rotating. It is a close-clearance device, its leakage following the laws of resistance flow rather than of orifice flow; its L/D ration is small.

Flush: A small amount of fluid which is introduced into the seal chamber in close proximity to the sealing faces and usually used for cooling the seal faces. See Quench.

Free Length: The uncompressed axial length of a face-seal assembly. The term is also applicable to a spring or a bellows.

Free-Lip Seal Inner Diameter: The inner diameter of the seal lip, measured in the free state without the spring installed.

Functional Lip Diameter: 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.

Garter Spring: A helically coiled wire spring with its ends connected. It is used in tension for maintaining a radial sealing force between the sealing element of a radial lip seal and a shaft.

Gasket: A device which is used between two relatively static surfaces to prevent leakage. It is made of any of several deformable materials. See *Static Seal*

Gland Closure: See *Gland Follower*.

Gland Follower: The axially movable part of a stuffing box, which is forced against the seals by means of a manual adjustment, resulting in an increase in radial sealing force.

Gland Plate: An end plate which connects the non-rotating assembly of a mechanical seal to the stuffing box.

Gland: The cavity of a stuffing box.

Hard Face: A seal facing of high hardness, which is applied to a softer material, such as by flame-spraying, plasma-spraying, or electroplating. A hard face can also be achieved by nitriding, carburizing, or welding.

Hat Ring: See *Collar*.

Head: See *Seal Head Section*.

Header: A rigid ring used to prevent axial movement of a seal, or seals, within a gland.

Heel: See *Seal Heel Section*.

Helix Contact Width: The axial width of that portion of the contact surface of a helixseal 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. Ref *Helixseal*.

Helix Seal: See *Windback Seal*.

Helixseal Rib Angle: The angle between 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.

Helixseal Rib Height: The height of the helical ribs, measured perpendicular to the outside lip surface.

Helixseal Rib Pitch: The circumferential displacement between adjacent helical ribs of a lip seal.

Helixseal Rib Width: The maximum width of a helical rib measured perpendicular to the rib's longitudinal axis. Ref *Helixseal*.

Helixseal: An Elastomeric, hydrodynamic, radial lip seal having the helically disposed elements on the outside lip surface.

Housing Bore: A cylindrical surface which mates with the outside face of the seal outer case.

Housing: A rigid structure which supports and locates the seal assembly with respect to the shaft.

Hydraulic Diameter: For a bellows seal, the effective balance diameter or equivalent piston diameter at a specific level or pressurization and bellows compression.

Hydraulic or Pneumatic Balance: A term which is susceptible to only mathematical definition. It is defined as the ratio of two areas: The area of the sealing face which is bounded by balance diameter and the inside diameter of the sealing face, and the area which is bounded by the outer and inner diameters of the sealing face.

Hydraulic or Pneumatic Load: The axial load resulting from fluid-pressure forces only.

Hydrodynamic Seal: A seal which has special geometric features on one of the mating faces. These features are designed to produce interfacial life, which arises solely from the relative motion between the stationary and rotating portions of the seal.

Hydroseal: An elastomeric, hydrodynamic, radial lip seal having the helically disposed elements formed on the shaft surface.

Hydrostatic Seal: A Seal which incorporates features which maintain an interfacial film thickness by means of pressure. The pressure is provided either by an external source or by the pressure differential across the seal. The interfacial pressure profile of a face seal is normally speed-dependent; The interfacial pressure profile of the hydrostatic seal is not speed-dependent.

Hydrostatic Step: A circumferential step which is cut in the nose section of a face seal. Its purpose is to generate stiffness characteristic of the fluid film in the interface. Ref ***Self-Acting Face Seal***.

Initial Spring Tension: The tension in a spring at the time of initial seal installation, the spring being most commonly of the garter type.

Injection: See ***Flush***. Ref ***Quench***.

Inner Knife-Edge Diameter: The diameter which corresponds to the tip of the smallest-diameter knife-edge in a stepped labyrinth seal.

