

TRANSMITTAL MANIFEST
NORTHERN STATES POWER COMPANY
PRAIRIE ISLAND NUCLEAR GENERATING PLANT

**Core Operating Limits Reports for Prairie Island
Unit 1 Cycle 20 Revision 1 and Unit 2 Cycle 20 Revision 1**

Correspondence Date: August 10, 2000

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Design Change	No
USAR	No
Commitment	No
Fire Protection Related	No

Comments:

Manifest Date: August 11, 2000

RMS - Doc Type: _____

NSP-NRC DDC

A001

August 10, 2000

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PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Core Operating Limits Reports for Prairie Island
Unit 1 Cycle 20 Revision 1 and Unit 2 Cycle 20 Revision 1

The attached revision to the Core Operating Limits Reports for Prairie Island Unit 1 Cycle 20 and Unit 2 Cycle 20 is being provided in accordance with the requirements of Technical Specification Section 6.7.A.6. The Unit 1 Cycle 20 and Unit 2 Cycle 20 Core Operating Limits Reports have been revised per Technical Specification Amendments 151/142 to relocate shutdown margin requirements from the Technical Specifications and to incorporate additional shutdown margin requirements identified by the reanalysis of the uncontrolled boron dilution event.

In this letter and attachments we have made no new commitments. If you have any questions related to this matter, please contact John Stanton at 651-388-1121-4083.



Donald A. Schuelke
Plant Manager
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Attachments: Core Operating Limits Report - Unit 1 Cycle 20 Revision 1
Core Operating Limits Report - Unit 1 Cycle 20 Revision 1

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PRAIRIE ISLAND NUCLEAR GENERATING PLANT

CORE OPERATING LIMITS REPORT

Unit 1 - Cycle 20

Revision 1

Note: This report is not part of the Technical Specifications.
This report is referenced in Technical Specifications.

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
CORE OPERATING LIMITS REPORT

Unit 1 - Cycle 20

Revision 1

This report provides the values of the limits for Unit 1 Cycle 20 as required by Technical Specification Section 6.7.A.6. These values have been established using NRC approved methodology and are established such that all applicable limits of the plant safety analysis are met.

Heat Flux Hot Channel Factor Limits

$$F_Q^{RTP} = 2.40$$

K(Z) values are provided in Figure 1.

V(Z) values are provided in Table 1 and Figures 2a through 2f.

Reference Technical Specification Sections: 3.10.B.1 and 3.10.B.2

Nuclear Enthalpy Rise Hot Channel Factor Limits

$$F_{\Delta H}^{RTP} = 1.77$$

$$PFDH = 0.3$$

If the nuclear enthalpy rise hot channel factor exceeds its limit in Technical Specification 3.10.B.1, reduce reactor power and the high neutron flux trip setpoint by 3.33% for each percent that the measured nuclear enthalpy rise hot channel factor exceeds the 3.10.B.1 limit.

Reference Technical Specification Sections: 3.10.B.1, 3.10.B.2, and 3.10.B.3

Linear Heat Generation Rate

The 95% probability level ECCS analysis calculation utilized a peak linear heat generation rate of 14.788 kW/ft.

The Appendix K ECCS analysis calculation utilized a peak linear heat generation rate of 15.167 kW/ft for the F_Q limit of 2.40.

Reference Technical Specification Section: 3.10.B

Axial Flux Difference Limits

The Axial Flux difference limits are provided in Figure 3.

The Axial Flux Difference target band is $\pm 5\%$.

Reference Technical Specification Sections: 3.10.B.4 through 3.10.B.9

Shutdown Rod Insertion Limits

The shutdown rods shall be fully withdrawn.

Reference Technical Specification Sections: 3.10.D

Control Rod Insertion Limits

The control rod banks shall be limited in physical insertion as shown in Figures 4, 5, and 6.

Reference Technical Specification Sections: 3.10.D and 3.10.G

Reactor Coolant Flow Limit

The reactor coolant system flow shall be $\geq 178,000$ gpm.

Reference Technical Specification Sections: 3.10.J

Shutdown Margin Requirements

Minimum Shutdown Margin requirements are shown in Table 2.

Reference Technical Specification Sections: Table TS.1-1 and Specifications 3.10.A and 3.10.D.3.

