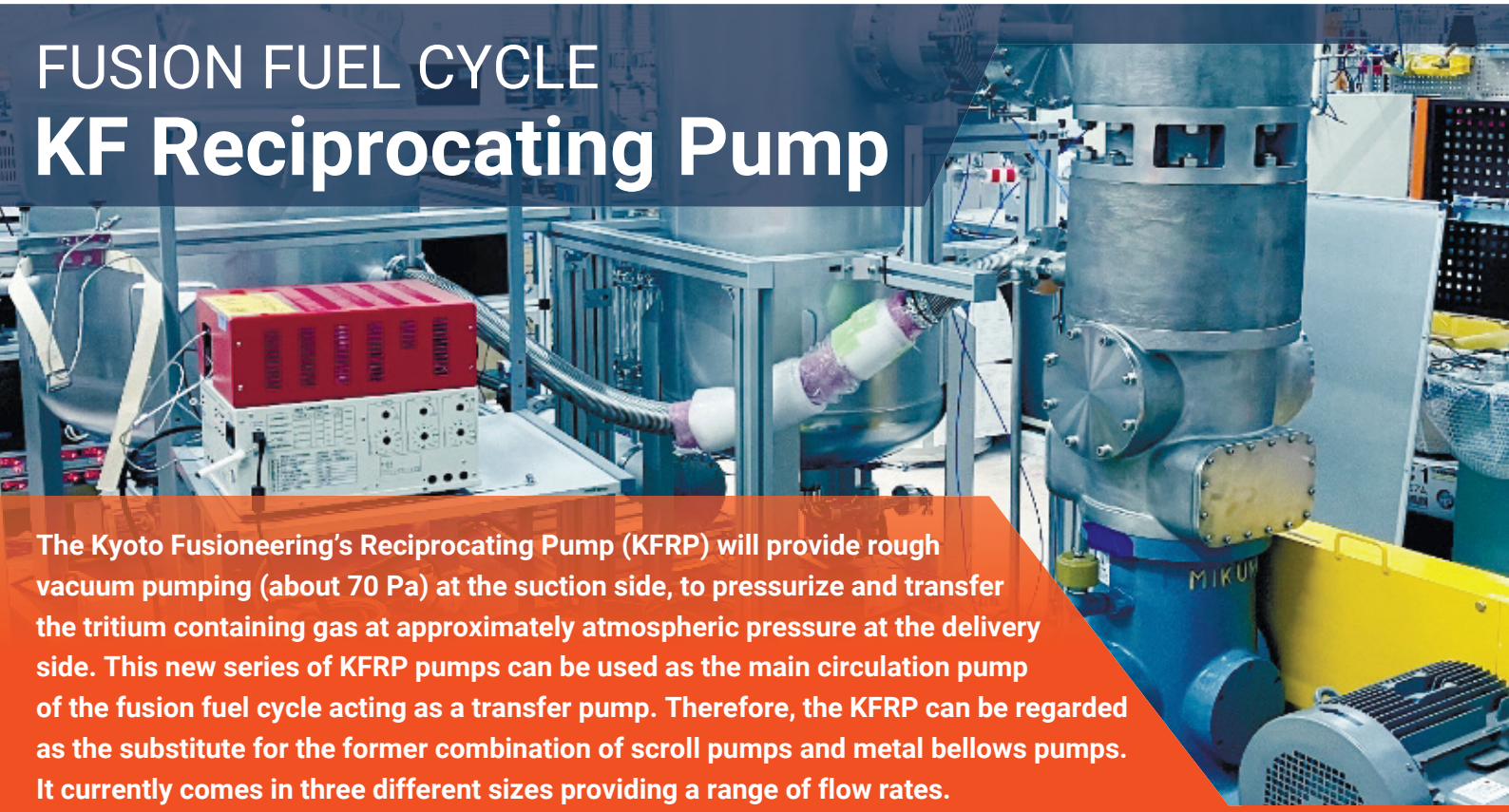
KYOTO FUSIONEERING

FUSION FUEL CYCLE
KF Reciprocating Pump



The Kyoto Fusioneering's Reciprocating Pump (KFRP) will provide rough vacuum pumping (about 70 Pa) at the suction side, to pressurize and transfer the tritium containing gas at approximately atmospheric pressure at the delivery side. This new series of KFRP pumps can be used as the main circulation pump of the fusion fuel cycle acting as a transfer pump. Therefore, the KFRP can be regarded as the substitute for the former combination of scroll pumps and metal bellows pumps. It currently comes in three different sizes providing a range of flow rates.

The KFRP is oil-free and has a 4-stage series of compression with a single coaxial piston and a cylinder made of stainless steel. Piston rings made of polyimide-carbon composite provide dry lubrication with minimum clearance.

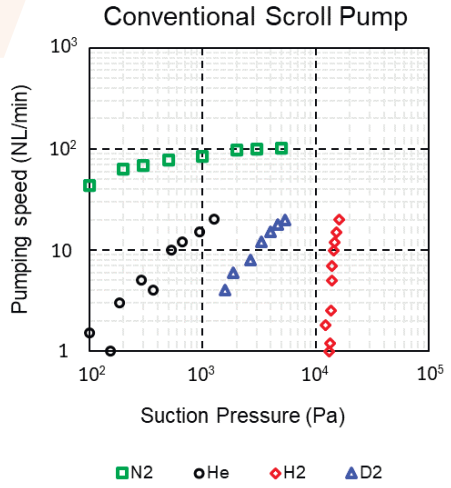
Compatibility of these materials has been confirmed with high concentration of tritium up to 100% for several years duration, based on testing in the previous model; no powder debris was observed after this extended period of operation.

