

BFN-16

Table 13.5-1
CONTROL ROD DRIVE SYSTEM TESTS
(Unit 1)

| <u>Test Description</u> | Preop Tests | Reactor Pressure,psig (With Core Loaded) | | | |
|---|----------------|---|-----|-----|------|
| | | 0 | 600 | 800 | 1000 |
| Position Indication | All | All | | | |
| Normal Insert/Withdraw Times | All | All | | | 4* |
| Coupling | All | All | | | |
| Friction | | All | | | 4* |
| Scram Times (Normal Accumulated Pressure) | All | All | 4* | 4* | All |
| Scram Times (Minimum Accumulator Pressure) | | 4* | | | |
| Scram Times (Zero Accumulator Pressure) | | | | | 4* |
| Scram Times (Scram Discharge Volume High Level) | All | | | | |
| Scram Times, Rated Power (Normal Accumulator Pressure) | | | | | 4** |

*Value refers to the four slowest drives as determined from the normal accumulator pressure scram test at ambient reactor pressure which are compatible with the Rod Worth Minimizer and withdrawal sequence requirements.

**Scram times of the four slowest rods will be determined at 25, 50, and 100 percent of rated power during planned reactor scrams at these power levels.

Table 13.5-2
MAJOR PLANT TRANSIENTS

| <u>TEST TITLE</u> | TEST CONDITION | | | | |
|---|-------------------------------------|-----|-----|----|-----|
| | Nominal Power, Percent of Rated | | | | |
| | 25 | 50 | 75 | 80 | 100 |
| | Nominal Core Flow, Percent of Rated | | | | |
| | 36 | 100 | 100 | 70 | 100 |
| Feedwater Pump Trip | | | A | | C |
| Main Steam Isolation Valves (One Valve) | | C | A | C | |
| Main Steam Isolation Valves (All Valves) | | | | | C |
| Turbine-Generator Stop Valve Fast Close | | B | | | A |
| Turbine-Generator Control Valve Fast Close | A | | A | A | |
| Recirculation Pump Trip (One Pump) | | C | B | | C |
| Recirculation Pump Trip (Two Pumps) | | C | C | | C |
| Loss of Generator and Offsite Power | C | | | | |

A - Unit 1 B - Units 2, 3 C - Units 1, 2, 3

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Table 13.5-3
STABILITY TESTS

| TEST TITLE | TEST CONDITION | | | | | | | | | | | | | |
|--|-------------------------------------|----|-----|----|----|----|-----|----|----|----|-----|----|-----|--|
| | Nominal Power, Percent of Rated | | | | | | | | | | | | | |
| | 25 | 40 | 50 | 25 | 47 | 60 | 75 | 37 | 65 | 80 | 100 | 50 | 97 | |
| | Nominal Core Flow, Percent of Rated | | | | | | | | | | | | | |
| | 47 | 70 | 100 | NC | 48 | 70 | 100 | NC | 48 | 70 | 100 | NC | 109 | |
| Flux Response to Rods | C | A | C | | A | A | C | A | A | A | C | A | | |
| Pressure Regulator Setpoint | C | A | C | | A | A | C | A | C | C | C | A | | |
| Pressure REGulator Backup Regulator | C | | C | | | | C | | | | C | | | |
| Feedwater System Setpoint | C | A | C | | A | A | C | A | C | C | C | A | B | |
| Feedwater System Drop Heater | | | | | | | | | | | | A | | |
| Bypass Valve | C | A | C | B | A | A | C | A | C | C | C | C | B | |
| Flow Control | C | C | C | | C | C | C | | C | C | C | | | |