LOCA

The Small and Large Break LOCA analyses performed for this cycle are valid for $F_Q \leq 2.80$ and $F_Q \leq 2.40$, respectively. The F_Q limit for the Large Break LOCA analysis is more limiting than the F_Q limit for the Small Break LOCA analysis. The Small Break LOCA analysis incorporates the $K(z)$ methodology. However, since the Small Break LOCA is less limiting than the Large Break LOCA analysis, no $K(z)$ penalty needs to be applied to calculations of most limiting F_Q values. Thus for the equation in Technical Specification 3.10.B, $K(z)$ is equal to 1. $K(z)$ is shown graphically in Figure 1.

Transient Power Distribution Penalty for $F_Q - V(z)$

Table 1 summarizes the bounding $V(z)$ values for the middle 80% of the core for Prairie Island Unit 1 Cycle 20. The $V(z)$ penalty takes the form of straight lines connecting data points determined as a function of core height. A particular $V(z)$ curve is valid over a given exposure range and equilibrium Axial Offset (AO) range as noted in Table 1. The $V(z)$ penalty for each exposure and AO range is shown graphically in Figures 2a - 2f.

Table 1
Bounding V(z) Values

Exposure Range	z(ft), V(z)	z(ft), V(z)
0 - 1.529 GWd/MTU Eq AO range: -3% to +8% Operating band: $\pm 5\%$ ΔI (Startup)	0.20, 1.000	6.30, 1.079
	0.39, 1.000	6.49, 1.077
	0.59, 1.000	6.69, 1.074
	0.79, 1.000	6.89, 1.070
	0.98, 1.000	7.08, 1.066
	1.18, 1.105	7.28, 1.062
	1.38, 1.102	7.48, 1.061
	1.57, 1.099	7.67, 1.061
	1.77, 1.096	7.87, 1.063
	1.97, 1.093	8.07, 1.066
	2.16, 1.090	8.26, 1.070
	2.36, 1.087	8.46, 1.073
	2.56, 1.084	8.66, 1.076
	2.75, 1.082	8.85, 1.080
	2.95, 1.082	9.05, 1.084
	3.15, 1.081	9.25, 1.088
	3.34, 1.081	9.44, 1.091
	3.54, 1.081	9.64, 1.095
	3.74, 1.081	9.84, 1.098
	3.93, 1.081	10.03, 1.101
	4.13, 1.081	10.23, 1.105
	4.33, 1.082	10.43, 1.108
	4.52, 1.083	10.62, 1.111
	4.72, 1.084	10.82, 1.115
	4.92, 1.084	11.02, 1.000
	5.11, 1.085	11.21, 1.000
	5.31, 1.085	11.41, 1.000
	5.51, 1.084	11.61, 1.000
	5.70, 1.084	11.80, 1.000
	5.90, 1.083	12.00, 1.000
	6.10, 1.081	

Table 1

Bounding V(z) Values (continued)

Exposure Range	z(ft), V(z)	z(ft), V(z)
1.529 – 4.290 GWd/MTU Eq AO range: -6% to +6% Operating band: $\pm 5\% \Delta I$	0.20, 1.000	6.30, 1.081
	0.39, 1.000	6.49, 1.078
	0.59, 1.000	6.69, 1.075
	0.79, 1.000	6.89, 1.072
	0.98, 1.000	7.08, 1.069
	1.18, 1.100	7.28, 1.066
	1.38, 1.098	7.48, 1.070
	1.57, 1.095	7.67, 1.073
	1.77, 1.093	7.87, 1.076
	1.97, 1.092	8.07, 1.079
	2.16, 1.091	8.26, 1.082
	2.36, 1.090	8.46, 1.084
	2.56, 1.089	8.66, 1.086
	2.75, 1.088	8.85, 1.088
	2.95, 1.086	9.05, 1.091
	3.15, 1.085	9.25, 1.094
	3.34, 1.083	9.44, 1.096
	3.54, 1.081	9.64, 1.098
	3.74, 1.080	9.84, 1.100
	3.93, 1.080	10.03, 1.103
	4.13, 1.081	10.23, 1.105
	4.33, 1.082	10.43, 1.108
	4.52, 1.084	10.62, 1.112
	4.72, 1.085	10.82, 1.116
	4.92, 1.086	11.02, 1.000
	5.11, 1.086	11.21, 1.000
	5.31, 1.087	11.41, 1.000
	5.51, 1.086	11.61, 1.000
	5.70, 1.086	11.80, 1.000
	5.90, 1.084	12.00, 1.000
	6.10, 1.083	

Table 1

Bounding V(z) Values (continued)