Inner Land Diameter: The diameter which corresponds to the smallest diameter land-step surface in a stepped labyrinth seal.

Inner Seal Case: 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, and lip-clamping devices.

Inside Seal Face: That surface of the inner case which faces the exterior of the lip-seal assembly.

Inside-Face Inner Diameter: The inner diameter of the inner case of a radial lip seal.

Inside-Mounted Seal: A mechanical seal with its seal head mounted inside the container which holds the fluid to be sealed.

Interface: 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.

Interference Load: The pressure loading which arises at the surface to be sealed, due to the deformation of the seal materials on assembly.

Internal and Inboard Seal: See *Inside-Mounted Seal*.

Internally Pressurized Seal: A seal the sealing components of which are activated by pressure from the inside diameter of the seal face.

Knife-Edge Diameter: The diameter which corresponds to the farthest outward protrusion, or to the farthest inward protrusion, of the knife-edge of a labyrinth seal.

Knife-Edge Ring: A ring shaped member in a labyrinth seal, in which the knife edges are machined or on which the knife-edges are mounted.

Knife-Edge: The narrow, circumferential knife-like edge or lip on a labyrinth seal which combined in series with other knife-edges, accomplished the throttling which achieves the seal.

Labyrinth Mushrooming: Degradation of the knife edges, due to contact with the stationary member, with resulting clearance and leakage.

Labyrinth Seal: A clearance-type seal in which the fluid being sealed must traverse a tortuous path in order to escape. Ref: Slant Tooth Labyrinth; Staggered Labyrinth; Stepped Labyrinth; Straight-Through Labyrinth; Straight-Through, Carry Over-Block Labyrinth.

Labyrinth-Seal Pitch: The number of knife-edges per inch in a labyrinth seal. Also, the number of throttlings per inch.

Land Diameter: The diameter of the cylindrical surface which is in closest proximity to the knife-edges and which, in combination with the knife-edges, effects the seal.

Land Ring: A ring shaped member in a labyrinth seal, which is either a straight-walled cylinder or a cylinder with axial steps. The land ring forms a clearance with the knife-edges effecting the seal.

Land: The cylindrical surface of the land ring in a labyrinth seal, which makes the closest approach to the knife-edges.

Leakage Rate: The quantity of fluid passing through a seal in a given length of time. For compressible fluids, it is normally expressed in standard cubic feet per minute (SCFM), and for incompressible fluids, in terms of cubic centimeter per unit time.

Leakage: See *Leakage Rate*.

Lifting Bias: See *Underbalance Seal*.

Line of Contact: The line which is formed by the intersection of the outside and inside lip surfaces.

Lip Force: 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.

Lip Inner Diameter: The inner diameter of the seal lip, measured with the spring installed.

Lip Opening Pressure: The pressure necessary for flowing air at 10,000 cubic centimeters per minute 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.

Lip Seal: An elastomeric or metallic seal which prevents leakage in dynamic and static applications by employing a scraping or wiping action, with a controlled interference between the seal lip and the mating surface.

Lug Spring: See **Finger Spring**.

Magnetic Seal: A seal which uses magnetic material, instead of springs or a bellows, to provide the closing force.

Major Knife-Edge Diameter: The diameter which corresponds to the larger of the two knife-edge diameter in a staggered labyrinth seal.

Major Land Diameter: The diameter which corresponds to the larger of the two land diameters in a staggered labyrinth seal.

Marcel Spring: See **Wave Spring**.

Mating Face: The lapped face on a seal mating ring which effects the primary seal when in close proximity to the seal lip. This face forms one of the two boundaries of the interface.

Mating Ring: A disc or ring shaped member, mounted either on a shaft or in a housing, which provide the primary seal when in proximity to the face of an axially adjustable face-seal assembly.

Mechanical End Face Seal: See **Face Seal**.

Mechanical Load: The load which is applied to a seal to ensure contact between the mating surfaces, without regard to fluid pressure.

