

3.5 INSTRUMENTATION SYSTEMS

3.5.1 Operational Safety Instrumentation

Applicability

Applies to plant operational safety instrumentation systems.

Objective

To provide for automatic initiation of the Engineered Safety Features in the event that principal process variable limits are exceeded, and to delineate the conditions of the plant instrumentation and safety circuits necessary to ensure reactor safety.

Specification

- 3.5.1.1 The Engineered Safety Features initiation instrumentation setting limits shall be as stated in Table 3.5-1.
- 3.5.1.2 For on-line testing or in the event of a subsystem instrumentation channel failure, plant operation at rated power shall be permitted to continue in accordance with Tables 3.5-2 through 3.5-5.
- 3.5.1.3 In the event the number of channels in service listed in Table 3.5-5 falls below the limits given in the column entitled Minimum Channels Operable, operation shall be limited according to the requirement shown in Column 2.
- 3.5.1.4 The containment ventilation isolation function is only required when containment integrity is required.
- 3.5.1.5 In the event the number of operable channels of a particular functional unit listed in Tables 3.5-2, 3, or 4 falls below the limits given in the column entitled Total Number of Channels, operation shall be limited according to the requirement shown in Column 3.

TABLE 3.5-2

REACTOR TRIP INSTRUMENTATION LIMITING OPERATING CONDITIONS

NO.	FUNCTIONAL UNIT	1	2	3	APPLICABLE CONDITIONS
		TOTAL NO. OF CHANNELS	MINIMUM CHANNELS OPERABLE	OPERATOR ACTION IF COLUMN 1 OR 2 CANNOT BE MET	
1.	Manual	2 2	2 2	ACTION 1 ACTION 8	Reactor Critical Hot/Cold Shutdown *
2.	Nuclear Flux Power Range				
	A. High Setpoint	4	3	ACTION 2	Reactor Critical
	B. Low Setpoint	4	3	ACTION 2	Reactor Critical **
3.	Nuclear Flux Intermediate Range	2	2	ACTION 3	Reactor Critical **
4.	Nuclear Flux Source Range				
	A. Startup	2	2	ACTION 4	Reactor Critical ***
	B. Shutdown	2	1	ACTION 5	Hot/Cold Shutdown
	C. Shutdown	2	2	ACTION 8	Hot/Cold Shutdown *
5.	Overtemperature ΔT	3	2	ACTION 6	Reactor Critical
6.	Overpower ΔT	3	2	ACTION 6	Reactor Critical
7.	Low Pressurizer Pressure	3	2	ACTION 6	*****
8.	Hi Pressurizer Pressure	3	2	ACTION 6	Reactor Critical
9.	Pressurizer Hi Water Level	3	2	ACTION 6	*****
10.	Low Reactor Coolant Flow				
	A. Single Loop	3/loop	2/loop	ACTION 6	$\geq 45\%$ of rated power
	B. Two Loop	3/loop	2/loop	ACTION 6	****

TABLE 3.5-2 (Continued)

REACTOR TRIP INSTRUMENTATION LIMITING OPERATING CONDITIONS

<u>NO.</u>	<u>FUNCTIONAL UNIT</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>APPLICABLE CONDITIONS</u>
		<u>TOTAL NO. OF CHANNELS</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>OPERATOR ACTION IF COLUMN 1 OR 2 CANNOT BE MET</u>	
11.	Turbine Trip				
	A. Auto Stop Oil Pressure	3	2	ACTION 6	*****
	B. Turb Stop Valves	2	2	ACTION 6	*****
12.	Lo Lo Steam Generator Water Level	3/SG	2/SG	ACTION 6	Reactor Critical
13.	Underfrequency 4 KV System	3	2	ACTION 6	Reactor Critical
14.	Undervoltage on 4 KV System	3	2	ACTION 7	Reactor Critical
15.	Control Rod Misalignment Monitor				
	A. ERFIS Rod Position Deviation	1	1	ACTION 9	Reactor Critical
	B. Quadrant Power Tilt Monitor (upper and lower ex-core neutron detectors) "Detector Current Comparator"	1	1	ACTION 10	>50% of rated power

