



# GE Nuclear Energy

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REV A	

### REVISION STATUS SHEET

DOCUMENT TITLE IOP-3. TURBINE STARTUP AND GENERATOR SYNCHRONIZATIONLEGEND OR DESCRIPTION OF GROUPSTYPE: OPERATING PROCEDUREFMF: K 6 / 7MPL ITEM NO: A80-3020

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1.0 SCOPE/APPLICABILITY

This procedure provides detailed instructions and limitations for varying reactor power, both increasing and decreasing, when operating above [45%] of rated thermal power.

2.0 DISCUSSION

This procedure provides a means for organizing the many diversified activities associated with power plant operation for efficient reactor power ascension and power maneuvering. This procedure will normally be integrated into an overall plant startup. Integrated Operating Procedures "Approach to Criticality" (IOP-1), "Heatup and Pressurization" (IOP-2), and "Turbine Startup and Generator Synchronization" (IOP-3), should be initiated in such a manner so as to provide an uninterrupted succession from one procedure to another. In addition, plant shutdown from [35%] power shall normally be conducted in accordance with "Unit Shutdown to Unit Off-Line, Main Condenser Available" (IOP-5).

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Steady-state operating values of the following parameters shall be maintained within the limits specified:

- a. MCPR 1.23(minimum)
- b. LHGR later(peak)
- c. Peaking Factors
  - 1. Gross later(maximum)
  - 2. Local later
  - 3. Total later
- d. Generator output 1356 MW(e)
- e. Total steamflow  $764.37 \times 10^4$  kg/hr
- f. Total Feedwater flow  $762.73 \times 10^4$  kg/hr
- g. Core coolant flow  $58.0 \times 10^6$  ton/hr
- h. Steam dome pressure  $72.1 \text{ kg/cm}^2(\text{g})$
- i. Final feedwater temperature  $215.7 \text{ }^\circ\text{C}$

3.2 Core thermal power as a function of core flow shall be maintained within the allowable operating limits as shown on the Power to Flow Operating Map.



3.0 PRECAUTIONS AND LIMITATIONS(continued)

- 3.3 Any control rod movements are to be performed in accordance with approved rod sequence.
- 3.4 Do not allow main condenser pressure to exceed 127 mm Hg absolute. Hold or reduce load as necessary to maintain condenser pressure less than 127 mm Hg absolute.

3.5 Maintain reactor water chemistry within the following limits:

Chlorides	< 10 ppb
Conductivity at 25 °C	< 0.20 μS/cm
pH at 25 °C	6.4 -- 7.8
Dissolved Oxygen	< 200 ppb
Silica (SiO <sub>2</sub> )	< 100 ppb
Sulfate	< 10 ppb
Total Iron (Fe)	< 10.0 ppb
Copper (Cu)	< 0.5 ppb
All other metals	< 4.5 ppb

3.6 Maintain feedwater chemistry within the following limits:

Chlorides	< 0.16 ppb
Conductivity at 25 °C	< 0.057 μS/cm
Dissolved Oxygen	20.0 – 30.0 ppb
Silica (SiO <sub>2</sub> )	< later ppb
Sulfate	< 0.16 ppb
Iron, insoluble (Fe)	< 1.0 ppb
Iron, soluble (Fe)	< 0.1 ppb
Total Copper (Cu)	< 0.05 ppb
All other metals	< 0.35 ppb

4.0 PREREQUISITES

- 4.1 Plant conditions shall be as established by IOP-3, "Turbine Startup and Generator Synchronization".
- 4.2 Load changes should normally be made as directed by the Power Generation Control System(PGCS), except for emergency load reductions as directed by the [Control Room Shift Supervisor].



## 5.0 PROCEDURE

### 5.1 General Procedure

5.1.1 Perform the following surveillance tests at the indicated conditions and time intervals:

- a. [Core thermal margins, later].
- b. [Selected Reactor Trip System scram setpoints and Automatic Rod Block Monitor setpoints, later].
- c. [Reactor water sample and off-gas sample analyses, later].
- d. [Neutron Monitoring System, later].
- e. [Main Generator Power-Load Unbalance test, later].
- f. [Other required surveillance tests, later].