NC= Natural Circulation

A - unit 1 B - units 2, 3 C - units 1, 2, 3

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TABLE 13.5-4

STARTUP TEST PROGRAM (UNIT 1)

| TEST NO. | TEST CONDITION (See Figure 13.5-2) | OPEN VESS OR COLD TEST | HEAT UP | 50% Flow Line | | | | 75% Flow Line | | | | 100% Flow Line | | | | ≥20% 105% 8 | WARRANTY |
|----------|--|------------------------|---------|---------------|-------|-------|-------|---------------|-------|-------|-------|----------------|-------|--------|-------|-------------------|----------|
| | | | | 15-35 | 30-50 | 40-60 | 15-35 | 37-57 | 50-70 | 65-85 | 27-47 | 55-75 | 70-90 | 95-100 | 40-60 | | |
| | | | | ~48 | 70 | ~104 | NC | 48 | 70 | ~102 | NC | ~48 | ~70 | 100 | NC | | |
| | | | | 1 | 3 | 2 | 2A | 5A | 5 | 4 | 4A | 7A | 7 | 6 | 6A | | |
| 1 | Chemical & Radiochemical | X | X | X | | X | | | | | X | | | X | | | |
| 2 | Radiation Measurements | X | X | X | | X | | | | | | | | X | | | |
| 3 | Fuel Loading | X | | | | | | | | | | | | | | | |
| 4 | Full Core Shutdown Margin | X | | | | | | | | | | | | | | | |
| 5 | Control Rod Drive System | X | X | X | | X | | | | | | | | X | | | |
| 6 | SRM Performance & Control Rod Sequence | X | X | X | | | X | | | | X | | | | | | |
| 7 | Not Applicable | | | | | | | | | | | | | | | | |
| 8 | Not Applicable | | | | | | | | | | | | | | | | |
| 9 | Not Applicable | | | | | | | | | | | | | | | | |
| 10 | IRM Calibration | X | X | X | | | | | | | | | | | | | |
| 11 | LPRM Calibration | | | X | | X | | | | X | | | | X | | | |
| 12 | APRM Calibration | | X | X | | X | | | | X | | | | X | | X | |
| 13 | Process Computer | X | X | X | | | | | | | | | | X | | | |
| 14 | RCIC System | | X | M | | | | | | | | | | | | | |
| 15 | HPCI System | | X | | | M | | | | | | | | | | | |
| 16 | Reactor Vessel Temperature | | X | | | | X | | | | X | | | | X | | |
| 17 | System Expansion | X | X | X | | | | | | | | | | | | | |
| 18 | Core Power Distribution | | | X | | X | | | | X | | | | X | | X | |
| 19 | Core Performance | | | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| 20 | Elec. Output & Heat Rate | | | | | | | | | | | | | | | X | |
| 21 | Flux Response to Rods | | | M | M | M | M | M | M | X | M | M | M | M | X | | |
| 22 | Press. Reg.: Setpoint Changes | | | M | M | M | M | M | M | X | M | M | M | M | X | | |
| | : Backup Regulator | | | M | | M | | | | M | | | | M | | | |
| 23 | FW System: FW Pump Trip | | | | | | | | | M | | | | M | | | |
| | : Water Level Stpt. Chg. | | | MA | M | MA | M | M | M | MA | X | MA | MA | MA | X | | |
| | : Heater Loss | | | | | | | | | | | | | M* | | | |
| 24 | Bypass Valves | | | MA | MA | MA | M | MA | MA | X | MA | MA | MA | MA | X | | |
| 25 | Main Steam Iso. Valves: Each Vlv. | | X | | | M,SP | | | | M,SP | | | M,SP | | | | |
| | : Full Iso. | | | | | | | | | | | | | M,SE | | | |
| 26 | Relief Valves | | X | M | | M,SE | | | | M | | | | | | | |
| 27 | Turbine : Stop Valve Trip | | | | | | | | | | | | | M,SE | | | |
| | : Control Valve Trip | | | M,SP | | | | | | M,SE | | | A,SE | | | | |
| 29 | Flow Control | | | LMA | MA | MA | | MA | MA | MA | | MA | MA | MA | | | |
| 30 | Recirc. System: One Pump Trip | | | | | M | | | | | | | | M | | | |
| | : Two Pump Trip | | | | | M | | | | M | | | | M | | | |
| | : Flow Calibration | | | X | | X | X | | | X | | | | X | | X | |
| 31 | Loss of T-G & Offsite Power | | | M,SE | | | | | | | | | | LSE | | | |
| 32 | Recirc. Loop Control | X | X | | X | X | | | | | | | | | | | |
| 35 | Recirc. And Jet Pump Calibration | X | | | | | | | | | | | | | | | |
| 36 | Equalizer Open | | | | | M | | | | | | | | M | | | |
| 39 | Water Level verification in Reactor Vessel | | X | | | X | | | | | | | | X | | | |
| 70 | Reactor Water Cleanup System | | X | | | | | | | | | | | | | | |
| 71 | Residual Heat Removal System** | | | | | | | | | | | | | | | | |
| 72 | Drywell Atmosphere Cooling System | | X | | | X | | | | | | | | | | | |
| 73 | Cooling Water Systems | | X | | | X | | | | | | | | | | | |
| 90 | Vibration** | X | X | X | | X | | | | X | | | | X | | | |
| 92 | Steam Separator and Dryer | | X | X | | XSP | X | | | XSP | | | | X*,X | | XSP | |
| 93 | Not Applicable | | | | | | | | | | | | | | | | |

