## V32 LOW-COST UHV METAL SEAL OF ANY CONFIGURATION

Difficulties with aluminium wire seals

Covers for large vacuum tanks of circular, rectangular or any other shape, are most often sealed with a 1 to 2 mm diameter aluminium wire, when an elastometer seal is not allowed and when a high temperature bake-out is not required. These aluminium wire seals are normally mounted on a carrying frame to provide the required configuration and to make it possible to handle such seals when the dimensions are large e.g. 1 x 2 metres. The aluminium wire alone is very cheap but its fixing on the supporting frame requires considerable manual labor. Handling is very delicate and quite often the wire may come off its support at the slightest mismanipulation. This is a serious shortcoming when vacuum maintenance work has to be performed on an accelerator where the environment is radio-active and where the work should be done quickly and reliably.

Use in the PSB

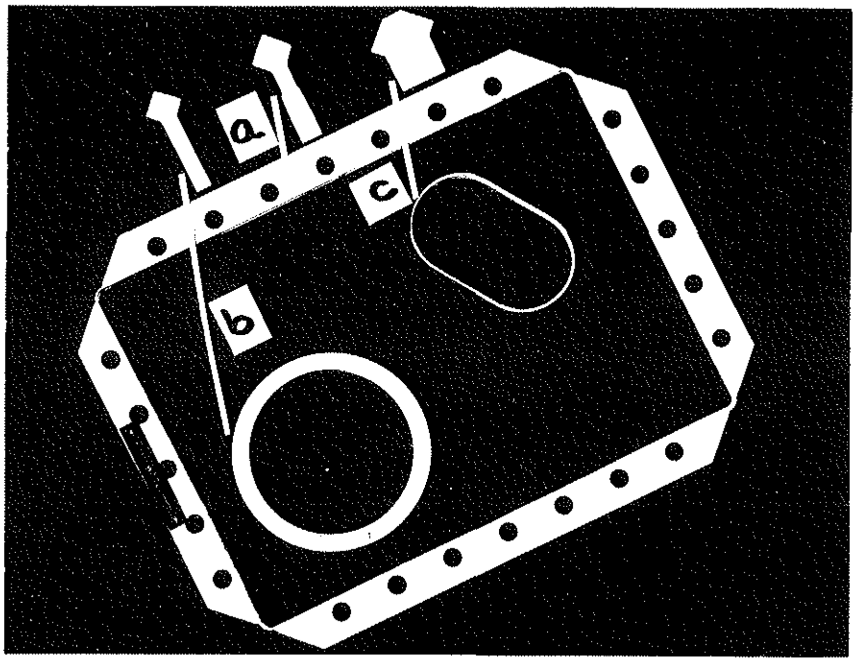
As the 4-ring PSB has many large vacuum tanks, usually of rectangular configuration with large covers (1.5 x 2 metres), which must be sealed for UHV by easy-to-handle and dependable metal seals, there was sufficient motive to find a solution less delicate than the traditional aluminium wire on supporting frame. The major objective was to find a suitable seal geometry which would be self-supporting and therefore not require a frame.

The Leybold-Heraeus aluminium seal disk

A nice example of a self-supporting seal edge for circular configuration is the Leybold-Heraeus soft aluminium lip seal disk. Here, the diamond-shaped seal edge on the disk can be obtained by spinning in a lathe using an appropriate tool. This type of seal made to CERN specification (see Fig. 1b) is already used in large quantities in conjunction with the quick coupling arrangement described in Technology Note V30.

CERN development of self-supporting aluminium seal applicable to non-circular shapes

In order to apply the Leybold seal disk geometry to seals of non-circular shapes we had to solve the problem of how to form the seal edge on, for example, a rectangular shaped seal made from soft aluminium sheet. Initially we imagined such a seal being made by stamping the configuration in a sheet 1 to 1.5 mm thick and then developing an appropriate tool and method to produce the diamond shape along the edge. Cold forming techniques were used quite successfully, however the rounded corners of the seal invariably gave problems.




This approach was therefore abandoned, and we then tried to produce the seal from a strip of aluminium with the seal edge already formed on it. This method was finally successful, after the welding problems had been solved by the CERN workshops, and a way was found to bend the strip without buckling it. As seen in Fig. 1a the supporting frame is an integral part of the seal and it can have any number of mounting holes. The holes and cut-outs for the bends are punched into the strip before forming it into the required shape in a special tool. The ends are then butt-welded together. Fig. 1b shows a seal disk developed for use with the quick vacuum-coupling and Fig. 1c is a turned seal which was afterwards formed into the race-track shape shown. The turned version was developed for a special application in the CERN Proton Synchrotron and had to fit into already existing O-ring grooves for the purpose of replacing radiation damaged elastomer rings by metal seals.

References

The aluminium lip seal described here eliminates the problems encountered with the wire seal fixed to a support and has been successfully employed on the many large vacuum tanks in the PSB. More recently this seal design has also been applied to the PS, MSC and SPS. The soft aluminium strip with the diamond shaped edge, from which the seals are made, has been drawn by Alusuisse in Chippis, CH, in lengths of 8 metres. Further information can be obtained from C.E. Rufer, MPS Division, CERN.

April 1974