



TOKAMAK EXHAUST PROCESSING SYSTEM

Typical glovebox configuration. Photo: US ITER

U.S. CONTRIBUTION

US ITER is responsible for the design, fabrication, and delivery of the tokamak exhaust processing system.

OVERVIEW

The ITER fusion fuel cycle demands the processing of an unprecedented throughput of hydrogen isotopes, including tritium. To facilitate environmental responsibility and economic application of fusion technology, the recycling of hydrogen isotopes is vital. The tokamak exhaust processing system separates the exhaust gases into a pure hydrogen isotope stream and a hydrogen-free gas stream. The hydrogen stream is sent to an isotope separation system (furnished by the European Union) to deliver deuterium and tritium to the fuel storage and delivery system. The system provides a technically mature, robust, and cost-effective separation solution. The system consists of a series of interconnected process components including catalysts, sieves, and permeators to separate the hydrogen isotopes from impurities.

STATUS

Final design is complete. Preparation for manufacturing is underway.



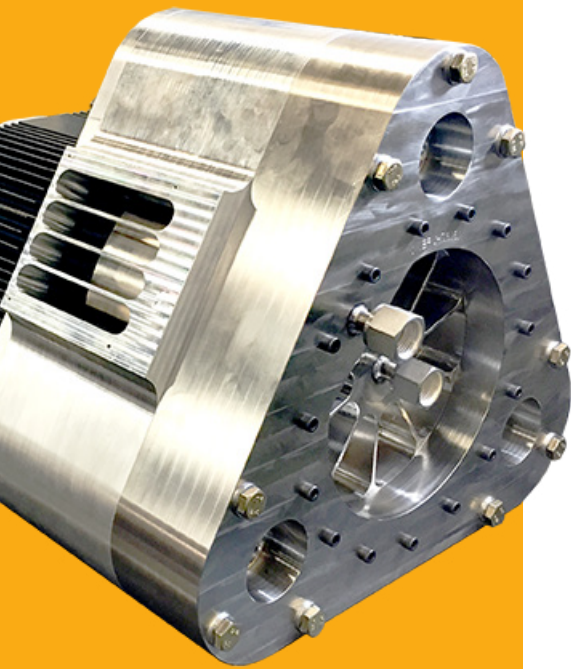
Testing of an ambient molecular sieve bed. Photo: US ITER



U.S. DEPARTMENT
of ENERGY

OAK RIDGE
National Laboratory





Scroll pump.
Photo: US ITER



Metal bellows pump.
Photo: US ITER

TECHNICAL DESCRIPTION

Six nitrogen-filled gloveboxes: 35 m³ each, totaling 210 m³,
3 km of piping

Hydrogen isotope processing technologies:

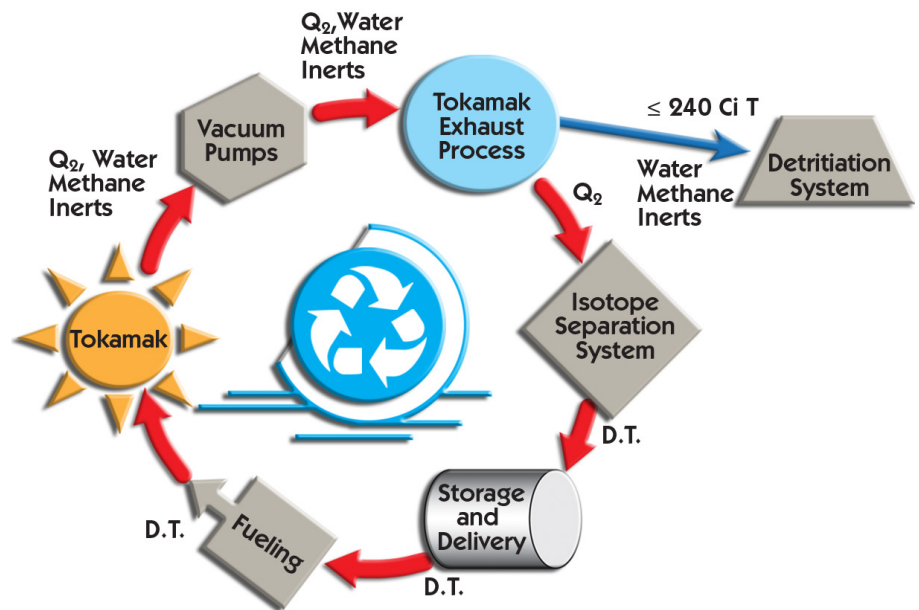
- Permeator
- Palladium membrane reactor
- Ambient molecular sieve bed
- Cryogenic molecular sieve bed
- Catalytic reactor

Throughput: 220 Pa*m³/s:

Tritium recycled per year: ~100 kg

Output criteria:

- Impurity concentration to isotope separation system <1 PPM
- Tritium to detritiation system less than 240 Ci T/day



ITER fuel cycle illustration. Photo: US ITER

CONTACT

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US ITER is managed by Oak Ridge National Laboratory in Tennessee, with partner labs Princeton Plasma Physics Laboratory in New Jersey and Savannah River National Laboratory in South Carolina.