Exposure Range	z(ft), V(z)	z(ft), V(z)
4.290 – 8.290 GWd/MTU Eq AO range: -6% to +4% Operating band: $\pm 5\% \Delta I$	0.20, 1.000	6.30, 1.078
	0.39, 1.000	6.49, 1.076
	0.59, 1.000	6.69, 1.073
	0.79, 1.000	6.89, 1.072
	0.98, 1.000	7.08, 1.072
	1.18, 1.101	7.28, 1.072
	1.38, 1.100	7.48, 1.076
	1.57, 1.098	7.67, 1.079
	1.77, 1.096	7.87, 1.082
	1.97, 1.094	8.07, 1.084
	2.16, 1.093	8.26, 1.087
	2.36, 1.091	8.46, 1.088
	2.56, 1.089	8.66, 1.090
	2.75, 1.088	8.85, 1.091
	2.95, 1.085	9.05, 1.093
	3.15, 1.083	9.25, 1.095
	3.34, 1.081	9.44, 1.097
	3.54, 1.079	9.64, 1.098
	3.74, 1.077	9.84, 1.100
	3.93, 1.078	10.03, 1.102
	4.13, 1.079	10.23, 1.105
	4.33, 1.080	10.43, 1.108
	4.52, 1.082	10.62, 1.112
	4.72, 1.083	10.82, 1.116
	4.92, 1.083	11.02, 1.000
	5.11, 1.084	11.21, 1.000
	5.31, 1.084	11.41, 1.000
	5.51, 1.084	11.61, 1.000
	5.70, 1.083	11.80, 1.000
	5.90, 1.082	12.00, 1.000
	6.10, 1.080	

Table 1

Bounding V(z) Values (continued)

Exposure Range	z(ft), V(z)	z(ft), V(z)
8.290 – 13.290 GWd/MTU Eq AO range: -6% to +2% Operating band: $\pm 5\% \Delta I$	0.20, 1.000	6.30, 1.072
	0.39, 1.000	6.49, 1.070
	0.59, 1.000	6.69, 1.069
	0.79, 1.000	6.89, 1.071
	0.98, 1.000	7.08, 1.075
	1.18, 1.101	7.28, 1.079
	1.38, 1.101	7.48, 1.082
	1.57, 1.100	7.67, 1.086
	1.77, 1.099	7.87, 1.088
	1.97, 1.097	8.07, 1.090
	2.16, 1.096	8.26, 1.092
	2.36, 1.093	8.46, 1.093
	2.56, 1.091	8.66, 1.094
	2.75, 1.088	8.85, 1.095
	2.95, 1.085	9.05, 1.097
	3.15, 1.082	9.25, 1.098
	3.34, 1.080	9.44, 1.100
	3.54, 1.077	9.64, 1.101
	3.74, 1.075	9.84, 1.104
	3.93, 1.075	10.03, 1.107
	4.13, 1.076	10.23, 1.111
	4.33, 1.077	10.43, 1.116
	4.52, 1.077	10.62, 1.120
	4.72, 1.078	10.82, 1.126
	4.92, 1.079	11.02, 1.000
	5.11, 1.079	11.21, 1.000
	5.31, 1.079	11.41, 1.000
	5.51, 1.078	11.61, 1.000
	5.70, 1.078	11.80, 1.000
	5.90, 1.076	12.00, 1.000
	6.10, 1.074	

Table 1

Bounding V(z) Values (continued)

Exposure Range	z(ft), V(z)	z(ft), V(z)
13.290 – 16.790 GWd/MTU Eq AO range: -6% to +4% Operating band: $\pm 5\%$ ΔI	0.20, 1.000	6.30, 1.101
	0.39, 1.000	6.49, 1.103
	0.59, 1.000	6.69, 1.106
	0.79, 1.000	6.89, 1.107
	0.98, 1.000	7.08, 1.108
	1.18, 1.117	7.28, 1.108
	1.38, 1.115	7.48, 1.106
	1.57, 1.113	7.67, 1.105
	1.77, 1.111	7.87, 1.102
	1.97, 1.107	8.07, 1.099
	2.16, 1.103	8.26, 1.096
	2.36, 1.099	8.46, 1.097
	2.56, 1.094	8.66, 1.097
	2.75, 1.089	8.85, 1.098
	2.95, 1.084	9.05, 1.099
	3.15, 1.079	9.25, 1.099
	3.34, 1.078	9.44, 1.102
	3.54, 1.082	9.64, 1.105
	3.74, 1.086	9.84, 1.108
	3.93, 1.090	10.03, 1.112
	4.13, 1.095	10.23, 1.117
	4.33, 1.098	10.43, 1.123
	4.52, 1.101	10.62, 1.129
	4.72, 1.104	10.82, 1.136
	4.92, 1.106	11.02, 1.000
	5.11, 1.107	11.21, 1.000
	5.31, 1.109	11.41, 1.000
	5.51, 1.107	11.61, 1.000
	5.70, 1.107	11.80, 1.000
	5.90, 1.105	12.00, 1.000
	6.10, 1.102	

