Parkside Industries Corp.

PTFE Compression Molding Specialists

Technical Reference Guide

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Section 1.1 General Description of Usage

Parts molded of PTFE are utilized in hydraulic and pneumatic cylinders, motors, pumps and valves. They reduce equipment wear, fluid loss, and frequency of packing changes. Suitable for static or dynamic (linear or rotary) applications. A complete V-ring seal requires at least one V-ring, one male adapter, and one female adapter. The female adapter provides an extra sealing edge.

Section 2.1 Chemical Resistance

PTFE resins are essentially chemically inert. Within the recommended operating temperature range the only chemicals known to react with these resins are molten alkali metals, fluorine in any form, chlorine tri-fluoride, and oxygen di-fluoride.

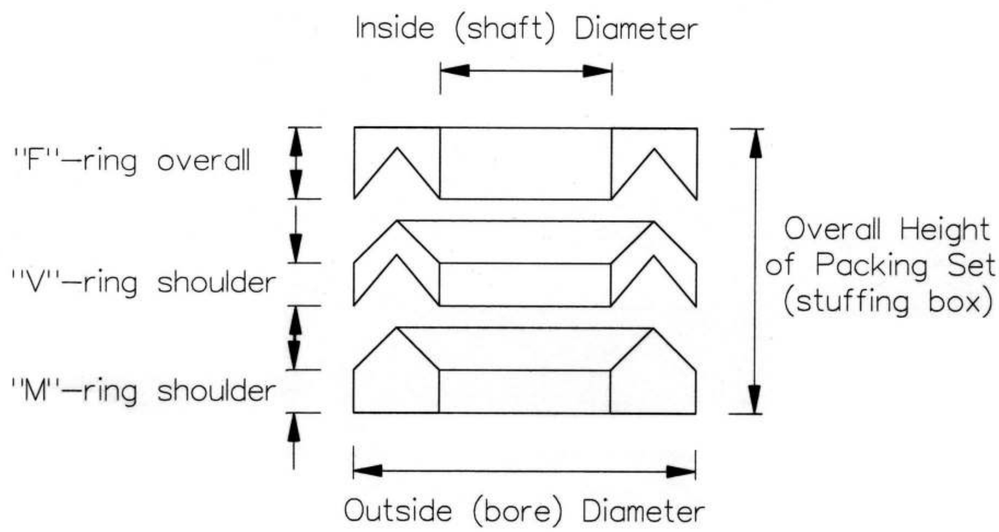
Section 3.1 Special Usage

Unfilled, virgin resins are considered FDA compliant, for use in food-processing equipment such as sanitary or flange gaskets.

Section 4.1 Temperature Range

Useful but varying mechanical properties are maintained from -400 to +500 deg F. As with most man-made materials extreme cold renders the finished product stiff and ridged, while extreme heat renders the finished product soft and pliable. This is normally only a concern during initial assembly. Applications above 500 deg F should be avoided: Harmful, toxic out-gassing can occur.

Section 5.1 Terminology



Section 6.1 Surface Finish

Similar to thermoplastic injection molding, the surface finish of a molded part takes on the same finish as the dies used to form the part. During the sintering process that surface loses some of its polished appearance as the molecular bonding takes place. Parts are then put through a de-flashing process to remove any loosely adhering material and to re-polish the surface. Upon magnification one can see the outlines of the un-sintered pellets which were compressed during the forming process. This is referred to as “orange peel” for its similarity to the texture of the outer skin of the citrus fruit. The natural resiliency of the resin allows the part to conform to the mating surface.

The recommended surface finish of the mating parts is in general, the smoother the better. Courser surfaces can allow some leakage in static applications. In dynamic applications the courser surface will also accelerate the wear of the part. The point of diminishing return for how smooth to make this surface vs cost, should be determined for the specific application.

Section 7.1 Tolerances/Dimensioning

Our resin vendors require tolerances in the percent volumetric shrink of the product they supply to us. Those volumetric tolerances translate to linear dimensions as follows: For rings with concentric ID & OD, typically acceptable tolerances are plus/minus .005" per inch of diameter. Different geometries will yield different results.

Varying our process can correct within limits for resin lots with different shrinkages. However the natural resilience of the resin allows the finished part to conform to the mating surface.

Section 8.1 Interference Fit vs. Nominal

Although a slip-fit may allow faster, easier assembly, an interference fit is generally preferred. This results in acquiring a seal on initial assembly, leaving maximum adjustment available to compensate for future wear.

If a packing-ring set is selected with nominal sizes of 1-1/4" ID and 1-3/4" OD, the shaft is assumed to measure 1.250" and the bore to measure 1.750". Ideally the packing-ring set ID will measure 1.250" plus nothing minus "something", and the OD will measure 1.750" minus nothing plus "something". Due to process variances the packing-ring sets will occasionally deviate in size but will function regardless.

