CONTROLLED COPY
CENTRAL FILE

2103-1.4
Revision 6
08/16/78

1 006
APR 23 1979
(22)

# THREE MILE ISLAND NUCLEAR STATION
# UNIT # 2 OPERATING PROCEDURE 2103-1.4
# REACTOR COOLANT PUMP OPERATION

Table of Effective Pages

| Page | Date | Revision | Page | Date | Revision | Page | Date | Revision |
|---|---|---|---|---|---|---|---|---|
| 1.0 | 05/12/77 | 0 | 26.0 | | | 51.0 | | |
| 2.0 | 05/12/77 | 0 | 27.0 | | | 52.0 | | |
| 3.0 | 04/18/78 | 4 | 28.0 | | | 53.0 | | |
| 4.0 | 04/18/78 | 4 | 29.0 | | | 54.0 | | |
| 5.0 | 08/16/78 | 6 | 30.0 | | | 55.0 | | |
| 6.0 | 10/13/77 | 2 | 31.0 | | | 56.0 | | |
| 7.0 | 10/13/77 | 2 | 32.0 | | | 57.0 | | |
| 8.0 | 06/28/78 | 5 | 33.0 | | | 58.0 | | |
| 9.0 | 06/28/78 | 5 | 34.0 | | | 59.0 | | |
| 10.0 | 04/18/78 | 4 | 35.0 | | | 60.0 | | |
| 11.0 | 05/12/77 | 0 | 36.0 | | | 61.0 | | |
| 12.0 | 05/12/77 | 0 | 37.0 | | | 62.0 | | |
| 13.0 | 04/18/78 | 4 | 38.0 | | | 63.0 | | |
| 14.0 | 04/18/78 | 4 | 39.0 | | | 64.0 | | |
| 15.0 | 04/18/78 | 4 | 40.0 | | | 65.0 | | |
| 16.0 | 10/13/77 | 2 | 41.0 | | | 66.0 | | |
| 17.0 | 10/13/77 | 2 | 42.0 | | | 67.0 | | |
| 18.0 | 04/18/78 | 4 | 43.0 | | | 68.0 | | |
| 19.0 | 04/18/78 | 4 | 44.0 | | | 69.0 | | |
| 20.0 | 06/18/77 | 1 | 45.0 | | | 70.0 | | |
| 21.0 | 05/12/77 | 0 | 46.0 | | | 71.0 | | |
| 22.0 | | | 47.0 | | | 72.0 | | |
| 23.0 | | | 48.0 | | | 73.0 | | |
| 24.0 | | | 49.0 | | | 74.0 | | |
| 25.0 | | | 50.0 | | | 75.0 | | |

Unit 1 Staff Recommends Approval

Approval N/A Date —

Cognizant Dept. Head

Unit 2 Staff Recommends Approval

Approval N/A Date —

Cognizant Dept. Head

Unit 1 PORC Recommends Approval

N/A Date —

Chairman of PORC

Unit 2 PORC Recommends Approval

R P Warren Date 8/16/78

Chairman of PORC

Unit 1 Superintendent Approval

N/A Date —

Unit 2 Superintendent Approval

J L Seelinger Date 8/16/78

Manager Generation Quality Assurance Approval N/A Date 193 069

TMI 55-A Rev 8/77

THREE MILE ISLAND NUCLEAR STATION

UNIT #2 OPERATING PROCEDURE 2103-1.4

REACTOR COOLANT PUMP OPERATION

Table of Contents

THREE MILE ISLAND NUCLEAR STATION

UNIT #2 OPERATING PROCEDURE 2103-1.4

REACTOR COOLANT PUMP OPERATION

1.0 REFERENCES

1.1 Drawings Applicable for Operation.

1.1.1 RC Make-Up and Purification, B&R Dwg. 2024.

1.1.2 Intermediate Closed Cooling Water, B&R Dwg. 2029.

1.1.3 Nuclear Services Closed Cooling Water, B&R Dwg. 2030.

1.1.4 R.C. Pump Seal Recirculating and Cooling Water, B&R Dwg. 2601.

1.1.5 Valve Stem Leakoff Piping, B&R Dwg. 2632.

1.1.6 Oil Splash Shield Piping for R.C. Pump Motors, B&R Dwg. 2633.

1.2 Operating Procedure Applicable for Operation.

1.2.1 2102-1.3 Unit Startup.