TABLE 3.5-2 (Continued)

REACTOR TRIP INSTRUMENTATION LIMITING OPERATING CONDITIONS

<u>NO.</u>	<u>FUNCTIONAL UNIT</u>	1	2	3	<u>APPLICABLE CONDITIONS</u>
		<u>TOTAL NO. OF CHANNELS</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>OPERATOR ACTION IF COLUMN 1 OR 2 CANNOT BE MET</u>	
16.	Low Steam Generator Level Coincident With Steam Flow/Feedwater Flow Mismatch	2 Level and 2 Stm/ Feed Flow Mismatch Per SG	1 Level and 2 Stm/ Feed Flow Mismatch Per SG <u>OR</u> 2 Level and 1 Stm/ Feed Flow Mismatch Per SG	ACTION 6	Reactor Critical

REACTOR TRIP INSTRUMENTATION LIMITING OPERATING CONDITIONSTABLE NOTATIONS

- * With the control rod drive system capable of rod withdrawal.
- ** Below the P-10 (Low Setpoint Power Range Neutron Flux Interlock) setpoint.
- *** Below the P-6 (Intermediate Range Neutron Flux Interlock) setpoint.
- **** Above the P-10 (Low Setpoint Power Range Neutron Flux Interlock) setpoint or P-7 (Turbine First Stage Pressure Interlock) setpoint and below the P-8 (Low Setpoint Power Range Neutron Flux Interlock) setpoint.
- ***** Above the P-10 (Low Setpoint Power Range Neutron Flux Interlock) setpoint or P-7 (Turbine First Stage Pressure Interlock) setpoint.

ACTION STATEMENTS

- ACTION 1 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 12 hours. or be in the Hot Shutdown Condition within the next 8 hours.
- ACTION 2 - With the number of OPERABLE channels one less than the Total Number of Channels, Startup and/or Power Operation may proceed provided the following Conditions are satisfied:
- a. The inoperable channel is placed in the tripped condition within 1 hour.
 - b. Either, thermal power is restricted to less than or equal to 75% of rated power and the Power Range Neutron Flux trip setpoint is reduced to less than or equal to 85% of rated power within 4 hours; or, the Quadrant Power Tilt Ratio is monitored within 12 hours and every 12 hours thereafter, using the movable incore detectors to confirm that the normalized symmetric power distribution is consistent with the indicated Quadrant Power Tilt Ratio.
- ACTION 3 - With the number of channels OPERABLE one less than the Minimum Channels OPERABLE requirement and with the thermal power level:
- a. Below the P-6 (Intermediate Range Neutron Flux Interlock) setpoints, restore the inoperable channel to OPERABLE status prior to increasing thermal power above the P-6 setpoint.
 - b. Above the P-6 (Intermediate Range Neutron Flux Interlock) setpoint but below 10% of rated power, restore the inoperable channel to OPERABLE status prior to increasing thermal power above 10% of rated power.