Mechanical Seal: See **Face Seal**.

Metallic Belleville Bellows: A bellows with Belleville-type diaphragms which are shaped and welded into a convoluted structure.

Metallic Nesting: A bellows design wherein the shape of the diaphragms is such that they can nest when the bellows is not distended.

Minimum Compressed Length: The length of a spring, bellows or face-seal assembly which has been loaded to its solid height.

Minor Knife-Edge Diameter: The diameter which corresponds to the smallest of the two knife-edge diameters in a staggered labyrinth seal.

Minor Land Diameter: The diameter which corresponds to the smaller of the two land diameters in a staggered labyrinth seal.

Molded Angle: The angle between the molded face of a seal lip and the seal axis.

Molded Face: See *Seal Toe Face*.

Molded Seal Case: A design feature of a type of radial lip seal wherein the lip and case are made integral in the molding process.

Molecular Seal: A seal which is basically of the wind back type, but which is used for sealing vapors or gases. Because of this use, the grooves and lands are dimensioned differently than those of the windback seal.

Nesting Metallic Bellows: A bellows with diaphragms shaped to allow nesting of the convolutions.

Offset: The radial distance between the axis of the seal bore and the axis of shaft rotation.

Operating Length: For an installed face-seal assembly, the axial distance from the seal face to a reference plane. The term is also applied to the dimensional range within which a bellows can safely be operated.

Opposed Seal: Two seal which are so arranged that they face each other. In this arrangement, the two seals heads usually ride against the faces of a common mating ring.

Optical Flat: A transparent disc, usually of fused quartz, which has been lapped flat and polished to within approximately 0.1 lightband flatness on one face or on both faces. It is used to measure flatness in conjunction with a monochromatic light source.

Outer Knife-Edge Diameter: The diameter which corresponds to the largest-diameter land-step surface in a stepped labyrinth seal.

Outer Land Diameter: The diameter which corresponds to the largest-diameter land-step surface in a stepped labyrinth seal.

Outer-Case Inner Diameter: The inside, or smallest, diameter of the outer case on a lip-seal assembly.

Outside Seal Face: The surface of the seal case which is perpendicular to the shaft axis and which is not in contact with the fluid being sealed off.

Outside-Mounted Seal: A mechanical seal with its seal head mounted outside the container which holds the fluid to be sealed.

Outward Flow: A term which is applied to a face-seal flow condition wherein the flow is radially outward due to the fluid pressure being higher at the inner diameter of the seal lip.

Overbalanced Seal: A seal, the net hydraulic or closing force on which is positive; that is, applied pressure tends to close the seal. This is accomplished by the design balance diameter of the seal.

Package Seal: A term normally applied to a seal which is of a certain standard size and which is an assembly composed of a primary seal, a secondary seal, and a spring or bellows. All of these components are contained in a housing. The result is a convenient cartridge which can be inserted in a properly sized recess in a machine.

Packing: Any of a variety of materials, such as leather, carbon, cotton, or hemp, for fitting into a stuffing box. The packing is caused to make sealing contact with the shaft to be sealed adjustment of a gland which compresses the material against the base of the stuffing box.

Piston Ring: A ring with a basically rectangular cross-section and a single small gap. It seals by expanding or contracting against a mating cylindrical surface.

Piston-Ring Carrier: Ref *Secondary-Seal Carrier*.

Piston-Ring Packed Seal: An end-face seal assembly in which one or more piston rings are the secondary sealing means permitting axial motion.

Pitting: Surface voids usually caused by mechanical erosion, chemical corrosion, or cavitation.

Positive Drive: See *Anti-Rotation Device*.

Positive-Contact Bushing: A bushing, the inside diameter of which has direct contact with the outside diameter of a shaft or sleeve. Radial and axial clearances are provided in the housing.

Positive-Contact Seal: A seal, the primary function of which is achieved by one surface mating with another. Positive-contact seals include lip circumferential and face types of seals.

