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1.0 PURPOSE

This procedure provides the detailed instructions for placing the RCIC system in standby readiness; for verification of automatic startup, normal operation, and automatic shutdown; for starting and shutting down the system manually; and for other operations including system operational surveillance testing and system isolation, and bypassing of low-pressure isolation and high-temperature isolation interlocks during emergency conditions.

All system controls, indicators, and components referred to in this procedure are prefixed with the MPL identifier E51- unless otherwise specified.

Controls and indications are located on Panel [later].

2.0 PRECAUTIONS AND LIMITATIONS

2.1 Technical Specifications Requirements:

[later]

2.2 If the turbine is tripped by the mechanical overspeed trip, the turbine trip throttle valve must be manually reset at the turbine.

2.3 Use caution when pressurizing the RCIC steam supply line to avoid possible damage from excessive pressure surges.

2.4 The condensate storage pool (CSP) is the preferred source of suction water for the RCIC system when discharging into the reactor vessel.

2.5 Do not throttle RCIC turbine speed below the minimum acceptable operational limit of [750] rpm. Minimize RCIC operation at low turbine speeds.

2.6 The RCIC system will automatically isolate under any of the following conditions:

- Turbine exhaust pressure ≥ [later],
- RCIC steamline pressure ≤ 3.5 kg/cm^{2}g,
- RCIC steamline flow ≥ 300%, or
- RCIC equipment area ambient temperature ≥ [later]

2.0 PRECAUTIONS AND LIMITATIONS (continued)

2.7 The RCIC turbine will trip in response to an initiation of the system isolation logic, or any of the following conditions:

- Mechanical overspeed trip [125% of rated speed],
- Electrical overspeed trip [110% of rated speed],
- Pump suction pressure low, ≤ [0.1 kg/cm^{2}g],
- Reactor vessel water level high [L8],
- Turbine exhaust pressure high, ≥ 3.5 kg/cm^{2}g, or
- Manual trip.

2.8 Bypassing of the RCIC low-pressure isolation interlock and the high-temperature isolation shall be performed as directed by Emergency Operating Procedure EOP-[later].

2.9 When reactor vessel water level reaches L8, the following automatic system shutdown sequence will be initiated:

2.9.1 Close valves F045, F046, and F092,

2.9.2 Close F013 when F045 is fully closed, and

2.9.3 Resets system initiation logic.

2.10 The maximum water temperature for continuous system operation shall not exceed 60 °C. Short term system operation is allowed with water temperature up to 77 °C.

3.0 STARTUP OF THE RCIC SYSTEM

The following prerequisites shall be satisfied prior to conducting "Placing the RCIC System in Standby/Readiness Condition."

3.1 Required support systems available as follows:

3.1.1 [Condensate Makeup Water System,] to provide and maintain a minimum level of [later] m^3 of water in the condensate storage pool to be used as the primary source for the RCIC System.

3.1.2 Leak Detection and Isolation System, to provide monitoring of the RCIC System for indication of line breaks and valve stem leakage.

3.1.3 Instrument Air System(P52), to provide the motive power for testing the injection testable check valve, for operating the drain pot drain valves, and for operating the vacuum tank condensate pump discharge valves to Radwaste.

3.1.4 RCIC Room Cooling Unit, cooled by the RCW System, to provide cooling to the RCIC room and equipment.

3.1.5 [DC power, AC power systems available]

3.1.6 Nuclear Boiler System, to provide signals to the RCIC System on low reactor water level, high reactor water level, and high drywell pressure.

3.2 System valve lineup completed per Enclosure 1.

3.3 System instrumentation and control lineup completed per Enclosure 2.

3.4 Oil level in the turbine oil tank at least [later].

3.5 Reactor vessel pressure greater than [3.5] kg/cm^2g.

4.0 PLACING THE RCIC SYSTEM IN STANDBY/READINESS CONDITION

Place the RCIC system in standby readiness per the following sequence of steps:

*** NOTE ***

The RCIC System should be in the standby condition whenever the reactor vessel pressure is greater than [8.4] kg/cm^{2}g. | |

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4.1 Verify annunciators RCIC STEAMLINE PRESSURE LOW have cleared, then reset RCIC ISOLATION DIVISION 1 and RCIC ISOLATION DIVISION 2 logic.