Table 1

Bounding V(z) Values (continued)

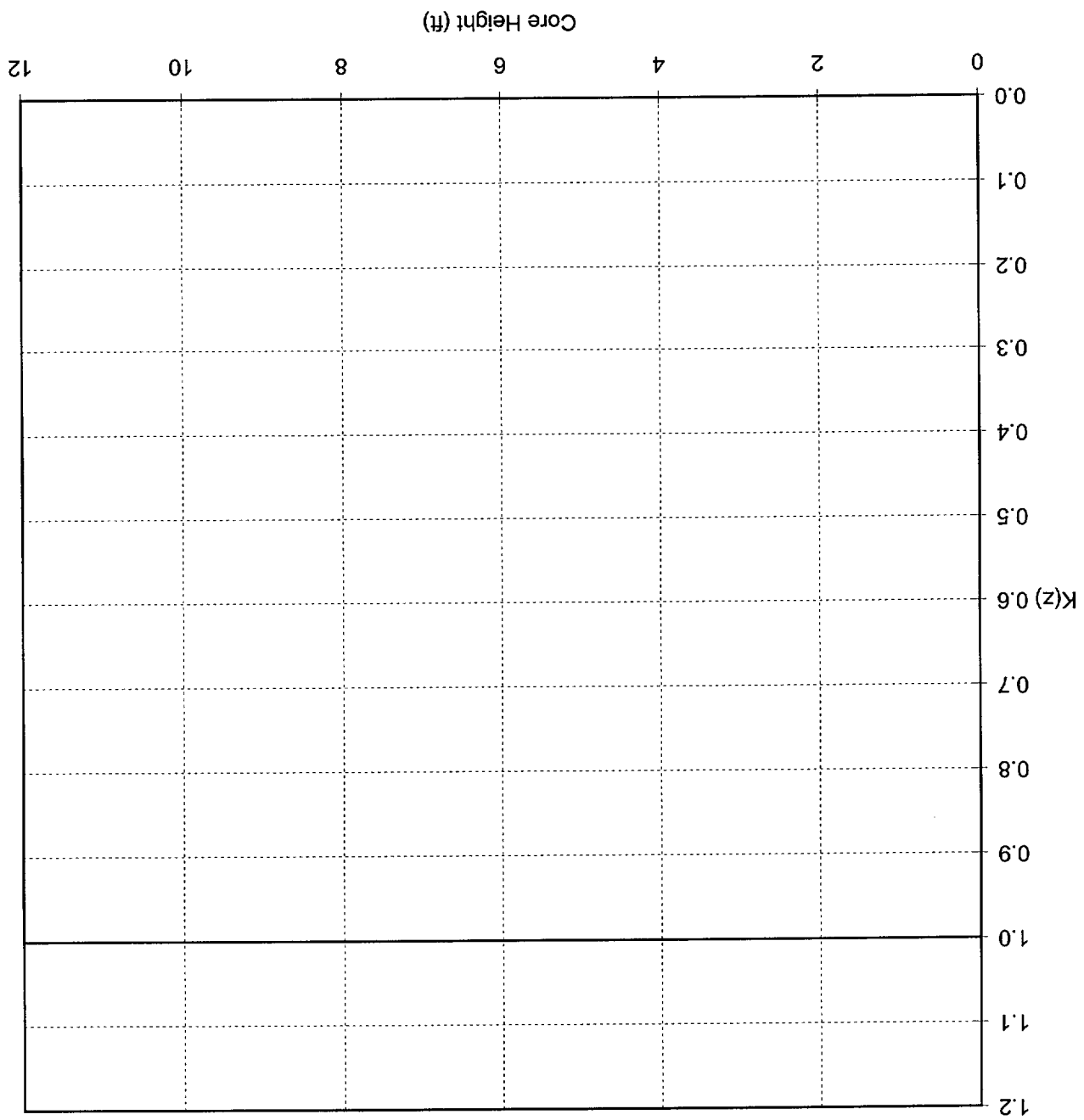
Exposure Range	z(ft), V(z)	z(ft), V(z)
16.790 GWd/MTU - EOC Eq AO range: -6% to +4% Operating band: $\pm 5\%$ ΔI	0.20, 1.000	6.30, 1.118
	0.39, 1.000	6.49, 1.118
	0.59, 1.000	6.69, 1.118
	0.79, 1.000	6.89, 1.117
	0.98, 1.000	7.08, 1.117
	1.18, 1.119	7.28, 1.117
	1.38, 1.117	7.48, 1.114
	1.57, 1.114	7.67, 1.112
	1.77, 1.111	7.87, 1.108
	1.97, 1.107	8.07, 1.103
	2.16, 1.103	8.26, 1.099
	2.36, 1.098	8.46, 1.097
	2.56, 1.093	8.66, 1.095
	2.75, 1.088	8.85, 1.095
	2.95, 1.084	9.05, 1.096
	3.15, 1.080	9.25, 1.098
	3.34, 1.080	9.44, 1.100
	3.54, 1.085	9.64, 1.103
	3.74, 1.090	9.84, 1.108
	3.93, 1.096	10.03, 1.114
	4.13, 1.102	10.23, 1.120
	4.33, 1.107	10.43, 1.128
	4.52, 1.111	10.62, 1.135
	4.72, 1.116	10.82, 1.143
	4.92, 1.119	11.02, 1.000
	5.11, 1.121	11.21, 1.000
	5.31, 1.123	11.41, 1.000
	5.51, 1.123	11.61, 1.000
	5.70, 1.124	11.80, 1.000
	5.90, 1.122	12.00, 1.000
	6.10, 1.120	