Preformed Packing: Molded packing rings used in a stuffing box.

Pressure Balance: See *Hydraulic or Pneumatic Balance*.

Pressurized Seal: A term which is applied to either of the two seals used in a system for preventing the mixing of two fluids. In this system, the pressure in the inner compartment, that is, the pressure between the two seals, is maintained at a higher level than that in the two outer compartments. Ref *Buffer Fluid*.

Primary Leakage: Leakage of a mechanical seal, with the fluid escaping from the region between the end faces of the primary sealing elements.

Primary Seal: The normally non-rotating part of a mechanical seal, wherein motion relative to the mating ring or shaft is high, as contrasted with the relatively little motion of the secondary seal.

Primary-Seal Carrier: That component of a face seal assembly or its surrounding stationary structure which contains grooves or slots into which the secondary seals are mounted.

Primary-Seal Ring: A ring-shaped member in a face seal or in a ring seal. It is normally made of carbon. The face of the primary-seal ring forms the primary seal with the mating ring.

Pumping Ring: A simplified impeller within a chamber, which circulates fluid through a closed loop for cooling purpose.

Pusher-Type Seal: A mechanical seal in which the secondary seal is pushed along the shaft or sleeve to compensate for face wear.

PV Factor: An arbitrary term which is the product of face pressure and relative sliding velocity. The units customarily used are pounds per square inch and feet per minute. The term is normally considered to provide some measure of severity of service and thus relates to a seal's wear life.

Quench: A neutral fluid which is introduced into a seal chamber or cavity for the purpose of diluting fluid which may have leaked through a seal. Ref **Flush**.

Radial Clearance: Half of the total difference between the nominal land diameter and the nominal knife-edge diameter.

Radial Height Dimension: The total radial distance from the bore of a ring-seal assembly to the outer surface of the outer case of the assembly.

Radial Lip Seal: A radial type 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.

Radial Seal: A positive contact seal which exerts radial sealing pressure over an annular shaft area, in order to retain fluids and/or exclude foreign matter.

Resiliency: The property of a sealing material which provides the ability to maintain constant sealing pressure, despite wear, misalignment, or out-of-round conditions.

Retainer: The portion of a seal which retains the seal ring.

Retaining Ring: A removal, discontinuous, lock ring which is used in groove in order to limit movement or locate a part.

Rib Leading Edge: The edge of the helix-lip seal rib, which faces the direction from which the interface fluid is being pumped by the shaft.

Rib: A long, narrow projection which is normally triangular in cross-section and which is molded into the outside lip surface of a helix-type lip seal. It is oriented at an angle to the shaft axis. One end of the rib forms part of the seal-lip contact surface.

Ring Seal: A piston-ring type of seal which assumes its sealing position under the pressure of the fluid to be sealed.

Rotary Seal: A mechanical seal which rotates with a shaft and is used with a stationary mating ring.

Rotating Seal Face: See *Mating Ring*.

Rotation Lock: Ref *Anti-Rotation Device*.

Rotor: See *Mating Ring*.

Rough Trim: Irregularities on the outside and inside lip surface in the immediate vicinity of the contact point. Ref *Radial Lip Seal*.

Run-In: The period of initial operation during which the seal-lip wear rate is greatest and the contact surface for a circumferential, or bore contact, seal.

Runner: A cylindrically shaped member attached to a shaft in order to provide the contact surface for a circumferential, or bore-contact seal.

Running Torque: The torque which is required for sustaining a shaft in rotary motion when operations are under stabilized conditions.

Safety Zone: See *Buffer Zone*.

Scraper: An exclusion seal which has metallic or other firm lips or scraping elements. It serves to remove foreign materials from a reciprocating shaft.

Screw Seal: See *Windback Seal*.

Scuffing: A mild degree of galling which results from the welding of asperities due to frictional heat. The welded asperities break, causing surface degradation.

