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## **AMS Fact Sheet: Rod Drop Time Measurements for DRPI Systems**

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A Pressurized Water Reactor (PWR) is equipped with control and shutdown rods which are inserted into and withdrawn from the reactor core to control the power level in the reactor. Rod drop time measurements are performed to ensure that the reactor trip functions of the rod control system operate properly, and within specific time limitations.

The Digital Rod Position Indication (DRPI) system is designed to continuously sense and display the positions of each of the control and shutdown rods. This is accomplished through the use of coil stacks which are mounted on the rod control housing above the reactor. The coils are excited with an AC voltage and magnetically sense the presence of the control rod drive shaft in the center of the coil.

The DRPI system consists of two redundant components (Data Cabinets A and B) which are located inside containment to monitor the coil currents and convert them into a digital position signal. The digital position information is then transmitted to the rod position display in the control room. As part of the test preparations for the rod drop tests, the AMS data acquisition system is connected to each of the data cabinets so the signals from the DRPI coils for each rod can be sampled. The data acquisition system is designed to remain unattended in containment for the duration of the tests. A high-speed communication system connects the data acquisition system to the control computer that is located outside of containment near the rod control power cabinets. This computer is used to control the data acquisition system, store the test data, analyze the data, and display the results. Figure 1 provides the basic set-up configuration for the tests.

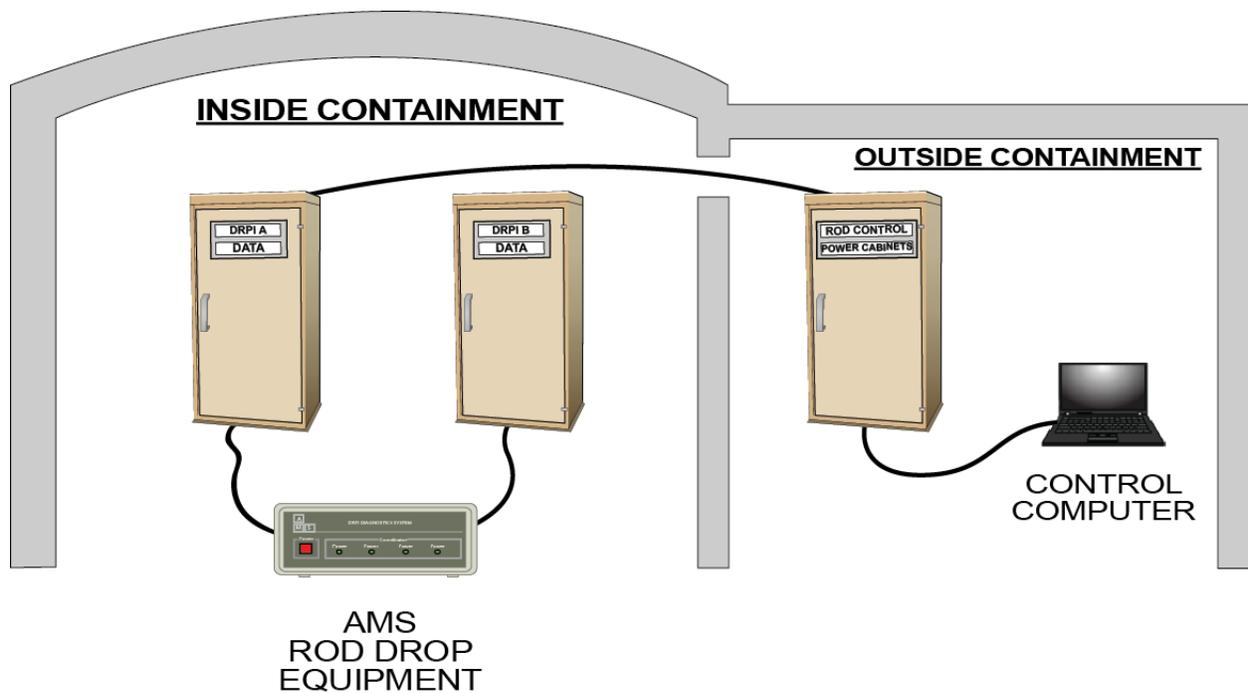
To perform the rod drop time test in plants equipped with DRPI, the AC excitation voltage to the DRPI coils may be turned off and the voltage across all the coils in the stack monitored while the rods are dropped. However, an AMS technique, referred to as the "Power-On" method (U.S. Patent # 6,404,835), allows the test personnel to perform the rod drop time measurements with DRPI power energized. For either method, the motion of the rod drive shaft through the coil stack induces a voltage in the coils which is proportional to the drive shaft velocity through the coil stack.



AMS has the capability to measure the drop times of individual rods, banks or rods, or all the control and shutdown rods at the same time. The rod drop tests are performed according to the following general procedure:

1. One or more control or shutdown rods are fully withdrawn from the reactor,
2. The test equipment is set for data acquisition mode
3. The reactor trip breaker is opened to allow the rod(s) to drop, triggering the data acquisition. The output from the DRPI coils is monitored to provide the rod drop time test signals.

A normal set of rod drop time measurements performed using AMS test equipment takes about 45 minutes or less to complete, depending on how many rods are tested at the same time.



**Figure 1. AMS Rod Drop Test Equipment Configuration**