4.2 Fill the RCIC System water line as follows:

4.2.1 Display the RCIC System Format [identification, later].

4.2.2 Open suction valve from CSP, F010.

4.2.3 Open test return valve F022.

| 4.2.4 Open manual valve F070 locally to pressurize the RCIC discharge piping with Condensate Makeup water.

4.2.5 Vent the injection line locally(manual valves F601 and F602).

4.2.6 Vent the injection pump locally (manual valves F618 and F619).

4.2.7 Verify RCIC pump suction pressure (PI-302) indicates [later] kg/cm^{2}g.

4.2.8 Close test return valve F022.

4.2.9 Verify annunciator alarm[A-xxx, later] DISCHARGE LINE NOT FILLED is cleared.

4.0 PLACING THE RCIC SYSTEM IN STANDBY/READINESS CONDITION(continued)

4.3 Line up the turbine exhaust as follows:

4.3.1 Lock open turbine exhaust valve F068.

4.3.2 Lock open vacuum tank vacuum pump discharge isolation valve F069.

4.4 Verify RCIC turbine not in tripped condition. Reset the turbine trip if necessary and verify that turbine trip annunciator has cleared.

4.5 Open the RCIC Turbine Trip and Throttle valve[F-xxx] by positioning the valve control switch to OPEN and hold until it indicates fully open.

4.6 Verify the annunciator TURBINE TRIP AND THROTTLE VALVE NOT FULLY OPEN [A-xxx] is clear.

4.7 Line up the steam supply to the RCIC system as follows:

4.7.1 Open the steam supply drain pot isolation valves F025 and F026.

4.7.2 Open the steam supply drain trap bypass valve F054.

4.7.3 Lock open steam supply outboard isolation valve F064.

4.7.4 Warm steamline by throttling open warmup valve F076.

4.7.5 When steam pressure to turbine is maintained at approximately reactor pressure, close steamline drain pot bypass valve F054.

4.7.6 When steam pressure to turbine is approximately equal to reactor pressure, lock open steam supply inboard isolation valve F063.

4.7.7 Close steam line warmup valve F076.

4.8 Place RCIC flow controller in automatic and verify a setpoint value of 182 m^3 / hr.

4.9 Confirm RCIC System alarms are clear.

5.0 AUTOMATIC STARTUP/INITIATION OF THE RCIC SYSTEM

*** NOTE ***

Low reactor water level (L2) or high drywell pressure signal will automatically initiate the system. For quick start of the RCIC system, the RCIC MANUAL INITIATION switch can be placed in the ARM position and the push-button depressed. Startup via either method requires that the RCIC system has been lined up in accordance with the instructions given in Section 4.0 above.

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Upon automatic initiation, verify that the RCIC System automatically achieves the following configuration:

5.1 The RCIC System Format [identification, later] is displayed.

5.2 Steam supply bypass valve F092 opens.

5.3 The turbine accelerates.

5.4 Barometric condenser vacuum pump C-xxx starts.

5.5 CSP suction valve F010 opens(if closed).

5.6 Cooling water supply valve F046 opens.

5.7 Test return to suppression pool valves F022 and F059 close(if open).

5.8 Steam supply to turbine valve F045 opens [10 seconds delay].

5.9 RCIC injection valve F013 opens [10 seconds delay].

5.10 Steam supply line drain pot drain valves F025 and F026 close when F045 is fully open.

5.11 Minimum flow bypass valve F019 opens when RCIC flow is [$\leq$ 27.3 m^3 / hr] and the pump discharge pressure $\geq$ [later] kg/cm^2g.

5.12 Testable check valve F065 disc opens as pump discharge pressure increases above reactor pressure.

5.13 Minimum flow bypass valve F019 closes as RCIC flow increases above [54.5 m^3 / hr].

6.0 MANUAL STARTUP/INITIATION OF THE RCIC SYSTEM

*** NOTE ***

For quick start of the RCIC system, the RCIC MANUAL INITIATION switch can be placed in the ARM position and the push-button depressed. This will automatically start the system in the same manner as given in section 5.0. The instructions given in this section is applicable for a complete manual system startup.

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6.1 Verify that the system has been lined up in the Standby/Readiness condition in accordance with section 4.0.

