



TR0700317

SENSORY SYSTEMS FOR A CONTROL ROD POSITION USING REED SWITCHES FOR THE INTEGRAL REACTOR

Je-Yong Yu, Suhn Choi, Ji-Ho Kim and Doo-Jeong Lee

Power Reactor Development Center, Korea Atomic Energy Research Institute
P.O. BOX 105, Yuseong, Daejeon, 305-600, Korea
Phone: 82-42-868-2835, Fax: 82-42-868-8990
E-mail: yjy@kaeri.re.kr

ABSTRACT

The system-integrated modular advanced reactor (SMART) currently under development at the Korea Atomic Energy Research Institute is being designed with a soluble boron free operation and the use of nuclear heating for the reactor start-up. These design features require a Control Element Drive Mechanism (CEDM) for the SMART to have a fine-step movement capability as well as a high reliability for a fine reactivity control. Also the reliability and accuracy of the information for the control rod position is very important to the reactor safety as well as the design of the core protection system. The position indicator is classified as a Class 1E component because the rod position signal of the position indicator is used in the safety related systems. Therefore it will be separated from the control systems to the extent that a failure of any single control system component of a channel and shall have sufficient independence, redundancy, and testability to perform its safety functions assuming a single failure. The position indicator is composed of a permanent magnet, reed switches and a voltage divider. Four independent position indicators around the upper pressure housing provide an indication of the position of a control rod comprising of a permanent magnet with a magnetic field concentrator which moves with the extension shaft connected to the control rod. The zigzag arranged reed switches are positioned along a line parallel to the path of the movement of the permanent magnet and it is activated selectively when the permanent magnet passes by. A voltage divider electrically connected to the reed switches provides a signal commensurate with the position of the control rod. The signal may then be transmitted to a position indicating device.

In order to monitor the operating condition of the rotary step motor of CEDM, the angular position detector was installed at the top of the rotary step motor by means of connecting between the planetary gear and the rotating shaft of the rotary step motor. The permanent magnet positioned in the planetary gear holder which is designed to rotate of 60° in corresponding to each step of the rotary step motor. Therefore the angular position detector can measure one step angular increase of the rotary step motor by means of detecting the angular position of the permanent magnet using the reed switch assembly outside the pressure housing of the angular position detector. The angular position detector with planetary gear can measure precisely the control rod position by considering the gear ratio and the ball screw lead as well as can check the operating condition of the rotary step motor of CEDM at real time. The two sensory systems of the position indicator and the angular position detector will cooperate to measure the position of the control rod more reliably.