¹Power is in percent of rated power, 3293Mwt.

²Flow is in percent of rated flow, 102.5x10⁵ lbs/hr

* = 90% rated power

** = Actual test condition to be determined

M=Master Manual Control Mode

A=Automatic Control Mode

L=Local Manual Control Mode

X=Test independent of flow control mode.

SP=Scram Possibility

NC=Natural Circulation

SE=Scram Expected

TABLE 13.5-5

STARTUP TEST PROGRAM (UNIT 2)

| TEST CONDITION (See Figure 2) | OPEN VESSEL OR CRD TEST | | HEAT UP | 60% Flow Control Line | | 78% Flow Control Line | | 100% Flow Control Line | | 95-100 -109 4F | | |
|-------------------------------|-------------------------|---|---------|-----------------------|---------------|-----------------------|--------------|------------------------|---------------|----------------------|--------------|--------------|
| | Power %1 Flow %2 | | | 30-50 -47 | 40-90 -104 | 53 -116 | 37-57 -46 | 50-70 -70 | 65-85 -102 | | 55-75 -46 | 70-90 -70 |
| 1 | X | X | X | X | X | X | X | X | X | X | X | X |
| 2 | X | X | X | X | X | X | X | X | X | X | X | X |
| 3 | X | X | X | X | X | X | X | X | X | X | X | X |
| 4 | X | X | X | X | X | X | X | X | X | X | X | X |
| 5 | X | X | X | X | X | X | X | X | X | X | X | X |
| 6 | X | X | X | X | X | X | X | X | X | X | X | X |
| 9 | X | X | X | X | X | X | X | X | X | X | X | X |
| 10 | X | X | X | X | X | X | X | X | X | X | X | X |
| 11 | X | X | X | X | X | X | X | X | X | X | X | X |
| 12 | X | X | X | X | X | X | X | X | X | X | X | X |
| 13 | X | X | X | X | X | X | X | X | X | X | X | X |
| 14 | X | X | X | X | X | X | X | X | X | X | X | X |
| 15 | X | X | X | X | X | X | X | X | X | X | X | X |
| 16 | X | X | X | X | X | X | X | X | X | X | X | X |
| 17 | X | X | X | X | X | X | X | X | X | X | X | X |
| 18 | X | X | X | X | X | X | X | X | X | X | X | X |
| 19 | X | X | X | X | X | X | X | X | X | X | X | X |
| 20 | X | X | X | X | X | X | X | X | X | X | X | X |
| 21 | X | X | X | X | X | X | X | X | X | X | X | X |
| 22 | X | X | X | X | X | X | X | X | X | X | X | X |
| 23 | X | X | X | X | X | X | X | X | X | X | X | X |
| 24 | X | X | X | X | X | X | X | X | X | X | X | X |
| 25 | X | X | X | X | X | X | X | X | X | X | X | X |
| 26 | X | X | X | X | X | X | X | X | X | X | X | X |
| 27 | X | X | X | X | X | X | X | X | X | X | X | X |
| 29 | X | X | X | X | X | X | X | X | X | X | X | X |
| 30 | X | X | X | X | X | X | X | X | X | X | X | X |
| 31 | X | X | X | X | X | X | X | X | X | X | X | X |
| 32 | X | X | X | X | X | X | X | X | X | X | X | X |
| 33 | X | X | X | X | X | X | X | X | X | X | X | X |
| 34 | X | X | X | X | X | X | X | X | X | X | X | X |
| 35 | X | X | X | X | X | X | X | X | X | X | X | X |
| 70 | X | X | X | X | X | X | X | X | X | X | X | X |
| 71 | X | X | X | X | X | X | X | X | X | X | X | X |
| 72 | X | X | X | X | X | X | X | X | X | X | X | X |
| 73 | X | X | X | X | X | X | X | X | X | X | X | X |
| 74 | X | X | X | X | X | X | X | X | X | X | X | X |