REACTOR TRIP INSTRUMENTATION LIMITING OPERATING CONDITIONSTABLE NOTATIONS

- ACTION 4 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, suspend all operations involving positive reactivity changes.
- ACTION 5 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, verify compliance with Shutdown Margin within 1 hour and at least once per 12 hours thereafter.
- ACTION 6 - With the number of OPERABLE channels one less than the Total Number of Channels, Startup and/or Power Operation may proceed until performance of the next required operational test provided the inoperable channel is placed into the tripped condition within 1 hour.
- ACTION 7 - With the number of OPERABLE channels one less than the Total Number of Channels; place the inoperable channel into the tripped condition within 1 hour, and restore the inoperable channel to OPERABLE status within 7 days or be in at least the Hot Shutdown Condition within the next 8 hours.
- ACTION 8 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or render the control rods incapable of withdrawal.
- ACTION 9 - Log individual rod position within 1 hour and every hour thereafter, and following load changes of >10% of rated power, or after >30 inches of control rod motion. In addition to the above ACTIONS, if both rod misalignment monitors (15.A and 15.B) are inoperable with reactor power >50% of rated power for 2 hours or more, the nuclear overpower trip shall be reset to $\leq 93\%$ of rated power.
- ACTION 10 - Log individual upper and lower ion chamber currents within 1 hour and every hour thereafter, and following load changes of >10% of rated power, or after >30 inches of control rod motion. In addition to the above ACTIONS, if both rod misalignment monitors (15.A and 15.B) are inoperable with reactor power >50% of rated power for two hours or more, the nuclear overpower trip shall be reset to ≤ 93 percent of rated power.

TABLE 3.5-3

ENGINEERED SAFETY FEATURES INSTRUMENTATION LIMITING OPERATING CONDITIONS

<u>NO.</u>	<u>FUNCTIONAL UNIT</u>	<u>1 TOTAL NO. OF CHANNELS</u>	<u>2 MINIMUM CHANNELS OPERABLE</u>	<u>3 OPERATOR ACTION IF COLUMN 1 OR 2 CANNOT BE MET</u>	<u>APPLICABLE CONDITIONS</u>
1.	SAFETY INJECTION				
A.	Manual	2	2	ACTION 11	>200°F
B.	High Containment Pressure (Hi Level)	3	2	ACTION 12	>200°F
C.	High Differential Pressure between Any Steam Line and the Steam Header	3/Steam Line	2/Steam Line	ACTION 12	#
D.	Pressurizer Low Pressure	3	2	ACTION 12	#
E.	High Steam Flow In 2/3 Steam Lines Coincident with Low T_{avg} in 2/3 loops	2/Steam Line and 1 T_{avg} / Loop	1/Steam Line and 1 T_{avg} in 2 Loops OR 2/Steam Line and 1 T_{avg}	ACTION 12	≥ 350 °F ##
F.	High Steam Flow In 2/3 Steam Lines Coincident with Low Steam Pressure in 2/3 lines	2/Steam Line and 1 Press/ Line	1/Steam Line and 1 Press in 2 Lines OR 2/Steam Line and 1 Press	ACTION 12	≥ 350 °F ##
2.	CONTAINMENT SPRAY				
A.	Manual	2	2	ACTION 11	>200 °F
B.	High Containment Pressure (Hi Hi Level)	3/Set	2/Set	ACTION 12	>200 °F

TABLE 3.5-3 (Continued)

ENGINEERED SAFETY FEATURES INSTRUMENTATION LIMITING OPERATING CONDITIONS

<u>NO.</u>	<u>FUNCTIONAL UNIT</u>	<u>1</u> <u>TOTAL NO.</u> <u>OF</u> <u>CHANNELS</u>	<u>2</u> <u>MINIMUM</u> <u>CHANNELS</u> <u>OPERABLE</u>	<u>3</u> <u>OPERATOR ACTION IF</u> <u>COLUMN 1 OR 2</u> <u>CANNOT BE MET</u>	<u>APPLICABLE</u> <u>CONDITIONS</u>
3.	LOSS OF POWER				
	A. 480V Emerg. Bus Undervoltage (Loss of Voltage)	2/Bus	1/Bus	ACTION 13	Reactor Critical
	B. 480V Emerg. Bus Undervoltage (Degraded Voltage)	3/Bus	2/Bus	ACTION 13	Reactor Critical ###

TABLE 3.5-3 (Continued)

ENGINEERED SAFETY FEATURES INSTRUMENTATION LIMITING OPERATING CONDITIONS

TABLE NOTATIONS

- # Above P-11 (Low Pressure SI Block Permit) interlock
- ## Trip function may be blocked below P-12 (Low T_{avg} Interlock) setpoint
- ### The reactor may remain critical below the Power Operating conditions with this feature inhibited for the purpose of starting reactor coolant pumps

ACTION 11 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in at least the Hot Shutdown Condition within the next 8 hours and the Cold Shutdown Condition within the following 30 hours.