6.2 Open cooling water supply valve F046.

6.3 Start the barometric condenser vacuum pump C–xxx.

6.4 Open steam supply bypass valve F092. Note that turbine will accelerate but will return to between [700 - 1000 rpm.]

6.5 Open steam to turbine admission valve F045. Observe that turbine speed and pump discharge pressure show a gradual increase.

6.6 Verify that steam supply drain pot drain valves F025 and F026 close when F045 is fully open.

6.7 Verify that the minimum flow bypass valve F019 opens when system flow is [< 27.3 m^3 / hr] and pump discharge pressure > [later] kg/cm^2g.

6.8 Open injection valve F013 . Note that the testable check valve F065 opens as reactor injection begins.

6.9 Verify minimum flow bypass valve F019 closes as flow increases above [54.5 m^3 / hr.]

6.10 Adjust the setpoint of the flow controller to the desired value, however; do not operate the turbine below [750] rpm.

7.0 NORMAL OPERATION OF THE RCIC SYSTEM

7.1 Normal Operating Parameters

Monitor the RCIC System Format [later]display and verify that the operating parameters are within the expected range as follows :

Variable	Normal Value
Steam line ΔP, Division I	later, from E31
Steam pressure to turbine	10.5 to 82.8 kg/cm2 abs
Turbine speed	later
Turbine exhaust pressure	1.1 to 1.8 kg/cm^2 abs
Turbine exhaust diaphragm pressure, Division I	later
Pump suction pressure	later
Pump discharge pressure	later
RCIC flow	0 to 186 m^3/hr
Valve F022 position	Variable

7.2 Shifting of RCIC Suction Between the CSP and the Suppression Pool.

*** NOTE ***

The RCIC pump suction may be switched from the CSP to the suppression pool during system operation.

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7.2.1 Switch the RCIC suction from the CSP to the suppression pool as follows:

7.2.1.1 Open suppression pool suction valve F031.

7.2.1.2 When valve F031 reaches full open, verify that suction valve from the CSP F010 automatically closes.

7.2.1.3 Verify RCIC suction pressure reaches approximately [later] kg/cm^2g.

7.0 NORMAL OPERATION OF THE RCIC SYSTEM(continued)

7.2 Shifting of RCIC Suction Between the CSP and the Suppression Pool (continued).

7.2.2 Switch the RCIC suction from the suppression pool to the CSP as follows:

7.2.2.1 Verify that the CSP level is above the low level alarm setpoint.

7.2.2.2 Open CSP suction valve F010.

7.2.2.3 When valve F010 reaches full open, close suppression pool suction valve F031.

7.2.2.4 Verify RCIC suction pressure reaches approximately [later] kg/cm^2g.

8.0 SHUTDOWN OF THE RCIC SYSTEM

8.1 Automatic Shutdown on Level 8

8.1.1 Verify that the RCIC System automatically achieves the following configuration:

8.1.1.1 The RCIC System Format [later] is displayed.

8.1.1.2 The steam supply valve F045 is closed.

8.1.1.3 Cooling water supply valve F046 is closed.

8.1.1.4 Steam supply bypass valve F092 is closed

8.1.1.5 When F045 is fully closed, Injection valve F013 and Minimum Flow valve F019 close, drain pot isolation valves F025 and F026 open.

8.2 Automatic Shutdown on Turbine Trip

Upon a RCIC turbine trip, verify that the the system automatically achieves the following configuration:

8.2.1 The Trip and Throttle valve [F-xxx] is closed,

8.2.2 Injection valve F013 closes after the Trip and Throttle valve is fully closed,

8.2.3 Minimum Flow valve F019 closes after the Trip and Throttle valve is fully closed.

After conditions causing the turbine trip are clear, close steam supply valve F045 and steam supply bypass valve F092. Reset the turbine Trip and Throttle valve by holding its control switch in the CLOSE position until the valve motor close status light is lit, then open the valve by placing its control switch to OPEN and holding it until the open status light is lit. The Trip and Throttle valve open indicating light should also be lit.