A key advantage of this pump is the small difference observed in performance for different gas species (H, D, T, He).

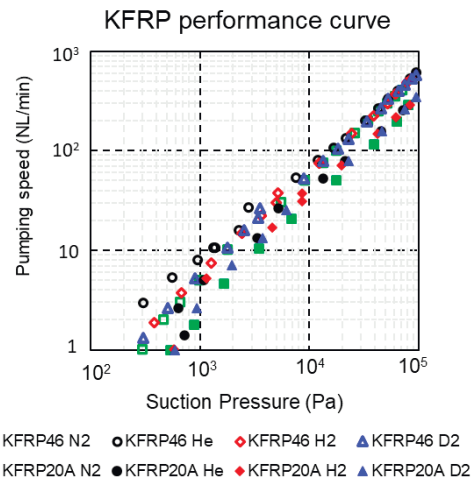
Product Index		KFRP46	KFRP20A	KFRP20B*
Pump Type		Reciprocating vacuum pump		
Min Suction Pressure	(N_2)	69 Pa	35 Pa	_*
	(H_2)	150 Pa	206 Pa	_*
Flow Rate at 650 Pa	(N_2)	180 NL/h	70 NL/h	50 NL/h
Helium Leak Test		10^{-8} Pa·m³/sec		
Cooling Method		Water cooling	Air cooling	Water cooling*
Power Draw		5.5 kW		
Pump Weight		620 kg	560 kg	480 kg
Nozzle Type		1 inch, JIS B2290	3/4 inch, JIS B2290	
Lead time		About 14 months from the order to delivery		
Remarks		High tritium compatibility almost same performance with different light gas species		

*Currently under development, subject to change

Conventional Scroll Pump



KFRP



Kyoto Fusioneering's Fuel Cycle Team

The team is led by Prof. Satoshi Konishi and Dr. Christian Day, who are world-leading specialists with unique and widespread experience in blanket, divertor, primary loop engineering, and fusion fuel cycles from involvement at the National Institutes for Quantum Science and Technology (QST), ITER, the Tritium Systems Test Assembly (TSTA), EUROfusion and other institutions.
Kyoto Fusioneering can provide a tritium fuel cycle design as well as components (turbo molecular pump, proton conductors pump, tritium storage, tritium measuring system, isotope separation system, fuel clean-up system, air detritiation system, water detritiation system, etc.).

Prof. Satoshi Konishi - Chief Executive Officer

Co-founded Kyoto Fusioneering in 2019 while working as a professor at Kyoto University. Ph.D. in Engineering from the University of Tokyo, has been involved in R&D in fusion technology, advanced nuclear system design and tritium engineering, including on the ITER project, for four decades. Has a lifelong ambition to find a solution for harmonized co-existence of humankind and the natural environment.

Dr. Christian Day - Senior Vice President, Head of Fuel Cycle

Ph.D. in Process Engineering at University of Karlsruhe, Germany. For almost three decades working at Karlsruhe Institute of Technology in all areas of tritium, fueling and vacuum technologies for ITER and other fusion devices. Developed the concept of Direct Internal Recycling to arrive at an attractive reactor scale fuel cycle architecture. Held responsibility for the EUROfusion fuel cycle program for 10 years.

Dr. Colin Baus - Vice President, Head of Plant technology

As Co-Head of Plant Technology has lead many fuel cycle and thermal cycle projects for devices like UKAEA/STEP. Holds Ph.D. (Large Hadron Collider at CERN) and has deep knowledge in nuclear physics as co-author of simulation tool CRMC. Other industry experiences includes CTO positions and Chief Quant at financial cooperation.

Yoshifumi Kume - Vice President, Head of Plant technology

Leading fusion fuel cycle and fusion thermal cycle technology development as Co-Head of Plant technology. Previously worked at Mitsubishi Chemical and engaged in heat balance and production management, equipment modification and purchasing. Has led concept design of fusion power plant, including UNITY-1 (Japan) and UNITY-2 (Canada), and develop new components and technology related to fusion thermal and fuel cycle.

Yoshinao Matsunaga - Fuel Cycle Team Leader

Specializes in chemical engineering, previously worked at Mitsubishi Chemical and engaged in an ethylene production plant. Currently, working on R&D for Exhaust Pumping Train, Direct Internal Recycling (DIR), Fuel Clean Up System (FCUS), and other systems, and is spearheading the overall R&D of Kyoto Fusioneering's Fuel Cycle Team.

Reference

S.Konishi et al. "Tritium evacuation performance of a large oil-free reciprocating pump." Fusion Engineering and Design 28 1995 357-361.
S Konishi et al. "Design of tritium collecting system from Lipb and Lipb dropping experiment." AMER NUCLEAR SOC , Vol. 60, 2011.
S.Konishi et al. "Tritium extraction material behavior and hydrogen transport mechanism." Energy materials science 2012.12
S.Konishi et al. "Development of Divertor Material with Directional Thermal Conductivity." Asian-core university program on AES 2012.1

Kyoto Fusioneering., Ltd
email: biz@kyotofusioneering.com

Our Website