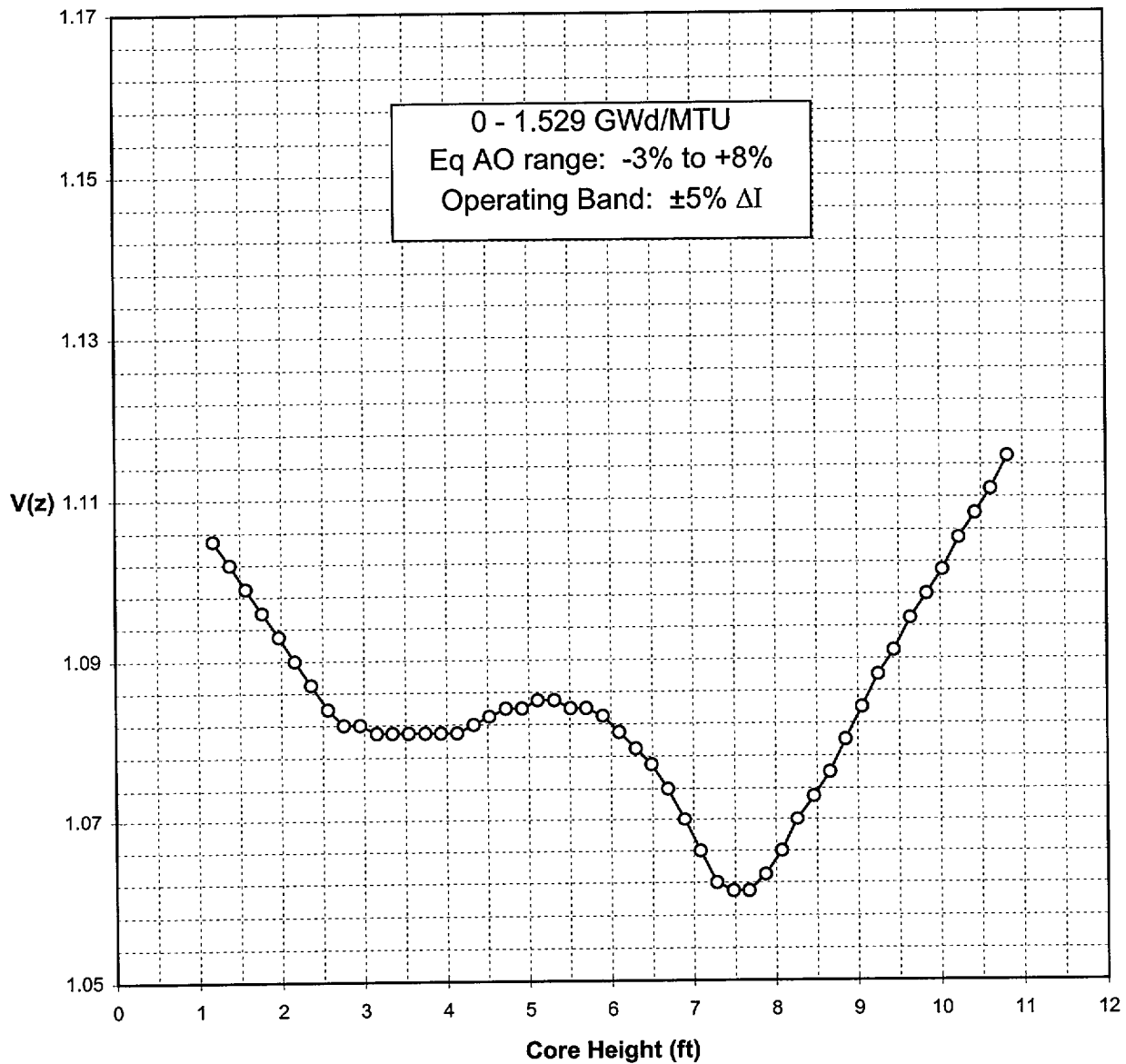
Table 2
Minimum Required Shutdown Margin