1.2.2 2102-3.1 Unit Shutdown.

1.2.3 2102-3.2 Unit Cooldown.

1.2.4 2104-1.2 Make-Up and Purification.

1.2.5 2104-1.3 Decay Heat Removal.

1.2.6 2104-1.6 Intermediate Cooling.

1.2.7 2104-3.2 Nuclear Service Closed Cooling Water.

1.2.8 2103-1.1 Filling and Venting the R.C. System.

1.3 Manufacturers' Instruction Manual.

1.3.1 Reactor Coolant Pump Motors, Allis Chalmers, No. 09-0007 (B&R File 7).

1.3.2 Reactor Coolant Pumps, Bingham, No. 01-0317 (B&R File 7).

1.4 Applicable System Descriptions.

1.4.1 None.

1.5 Curves, Tables, etc.

1.5.1 Plant Operation Curves, Figure 1 and 1A.

1.5.2 RCP Interlocks and Trips, Table 1.

1.5.3 RCP Alarms, Table 2.

2.0 LIMITS AND PRECAUTIONS

2.1 Equipment.

2.1.1 Pump.

2.1.1.1 See Figures 1 and 1A for the system pressure that must be maintained for required reactor coolant pump.

NOTE: It is permissable to start one RC pump outside of the Single Pump in a Loop curve, but within the Two Pumps/Loop curve provided that the second pump is started as soon as feasible, and not to exceed 10 minutes.

2.1.1.2 Seal Injection Water flow and Intermediate Closed Cooling Water to the Reactor Coolant Pumps must be established before starting any of the Reactor Coolant Pumps.

2.1.1.3 Seal Injection water flow must be started at least 30 minutes prior to starting a Reactor Coolant Pump.

2.1.1.4 Seal Injection water flow is required to all Reactor Coolant Pumps when Reactor Coolant temperature is above 200°F.

2.1.1.5 Securing a reactor coolant pump when operating in the loss of injection mode (intermediate cooling still operating) will cause high reactor coolant pump seal temperatures.

2.1.1.6 Maximum allowable temperature of seal water entering the seal return coolers is 185F as indicated by RC-21-TR on Panel 10.

| | |
|---|---|
| RC-21-TE1 | RC-P-1A |
| RC-21-TE2 | RC-P-1B |
| RC-21-TE3 | RC-P-2A |
| RC-21-TE4 | RC-P-2B |

193 072

2.1.1.7 Normal Seal Injection flow is 10 GPM/Pump.

2.1.1.8 Reactor Coolant Pump will trip immediately when both Seal Injection water and Intermediate Cooling water are lost.

2.1.1.9 Prior to RC Pump startup with Seal Injection operating, verify Second Seal Staging pressure is approximately two thirds system pressure and Third Seal Staging pressure is approximately one third system pressure.

2.1.1.10 Do not start a Make-Up Pump if no others are running and an open flow path to the RC Pump Seals exists.

NOTE: The restriction bushing in the Reactor Coolant Pump may be exposed to excessive DP.

2.1.1.11 The Seal Return line is necessary to stage the DP across the mechanical seals. Its normal flow rate is 1.1 GPM as sensed by MU-10-FT1, 2, 3, and 4 respectively for RC-P-1A, B, 2A, B as indicated by computer points 0771-0774.

2.1.1.12 Verify the Seal Return valves close if:

1. Injection is lost when pump is idle.
2. Both Seal Injection and cooling water are lost.

2.1.1.13 Maximum Seal Return Flow is 1.9 GPM.

2.1.1.14 To avoid damage to the mechanical seals, the Reactor Coolant Pump must be stopped if Seal Return temperature exceeds 185F as recorded by RC-20/21-TR on panel 10.

2.1.1.15 Pump Manufacturer shall be notified when RC Pump Steady State vibration measured at the pump coupling reaches 15 mils peak amplitude.

NOTE: During startup of first pump per steam generator shaft vibration of 20 mils is permissible for a period not to exceed 4 hours.

193 073

2.1.1.16 The pump should not be uncoupled from the motor until the Reactor Coolant System pressure is less than or equal to 40 psig. Do not start the injection system when the pump is uncoupled.

2.1.1.17 Prior to starting an RC Pump, open the Seal Return Valves MU-V33A, B, C, D a minimum of 15 minutes to vent the seal cavity area. Leave the Seal Return Valve open at all times when the pump is operating.