8.0 SHUTDOWN OF THE RCIC SYSTEM (continued)

8.3 Manual Shutdown to Standby Readiness following System Operation.

8.3.1 Reset the RCIC initiation logic.

8.3.2 Transfer the RCIC flow controller to MANUAL and reduce turbine speed to approximately 1200 rpm.

8.3.3 Check that the minimum flow valve F019 opens when RCIC flow decreases to 27.3 m^3 / hr.

8.3.4 Close turbine steam supply valve F045 and steam supply bypass valve F092.

8.3.5 Verify the system automatically achieves the following configuration upon closure of valve F045:

8.3.5.1 Injection valve F013 closes.

8.3.5.2 Minimum flow valve F019 closes.

8.3.5.3 Both steam supply drain pot drain valves F025 and F026 open.

8.3.6 Close turbine cooling water valve F046.

8.3.7 Stop the barometric condenser vacuum pump C-xxx.

8.3.8 Set the flow controller to AUTO and its setpoint to 182 m^3 / hr.

8.4 Shutdown From Standby Readiness to Secured Status.

8.4.1 Close steam isolation valves F063 and F064.

8.4.2 Close turbine exhaust valve F068.

8.4.3 Close suction valve from CSP F010.

8.4.4 Close vacuum tank vacuum pump discharge isolation valve F069.

9.0 OTHER OPERATIONS

9.1 RCIC System Isolation.

For isolating the system manually, position the RCIC MANUAL ISOLATION switches A & B to the ISOLATE position. Upon manual or automatic system isolation, verify that the system achieves the following lineup:

9.1.1 Both steam supply isolation valves F063 and F064 close.

9.1.2 Steamline warmup valve F076 closes if it is open.

9.1.3 RCIC turbine trips.

9.1.4 Upon closure of the turbine Trip and Throttle valve[F-xxx], verify the following:

9.1.4.1 Injection valve F013 closes.

9.1.4.2 Minimum flow valve F019 closes.

9.2 System Surveillance Testing, Suppression Pool to Suppression Pool.

A system surveillance can be performed, with the pump taking suction from the suppression pool, and returning the flow to the suppression pool via the test return line. The frequency and conditions will be specified by the Technical Specifications. Perform the following steps:

9.2.1 Verified that the system has been lined up in the Standby/Readiness condition in accordance with Section 4.0. Open Suppression Pool Suction valve F031.. When F031 is fully opened, verify that CSP Suction valve F010 closes automatically.

9.0 OTHER OPERATIONS (continued)

9.2.2 Open cooling water supply valve F046.

9.2.3 Start the barometric condenser vacuum pump C–xxx.

9.2.4 Open steam supply bypass valve F092. Note that turbine will accelerate but will return to between [700 - 1000 rpm.]

9.2.5 Open steam to turbine admission valve F045. Observe that turbine speed and pump discharge pressure show a gradual increase.

9.2.6 Verify that steam supply drain pot drain valves F025 and F026 close when F045 is fully open.

9.2.7 Verify that the minimum flow bypass valve F019 opens when system flow is less than 27.3 m^3 / hr with pump discharge pressure greater than [later] kg/cm^2g.

9.2.8 Fully open Test Return valve F059.

9.2.9 Throttle open Test Return valve F022 to achieve a system flow of 182 m^3/hr. at a discharge pressure of 83 kg/cm^2.

9.2.10 Verify minimum bypass valve F019 closes as flow increases above 54.5 m^3 / hr.

9.2.11 Shut down system to Standby/Readiness condition in accordance with procedures in Step 8.3.

9.2.12 Close Test Return valves F059 and F022.

9.0 OTHER OPERATIONS (continued)

9.3 System Surveillance Testing, Injecting Into the Reactor.

At frequency and reactor conditions specified by the Technical Specifications, perform this surveillance testing as follows:

9.3.1 Verify that the system has been lined up in the Standby/Readiness condition in accordance with Section 4.0.

9.3.2 Initiate the recording of the system response of preselected parameters.

9.3.3 Start the system arming and depressing the MANUAL INITIATION switch.

9.3.4 Verify that the system achieves the proper lineup in accordance with Section 5.0.

9.3.5 Verify that the system transient response matches that previously established.

9.3.6 Shut down the system to Standby/Readiness condition in accordance with procedures in Step 8.3.

9.0 OTHER OPERATIONS (continued)

9.4 Emergency Operation, Bypassing of Low-Pressure Isolation Interlock

CAUTION

EXECUTE THE FOLLOWING STEPS ONLY AS DIRECTED BY SYMPTOMATIC EMERGENCY OPERATING PROCEDURE SEOP-RC-01, RPV CONTROL

[LATER]

9.5 Emergency Operation, Bypassing of High-Temperature Isolation Interlocks

CAUTION

EXECUTE THE FOLLOWING STEPS ONLY AS DIRECTED BY SYMPTOMATIC EMERGENCY OPERATING PROCEDURE SEOP-SC-03, SECONDARY CONTAINMENT CONTROL

9.5.1 When directed, at the SSLC cabinets, place the RCIC Division I and II Temperature Sensor Test Switches to the TEST position.