5.1.2 After each control rod is fully withdrawn, perform a rod coupling check. If a rod is uncoupled, stop further rod withdrawal and core flow increase and refer to [later, procedure for rod uncoupled].

5.1.3 Monitor the Off-Gas System pre-treatment and post-treatment activity peaks during and after power changes and/or rod movements.

5.1.4 Maintain generator loading within the limits of the Generator Capability Curve (Attachment 1). Verify that a power change request will not cause operation outside of the Generator Capability Curve.

5.1.5 Whenever possible, generator load increases and decreases should be performed within the Time for Load Changes Curve (Attachment 2).

5.1.6 Start (stop) additional condensate filter/demineralizers as needed to maintain [specified, later] kg/cm<sup>2</sup> across the in-service units.



5.2 Power Increase to Rated Flow Control Line

- 5.2.1 Initiate control rod withdrawal as necessary to increase reactor power to [45%].
- 5.2.2 Increase the speed of the recirculation pumps to [40]%.
- 5.2.3 Place the low pressure drain pumps(LPDPs) and the high pressure drain pumps(HPDPs) into service in accordance with SOP-[later].
- 5.2.4 Resume control rod withdrawals to establish the rated rod pattern.

5.3 Power Increase Along Flow Control Line to Rated Power

- 5.3.1 Transfer the Recirculation Flow Control System to the Auto Flow Control mode in accordance with SOP-B34/C81.
- 5.3.2 Initiate power increase by increasing recirculation flow along the flow control line until the specified power level is reached.
- 5.3.3 When generator load is greater than [65% turbine load], with the second-stage reheater in service, verify the following valves have opened:  
  
[ Main steam to second stage reheater control valves on both MS/Rs, L A T E R ].
- 5.3.4 At steady-state power generation, adjust control rod positions as necessary to compensate for xenon transients.

5.4 Power Decreases Along Flow Control Line

- 5.4.1 If plant shutdown is planned and Primary Containment entry is anticipated, commence de-inerting of the primary containment.
- 5.4.2 Initiate recirculation flow decrease. Observe that recirculation flow decreases and verify that power decreases at the selected rate.
- 5.4.3 Decrease recirculation flow until the recirculation pump speed has been decreased to [40%].



5.5 Power Decrease By Control Rod Insertions

5.5.1 Transfer the Recirculation Flow Control System to the Manual Flow Control Mode in accordance with SOP-B34/C81.

5.5.2 Initiate power decrease to the specified level [50%] by inserting control rods in the selected sequence.

5.5.3 When generator load has been reduced below [65%] turbine load, verify that the following valves are closed:

[ Main steam to second stage reheater control valves on both MS/Rs, L A T E R ].

5.5.4 At [50%] power, reduce the speed of the recirculation pumps to [30%].

5.5.5 Stop the HPDPs and LPDPs in accordance with SOP-[later].

5.5.6 Continue control rod insertions until reactor power has been decreased to [45%]. During the power decrease, perform step 5.5.6.

5.5.7 Continue power reductions in accordance with IOP-5, "Unit Shutdown to Unit Off-Line, Main Condenser Available", if desired.



## 6.0 REFERENCES

- 6.1 Starting and Loading Instructions for Nuclear Unit Steam Turbines [later].
- 6.2 Large Steam Turbine-Driven Generators [later].
- 6.3 Reactor System Heat Balance, 23A4562, Revision 1.
- 6.4 GETAB Operating Limits, 38F1HA981, Revision B.
- 6.5 Water Quality Specification, 22A8479, Revision 2, PAE No. 1.A.9. |





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ATTACHMENT 1. Generator Estimated Capability Curve (typical)



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ATTACHMENT 2. Time for Load Changes Curve (typical)



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ATTACHMENT 3. Power to Core Flow Map (PAE design basis)