2.1.1.18 Seal Return valves (MU-V33A, B, C, D) should be CLOSED when RCS pressure is less than 150 psig.

2.1.1.19 The RC Pump Seal Leakage Flow alarm point is 0.33 gpm. If the sum of the Seal Leakage Flow, as indicated by WDL-FIT-7107, 8, 9, 10 respectively for RC-P-1A, 1B, 2A, 2b and the Seal Return Flow, as indicated by computer point 0771-774 is greater than 1.9 gpm, the pumps must be stopped.

NOTE: During pressure and temperature transients, seal leakage may exceed the above limits, but as the system stablizes, seal leakage should return to normal levels.

2.1.1.20 Pumps must be tripped when either seal cavity pressure exceeds 2500 psig.

2.1.1.21 Cooling water flow to the pumps must be 50 gpm (-0 + 10 gpm) as indicated by local IC-FI-7566, 7567, 7568, and 7569.

2.1.1.22 Maximum seal injection temperature is 125°F.

2.1.2 Motors.

2.1.2.1 Maximum allowable voltage variation is ± 10 percent.

193 074

2.1.2.2 Maximum allowable frequency variation is ± 5 percent.

2.1.2.3 Maximum allowable voltage plus frequency variation is ± 10 percent.

2.1.2.4 Maximum time for locked Motor without damage at 100 percent voltage is 11.5 seconds.

NOTE: Time to full speed from zero speed - 100 percent voltage with no reverse RC Flow is 8 seconds.

NOTE: Time to full speed from zero speed - 100 percent voltage with reverse RC Flow (3 pumps operating and starting fourth Pump) is 11 seconds.

2.1.2.5 Pump Motor start limits are 3 starts from ambient temperature, allowing the motor to coast to rest between starts, or 2 starts if motor is at operating temperature. Thereafter, 20 minutes running or 40 minutes with motor stopped must elapse before an additional start may be attempted.

2.1.2.6 Minimum speed without high pressure oil lift pumps operating is 300 RPM.

2.1.2.7 Maximum allowable thrust bearing temperature is 200°F (this is a shutdown point) as indicated by the following computer points. Maximum allowable radial bearing temperature is 185°F as indicated by the following computer points (this is a shutdown point).

Thrust Bearing Temperature

| | | |
|---|---|---|
| 0426 | RCP 1A | DOWNTHRUST BRG TEMP |
| 0427 | RCP 1B | DOWNTHRUST BRG TEMP |
| 0428 | RCP 2A | DOWNTHRUST BRG TEMP |
| 0429 | RCP 2B | DOWNTHRUST BRG TEMP |

| | | |
|---|---|---|
| 0430 | RCP 1A | DOWNTHRUST BRG TEMP |
| 0431 | RCP 1B | DOWNTHRUST BRG TEMP |
| 0432 | RCP 2A | DOWNTHRUST BRG TEMP |
| 0433 | RCP 2B | DOWNTHRUST BRG TEMP |

Radial Bearing Temperatures

| | | |
|---|---|---|
| 0434 | RCP 1A | UPPER RADIAL BRG TEMP |
| 0435 | RCP 1B | UPPER RADIAL BRG TEMP |
| 0436 | RCP 2A | UPPER RADIAL BRG TEMP |
| 0437 | RCP 2B | UPPER RADIAL BRG TEMP |
| 0438 | RCP 1A | LOWER RADIAL BRG TEMP |
| 0439 | RCP 1B | LOWER RADIAL BRG TEMP |
| 0440 | RCP 2A | LOWER RADIAL BRG TEMP |
| 0441 | RCP 2B | LOWER RADIAL BRG TEMP |

2.1.2.8 Maximum allowable stator temperature 150°C (302°F), as indicated by computer points 1670, 1671, 1672 and 1673 respectively for RCP 1A, 2B, 2A, and 1B stator temperature.

2.1.2.9 Maximum allowable time without cooling water is 10 minutes including coastdown time.

2.1.2.10 Minimum allowable voltage at motor terminals during starting is 80 percent.

2.1.2.11 The backstop and oil lift pumps must be running prior to or at 500 RPM when the RC Pump Motor is de-energized. The pumps should auto-start when RC Pump speed decreases below 1098 RPM or upon RC pump trip.