9.5.2 Continue to monitor RCIC Equipment Area temperatures and perform the functions as directed by SEOP-SC-03, Secondary Containment Control.

10.0 REFERENCES

10.1 Reactor Core Isolation Cooling System Design Specification, 22A6290, revision 3, PAE NO. 3.76.

10.2 Reactor Core Isolation Cooling System, P&ID,705E883, revision 3, PAE NO. 3.77.

10.3 Reactor Core Isolation Cooling System, Process Flow Diagram, 796E329, revision 3, PAE NO. 3.78

10.4 Reactor Core Isolation Cooling System, IBD, 137C8316, revision 1, PAE NO. 3.79

10.5 Leak Detection and Isolation System, IBD, 137C8948, draft revision 0, PPE NO. 5.16.4.

10.6 Symptomatic Emergency Operating Procedure Guidelines, draft, 23A6146, PPE 1.B.21..

ENCLOSURE 1: RCIC MOV/AOV VALVE LINEUP, SHUTDOWN & ISOLATED.

Valve Number	Description	Panel Number	Switch Position	Valve Position
F004	Condensate pump discharge	Later	CLOSE	C
F005	Condensate pump discharge		CLOSE	C
F010	CSP suction		NORMAL	C
F013	Injection Shutoff		AUTO	C
F019	Minimum flow to suppression pool		AUTO	C
F022	Test return to suppression pool		AUTO	C
F025	Steam supply drain pot drain		C	C
F026	Steam supply drain pot drain		C	C
F031	Suppression pool suction		AUTO	C
F045	Steam supply to turbine		AUTO	C
F046	Cooling water		AUTO	C
F054	Steam supply drain trap bypass		C	C
F059	Test return to suppression pool		NORMAL	C
F063	Steam supply inboard isolation		L. CLOSE	C
F064	Steam supply outboard isolation		L. CLOSE	C
F065	Testable check valve		N/A	C
F066	Testable check equalizing		N/A	C
F068	Turbine exhaust		L. CLOSE	C
F069	Vacuum pump discharge isolation		L. CLOSE	C
F076	Steam supply warmup		AUTO	C
F092	Turbine steam supply bypass		AUTO	C
F-xxx	Turbine governor		N/A	O
F-xxx	Turbine trip & throttle		AUTO	C

NOTE

Manual valve lineup will be provided later as the valve numbers and the P&ID are being changed to reflect standardization.

ENCLOSURE 2: RCIC ELECTRICAL LINEUP

Component Number	Description	Switch /Breaker Number	Required Status
F010	CSP suction	LATER	C
F013	Injection Shutoff		C
F019	Minimum flow to suppression pool		C
F022	Test return to suppression pool		C
F031	Suppression pool suction		C
F045	Steam supply to turbine		C
F046	Cooling water		C
F059	Test return to suppression pool		C
F063	Steam supply inboard isolation		C
F064	Steam supply outboard isolation		C
F068	Turbine exhaust		C
F069	Vacuum pump discharge isolation		C
F076	Steam supply warmup		C
F092	Turbine steam supply bypass		C
F-xxx	Turbine trip & throttle		C
C-XXX	Vacuum pump		C
C-yyy	Condensate pump		C

ENCLOSURE 3: RCIC INSTRUMENTATION AND CONTROL LINEUP.

Component Number	Description	Panel Number	Position
	Vacuum pump control switch		Auto from Stop
	Condensate pump control switch		Auto from Stop
	Flow controller		Manual & minimum
	RCIC DIV 1 ISOLATION RESET Control switch		Normal
	RCIC DIV 2 ISOLATION RESET Control switch		Normal
	RCIC MANUAL INITIATION Control switch		Disarm
	RCIC Logic Initiation Reset Switch		Normal
	Level 8 Reset Switch		Normal
	Turbine Trip/Reset Switch		Normal