ACTION 12 - With the number of OPERABLE channels one less than the Total Number of Channels, Power Operation may proceed until performance of the next required operational test provided the inoperable channel is placed into the tripped condition within 1 hour.

ACTION 13 - With the number of OPERABLE channels one less than the Total Number of Channels; place the inoperable channel into the blocked condition within 1 hour, and restore the inoperable channel to OPERABLE status within 48 hours or be in at least the Hot Shutdown Condition within the next 8 hours and the Cold Shutdown Condition within the following 30 hours.

TABLE 3.5-4

ISOLATION FUNCTIONS INSTRUMENTATION LIMITING OPERATING CONDITIONS

<u>NO.</u>	<u>FUNCTIONAL UNIT</u>	<u>1</u> <u>TOTAL NO.</u> <u>OF</u> <u>CHANNELS</u>	<u>2</u> <u>MINIMUM</u> <u>CHANNELS</u> <u>OPERABLE</u>	<u>3</u> <u>OPERATOR ACTION IF</u> <u>COLUMN 1 OR 2</u> <u>CANNOT BE MET</u>	<u>APPLICABLE</u> <u>CONDITIONS</u>
1.	CONTAINMENT ISOLATION				
	A. Phase A				
	i. Safety Injection	See Item No. 1 of Table 3.5-3 for all Safety Injection initiating functions and requirements			
	ii. Manual	2	2	ACTION 11	>200 °F
	B. Phase B	See Item No. 2 of Table 3.5-3 for all Containment Spray initiating functions and requirements			
	C. Ventilation Isolation				
	i. High Containment Activity, Gaseous	1	0	ACTION 14	During Containment Purge
	ii. High Containment Activity, Particulate	1	0	ACTION 14	During Containment Purge
	iii. Phase A	See Item No. 1.A of Table 3.5-4 for all Phase A initiating functions and requirements			

TABLE 3.5-4 (Continued)

ISOLATION FUNCTIONS INSTRUMENTATION LIMITING OPERATING CONDITIONS

<u>NO.</u>	<u>FUNCTIONAL UNIT</u>	<u>1</u> <u>TOTAL NO.</u> <u>OF</u> <u>CHANNELS</u>	<u>2</u> <u>MINIMUM</u> <u>CHANNELS</u> <u>OPERABLE</u>	<u>3</u> <u>OPERATOR ACTION IF</u> <u>COLUMN 1 OR 2</u> <u>CANNOT BE MET</u>	<u>APPLICABLE</u> <u>CONDITIONS</u>
2.	STEAM LINE ISOLATION				
	A. High Steam Flow in 2/3 Steam Lines Coincident with Low T_{avg} in 2/3 loops	See Item No. 1.E of Table 3.5-3 for initiating functions and requirements			
	B. High Steam Flow in 2/3 Steam Lines Coincident with Low Steam Pressure in 2/3 lines	See Item No. 1.F of Table 3.5-3 for initiating functions and requirements			
	C. High Containment Pressure (Hi Hi Level)	See Item No. 2.B of Table 3.5-3 for initiating functions and requirements			
	D. Manual	1/Line	1/Line	ACTION 15	≥ 350 °F
3.	FEEDWATER LINE ISOLATION				
	A. Safety Injection	See Item No. 1 of Table 3.5-3 for all Safety Injection initiating functions and requirements			

TABLE 3.5-4 (Continued)

ISOLATION FUNCTIONS INSTRUMENTATION LIMITING OPERATING CONDITIONS

TABLE NOTATIONS

- ACTION 14 - With less than the Total Number of Channels, Power Operation may continue provided the Containment Ventilation Purge and Exhaust valves are maintained closed.
- ACTION 15 - With the number of channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or declare the associated valve inoperable and take the ACTION required by Specification 3.4.3.