

4.6 Functional Design of Reactivity Control System

The information in this section of the reference ABWR DCD, including all subsections and figures, is incorporated by reference with the following departures and a supplement.

STD DEP 4.6-1

STD DEP 7.7-1

4.6.1.2 Description

The CRDHS supplies clean, demineralized water which is regulated and distributed to provide charging of the HCU scram accumulators and purge water flow to the FMCRDs during normal operation. The CRDHS is also the source of pressurized water for purging the Reactor Internal Pumps (RIPs) and the Reactor Water Cleanup (CUW) System pumps, and Nuclear Boiler System (NBS) reference leg instrument lines.

The CRD System performs the following functions:

- (12) *(Supplies purge water for the RIPs, and CUW pumps, and NBS reference leg instrument lines.*

4.6.1.2.3 Hydraulic Control Units

STD DEP 4.6-1

FMCRD friction testing also utilizes a special test fixture connected to the HCU test port. The test fixture contains a small pump and associated hydraulic controls to pressurize the underside of the hollow piston. When the pressure under the hollow piston is high enough to overcome both the combined hollow piston and control rod weight and the drive line friction, the hollow piston will separate from the ball-nut and drift the control rod into the core. Instrumentation measures the pressure under the hollow piston as it is being inserted. The measured pressure is a direct indication of the drive line friction. Water for the test fixture pump is supplied from the CRD pump suction discharge line via piped connections to test ports located in the HCU rooms.

4.6.1.2.4 Control Rod Drive Hydraulic Subsystem

The Control Rod Drive Hydraulic Subsystem (CRDHS) supplies water under high pressure to charge the accumulators, to purge the FMCRDs and to purge the Reactor Internal Pumps (RIPs) and the Reactor Water Cleanup (CUW) System pumps, and the NBS reference leg instrument lines. The CRDHS provides the required functions with the pumps, valves, filters, piping, instrumentation and controls shown on the CRD System P&ID (Figure 4.6-8). Duplicate components are included where necessary to assure continuous system operation if an inservice component should require maintenance. For system and component classification, see Section 3.2.

4.6.1.2.4.1 Hydraulic Requirements

The CRDHS process conditions are shown in Figure 4.6-9. The hydraulic requirements, identified by the function they perform, are:

- (4) Approximately 4 L/min purge flow is provided to the NBS reference leg instrument lines. The purge flow maintains the RPV water level instrument reference lines filled to address the effects of noncondensable gases in the instrument lines to prevent erroneous reference information after a rapid RPV depressurization event.

4.6.1.2.5.1 Normal Operation

Normal operation is defined as those periods of time when no control rod drives are in motion. Under this condition, the CRD System provides charging pressure to the HCU's and supplies purge water to the control rod drives, RIPs ~~and~~, CUW pumps, and purge water to the NBS reference leg instrument lines.

A multi-stage centrifugal pump (C001) supplies the system with water from the condensate and feedwater system and/or CST. A constant portion of the pump discharge is continuously bypassed back to the CST in order to maintain a minimum flow through the pump. This prevents overheating of the pump if the discharge line is blocked. The total pump flow during normal operation is the sum of the bypass flow, the FMCRD purge water flow through the flow control valve (F010), the RIP purge flow, ~~and the CUW pump purge flow, and NBS reference leg instrument purge flow.~~ The standby pump provides a full capacity backup capability to the operating pump. It will start automatically if failure of the operating pump is detected by pressure instrumentation located in the common discharge piping downstream of the drive water filters.

4.6.6.1 CRD and FMCRD Maintenance Procedures During Maintenance

The following standard supplement addresses COL License Information Item 4.5.

Fine motion control rod drive (FMCRD) maintenance procedures prohibit coincident removal of control rod drive (CRD) blade and drive of the same assembly.

Contingency procedures provide for core and spent fuel cooling and mitigative actions during CRD replacement with fuel in the vessel.

These procedures are in accordance with the guidelines in GE Licensing Topical Report NEDO-33297, Class 1, dated January 2007, titled "Advanced Boiling Water Reactor (ABWR) Procedures Development Plan." Section 13.5.