Seal Assembly: A group of detail parts, or a unitized assembly, 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.

Seal Base: See *Outside Seal Face*.

Seal Bore: The diameter which corresponds to the innermost surface of a face-seal assembly. The surface referred to can be on the primary-seal ring, the primary-seal carrier, or the secondary-seal carrier, whichever has the smallest inner diameter.

Seal Bushing: A type of seal consisting of a close fitting sleeve within which the shaft rotates. Leakage is controlled by the clearance between the shaft and the bushing.

Seal Case Bore: See *Outer-Case Inner Diameter*.

Seal Case Width: The total axial width of the seal case. Ref *Radial Lip Seal*.

Seal Case: A rigid member to which the seal lip is attached.

Seal Cavity Pressure: the pressure on the upstream or high-pressure side of a seal assembly.

Seal Cavity: The annular area between a bore and a shaft, into which a seal is installed

Seal Chamber: See *Seal Cavity*.

Seal Contact Approach Angle: See *Seal Outside Lip Angle*.

Seal Contact Point: The point of intersection between the outside and inside lip surfaces of a radial lip seal.

Seal Contact Surface: The portion of the seal lip which circumferentially contacts the shaft to form the seal-shaft interface.

Seal Flex Section: The portion of a seal lip which is bounded by the head and heel sections of a lip seal, and which has as its primary function the permitting of relative motion between the seal lip and the case.

Seal Head Section: The portion of a lip seal which is generally defined by the inside and outside lip surfaces and the spring groove.

Seal Head: An assembly of parts comprising the complete functional unit of the axially movable part of a mechanical face seal.

Seal Heel Section: The portion of a lip seal which is attached to the seal case and bounded by the flex section and the outside face.

Seal Helix Angle: The angle between a helical rib and the line of contact in the plane of the surface of the seal outside lip.

Seal Helix Contact Angle: The angle between the contact surface of the rib leading edge and the line of contact.

Seal Housing: A structure which supports and locates the primary seal.

Seal Inside Lip Angle: The angle between the inside lip surface and the axis of the seal case.

Seal Inside Lip Surface: The inside truncated conical surface of the lip, the minor diameter of which terminates at the contact point. It is formed by cutting with a knife, or by a similar point.

Seal Lip Diameter: The inner diameter of the seal lip, measured in the free state with the spring installed.

Seal Lip Length: The axial distance between the thinnest part of the flex section and the contact point.

Seal Lip: The part of a lip seal which comes in closest proximity to the mating surface and which, together with the mating surface, forms the primary seal. The term 'seal lip' is sometimes used for describing a section of a mechanical face seal. The preferred term, in the latter case, is seal nose.

Seal Nose: The part of the primary seal ring of a face seal which comes in closest proximity to the mating surface and which together with the mating surface, forms the primary seal.

Seal Outer Case: A thin-wall metal structure which encases the lip-seal assembly and contains the inner case, the primary-seal ring, the spring parts, and the secondary seal.

Seal Outer Diameter: The external diameter of a lip-seal assembly, which normally corresponds to the out diameter of the outer seal case. In a package-type mechanical face seal, the diameter which corresponds to the outside surface of the cup.

Seal Outside Lip Angle: The angle between the outside lip surface and the axis of the seal case.

Seal Outside Lip Surface: The outside truncated conical surface of the lip, the minor diameter of which terminates at the contact point. It is formed by cutting with a knife, or by a similar operation.

Seal Plate Face: See *Mating Face*.

Seal Plate: See *Mating Ring*.

Seal Slant: The difference between the maximum and minimum axial dimensions from the seal-lip contact point to the outside face of the case. Ref *Radial Lip Seal*.

Seal Spring Groove: A depression formed in the head section of the seal lip. It is generally semicircular in form and usually serves to accommodate a garter spring.

Seal Spring Retaining Lip: The portion of the lip seal head section which is bounded by the spring groove and the toe face and which holds the extension spring in position.

