AD/RHIC–62

R H I C P R O J E C T

Brookhaven National Laboratory
Associated Universities, Inc.
Upton, NY 11973

Pneuma–Seal Vacuum Seal

J. Briggs, R. Davis, R. Gibbs,
A. Muscarella and D. Wilson

January 1990

PNEUMA-SEAL VACUUM SEAL

Introduction

Several RHIC magnets have been tested in a single magnet test facility at Brookhaven National Laboratory. The magnet test set-up equipment includes two end cans that provide temporary end closures, cryogenic bayonet connector for helium supply, helium return, LN_2 supply, and LN_2 vent. In addition, electric power supply connections and cryogenic feedthroughs for electronic sensors are provided. The vacuum seals used on the end cans sliding enclosures have experienced difficulties since first installed. During the recent testing of DR007, the seals leaked badly and required copious amounts of Apiezon to plug the leaks. It became very time consuming to obtain an acceptable insulating vacuum. Seal reliability was very poor. Following the cold test of DR007, a test fixture was constructed to test Pneuma-seals. This technical note will discuss the test fixture, test procedures, test results, and recommendations. The test results proved conclusively that, if the recommendations provided in this technical note are followed, the seal will perform reliably.

Pneuma Seals

The seals are manufactured by Presray Corporation, which is located in Pawling, New York. The seals are a cylindrical one piece molded construction. Seal material is Ethylene Propylene Diene Monomer (EPDM). A pressure regulated supply system of air or N_2 gas is used to inflate the seals. As shown in Fig. 1, the seal I.D. has a gap which is closed when the seal is inflated. In the static state, the seal O.D. is in contact with the I.D. of the outer containment. In prior magnet tests, Apiezon was applied around the seal and between the two cylindrical vacuum shells.

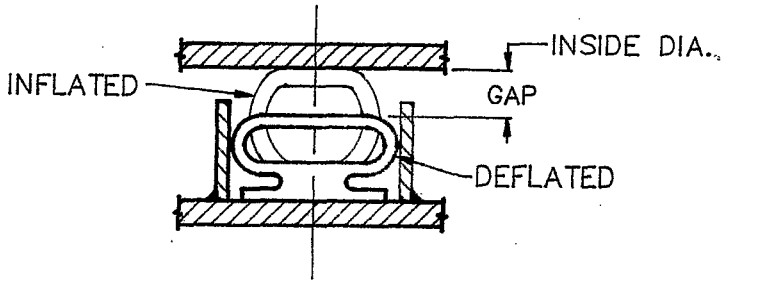

Figure 1, Pneuma Seal and Sealing Surfaces

Test Fixture

The test fixture, shown in Fig. 2, is made from an 8 inch length of 24 inch O.D. pipe with a flat circular plate attached to the I.D. The I.D. of the outer 34 inch long cylindrical section is 25.625 inches. The vacuum seal is formed between the 24 inch O.D. insert and the I.D. of the 34 inch long section. At the opposite end, a flat plate is used for an end cover which is connected to a vacuum pump and helium leak detector.

