Westinghouse Technology Systems Manual

Chapter 8

ROD CONTROL AND INSTRUMENTATION

Section

8.0 ROD CONTROL AND INSTRUMENTATION

Introduction

The purpose of the Rod Control System (Section 8.1) is to maintain a programmed average temperature (Section 1.2) in the reactor coolant system by regulating the reactivity in the core. An error between the programmed reference temperature (T_{ref}), based on turbine impulse pressure, and the highest average temperature (T_{avg}) of the reactor coolant, generates a signal to cause automatic rod movement. Rod speed is varied, depending on the magnitude of the error between T_{ref} and T_{avg}. Rod direction (either into or out of the core) is dependent on whether T_{avg} is higher or lower than T_{ref}.

The rods are separated into two functional categories, shutdown rods and control rods, with each category consisting of several individual banks. The shutdown banks provide a large negative reactivity insertion upon a reactor trip and insure that the reactor shuts down and remains subcritical. The shutdown banks are always fully withdrawn during normal operation and are placed in this position by manual rod control prior to criticality.

The control bank rods are used to start up the reactor. After criticality is achieved, these rods are used to regulate the reactivity in the core to maintain the programmed T_{avg}. In addition, these are the only rods that can be manipulated under automatic rod control.

Power to the rod drive mechanisms is supplied by two motor generator sets, which are powered from two separate 480-volt, three-phase buses. The AC power from the MG sets is distributed to the rod control power cabinets via two series connected reactor trip breakers. A reactor trip signal, opening either one or both trip breakers, removes power from the rod drive mechanisms. Once power is removed from the magnetic coils of the rod drive mechanisms, all rods (shutdown and control) fall into the core by gravity.

The locations of the rods within the core are displayed by both individual rod position indication and group position indication. The individual rod position indication may be either the analog type (Section 8.2) or the digital type (Section 8.3), depending on the age of the plant. Older plants normally have the analog type of position indication. The group rod position indication is a demanded position indication, and receives the same signal that induces rod motion.

There are operating and Technical Specification restrictions placed on rod position during power operations. One such restriction, called the rod insertion limits (Section 8.4), ensures that the reactor can be shut down from its present condition, assuming various design considerations.