Seal Static Lip: The section of the helixseal lip of a radial lip seal, which is in continuous circumferential contact with the shaft being sealed.

Seal Toe Face: The annular surface of the spring retaining lip

Seal Trim Surface: See *Seal Inside Lip Surface*.

Seal Unsprung Lip Diameter: See *Free-lip Seal Inside Diameter*.

Seal Width: The over-all axial dimension of the lip-seal assembly. This normally corresponds to the axial width of the outer seal case.

Seal: A device designed to prevent the movement of fluid from one chamber to another, or to exclude contaminants.

Sealing Dam: See *Seal Nose*.

Sealing Element: The normally flexible elastomeric component of a lip seal assembly, which rides against the rotating surface and effects the seal.

Sealing Face: The lapped surface of the seal, which comes in closest proximity to the face of the mating ring of a face seal, thus forming the primary seal. With reference to lip seals, the preferred term is 'seal contact surface'.

Sealing Unitized Assembly: A seal assembly in which all components necessary for accomplishing the complete sealing functions are retained in a single package.

Sealing-Face Inner Diameter: The diameter which corresponds to the inner edge of the sealing face on the seal nose.

Sealing-Face Outer Diameter: The diameter which corresponds to the outer edge of the sealing face on the seal nose.

Sealing-Face Width: The radial distance from the inside edge to the outside edge of the nose part of the sealing face.

Seal-Plate Packing: A secondary sealing unit, in the form of a static gasket, which is used for preventing leakage between the mating plate and the machines element (Usually a shaft) to which the unit is attached.

Seat: See *Mating Ring*.

Seating Bias: The hydraulic or pneumatic balance designed into a seal in order to achieve a certain face contact load. The use of the terms "overbalanced" or "underbalanced", rather than the term "seating bias", is preferred.

Secondary Seal Lip: A short, non-spring-loaded lip which is located at the outside seal face of a radial lip seal to protect the shaft and to prevent ingress of atmospheric contaminants. There is either no interference, or only limited interference, between the lip and its mating shaft.

Secondary Seal: A device, such as bellows, piston ring, or "O" ring, which allows axial movement of primary seal of a mechanical face seal, without undue leakage.

Secondary-Seal Carrier: That component of a face seal assembly or its surrounding stationary structure which contains grooves or slots into which the secondary seals are mounted.

Secondary-Seal Land Diameter: The diameter of the surface of the face-seal assembly which contacts the secondary seal. The sealing land may also be on a stationary surface which is not a part of the seal assembly. For a balanced seal, this diameter is also the balance diameter.

Secondary-Seal Land: The cylindrical surface against which the secondary seal rides to effect the secondary sealing.

Self-Acting Face Seal: A type of mechanical face seal which has a face with a single circumferential step. This design feature results in the average film pressure increasing as the closing force increase beyond that which corresponds to the design clearance. Ref *Hydrostatic Step*.

Shaft Diameter: The outside diameter of the shaft at the axial location where the seal is mounted.

Shaft Eccentricity: The radial distance which the geometric center of a shaft is displaced from the axis of shaft rotation.

Shaft Interference: The radial interference between the inner diameter of the seal lip and the out diameter of the shaft.

Shaft Out-of-Round: The deviation of the shaft 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.

Shaft Roughness: Those irregularities on the surface of a shaft which are within 0.030 inch-roughness width cut off. Roughness is designated as the arithmetic average (AA) deviation of the height of the irregularity above the centerline of the roughness-surface trace; it is expressed in micro-inches.

Shaft Runout: Twice the distance which the center of a shaft is displaced from the axis of rotation; that is, twice the eccentricity.

Shaft Seal: See *Bore Seal*.

Shear Nitch: An anti-rotation device formed by shearing a small section of the seal cup and bending it into a slot cut in the primary seal carrier.

Single-Acting Seal: See *Unidirectional Seal*.

