



# K-Seal

## Nuclear Primary Pump Seal



## *FKSM*

FKSM was founded in 1979 and has designed and manufactured mechanical seal, welded metal bellows, and silicon carbide. We have provided our products not only for petrochemical but also for semi-conductor, aerospace, medical, and other various industries. Nuclear power plant main pump seals had been developed since 1998 as part of the national project of Korea and completed its development in 2003. Since 2005, they supplied to nuclear power plant in Korea Nuclear Power Plant.

### *Verified Performance*

The safety of nuclear power system equipment, that is, the preparation for emergencies and the reliability of the equipment are particularly important. The main pump of the nuclear power plant circulates the coolant (Reactor Coolant), and the mechanical seal performs covers in the entire operating range of normal and abnormal conditions. Therefore, high reliability and safety are required, and FKSM's K-series seal meets the requirement perfectly.

K-series seal was optimally designed through computer simulation and verified its performance by thousands of hours of performance testing including

dozens of unusual situations. In order to ensure the reliability of the products, FKSM has been cooperated with KEPCO E&C, from initial stage of design condition to final performance verification with test results at FKSM test Lab. Since 2005, about a hundreds of seals have been applied to nuclear power plants in Korea and its performance has been proven.

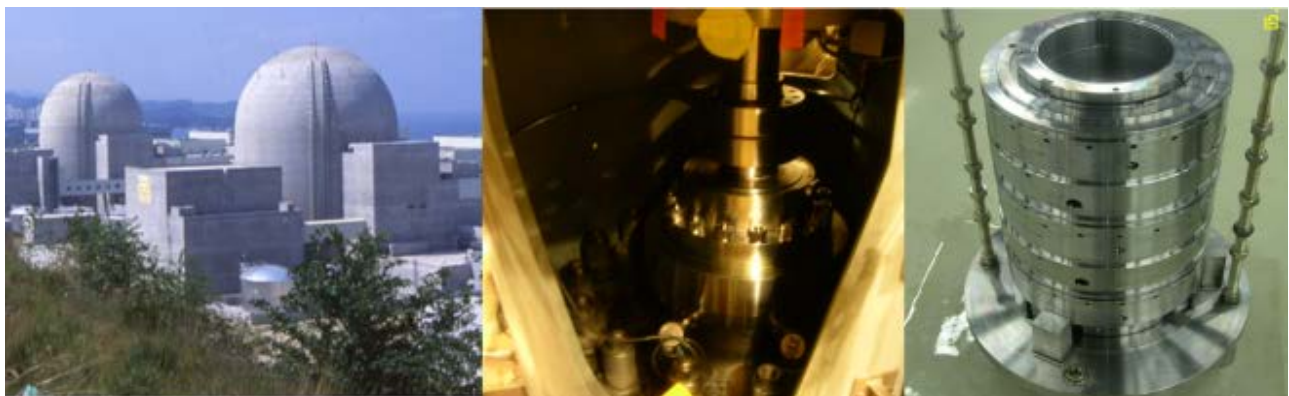
The design life is 50,000 hours. After 50,000 hours of use in the field, no specific wear or diagnose conditions have been observed.

R & D is continuously carried out in accordance with customer's needs, and the required performance verification continues to cooperate with KEPCO E&C.

### *Adaptable Design*

Flowserve K-Seal is easily adapted to existing primary pumps in pressurized water reactors (PWR), pressurized heavy water reactors (PHWR)

- Reactor coolant pumps (RCP)
  - Shin-Kori Unit # 1, 2
  - Shin-Wolsong Unit # 1, 2
  - Hanbit Unit # 3, 4, 5, 6
  - Hanul Unit # 3, 4, 5, 6
  - Saeul Unti #1, 2
- Primary Heat transport pumps (PHTP)
  - Wolsong # 2, 3, 4



## *Features and Benefits*

### **Cartridge Construction**

Cartridge simplifies installation and keeps associated maintenance costs low. It also enables more accurate seal setting and facilitates testing of the complete seal prior to installation.

### **Hydrodynamic Seal Face Technology**

Hydrodynamic technology improved reliability and running periods. Three different seal face lift designs are available to ensure faces are non-contacting over a broad operating range: Slotted Silicon carbide and precision face topography.

### **Triple Seal Design**

Seal consists of three stages. Each stage is capable of handling 100% of the system pressure. During normal operation, system pressure is distributed equally among the stages. In the event of stage failure, pressure is automatically redistributed among the remaining stages, allowing the plant to safely complete the fuel cycle.

### **Interchangeable Stage Components**

The same seal face design of three stage enable spare parts inventories and carrying costs to be reduced. Maintenance, training and assembly procedures are also simplified.

