INDIAN POINT STATION

UNIT NO. 2

SOP-1.3 REV. 0

REACTOR COOLANT PUMP OPERATION

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Reactor Coolant Pump Operation

1.0 Intent

To detail the verifications and operations required to start, operate and shutdown a Reactor Coolant Pump (RCP).

2.0 Precautions and Limitations

2.1 To preclude Reactor Coolant System (RCS) pressure spikes which exceed the RCS pressure-temperature relationship requirements of the Technical Specifications (refer to Graphs Book), do not start a RCP, if no other RCPs are running, unless one of the following conditions is met:

A. A gas bubble exists in the RCS. The bubble may be either air, nitrogen or steam. If the bubble is in the pressurizer (nitrogen or steam), the pressurizer level must be less than 95% of span. If the bubble exists in the steam generators due to filling drained loops (air), the pressurizer should be completely filled.

NOTE: Indicated pressurizer level must be corrected to take into account temperature as per Graphs Book.

OR

B. There is complete temperature equalization between the water in the Reactor Vessel and the water in the Steam Generators. Since no instrumentation is available to verify this, it is a judgement decision. The means and speed of previous plant cooldown as well as the time duration of the cooldowned condition need to be considered.

2.2 The following motor starting times must be observed under all circumstances:

1. Starts should not average more than 6 per day throughout the life of the motor.

2. Two successive starts are permitted, providing the motor is allowed to coast to a stop between starts.

3. A third start may be made when the windings and the rotor core have cooled by running for a period of 20 minutes after the second start or by standing idle for a period of 45 minutes.

4. All successive starts may be made when the windings and the rotor core have cooled by either running or standing idle after the third start for a period of 4 hours.

2.3 If the Reactor Coolant System pressure cannot be maintained 10 psi greater than Volume Control Tank pressure, the No. 1 seal return valves and the No. 1 seal bypass valve must be closed to prevent backflow of the Volume Control Tank cover gas

2.4 Do not open the No. 1 seal bypass valve unless the No. 1 seal return valves are open and there is at least a 100 psi differential across the No. 1 seals. This will prevent lifting the seal ring off the runner, which can cause the seal ring to hang up.

2.5 When power is being supplied via GT-25 and GT-26, do not normally operate more than one RCP. If it is necessary to operate two RCPs, first parallel the diesels onto the 480 volt buses and then separate the 480 volt buses from the 6900 volt buses. This will prevent a blackout if the gas turbine feeder clears on overcurrent. Following successful starting of the second RCP, the 480 volt buses should be retied to the 6900 volt buses Under no circumstances are more than two RCPs to be operated on the gas turbine feeder.

NOTE: If power is being supplied to GT-25 and GT-26 via GT-BT, the loads being supplied by GT-35 and GT-36 must be considered prior to starting any RCPs.

2.6 Whenever the RCP is barred over, the torque required should not exceed 400 ft.-lbs. If exceeded, the RCP should not be started.

2.7 Only one RCP is to be started at any one time. It must be up to speed prior to starting another RCP.

2.8 The maximum allowable pressure on the component cooling side of the thermal barrier is 225 psig.

3.0 Initial Conditions

The following conditions must be met prior to starting a RCP:

3.1 150 gpm Component Cooling flow to the upper motor bearing cooler.

3.2 5 gpm Component Cooling flow to the lower motor bearing cooler.

NOTE: Absence of the "RCP No. * Bearing Coolant Low Flow" alarm can serve as verification of conditions 3.1 and 3.2.

3.3 25 gpm Component Cooling flow to the thermal barrier cooling coil.

NOTE: Absence of the ""hermal Barrier CCW Header Low Flow" alarm can serve as verification of this condition.

3.4 6-10 gpm seal injection flow.

NOTE: A positive ΔP indication ($\sim$ 10") across the thermal barrier can serve as verification of this condition. The seal injection flows need not be accurately set and balanced prior to the point of all four pumps being in operation unless extended operation with less than four pumps is anticipated.

3.5 $\geq$ 275 psi ΔP indicated across the No. 1 seal.

3.6 An indicated seal injection temperature in the range of 60-150°F.

3.7 An indicated volume control tank pressure in the range of 15-60 psig.

3.8 Normal level in the No. 2 seal return standpipe.

NOTE: Absence of the "Reactor Coolant Pump Standpipe High Level" and the "Reactor Coolant Pump Standpipe Low Level" alarms or if one or both is annunciated, absence of the RCP No. * abnormal standpipe level light can serve as verification of this condition.

* 21, 22, 23 or 24 as applicable.

3.9 Normal level in the RCP motor bearing oil reservoirs.

NOTE: Absence of the "Reactor Coolant Pump Motor Oil High Level" and the "Reactor Coolant Pump Motor Oil Low Level" alarms or if one or both is annunciated, absence of the RCP No. * abnormal motor oil level light can serve as verification of this condition.

3.10 $\geq$ 0.3 gpm indicated No. 1 seal return flow.

3.11 The RCS pressure-temperature requirements for operation of the RCPs must be met (refer to Graphs Book).

4.0 Procedure

4.1 Startup

4.1.A Verify that all initial conditions are met.

4.1.B If the No. 1 seal return flow is less than 1 gpm, open the No. 1 seal bypass valve.

CAUTION

Do not open the No. 1 seal bypass valve unless the No. 1 seal return valve is open and there is at least a 100 psi differential across the No. 1 seal.

4.1.C Start the Bearing Lift Pump. The bearing lift oil must be directed to the upper thrust shoes at a minimum pressure of 500 psig (white light permissive) for two (2) minutes prior to starting the RCP.

