



An explanation of the “cracks” common on the OD of a Graphite die molded ring:

Flexible graphite is the raw material which Graphite seal rings are made from. It is important to know the nature of flexible graphite material to thoroughly understand the inherent nature of seals made with it.

Flexible graphite is basically a carbon based sheet material made from graphite “flakes” mined from the ground and processed to prepare the billions of tiny flakes for mechanically bonding them into a homogeneous, monolithic roll of various thickness and lengths.

These rolls are used by fabricators, such as AS&P, to manufacture seal rings using two basic construction techniques, die molding or die cutting, or a combination of both.

#### Die Molding or Forming:

Under this construction method, thin rolls of graphite, 3/8” for example, are sliced off the master roll. A specified length of this “ribbon” of material is then wrapped around the mandrel, to form the parts ID, of a compression die. The remaining die parts are assembled and the die is compressed to a predetermined distance to make the proper size part height. During this compression the material inside is crushed. During this crushing process the layers collapse and naturally form V’s and W’s until eventually it becomes compacted and appears to be a shiny solid part. This is one of the benefits of this material for making seals, that it is very compactable and conformable and can “hold” a shape such as an ID / OD seal ring. It is not however a solid part, like a metal ring is a solid part. Die molded rings are made up of crushed graphite ribbon and the fissures or “cracks” on the OD are inherent in their construction. They cannot be removed. We can minimize their appearance by compressing the ring more, however this increases the rings density and can cause performance issues.

#### Die Cutting:

Under this method of construction material is “sheeted” off the master roll in sheets for example 24” x 24” x .015” thick. Several of these sheets are bonded together to achieve a homogeneous laminate a thickness that matches the finished ring height. Special dies are used to “cookie cut” ID / OD rings from the laminate. These rings do not contain the telltale lines on the OD and sometimes ID inherent in die molded ring.

It is important to add that at this point that because of the very nature of the raw material, regardless of which constructions is used, graphite flaking is always a possibility in an uncontained graphite seal.

AS&P has been manufacturing seals for high temperature turbine applications in both constructions for over 22 years. Fuel Nozzle Seals, Bleed Air Seals, Compressor Seals, Exhaust Seals are just a few of the applications where this material is used today. When there is a concern about the possibility of flaking or loose particles causing a detrimental condition in the application, AS&P has responded with our Tri-Clad system that encapsulates the graphite material in a thin metal casing, still enabling the compressive advantages of the graphite, but “hiding” it from the rigors of the application forces thereby preventing flaking from occurring.

In closing, based on our experience and the excellent performance history of these seals, we do not feel that the “crack” on the OD of the die molded ring will cause a detrimental condition any more than the



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presence of the seal itself, if flaking is the concern. However, we will be happy to review the alternatives we've outlined above, and others, as possible replacements to the die molded part, if your final determination so dictates.