8 Included only to meet Test 34 Requirements
 9 Trip the Generator Field Breaker
 10 Heat up tests of MSTRs & Relief Valves are Unit 1 only (cf Page 30)
 11 Determine Maximum power without scram
 12 Determine Maximum power without scram
 13 Not required if 50% power testing will be done within about 2 months
 L = Local Manual Flow Control mode
 M = Master Manual Flow Control Mode
 A = Automatic flow Control Mode
 X = Scram Possibility
 SP = Scram Expected
 SE = Scram
 NC = Natural Circulation

*Applies to unit 3 and, subsequent to equipment installation, to unit 2.

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TABLE 13.5-6

STARTUP TEST PROGRAM (UNIT 3)

| | TEST CONDITION (See Figure 2) | Power, %1 | OPEN VESSEL OR COLD TEST | HEAT UP | 50% Flow Control Line | | | | 75% Flow Control Line | | | | 100% Flow Control Line | | | |
|----|--|-----------|--------------------------------------|----------------|-----------------------|-------|--------------------------------|-----|-----------------------|-------|--------------------------------|-----|------------------------|--------------------------------|--------|-----|
| | | Flow, %2 | | | 15-35 | 30-50 | 40-60 | -25 | 37-57 | 50-70 | 65-85 | 37 | 55-75 | 70-90 | 95-100 | ~50 |
| | | | | | ~47 | ~70 | ~104 | NC | -48 | -70 | -102 | NC | -48 | -70 | -100 | NC |
| | | | 1 | 2D | 2E | 2A | 3C | 3D | 3E | 3A | 4C | 4D | 4E | 4A | | |
| 1 | Chemical & Radiochemical | | X | X | X | | X | | | | X | | | X | | |
| 2 | Radiation Measurement | | X | X | X | | X | | | | X | | | X | | |
| 3 | Fuel Loading | | X | | | | | | | | | | | | | |
| 4 | Full Core Shutdown Margin | | X | | | | | | | | | | | | | |
| 5 | CRD | | X | X | X ¹⁰ | | | | | | | | | X | | |
| 6 | SRM Perf. & Control Rod Seq. | | X | X | X | | | | | | | | | | | |
| 9 | Water Level Measurement | | | X | X | | | | | | | | | X | | |
| 10 | IRM Performance | | X | X | X | | | | | | | | | | | |
| 11 | LPRM Calibration | | | | X | | X | | | | X | | | X | | |
| 12 | APRM Calibration | | | X | X | | X | | | | X | | | X | | |
| 13 | Process Computer | | X | X | X ⁰ | | | | | | | | | X | | |
| 14 | RCIC | | | X | X | | | | | | | | | | | |
| 15 | HPCI | | | X | | | X | | | | | | | | | |
| 16 | Selected Process Temperature | | | X | | | | | | | | | | | X | |
| 17 | System Expansion | | X | X | X | | | | | | | | | | | |
| 18 | Core Power Distribution | | | | X | | X | | | | X | | | X | | |
| 19 | Core Performance | | | | X | X | X | X | X | X | X | X | X | X | X | |
| 20 | Steam Production | | | | | | | | | | | | | X | | |
| 21 | Flux Response to Rods | | | | X | | X | | | | X | | | X | | |
| 22 | Press. Reg.: Setpoint Changes | | | | X | | X | | | | X | X | X | X | | |