2.1.2.12 Approximate motor current for the four pump cold RC temperature (Test) condition is 731 amps at normal power factor and 790 amps at a possible reduced power factor, which may occur for several minutes following the start of the pump.

193 076

NOTE: A power factor of .9 or greater is considered to be normal.

2.1.2.14 No operations involving breaching of an oil hydraulic system on a RCP motor are to be performed until the RC System has been cooled to below 400°F. This includes maintenance, troubleshooting, fill and drain.

2.1.2.15 Minimum cooling water flow (95° or less) to each RC Pump motor air cooler is 80 GPM (alarm setpoint). If the NSCCW temperature increases to 105°F, 176 GPM per cooler is required.

2.1.2.16 Minimum cooling water flow to upper bearing cooler is 50 GPM per cooler (alarm setpoint), and maximum flow is 75 GPM.

2.1.2.17 Minimum cooling water flow to lower bearing oil cooler is 8 GPM (alarm setpoint), and maximum flow is 12 GPM.

2.1.2.18 Maximum cooling water flow to each RC Pump Motor Air Cooler is 110 GPM. There are 2 coolers per motor, with common inlet and outlet or a maximum flow of 220 GPM per pump motor, for air coolers.

2.1.2.19 Maximum cooling water temperature to RCP motor air and lube oil coolers is 105°F.

2.1.2.20 To minimize vent valve noise during RCP startup, start RC-P-2A or RC-P-2B first, followed by the second pump in that loop. Secure pumps in the opposite order.

2.2 Administrative.

2.2.1 Never start two R.C.P.'s simultaneously. Start the second pump after the starting current from the first pump returns to normal running current.

2.2.2 If available, loose parts monitor should be energized and volume turned up prior to starting a Reactor Coolant Pump.

2.2.3 Class 1E Electrical System lined up per 2107-1.2 prior to starting R.C.P.'s.

2.2.4 R.C.P.'s must be tripped if:

2.2.4.1 Motor bearing temps. exceed the following:

| | | |
|---|---|---|
| Upper & Lower Guide | 185 F | (computer pts 434-441). |
| Up & Down Thrust | 200 F | (computer pts 426-433). |

2.2.4.2 Motor Stator temp. exceeds 150°C (302°F) (computer pts 1670-1673).

2.2.4.3 Loss of Cooling Water to the motor coolers.

2.2.4.4 Pump Seal Return, Leakage or seal recirculation outlet temperature outlet exceeds 185°F as recorded on Panel 10.

2.2.4.5 Motor stand vibration exceeds 3 mils (0.003 in.).

2.2.4.6 Air cooler leak detection alarm (computer alarm pts. 2999-3002).

2.2.4.7 Shaft vibration from IRD System exceeds 20 mils for four hours.

2.2.4.8 Shaft vibration exceeds 30 mils under any conditions.

2.2.4.9 Either seal cavity pressure exceeds 2500 psig as recorded on Panel 8.

2.2.4.10 Seal Return flow plus Seal Leakage flow exceeds 1.9 gpm.

2.2.4.11 When both seal injection water and intermediate closed cooling water to pump are lost.

2.2.5 The pump may be operated with any two seals leaking. Leakage of a seal is indicated when seal cavity pressures indicate the following:

193 078

| | | | |
|---|---|---|---|
| $P_2$ | = | System pressure | Lower seal leaking |
| $P_3$ | = | ½ System pressure | Lower Seal leaking |
| $P_2$ | = | ½ System pressure | Middle seal leaking |
| $P_3$ | = | ½ System pressure | Middle seal leaking |
| $P_2$ | = | ½ System pressure | Upper Seal leaking |
| $P_3$ | = | 0 pressure | Upper Seal leaking |
| $P_2$ | = | System pressure | Lower 2 seals leaking |
| $P_3$ | = | System pressure | Lower 2 seals leaking |
| $P_2$ | = | 0 pressure | Upper 2 seals leaking |
| $P_3$ | = | 0 pressure | Upper 2 seals leaking |
| $P_2$ | = | System pressure | Upper and Lower seals leaking |
| $P_3$ | = | 0 pressure | Upper and Lower seals leaking |

NOTE: All values are approximate. Destaging may cause only a partial $\Delta P$ across a seal.