Slant-Tooth Labyrinth: a type of labyrinth seal with slanted knife-edges, which tend to increase sealing effectiveness by more complete dissipation of kinetic energy of the fluid.

Slinger: A washer-like device which is mounted next to a seal plate and used from imparting radial momentum to a liquid in order to keep the latter away from the sealing interface.

Snap Ring: See *Retaining Ring*.

Solid Length: See *Minimum Compressed Length*.

Solid Seal Ring: An endless seal ring made of a single material, as opposed to one with a coating.

Spiral Wound Gasket: A device which is formed by winding a metal and a suitable filler layer into a spiral. It is usually "V" shaped and it seals statically. See **Static Seal**.

Split Seal: A seal which has its primary sealing elements split in a plane parallel to the axis of the shaft, with the result that, instead of the ring being continuous, they are each essentially two semicircles. Modified designs of lip seals feature units with a single lip separation and with one or more separations of the metallic stiffening members.

Spreader Spring: A spring which is designed to produce a sealing force against the lips of both "U" and "V" type seal packings.

Spring Adapter: A ring which serves as a spring seat for uniformly transmitting the spring force to the seal member. It may have any one of a variety of sections.

Spring Backwind: See *Initial Spring Tension*.

Spring Force: The axial force exerted by a spring to overcome dynamic force and any secondary-seal friction force.

Spring Free Length: The total unconfined length of a spring. For a garter spring, it would not include the nib length.

Spring Mean Coil Diameter: The spring coil diameter minus the spring diameter.

Spring Outside Coil Diameter: The outer diameter of an individual helical coil of an extension spring.

Spring Position: The axial distance between the seal contact point and the centerline of the spring groove of a radial lip seal; commonly referred to as the "R" value.

Spring Pressure: The face pressure between the primary elements of the seal which result from the spring load.

Spring Seat: See *Spring Adapter*.

Spring: A machine element which is capable of storing energy and releasing it, as required. The most commonly used type is the coil spring, and the latter is to be understood when the term spring is not further defined. In face seals, its principal use is to keep the faces of the primary sealing element together and, when used for such purpose, it is considered to be a part of the seal head.

Spring-Assembled Inside Diameter: The inner diameter of the garter spring, as assembled in a radial lip seal, with the ends securely joined.

Stage: As applied to labyrinth seals, a stage comprises one knife-edge and the space, or gap, between the latter and an adjacent knife-edge.

Staggered Labyrinth: A type of labyrinth seal with the knife-edges projecting into a sleeve which has corresponding recesses. Thus the axial travel of such a seal is restricted by the width of a stage minus the width of the knife-edge and the width of the lip on the sleeve.

Starting Torque: The torque which is required for initiating rotary motion.

Static Lip Contact Width: The axial width of the contact surface developed by a static lip. Ref *Helixseal*.

Static Seal: A seal between two surfaces which have no relative motion.

Stationary Ring: A ring which is mounted in, or on, the non-rotating seal assembly. Normally, it is the main sealing member which loads against the rotating mating ring.

Step-Gap Ring Seal: A segmented ring seal in which flow paths are restricted by steps in the primary ring. Also, a piston-ring type of seal which incorporates a step in the gap.

Step-Joint Seal: See *Step-Gap Ring Seal*.

Stepped Labyrinth: A type of Labyrinth seal incorporating knife-edge and land surface pairs which are axially assembled with adjacent pairs, of decreasing diameter.

Stick-Slip: A friction phenomenon which can be described as a jerky motion which sometimes results when one surface is being dragged across another. Normally it is associated with a non-lubricated or boundary-lubricated condition.

Straight-Cut Joint: The gap in a ring seal or piston ring, which has parallel sides, as opposed to a step gap or step joint.

Straight-Through Labyrinth: A type of labyrinth seal incorporating a constant clearance between knife-edges and a cylindrical sleeve of constant diameter.

Straight-Through, Carry-Over Block Labyrinth: A type of labyrinth seal incorporating a land ring with integral carry-over blocks extending into the radial clearance between knife-edge and land diameter.

