PyraFlat Rectangular Flanges - Application Note

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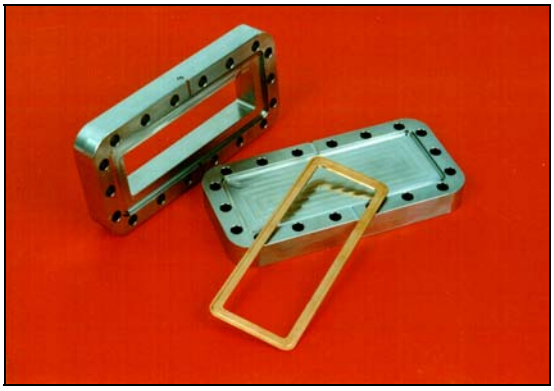
INTRODUCTION



In 1997, over 300 sets of PyraFlat flanges were installed at the Synchrotron Radiation Laboratory at the Stanford Linear Accelerator Center (SLAC) in California. The PyraFlat was tested against and prevailed over all its UHV rectangular flange competitors in tests conducted by SLAC for use on the positron-electron collider system (PEP II Project). Routine visits verify that the PyraFlat flange continues to meet SLAC's performance requirements.

PRODUCT DESCRIPTION

The PyraFlat flange, used for non-circular seals, utilizes the same sealing principle as the ConFlat® flange developed by Varian.

Introduced and patented by Thermionics, the PyraFlat flange is an all-metal "stored energy seal". Two symmetrical (identical mating) flanges with concentric knife edges are clamped together to "bite" into a copper gasket. This captures the gasket and produces a lateral cold-flow of the material. The outer rim of the flange assembly limits the flow of material, causing the gasket to fill any small imperfections in the flange surfaces. This arrangement produces a dynamic seal with energy "stored" within the captured gasket.

The complete flange assembly may be repeatedly temperature-cycled between -196°C and +500°C under ultra high vacuum conditions without exhibiting significant* leakage.

PARTICLE PHYSICS APPLICATION AT SLAC

The Stanford Linear Accelerator Center PEP 2 project utilizes UHV rectangular flanges for high- energy wave guide couplings in its positron-electron collider system. The collider produces large quantities of atomic particles known as 'B'

* less than 2 x 10^{-10} std. cc/sec, as measured by a helium mass spectrometer leak detector.

mesons By studying the characteristics of 'B' mesons researchers expect to gain closer insight into the basic structure of matter.

Collisions between electrons and positrons circulating in opposite directions within two large (separate) accelerator rings produce 'B' mesons. The low energy ring, -LER, contains the circulating electrons. The high energy (positron) ring, -HER, is mounted directly below the LER in the same horizontal plane. The beams are made to collide at a common interaction point by magnetically deflecting the two beams into the same coincident path . This system is known as the "Asymmetric 'B' Factory" because the electrons and positrons circulate and collide with unequal energies.

In order to replenish the energy lost by the electron and positron beams as they circulate, a system of high power Klystrons and resonant cavities is used to inject Radio Frequency (RF) energy directly into the storage rings which are maintained at ultra-high vacuum. A series of 476 MHz rectangular waveguides are used to couple the RF energy into the accelerator system. A demountable rectangular flange having the same cross sectional dimensions as the waveguide was chosen as the most practical coupling device.

A total of 26 copper accelerator cavities are employed to maintain the particle beam energy levels. A 1.2 megawatt Klystron (6 in LER and 20 in HER) powers each cavity. PyraFlat flanges were tested and selected exclusively to couple the Klystron/cavity assemblies to the LER and the HER.

PEP II PROJECT - RECTANGULAR UHV FLANGE REQUIREMENTS

Key requirements by SLAC to meet the PEP II Project system specifications:

1. The flanges must meet ultra high vacuum specifications, including bakeability to 250°C.
2. Assembly and disassembly of the flanges should be simple so that individual Klystron/cavity modules can be easily installed and removed.
3. The inside flange surfaces exposed to rf energy should be free of discontinuities so that RF wave patterns are not disrupted
4. Absolute reliability of the flange is essential in this critical application.

SLAC tested all brands of UHV rectangular flanges to these rigid requirements. Thermionics' PyraFlat was the only rectangular flange to meet or exceed the requirements.