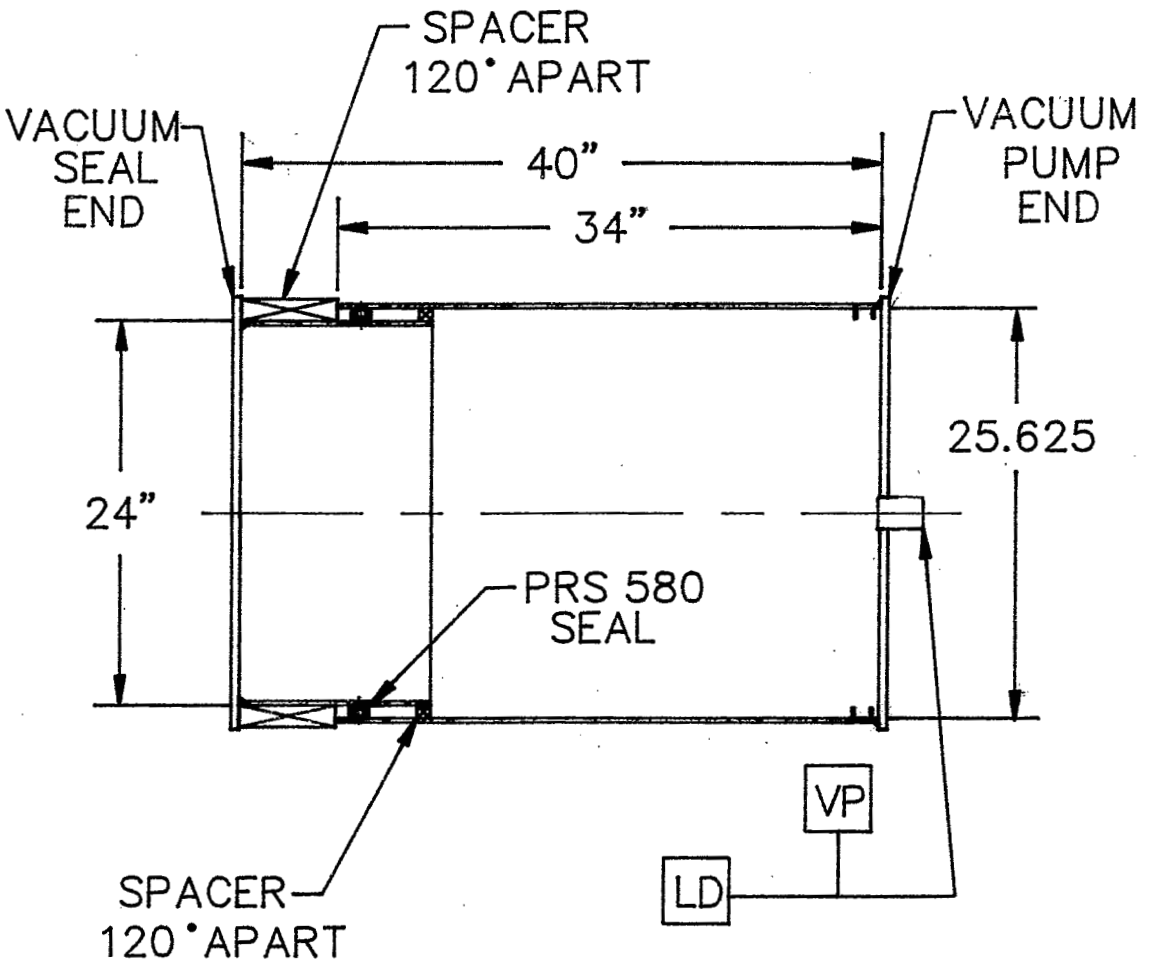

Figure 2, Test Fixture

Test Procedure

Again, the seals are circular and are one piece molded construction. First, the new seals were examined for flaws and imperfection. Areas which would cause the seal to leak were sanded smooth with 400 grit sand paper, and then a minimum amount of vacuum grease was applied to the seal. The seal was installed in its groove, and the seal end cover was placed in position. Spacers were placed 120 degrees apart between the two cylinders to insure that their center lines were kept concentric. In addition, spacers were placed between the seal end closure and the 34 inch long cylinder to allow light to pass by the seal. This spacer allowed for the seal to be inspected and observed during the period that the seal was alternately inflated and deflated. The seal was then inflated with 30 psig of nitrogen gas. From a visual inspection through the open end (vacuum pump end), light was observed between the 9 and 12 o'clock region on the seal I.D. The seal pressure was cycled four times, each time it was pressurized, a time period was allowed for the seal material to flow until no change was observed. Fig. 3, shows the voids open to atmosphere as the seal was cycled. After each cycle, the amplitude in the voids decreases until the fourth cycle when it dissipates completely.

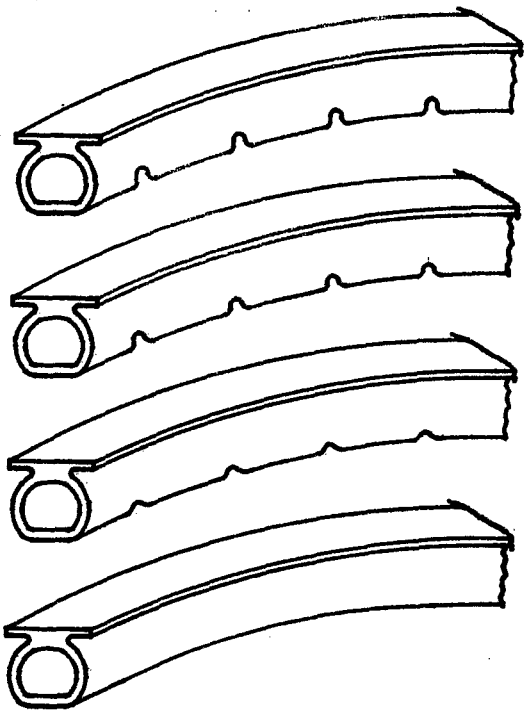

Figure 3, Typical Seal Surface I.D. in 4 cycles

Conclusion

The test results clearly demonstrate that the seal is a workable and viable seal for the application in question. The seal will perform without the use of apiezon, provided that good high vacuum techniques are followed. The seal requires a certain amount of training before it performs properly.

Recommendations

It is recommended that the following requirements be satisfied prior to installing the Pneuma-seal in the magnet test facility.

1. Install seal in the test fixture and qualify prior to installation in the Magnet Test Facility.

2. All excess material and imperfections must be smoothed with 400 grade sandpaper.

3. The space between the two cylinders must be uniform and controlled. Cylinder centers must be concentric.

4. All metal sealing surfaces must be inspected and have a 63 micro-inch finish.

5. Seal must be lubricated with a minimum amount of vacuum grease.

6. Apiezon is not required on any part of the seal including the valve stem.