2.2.6 If full Reactor Coolant System pressure exists in the upper seal cavity, and this condition persists, a planned unit shutdown should be scheduled.

2.2.7 Maintain seal cavity pressures at approximately 1/3 and 2/3 system pressure.

2.2.8 Verify the individual pump Seal Injection flow control valves (MU-V379, MU-V380, MU-V381, MU-V382) have been set for equal flows, about 10 gpm to each pump.

2.2.9 Do not run Lift Oil System longer than 12 hours to prevent carbonizing oil.

2.2.10 The high pressure lift pumps should stop after the main motor has reached 1098 RPM.

3.0 PREREQUISITES

Indicate Satisfactory Completion of Each Step by Initialing the Blanks for Each Step.

193 079

____3.1 The Nuclear Services Closed Cooling Water System is in normal operation per 2104-3.2.

____3.2 The Intermediate Closed Cooling Water System is in normal operation per 2104-1.6.

____3.3 The BOP Auxiliary and Class 1E Systems are lined up for normal operation per 2107-1.1 and 2107-1.2 respectively.

____3.4 Place the control switches for the RCP's in PULL-TO-LOCK and the DC powered HP lift pumps in OFF and position the circuit breakers as follows:

____3.4.1 RCP's 1A and 1B bkrs. racked in on 6900 V A.C. BUS 2-1.

____3.4.2 RCP's 2A and 2B bkrs. racked in on 6900 V A.C. BUS 2-2.

____3.4.3 Insure "69" switches for RCP bkrs. are in normal position with red flags showing.

____3.4.4 Backstop oil pump bkrs. racked in and closed on following MCC:

MCC 2-32A Units 6 BR; 6 DR RCP-1A

MCC 2-32A Units 7 BR; 7 DR RCP-1B

MCC 2-42A Units 6 BR; 6 DR RCP-2A

MCC 2-42A Units 7 CF; 7 EF RCP-2B

____3.5.5 H.P. oil lift pump bkrs. racked in and closed on following MCC:

____3.5.5.1 RCP-1A MCC 2-32A Unit 6 FF; BUS 2-1DC Unit U214C.

____3.5.5.2 RCP-1B MCC 2-32A Unit 7 FF; BUS 2-1DC Unit U214D.

____3.5.5.3 RCP-2A MCC 2-42A Unit 6 EF; BUS 2-2DC Unit U224C.

____3.5.5.4 RCP-2B MCC 2-42A Unit 7 DR; BUS 2-2DC Unit U224D.

____3.5.6 Verify all oil reservoirs are filled by absence of low level alarms.

193 080

____3.5.7 Power available to all associated RCP controls and instrumentation. Verify all instrumentation is working properly.

____3.5.8 Insure that a Make-Up Pump is running on minimum flow recirc. mode.

4.0 PROCEDURE

Indicate the Satisfactory Completion of Each Step by Initialing the Blanks for Each Step.

4.1 Start-Up

This section of the procedure will cover the steps necessary to start the RCP's when the plant is in a low pressure cold condition (less than 200 psig and less than 200°F). Three RCP's will be started when NPSH requirements have been met and will be used to heat the plant up to 500°F where the fourth RCP will be started and the heatup completed.

____4.1.1 Start seal injection flow to RCP's per 2104-1.2 and verify flow to seals by clearing Pump Loop Seal Injection Flow Low Alarm (Window 8.B37).

____4.1.2 With the RCS pressure greater than 150 psig, per 2104-1.2, Open RC Pump Seal Return Valves (MU-V33A, B, C, D). This must be done at least 30 minutes prior to pump startup to assure full venting of the seal cavities.. Make sure seal return is lined up to Make-Up tank per 2104-1.2.

4.1.3 If the RC System or MU System has been drained since seal injection was last stopped, vent or verify vented the seal cavities as follows:

| | | RC-P-1A | RC-P-1B | RC-P-2A | RC-P-2B |
|---|---|---|---|---|---|
| ____4.1.3.1 | OPEN iso valve | MU-V416 | MU-V420 | MU-V424 | MU-V428 |
| ____4.1.3.2 | OPEN iso valve | MU-V418 | MU-V422 | MU-V426 | MU-V430 |
| ____4.1.3.3 | SLOWLY OPEN vent valve | MU-V417 | MU-V421 | MU-V425 | MU-V429 |
| ____4.1.3.4 | Allow to vent for 2 minutes. | | | | |
| ____4.1.3.5 | SLOWLY OPEN vent valve | MU-V419 | MU-V423 | MU-V427 | MU-V431 |
| ____4.1.3.6 | Allow to vent for 2 minutes. | | | | |
| ____4.1.3.7 | CLOSE | MU-V419 | MU-V423 | MU-V427 | MU-V431 |
| ____4.1.3.8 | CLOSE | MU-V417 | MU-V421 | MU-V425 | MU-V429 |
| ____4.1.3.9 | CLOSE | MU-V418 | MU-V422 | MU-V426 | MU-V430 |
| ____4.1.3.10 | CLOSE | MU-V416 | MU-V420 | MU-V424 | MU-V428 |

____4.1.4 Verify RCS pressure is within limits of Figure 1 and 1A.

____4.1.5 Start one RCP's oil lift pump and backstop pumps. These must be on for a least 60 seconds prior to pump start. This should be done manually be depressing the Lube System Test button.

____4.1.6 Assure that RC Pump and Motor alarms are cleared and no condition exists that would be injurious to pump and motor operation. Abort motor start if such a conditon exists.

NOTE: As directed by Unit Heatup, start RC pumps per the following steps.

____4.1.7 Start the RCP by going to START on its control switch on Panel 4.

____4.1.8 After pump starts, verify the lift and backstop pumps have stopped when the pump reaches full speed.

NOTE: If for any reason the pump does not start or trips off during a start attempt, do not attempt

193 082

to restart the pump until the cause is determined and corrected.

____4.1.9 Carefully observe all alarmed parameters associated with the pump and motor performance to verify proper operation.

NOTE: Do not operate a single RC pump outside of Figure 1A, Curve 3 for more than ten minutes. If second pump in the same loop cannot be started, trip the single pump.

____4.1.10 Repeat steps 4.1.2 through 4.1.9 to start a second RCP in the same loop as the first pump.

NOTE: Prior to starting a 3rd RCP, rod groups 1-4 should be withdrawn as directed by Unit Heatup.

____4.1.11 Per 2102-1.1 insure Curve 3 of Figure 1A is met, and repeat steps 4.1.2 through 4.1.9 to start a third RCP.

NOTE: Expected heat up rate of 30°F per hour with 3 RCP's operating.

____4.1.12 When RCS temperature exceeds 525°F (fourth pump starting interlock) start fourth pump per steps 4.1.2 through 4.1.9 above.

4.2 Normal Operation.

During normal operation, the four RC pumps will be operating within the parameter limits of Table II.

NOTE: If an abnormal condition exists, follow up per the applicable alarm response, or 2203-1.4 RC Pump and Motor Emergencies.

4.3 RCP Shutdown and Layup

This section of the procedure will cover the steps necessary to secure the RCP's during a plant shutdown and cooldown.

____4.3.1 As directed by Unit Shutdown/Cooldown procedures, trip one RC pump in each loop as follows:

193 083

____4.3.1.1 Verify that power is available to all oil pumps by observing green indicating lights.

____4.3.1.2 Trip RCP by placing control switch on Panel 4 to stop after the power is within RPS limits and verify that oil pumps have started. If not, attempt to manually start oil pumps by using "Test pushbutton at Panel 4".

____4.3.1.3 When pump has stopped rotating approximately 8 minutes, the oil lift and backstop pumps should be tripped off.

____4.3.1.4 Maintain seal injection flow and I.C. cooling flow.

NOTE: On emergency trip refer to 2203-1.4.

____4.3.2 Ensure NPSH limits are maintained per Figure 1 and 1A for operating pumps during low RCS pressure condition.

____4.3.2.1 After the RPS is placed in Shutdown Bypass, go to two pump in a loop operation by starting a non-operating RCP pump and tripping the single pump in a loop. Insure RCS pressure and temperature stays within the limits of Figure 1, curve 4.

____4.3.3 As directed by Unit Shutdown/Cooldown, trip the remianing RC pumps per steps 4.3.1.1 to 4.3.1.4.

____4.3.4 After all RC pumps have been stopped and the RCS pressure is <200 psig and temp <200$^{o}$F, secure Nuclear Services Closed Cooling Water and Intermediate Closed Cooling Water per their applicable procedures.