NOTE: Whenever practicable, a man should be sent into containment to inspect the bearing lift oil system prior to and during initial running of same. Oil leaks at other facilities have resulted in serious fires.

4.1.D Select the noise monitor for the RCP to be started.

4.1.E Verify that the Station or Unit Auxiliary Transformer (whichever is supplying the load) tap changer is in automatic or be prepared to raise the tap position as the RCP is started. If power is being supplied via GT-25 and GT-26, assure that the bus section voltage is at least 6.9 KV prior to starting any RCP.

* 21, 22, 23 or 24 as applicable.

4.1.F Start the RCP.

CAUTION

Intermixing of the water in an idle loop (presuming all four loops are initially idle) with the water in the Reactor Vessel may cause a RCS temperature change. With a solid system this will result in a pressure transient. Be alert of same. Decrease charging pump speed and/or increase letdown flow on any pressure increase and vice versa.

NOTES:

1. A RCP takes between 18 and 20 seconds to come up to speed.

2. During the inrush current period, the voltage dip may cause several spurious alarms.

3. The "Reactor Coolant Loop No. * Low Flow Channel Trip" alarm will clear just prior to the RCP current returning on scale.

4. Normal running current is:

   A. Hot ~400 amps
   B. Cold, more than 1 RCP ~500 amps
   C. Cold, 1 RCP only ~540 amps

4.1.G Monitor the RCP vibration. With a hot RCS the following values should not be exceeded:

A. Vibration at the Frame - (top of motor stand)

1) At 3 mils (peak to peak composite) - satisfactory, but balancing should be done at the first convenient opportunity.

2) If vibration has reached 5 mils (peak to peak composite), shut down the pump. Westinghouse should be informed for further information.

B. Vibration at the Pump Shaft - (near bottom of pump coupling)

1) At 13 mils (peak to peak composite) - satisfactory but balancing should be done at first opportunity.

2) Over 13 mils - balance as soon as possible.

3) At 20 mils - inform Westinghouse.

4) At 30 mils, shutdown pump and inform Westinghouse.

* 21, 22, 23 or 24 as applicable.

4.1.H Monitor the rise in bearing temperatures (200°F maximum) and stator winding temperature (250°F maximum) until stabilization is achieved.

NOTE: It is allowable for the stator winding temperature to exceed 250°F during extended RCP running with a cold Reactor Coolant System.

4.1.I Stop the bearing oil lift pump after the RCP has run a minimum of one (1) minute.

4.1.J For successive starts, observe the motor starting times above.

4.1.K Close the No. 1 seal bypass valve after a No. 1 seal return flow of 1 gpm is indicated for each RCP.

NOTE: The No. 1 seal return flow will normally exceed 1 gpm whenever the RCS pressure is greater than 1500 psig.

4.2 Normal Operation

4.2.A All the initial conditions which applied to startup apply continuously to normal operations.

4.2.B Periodically monitor and log all pertinent parameters.

NOTE: With respect to thrust bearing shoe temperatures; the RCP thrusts downward at low RCS pressures and upwards at high RCS pressures. The changeover point is approximately 1500 psig.

4.2.C The No. 1 seal return flow should remain less than 5 gpm.

NOTE: Should the No. 1 seal return flow exceed 5 gpm, close the appropriate No. 1 seal return valve. The RCP should be taken out of service within 10 minutes.

4.2.D Whenever the RCS pressure is decreased below 2000 psig, the RCP No. 1 seal return flow must be closely monitored. When the No. 1 seal return flow on any pump decreases to 1 gpm, the common No. 1 seal bypass valve must be opened in order to provide adequate flow for cooling of the pump bearing.

NOTE: If during operation, the No. 1 seal return flow decreases below 1 gpm do not open No. 1 seal bypass valve but rather monitor seal return temperatures more frequently. If temperature reaches 170°F, the affected RCP should be shut down.

The reason for not opening bypass is that it will upset conditions on other No. 1 seals unnecessarily

4.3 Normal Shutdown

4.3.A Stop the RCP. Bearing lift oil is not required on shutdown.

4.3.B Cooling water to the motor bearing oil coolers should be maintained for at least one-half hour after shutdown.

4.3.C Injection water to the RCP should be flowing at all times when the Reactor Coolant System is filled and pressurized.

4.3.D Component Cooling Flow (25 gpm) to the thermal barrier must be maintained until the Reactor Coolant System temperature is below 150°F.

4.4 Emergency Shutdown

4.4.A Any of the following shall be cause for immediate shutdown.

4.4.A.1 Upper or lower motor bearing temperature $\geq$ 200°F.

NOTE: In the event component cooling flow to the RCP motor bearing oil coolers is lost, it will take between one (1) and two (2) minutes for the bearing temperature to reach 200°F.

4.4.A.2 Stator winding temperature $\geq$ 250°F.

NOTE: It is allowable for the stator winding temperature to exceed 250°F during extended RCP running with a cold Reactor Coolant System.

4.4.A.3 High or low oil level alarms in the motor bearing oil reservoirs.

4.4.A.4 $<$ 0.3 gpm No. 1 seal return flow (regardless of whether or not seal bypass flow exists).

4.4.A.5 $\leq$ 275 psi indicated ΔP across the No. 1 seal.

4.4.A.6 $>$ 170°F seal injection water temperature.

4.4.A.7 $\geq$ 5 mils vibration at the top of the motor stand.

4.4.A.8 $\geq$ 30 mils shaft vibration (just below the coupling).

4.4.A.9 Rapid increase of seal return flow above 5 gpm.

4.4.B Shut down the RCP in accordance with step 4.3.

4.4.C Refer to E-8 for loss of a RCP, E-9 for loss of seal injection, E-15 for loss of component cooling and E-4 for combined loss of seal injection and component cooling.