Reactor Coolant Pumps

Chapter 2.2
Objectives

1. State the purposes of the reactor coolant pump (RCP).
2. Describe the flow paths through the RCP.
3. Explain how the RCP seal minimizes leakage of reactor coolant to the containment building atmosphere.
4. State the safety-related function of the RCP motor flywheel.
Objectives (Continued)

5. State the purposes of the RCP motor anti-reverse rotation mechanism.
6. State the purpose of the RCP instrumentation.
Purposes of RCP

1. To provide the forced circulation of reactor coolant for the removal of core heat.

2. To provide energy to heat up the RCS from ambient temperature to greater than the minimum temperature for criticality prior to reactor startup.
Figure 2.2-1 Reactor Coolant Pump Operating Curve

- **B.H.P.** = Brake Horsepower
- **NPSH** = Net Positive Suction Head
- **SP. GR.** = Specific Gravity

Graph showing:
- % Pump Efficiency vs. THOUSAND GALLONS PER MINUTE
- Head vs. TOTAL HEAD IN FEET
- NPSH Required (Cold) vs. NPSH in Feet of Water

Legend:
- B.H.P. at SP. GR. = 1.0
- B.H.P. at SP. GR. = 0.76
Figure 2.2-2 Reactor coolant Pump Assembly

KEY:
- PRIMARY LOOP WATER @ TEMPERATURE
- COOLED PRIMARY LOOP WATER
- COMPONENT COOLING WATER

- COOLING WATER INLET
- STUD TENSIONER
- DRAIN
- GASKET LEAKAGE
- MOTOR HALF COUPLING
- COUPLING SPACER
- PUMP HALF COUPLING
- SHAFT
- COOLING WATER OUTLET
- INTEGRAL HEAT EXCHANGER
- MECHANICAL SEALS
- COVER—THERMAL BARRIER
- BEARING
- IMPELLER
- PUMP CASE
Figure 2.2-3 Reactor Coolant Pump Seal Assembly

- **Closure Stud**
- **Cooling Water Inlet Connection**
- **Drain**
- **Gasket Leakoff**
- **Pump Cover Assembly (Thermal Barrier)**
- **Hydro Bearing**
- **Seal Impeller**
- **Coupling Pump Half**
- **Seal Stationary Face**
- **Seal Rotating Face**
- **Controlled Leakage Pressure Reduction Paths**
- **Cooling Water Outlet Connection**
- **Seal Cooling Heat Exchanger**
Figure 2.2-4 Simplified Seal Diagram

- Containment Sump
- Vapor Seal
- Upper Seal
- Middle Seal
- Lower Seal
- Stationary Seal Face
- Rotating Seal Face 2
- Concentric Tube Heat Exchanger
- Recirc Impeller
- Impeller
- Controlled Bleed Off to VCT
- Pressure Breakdown Device

Flow rates and flow directions are indicated on the diagram.
Figure 2.2-5 Reactor Coolant Pump Motor Assembly

- **Flywheel**
- **Upper Bearing**
- **Cooler**
- **Main Terminal Box**
- **Anti-Reverse Rotation Device**
- **Lower Bearing**
- **To Pump Coupling**
Figure 2.2-6 Reactor Coolant Pump Instrumentation

- LUBE OIL COOLER
- VIBRATION SWITCH (2)
- UPPER OIL RESERVOIR (200 GAL)
- UPPER THRUST BEARING
- DOWNWARD THRUST BEARING
- STATOR WINDING
- CONTAINMENT SUMP
- STATIONARY SEAL FACE
- ROTATING SEAL FACE
- CONCENTRIC TUBE HEAT EXCHANGER
- 28 GPM
- 40 GPM IMPELLER
- RECIRC IMPELLER
- TO RCP 13.8KV BREAKER CONTROL
- STATOR WINDING (H)
- 0.3 GPM
- 1 GPM
- CONTROLLED BLEED OFF TO VCT
- PRESSURE BREAKDOWN DEVICE
- CCW
- PC
- T
- H
- L
The End