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ARTICLE 1

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SPLIT CONTAINER FOR LEAKS, WITH RUBBER SEALING RINGS

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Function of the Container

The function of this split container is to contain leaks in damaged cylindrical parts (pipes, flanges, etc.).

Main challenge of the project

The biggest technical challenge of this split container is to ensure sealing between the contact surfaces on each side of the container itself.

It is easy to see that the two parts of a split rubber ring will not provide a seal when joined in an assembly where they are pressed against each other, as shown in Fig. 1.

Fig. 1

So, how can sealing be achieved in this case? As mentioned above, we cannot simply split a sealing ring and then join them together to promote sealing between them. With the internal part pressurized, the rings would move apart and, consequently, sealing would not occur.

Solution found

The solution found was to assemble a folded, one-piece square section sealing ring on each side of the split container. Note that this configuration necessarily results in rubber sealing directly against rubber. This is an unprecedented assembly, since the usual practice in two-part seals is to mount rubber in contact with a rigid and smooth surface. Figure 2 below shows these two assemblies.

Fig. 2

Intuitively, we are led to imagine that in the unprecedented assembly, due to the action of the pressurized fluid, the rings would move apart and, consequently, sealing would not occur.

But could the opposite not occur?

We are faced with two different lines of reasoning. In the first hypothesis, the fluid would penetrate the space between the rings, pushing them apart and making sealing impossible.

In the second hypothesis, observing that the inner side is exposed to working pressure (3,000 psi) and the outer side is subjected to atmospheric pressure, we believe that the facts will occur as follows: The rings compress against the side walls of their respective channels and press against each other, favoring sealing between the parts. (see Fig. 3).

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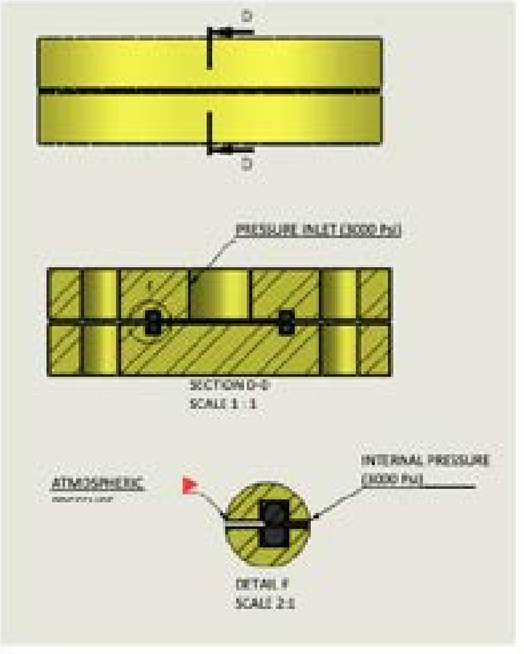

Fig. 3

Which of these scenarios actually occurred?

To obtain this answer, we performed a hydrostatic test (pressure of 4500 psi), using a novel assembly with two flat flanges of the same size with identical traditional sealing channels and O-ring seals, the first flange being blind and the second with a threaded central hole for pressure inlet, exactly as shown above in Figure 2 (unprecedented assembly) and Figure 3.

Hydrostatic test for validation of seals with rubber rings in direct contact

The hydrostatic test for this project would be 1.3 times the working pressure, but as this particular test would serve as a basis for future new applications, we chose to perform it at 1.5 times the working pressure of 3,000 psi, or 4,500 psi. The test yielded positive results, confirming the effectiveness of the unprecedented assembly (see Fig. 4).

Fig. 4

Finally, the container prototype was designed, manufactured, and tested at 3,900 psi (1.3 times the working pressure), as shown in Figure 5, confirming the effectiveness of the seal.

Details of the split container test prototype

Fig. 5. (Prototype of the split container disassembled)Hydrostatic test of the split container prototype

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Fig. 6. (Hydrostatic test with 1.3x working pressure = 3,900 psi.)

Note: For effective sealing when using the split container, which is the subject of this article, the external surfaces of the central piece, as well as the internal surfaces of the container, must have an adequate surface finish and be free of imperfections.

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