### **Increase Seal Face Safety**

The stability of the sealing surface was increased by

applying the heat shrinking design using the metal band inside and outside of the seal face.

## *Safety Through Redundancy*

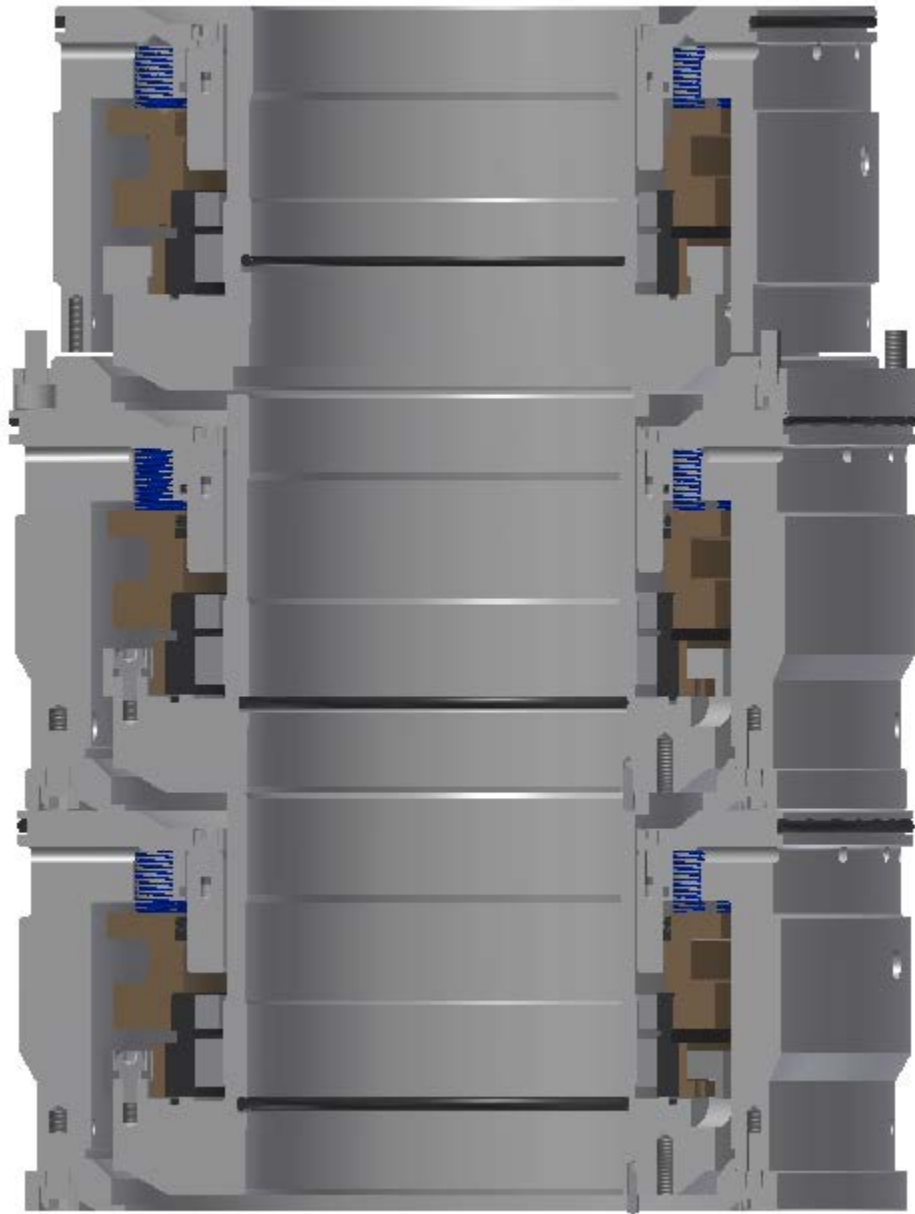
K-Seal is designed to handle 100% of the system pressure. Having multiple stages creates a safety margin through redundancy.

In addition, K-Seal has verified dozens of abnormal conditions to satisfy various performance requirements of the seal. Tests in abnormal condition include the situations where the primary seal failure, primary and secondary seal fail occurred, and in this case, it was confirmed that the sealing function of the seal was maintained and reliability was improved.

## *Testing Facility*

FKSM is capable to perform various tests at in house test lab. It can perform static tests on seals as well as various dynamic tests. These test equipment are used for new seal development and improvement of existing seal performance. In addition, not only developed products but also delivered products are subjected to a simple performance test according to the customer's request, and the quality of manufactured products is finally confirmed.





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