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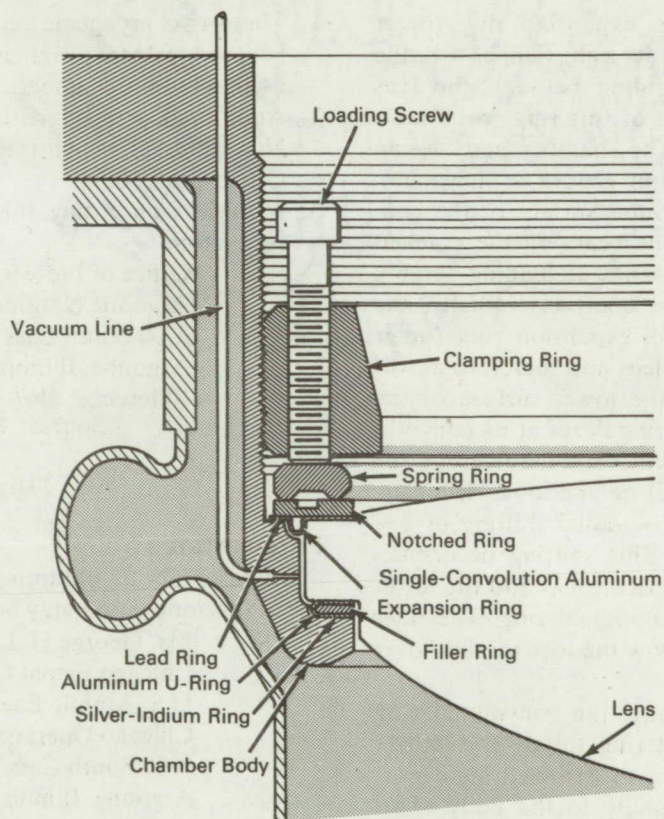


# AEC-NASA TECH BRIEF



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## Cryogenic Seal Remains Leaktight During Thermal Displacement



### The problem:

To maintain effective seals against the surfaces of a plastic member in a low-pressure system subjected to extreme temperature changes. In systems such as cryogenic bubble chambers, the plastic chamber lens displaces at a rate different from that of its mating chamber surfaces under the extreme temperature variations involved. These sealing surface movements make it difficult to maintain seal contact forces and to provide effective seal components capable of isolating

the cryogenic liquid on the inner side of the lens from the vacuum space on the outside of the lens.

### The solution:

An outer seal consisting of a single-convolution aluminum expansion ring bonded to the lens outer surface, and an inner seal consisting of a resin-filled aluminum U-ring bonded to the lens inner surface. The outer seal, which performs the critical task of isolating the cryogenic liquid from the vacuum space, bends axially and slides during both radial and axial

(continued overleaf)

lens movement to maintain its seal. The inner seal maintains sliding seal contact during radial expansion or contraction of the lens.

#### **How it's done:**

The application of these seals to the plastic lens of a cryogenic bubble chamber is illustrated. The aluminum U-ring (inner seal) is bonded to the lens, and bears on a silver-indium ring locked to the chamber body. The silver-indium ring, which is a round ring initially, is squeezed into a V-shaped groove that contains a slippery filler ring made of woven fabric coated with resin. This filler ring supports the legs of the U-ring to permit application of a large sealing force, but is slippery enough to allow relative radial displacement between the upper and lower U-ring legs.

The convoluted aluminum expansion ring (outer seal) is bonded to the lens by its right flange, with the U-shaped convolution extending between the lens and the body. The left flange of this ring rests on a lead ring which is locked to the chamber body by an interlocking annular V-rib and groove arrangement. A notched ring rests on the outer surface of the convoluted ring and a spring ring bears on the notched ring under pressure from a series of loading screws.

When the lens expands or contracts radially, the right flange of the aluminum expansion ring (outer seal), which is bonded to the lens and therefore moves with the lens, slides along the lower surface of the notched ring. The expansion ring flexes at its convolution to permit this movement. Simultaneously, the aluminum U-ring (inner seal) on the lower lens surface flexes at its base to allow radial shifting of one leg in relation to the other. This shifting occurs because the upper leg is bonded to the lens and the lower leg tends to stick to the silver-indium ring. The filler ring is slippery enough to allow the legs to slide over its surface.

As the lens displaces axially, the convoluted ring (outer seal) and the notched ring follow this movement by bending with respect to their left-hand portions, which are clamped solidly to the body. This bending is possible because of the thin section in the

notched ring. The right lobe of the spring ring follows the bending notched ring, and maintains suitable sealing pressure because the rounded lobe tends to roll on the notched ring surface.

The two lobes of the spring are eccentric with respect to the loading screw centerlines. The left lobe, which is nearer the screw centerlines, exerts more axial force than the right lobe when the screws are tightened. The smaller force of the right lobe allows radial slippage of the U-ring and convoluted expansion ring. The greater force of the left lobe maintains a positive seal between the body, the lead ring, and the expansion ring. Any chamber atmosphere which does leak past the U-ring (inner seal) is evacuated by a vacuum line.

#### **Notes:**

1. These two cryogenic seals are compact and are believed to form a tighter seal than seals presently used in bubble chambers.
2. Additional details are contained in U.S. Patent No. 3,238,574, which is available from U.S. Patent Office, price \$0.50.
3. Inquiries concerning this innovation may be directed to:

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#### **Patent status:**

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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