____4.3.5 Close Pump Seal Return Valves (MU-V33A, B, C, D).

____4.3.6 Secure seal injection to the RC pumps by insuring an alternate flow path available for the operating Make-Up Pump, and closing MU-V378.

4.3.7 Hand rotate RCP's once a week as radiation levels permit as follows:

____4.3.7.1 Start lift and backstop oil pumps.

____4.3.7.2 Hand rotate RCP.

____4.3.7.3 Operate oil pumps for 5 minutes.

____4.3.7.4 Secure oil pumps.

NOTE: Nuclear Services Closed Cooling Water to motor oil coolers should be established for hand rotation of the pumps as above.

____4.4 Special or Infrequent Operation.

Indicate Satisfactory Completion of Each Step by Initialing the Blank.

If a RCP must be shutdown during power operation, power should be lowered to the appropriate reduced power levels allowed by the safety system setpoints for the resulting combination of running RCP's, before stopping the pump. Before restarting a pump during plant operation, the reason for its initial trip or shutdown should be known and its cause corrected, all interlocks and safety alarms must be satisfied. The pump may not be restarted until the reactor power has been reduced to 30% of full power.

____4.4.1 RCP shutdown @ power.

____4.4.1.1 Reduce power within RPS limits.

____4.4.1.2 Verify that power is available to all oil pumps by observing green indicating lights.

____4.4.1.3 Trip RCP by placing control switch on Panel 4 to stop after the power is within RPS limits and verify that oil pumps have started. If not, attempt to manually start oil pumps by using "Test pushbutton at Panel 4".

____4.4.1.4 When pump has stopped rotating approximately 8 minutes the oil lift and backstop pumps should be tripped off.

____4.4.1.5 Maintain seal injection flow and Intermediate Closed cooling flow.

NOTE: On emergency trip refer to 2203-1.4.

____4.4.1.6 Reset RPS trips to correspond to operating RC pump combinations.

____4.4.2 RCP restart @ power.

____4.4.2.1 Initial cause of trip corrected.

____4.4.2.2 Reduce reactor power to <30% of full power.

____4.4.2.3 Start an oil lift and backstop oil pump 5 minutes prior to start of RCP. This should be done manually depressing the Lube System Test button.

____4.4.2.4 Verify all alarms cleared and all interlocks satisfied for associated pump. Abort start if all alarms do not clear.

____4.4.2.5 After pump starts, verify the lift and backstop pumps have stopped when pump reaches full speed.

____4.4.2.6 Reset RPS trips to correspond to operating RC pump combinations.

NOTE: If for any reason the pump does not start or trips off during a start attempt, do not attempt to restart the pump until the cause has been determined and corrected.

193 086

21

Table I

| | Interlocks<br>Start | Setpoint |
|---|---|---|
| A. | | |
| 1. | Temperature Switch | 500°F RCS Temp. |
| 2. | High Press. Oil Lift Sys. Press. | 1800 psig |
| 3. | Upper Reservoir Oil Level | 8.2 in. |
| 4. | Lower Reservoir Oil Level | 9.8 in. |
| 5. | Seal Injection Flow | 6 gpm |
| 6. | Seal Cooling Water Flow | 50 gpm |
| 7. | Air Cooler Cooling Water Flow | 160 gpm |
| 8. | Lower Brg Cooling Water Flow | 8 gpm |
| 9. | Upper Brg #1 Cooling Water Flow | 50 gpm |
| 10. | Upper Brg #2 Cooling Water Flow | 50 gpm |
| 11. | Zero Speed | 0.5 rpm |
| 12. | Reactor Power | Less than 30% |
| B. | Trips | |
| 1. | Running Undervoltage | |
| 2. | Instantaneous Overcurrent | |
| 3. | Current Differential | |
| 4. | Loss of both IC and seal injection to pumps | |
| 5. | Thermal Overload | |
| 6. | Phase Balance | |