| | : Backup Regulator | | | | X | | X | | | | X | | | X | | |
| 23 | FW System: FW Pump Trip | | | | | | | | | | | | | X | | |
| | : Water Level Stpt. Chg. | | | | X | | X | | | | X | X | X | X | | |
| 24 | Bypass Valves | | | | X | | X | X | | | X | X | X | X | X | |
| 25 | Main Steam Iso. Valves: Each Vlv. | | | X ⁹ | | | X,SP | | | | X | X | X | X | X | |
| | : Full Iso. | | | | | | | | | | | | | X,SP | | |
| 26 | Relief Valve: Capacity | | | | X | | | | | | | | | | | |
| | : Actuators ³ | | | X ⁹ | X | | | | | | X | | | | | |
| 27 | Turbine Trip and | | | | | | | | | | | | | X,SE ⁵ | | |
| | Generator Load Rejection | | | | X,SP | | | | | | X,SE ⁵ | | | | | |
| 30 | Recirc. System: Trip One Pump | | | | | | X ⁷ ,X ⁸ | | | | X ⁷ ,X ⁷ | | | X ⁷ ,X ⁷ | | |
| | Trip Both Pumps | | | | | | X | | | | X | | | X | | |
| | Sys. Performance | | | | | | X ¹² | X | | | X | | | X | X | |
| | Non-Cavit. Verif. | | | | | | X ¹² | | | | | | | | | |
| 31 | Loss of T-G & Offsite Power | | | | X,SE ⁵ | | | | | | | | | | | |
| 32 | Recirc. MG Set Speed Control | | | | L,M | L,M | L,M | L,M | L,M | L,M | L,M | L,M | L,M | L,M | | |
| 33 | Turbine Stop Valve Surv. Test | | | | X | | X | | | | X | | | X,SP ¹¹ | | |
| 34 | Vibration Measurements ⁴ | | | | X ¹³ | X | X | X | X | X | X | X | X | X | X | |
| 35 | Recirc. System Flow Calibration | | | | | | X | | | | X | | | X | | |
| 70 | Reactor Water Cleanup System | | | X | | | | | | | | | | | | |
| 71 | Residual Heat Removal System | | | | X | | | | | | | | | | | |
| 72 | Drywell Atmospheric Cooling System | | | X | | | | | | | | | | X | | |
| 73 | Cooling Water Systems | | | X | | | | | | | | | | X | | |
| 74 | Offgas System | | | | X | | X | | | | X | | | X | | |
| 75 | Reactor Shutdown From Outside Control Room | | | | X ¹⁴ | | | | | | | | | | | |

¹Percent of rated power, 3293 MWt

²Percent of rated flow, 102.5 x 10⁶ lb/hr

³Also obtain data with Tests 25, Full Iso & Test 27

⁴Obtain data with Test 30

⁵Perform Test 5, timing of 4 slowest control rods

in conjunction with these scrams

⁶Perform the Dynamic System Test Case

⁷Included only to meet Test 34 Requirements

⁸Trip the Generator Field Breaker

⁹Heat up tests of MSIVs & Relief Valves are

to check operation only

¹⁰RSCS cleared (40%)

¹¹Determine maximum power without scram

¹²From Test Condition 2E to 5

¹³Not required if 50% power testing will be

done in about 2 months

¹⁴At greater than 10% generator output

L = Local Manual Flow Control Mode

M = Master Manual Flow Control Mode

A = Automatic Flow Control Mode

x = Test Independent of Flow Control Mode

SP = Scram Possibility

SE = Scram Expected

NC = Natural Circulation