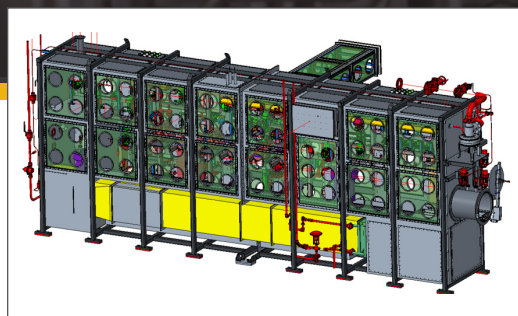# Tokamak Exhaust Processing System



*Typical glovebox configuration. Photo: US ITER*



*Example of a glovebox for tritium processes in the tokamak exhaust processing system.*
*Illustration: 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

The final design review was held at the ITER site in June. Design closure activities are proceeding.



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

# Tokamak Exhaust Processing System
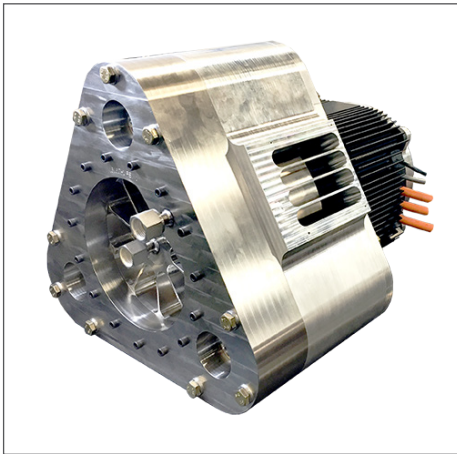


*Scroll pump. Photo: US ITER*



*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
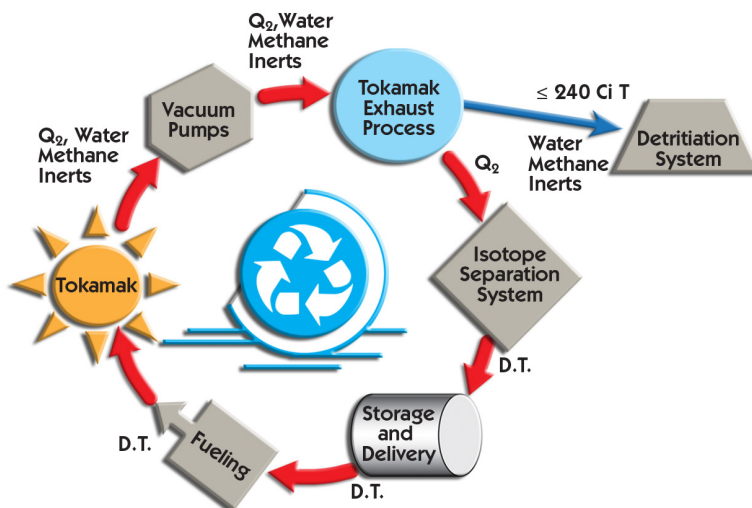Cryogenic molecular sieve bed
Catalytic reactor

**Throughput of 220 Pa\*m³/s:** unprecedented by an order of magnitude

**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. Image: US ITER*

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