Plant Conditions	Number of Charging Pumps in Service **		
	0 or 1 Pump	2 Pumps	3 Pumps
Modes 1 and 2	2%*	2%*	2%*
Mode 3, $T_{ave} \geq 520^{\circ}\text{F}$	2%	2%	2%
Mode 3, $T_{ave} < 520^{\circ}\text{F}$ $> 350^{\circ}\text{F}$	2.5%	2.5%	2.5%
Mode 4	2.5%	6%	8%
Mode 5	2.5%	6%	8%
Mode 6, ARI	5.26%	5.26%	9%
Mode 6, ARO	5.26%	7%	9.5%

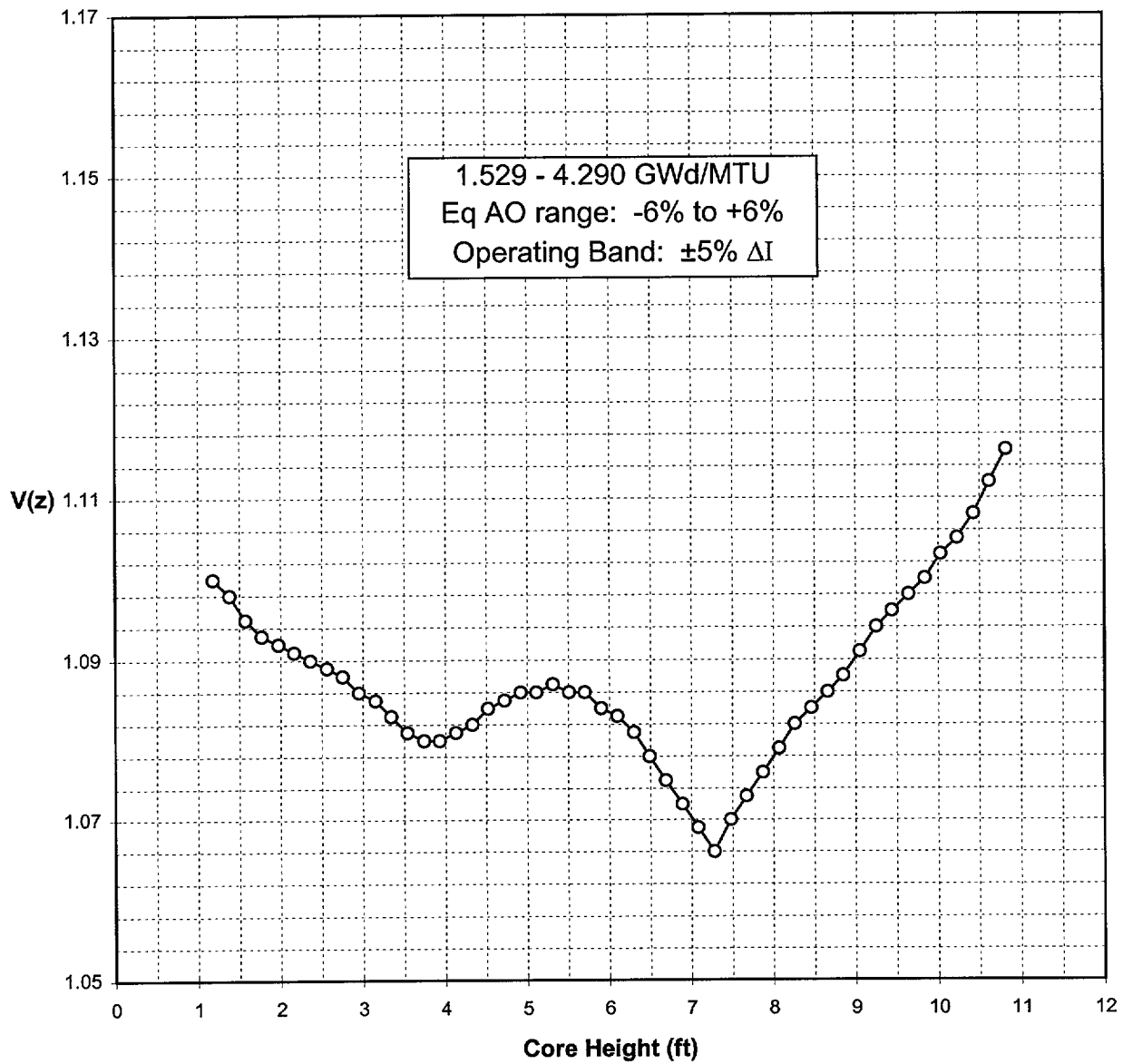
* For Modes 1 and 2, minimum shutdown margin requirements are provided by the Rod Insertion Limits.