Stuffing Box: A cylindrical cavity and the enclosing stationary parts surrounding a shaft, designed to accept a packing for the purpose of preventing leakage along the shaft.

Tandem Seal: A multiple-seal arrangement consisting of two seals mounted one after the other, with the faces of the seal heads oriented in the same direction.

Tangential Tension: As applied to a single-gap ring, the tension which is measured when equal radial forces are applied to the ring. The ring, under these forces, assume the shape it would have if it were confined to a cylindrical bore, and it is subject to the same stresses it would experience when so confined.

Three-Ring Design Seal: A segmented ring seal in which the radial and axial flow paths formed by the gaps in the primary ring are covered by two additional rings.

Torque Pin: A type of anti-rotation device. It consists of a metal pin, one end of which fits loosely in a hole or slot in the primary-seal carrier with the other end being solidly attached to the secondary-seal carrier.

Torque: As applied to sealing, a resistance to shaft rotation caused by a seal's frictional drag. It is normally expressed in foot-pound or inch-pound units.

Torsion Vibration: A vibration which has a circumferential or angular sense. It is often generated by a stick-slip action between mating seal faces.

Track: The marks made by a seal on the surface with which it mates.

Tracking Pattern: The path a seal ring makes when in rubbing contact with the mating ring or seal plate.

Trim Diameter: For a lip seal, the dimension of the seal case bore before mounting the seal on the shaft and without the spring.

Trim Face: See *Seal Inside Lip Surface*.

Trimming Angle: The angle between the trimmed face of a seal lip and the seal axis.

Unbalanced Seal: A seal the balance diameter of which is such that the net hydraulic or pneumatic closing force is not zero. Ref *Overbalanced Seal; Underbalanced Seal*.

Underbalanced Seal: A seal the balance diameter of which has a net hydraulic or pneumatic closing force which is negative; that is applied fluid pressure tends to open the seal.

Uni-Directional Seal: A seal which prevents the passage of fluid from one direction only.

Uni-Rotational Seal: A seal which is designed for applications in which shaft rotation is in one direction only.

Unit Face Load: See *Face Pressure*.

Unit Seal: A seal consisting of a single ring which is normally not subject to axial mechanical compression.

Unitized Seal: A sealing device with an integral bushing which functions as the shaft surface.

Vent Connection: A connection in the gland plate outboard of the seal, through which leakage fluid may be vented or a pressurizing fluid passed.

Vented Seal: A term applied to sealing systems in which the pressure between two seals is purposely maintained at a low level in order to prevent mixing of the two upstream fluids in either of the higher-pressure-level upstream compartments.

Viscoseal: See *Windback Seal*.

Water Hammer: The sound of concussion when a flowing liquid is suddenly stopped.

Wave Spring: A disc-washer type of spring which has been deformed to have a multiple-wave pattern in a plane perpendicular to its axis. Since it utilized little space, it is frequently used to produce compact seal assemblies.

Wear Rate: The amount of seal-surface wear, stated in terms of mils worn in some designated time period. One commonly used unit is mils per hundred hours.

Wedge-Type Seal: A type of secondary seal, of wedge shaped cross-section and sometimes used in mechanical end-face seals.

Weepage: A minute amount of liquid leakage by a seal it has rather arbitrary limits, but is commonly considered to be a leakage rate of less than one drop of liquid per minute.

Welded Metal Bellows: A bellows fabricated by welding together a series of thin metal washers to form an accordion type structure which, when assembled to other components of a seal assembly, acts both as the secondary seal and as the spring which loads the assembly.

Windback Seal: A helically grooved liner, installed either on a stationary member or on a rotating shaft, which operates through a clearance and tends to lower leakage by means of a pumping action resulting from the transfer of momentum to the fluid.

Wiper: See *Secondary-Seal Lip*.

Working Length: See *Operating Length*.