193 089

# TABLE II

| | ALARM | SETPOINT | IDENTIFICATION | COMPUTER POINT | ANNUNCIATOR |
|---|---|---|---|---|---|
| 1. | Oil Lift System Manifold Press. Low | 1000 psig | RC56-PS1,8,13,18 | 2967-2970 | |
| 2. | Backup Low Oil Flow | 0.24 gpm | RC 59-FS2,4,6,8 | | |
| | | | RC59-FS1,3,5,7 | 2975-2978 | |
| 3. | Lube Oil Flow Low | 7.0 gpm | RC58-FS1,3,5,7 | | |
| | | | RC58-FS2,4,6,8 | 2959-2962 | |
| 4. | Mtr. Upper Brg High Oil Level | 12.2 in. | RC60-LS1,3,5,7 | 2979-2981,2985 | |
| 5. | Mtr. Upper Brg Low Oil Level | 8.2 in. | RC60-LS2,4,6,8 | 2982-2984,2986 | |
| 6. | Mtr. Lower Brg High Oil Level | 13.8 in. | RC61-LS1,3,5,7 | 2987-2990 | |
| 7. | Mtr. Lower Brg Low Oil Level | 9.8 in. | RC61-LS2,4,6,8 | 2991-2994 | |
| 8. | Air Cooler Leak Detector High Level | 0 in. | RC62-LS1,2,3,4 | 2999-3002 | |
| 9. | Pump Full Speed Interlock | 1100 rpm | RC61-SS-1,3,5,7 | 2971-2974 | |
| 10. | High Inlet Air Temp | 122°F | RC51-TE1,2,3,4 | 0422-0425 | |
| 11. | Downthrust Brg. Temp High | 200°F | RC55-TE1,3,5,7 | 0426-0429 | Panel 8, Window F31 |
| 12. | Upthrust Brg. Temp High | 200°F | RC54-TE1,3,5,7 | 0430-0433 | Panel 8, Window E31 |
| 13. | Upper Journal Brg. Temp High | 185°F | RC53-TE1,2,3,4 | 0434-0437 | |
| 14. | Lower Journal Brg. Temp High | 185°F | RC52-TE1,2,3,4 | 0438-0441 | |
| 15. | High Stator Winding Temp | 302°F (150°C) | RC50-TE1,7,13,19 | 0442-0445 | Panel 8, Window E30 |
| 16. | Pump Tripped | N/A | N/A | 2962-2966 | Panel 8, Window E29 |
| 17. | Pump Seal Control Bleedoff Temp High | 185°F | RC-TAH-4506 | 0418-0421 | Panel 8, Window A31 |
| 18. | Pump Bearing Outlet Temp. High | 185°F | RC-TAH-450* | | Panel 8, Window B31 |
| 19. | Pump Seal Leakage Temp. High | 185°F | WDL-TE-7113 | | |
| | | | 7115,7117,7119 | | Later |
| 20. | Pump Seal Cavity Press. High | 2500 psig | RC-PAH-4500 | 2955-2958 | Panel 8, Strip Chart |
| | | | | | Panel 8, Window C31 |
| 21. | Pump Seal Injection Flow Low | 6 gpm | | | Panel 8, Window B27 |
| 22. | Pump Total Injection Flow Low-High | 24-64 gpm | RU-FA-4514 | | Panel 8, Window A27 |
| 23. | Pump Seal Bleedoff Flow High | 1.6 gpm | RU-FAH-4515 | 0771-0774 | Panel 8, Window C27 |
| 24. | Pump Seal Leakage Flow High | 0.33 gpm | WDL-FAH-7099 | | Panel 8A |
| 25. | Motor Overload | N/A | N/A | | Panel 8, Windows A29, B29, C29, D29 |
| 26. | Coolant Pump Auxiliary Oil Pump Trip | N/A | N/A | | Panel 8, Windows A30, B30, C30, D30 |
| 27. | Motor Lube System Trouble | N/A | N/A | | Panel 8, Windows A32, B32, C32, D32 |
| 28. | Motor-No Start; Wait 20 minutes | N/A | N/A | | Later |
| 29. | Pump Vibration High | 2x Normal | RC61-VS1,2,3,4 | 2995-2998 | Panel 8, Window E32 |
| 30. | Pump Seal Bleedoff Filter ΔP High | Later | RU-40DPA | | Panel 8, Window D27 |
| 31. | Pump Seal Leakage Chamber Level High | Later | RC-LS-8 | | Later |

21.0

2103-1.4
Revision 0
05/12/77

APR 2 3 1979

22

193 090

TMI DOCUMENTS

DOCUMENT NO: TM-017

COPY MADE ON 5/3/79 OF DOCUMENT PROVIDED BY METROPOLITAN EDISON COMPANY.

Wilda R. Mullinix, NRC

7906140254

193 068