



Tritium Separators

Separating Hydrogen Isotopes

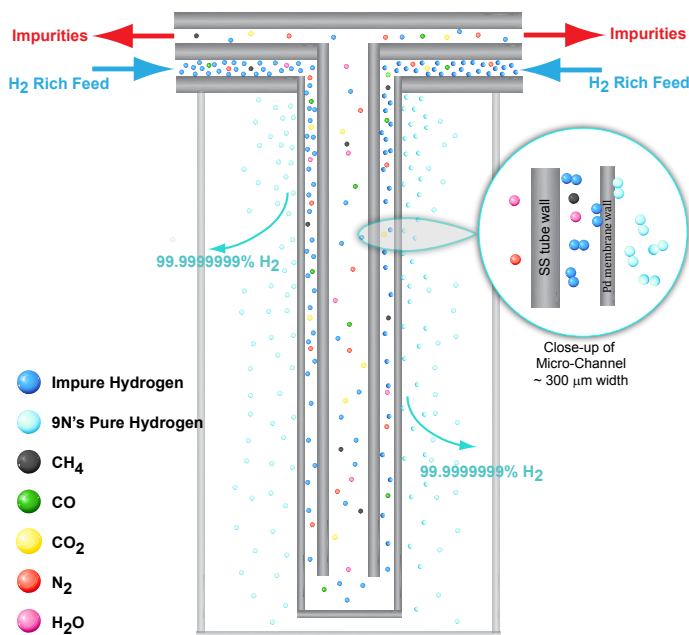
Power + Energy designs custom hydrogen separators to meet the particular specifications of its customer applications. With over twenty years of experience in hydrogen purification technologies, P+E is your best choice for challenging hydrogen isotope separation projects.

Each hydrogen or hydrogen isotope purifier is engineered to meet usage requirements, efficiency demands and operating conditions. Our design is robust and will last through years of operation without failure. Each assembly includes our patented, Micro-Channel™ palladium alloy diffusion cell, gas pre-heaters, thermocouple(s), heat exchangers, insulation and proper connections.



Benefits of Micro-Channel™ Separation Technology

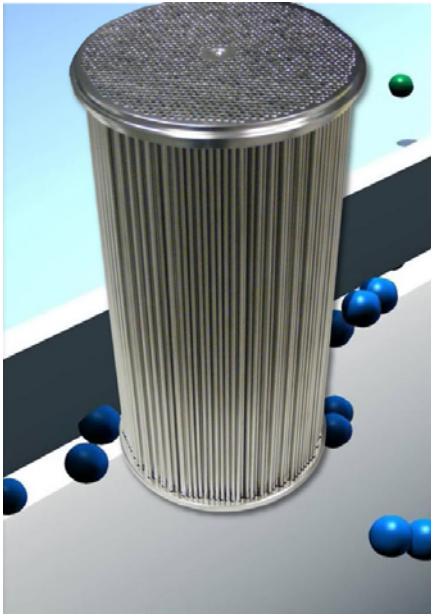
Characteristics of P&E's Micro-Channel Pd technology for removing all the hydrogen in a gas feed:



- Well distributed, low-impedance pumping to the entire membrane surface area.
- Micro-Channel separator design forces the feed gas to pass within 300μm of the hydrogen permeable membrane, for uniform processing of all feed gas.
- The robust Pd tubular membranes operate with very low stress because their small-diameter Pd tubes are held at only one end. This eliminates constraints in the axial direction due to thermal and hydrogen pressure expansion. Vertical mounting minimizes stresses on the membrane tubes.
- The system can be mounted directly to a turbo pump with large diameter tubing and ConFlat fittings.
- Numerous, annular micro-channels enable efficient heating of feed gas streams at high flow rates for optimal isotope recovery.
- P&E separators boast large membrane surface areas in a compact footprint for operating at standard temperatures and with minimal thermal losses.
- For low H₂ concentrations, an optional counter flow heat exchanger (between the feed input gas and raffinate output gas) reduces power consumption up to 25%.

Hydrogen Ion Separators

Using Micro-Channel™ Technology



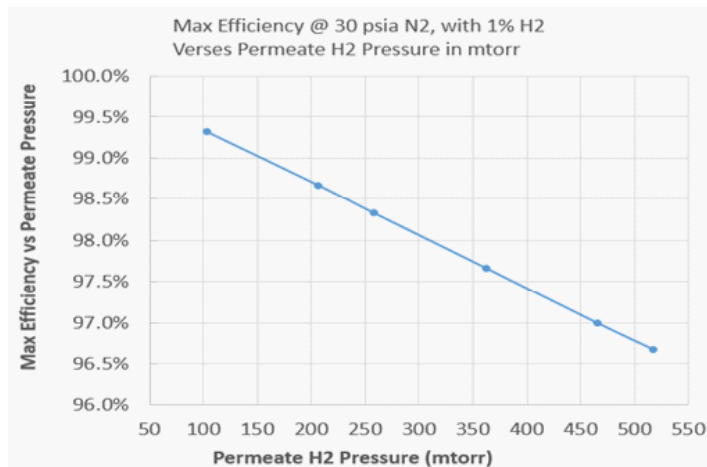
Power + Energy's hydrogen separation products use patented Palladium Alloy Micro-Channel™ Technology. At elevated temperatures and positive pressures, Palladium (Pd) metal permits the diffusion hydrogen and hydrogen isotopes, but not other gases.

In P+E's micro-channel hydrogen separator, a low-purity hydrogen feed gas is fed into a system containing a Micro Channel™ membrane assembly. The gas stream moves along Pd alloy tubes. When the molecular hydrogen comes into contact with the tubes' outer walls, it dissociates into atomic hydrogen and is absorbed into the metal's lattice structure. While diffusing through the membrane walls, individual hydrogen atoms share their electrons with the host palladium.

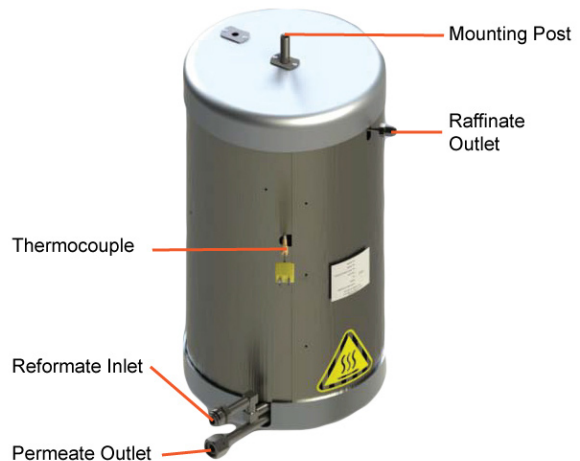
The hydrogen atoms recombine on the other side of the low pressure side of the wall and are desorbed as a hydrogen molecule. The resulting ultra-pure hydrogen has a purity level of 99.999999999%.

As a hydrogen isotope separator, it may be mounted with large-diameter straight piping, using conflates on a low impedance valve (optional), directly to a turbo pump. The distance between the Pd-based membranes and the turbo pump can be less than 30 cm, helping to achieve maximum isotope recovery for any operating conditions.

Maximum Efficiency, by Design



Separator Anatomy



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