Section 9.1 Oval Shaped Parts

We occasionally receive notice of a discrepancy described as "oval-shaped" for some of the products we manufacture, and have been asked to clarify the situation for inspection departments.

For injection-molded thermoplastic parts the resin is heated to a liquid phase and forced into steel dies. After sufficient time the resin cools to a stable solid phase and is ejected from the dies. During that cooling period the resin is confined to the dimensions of the dies, yet does undergo predictable shrinkage.

Assuming proper molding conditions are present in the molding cycle, i.e. resin melt- temperature, injection pressure, injection location, hold time, back pressure, etc., shrinkage and internal stresses will be at a minimum. (con't on next page)

Section 9.1 (con't) Oval Shaped Parts

Due to the confinement during the transition from liquid phase to solid phase, any distortion due to shrinkage or internal stresses is minimized. Very high dimensional consistency is easily obtainable.

PTFE (Polytetrafluoroethylene) resins however, are not injection-molded thermoplastics and are fabricated in a compression-sinter process very similar to powdered-metal technology.

The resin is compressed at room temperature to a pre-determined set of dimensions and then removed from the dies. The then fragile part is placed in an oven and undergoes a sintering (baking) cycle, which chemically bonds the resin, causes pre-determined shrinkage to take place, and relaxes all internal stresses. The shrinkage and stress-relief take place because the part is in an unrestricted "free" state during the sintering cycle. As a consequence of this required "free" state, there are no restrictions to inhibit any distortion that takes place during the cycle. It is that distortion which causes un-sintered round parts to become out-of-round. The out-of-round part resembles an ellipse, and is sometimes referred to as "egg-shaped".

This condition exists in all compression-molded parts to some degree and is normally insignificant due to the plasticity of the sintered resin. Where the distortion is great enough to cause measurement difficulties, the parts are typically placed on an appropriate mandrel which "rounds" out the diameters. The I.D. check becomes a matter of whether the part slips on or off too easily vs too tight a fit. The "rounded" out O.D. is then checked with suitable measuring devices. The remaining difficulty is those circumstances when the cross-sectional wall of the part is so great as to make the mandrel technique difficult. In that case dimensions are taken at several points around the diameters and averaged.

Section 10.1 Burrs vs. Parting Line Flash

We occasionally receive notice of a discrepancy described as "burrs" on various locations of the products we manufacture, and have been asked to clarify some definitions for inspection departments.

The term "burr" is ordinarily used in the context of metalworking operations such as lathe turning or milling operations. This condition ordinarily occurs where metal is removed via some process involving a cutting tool. Less than ideal circumstances such as dull cutting tools, improper feed rate, poor machine-ability of the metal, improper cutting bit material, etc., are the main sources of "burrs". Now given these burrs are metal, they themselves become a source of a whole range of problems such as: dangerous sharp edges that pose a hazard to assemblers, fit and interference problems, wear and damage problems when burrs break off and enter potentially harmful areas of application. These situations can be prevented with good metalworking procedures, and monitored by incoming inspection by referring to appropriate notes on the drawings as is currently done.

Parting Line Flash (PLF) on the other hand is a condition inherent to all plastics molding operations. The molding procedure requires the dies to assemble and disassemble during the molding cycle. The dies are assembled to form a cavity which the plastic resin is forced into. The dies are then disassembled and the plastic part is removed. Some of the components move against each other, requiring a certain minimum clearance between them. Those areas where clearance must exist, also provide very small cavities for the plastic resin to be forced into. When the dies are disassembled what remains of the resin forced into the clearance cavity of the assembled dies, is called "flash". Stated another way, this resin remaining where the dies separate and move "apart", is called PLF (Parting Line Flash). As stated earlier this is a required condition for the molding process. Note: In some interference geometries, flash is a desired component.

PLF is monitored by incoming inspection to the following parameters: 1)The flash must be tightly adhered to the main body of the part. It must require sharp cutting or scraping tools to remove. It must not be easily loosened or removed by hand. 2)The flash must not protrude from the main body of the part by more than .015" or in such a way that hampers the performance or function of the finished part. These situations are prevented with a de-flashing operation we perform as a final step in our manufacturing process which minimizes but not entirely removes, the condition. (con't on next page)

Section 10.1 (con't) Burrs vs. Parting Line Flash

Although these two conditions (burrs and PLF) appear similar to the untrained eye, they are indeed quite different. Consequently when incoming inspection refers to a condition described as "burrs" when in actuality it is PLF, we are at the situation currently being addressed: Incorrect or inappropriate usage of terminology.