** Charging pump(s) in service only pertains to steady state operations. It does not include transitory operations. For example, operations such as starting a second charging pump in order to secure the operating pump would fall under the one pump in service column.

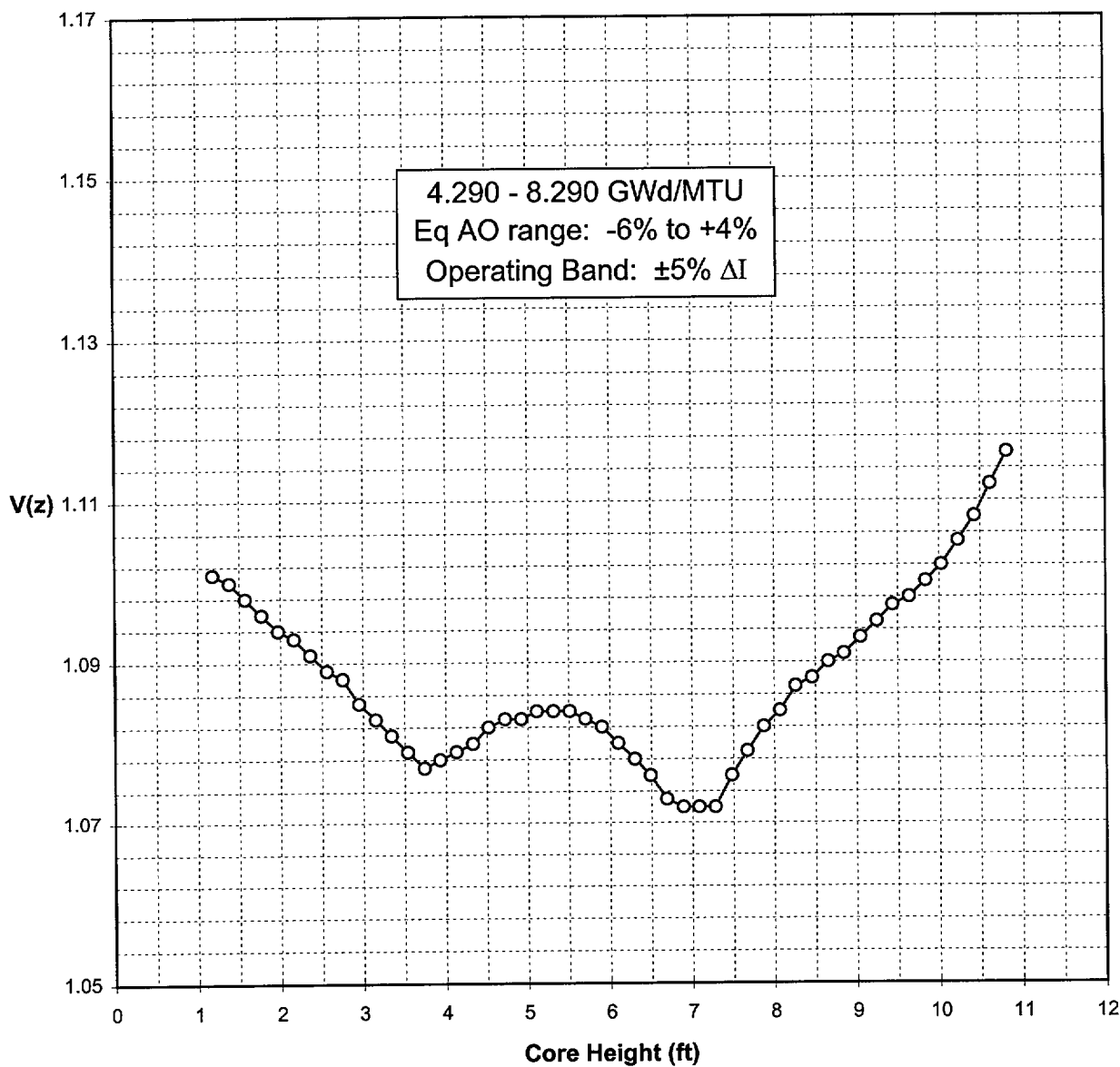




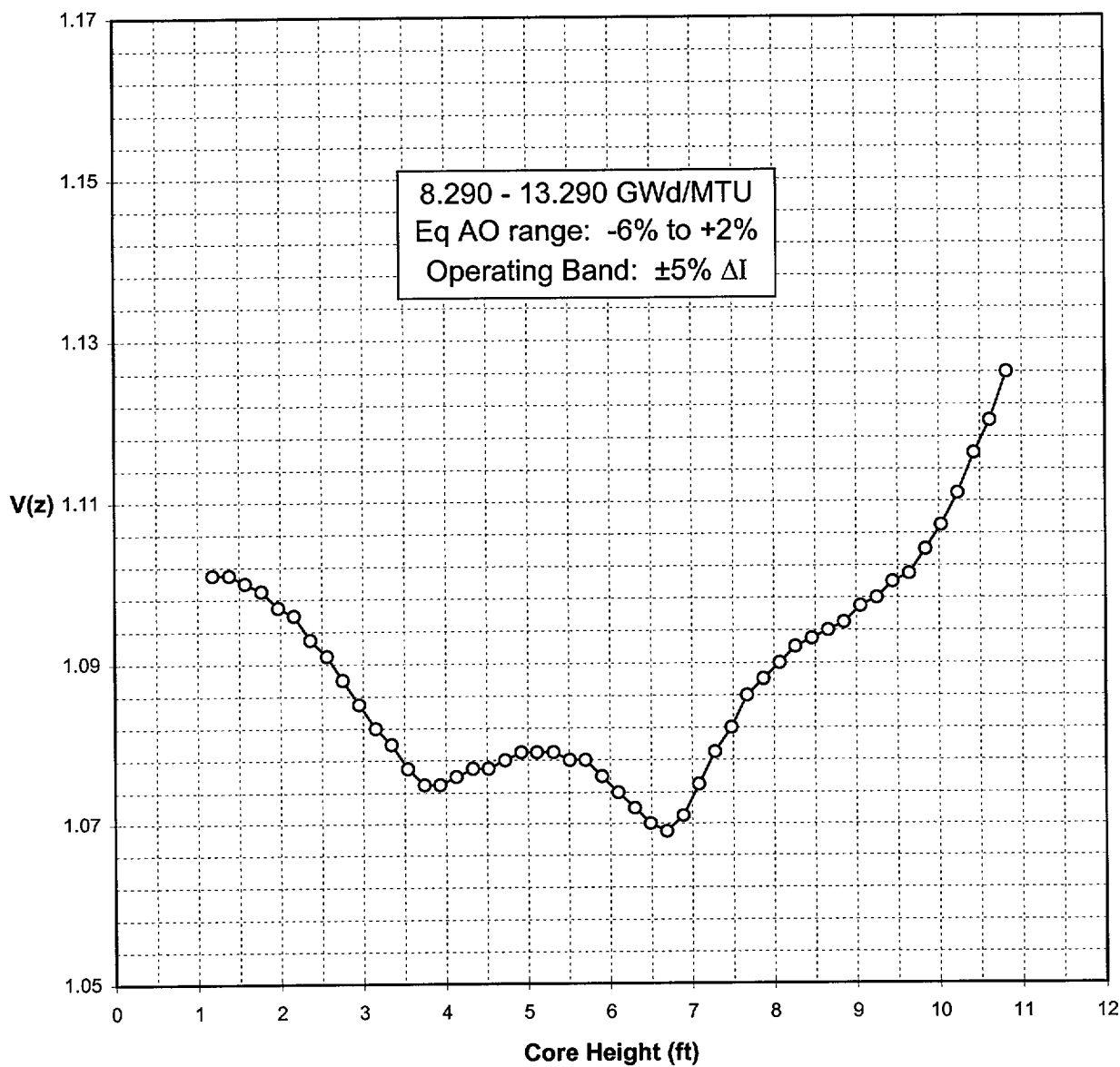
**Figure 2a: Bounding V(z) Values
From 0 - 1.529 GWd/MTU
(Startup)**



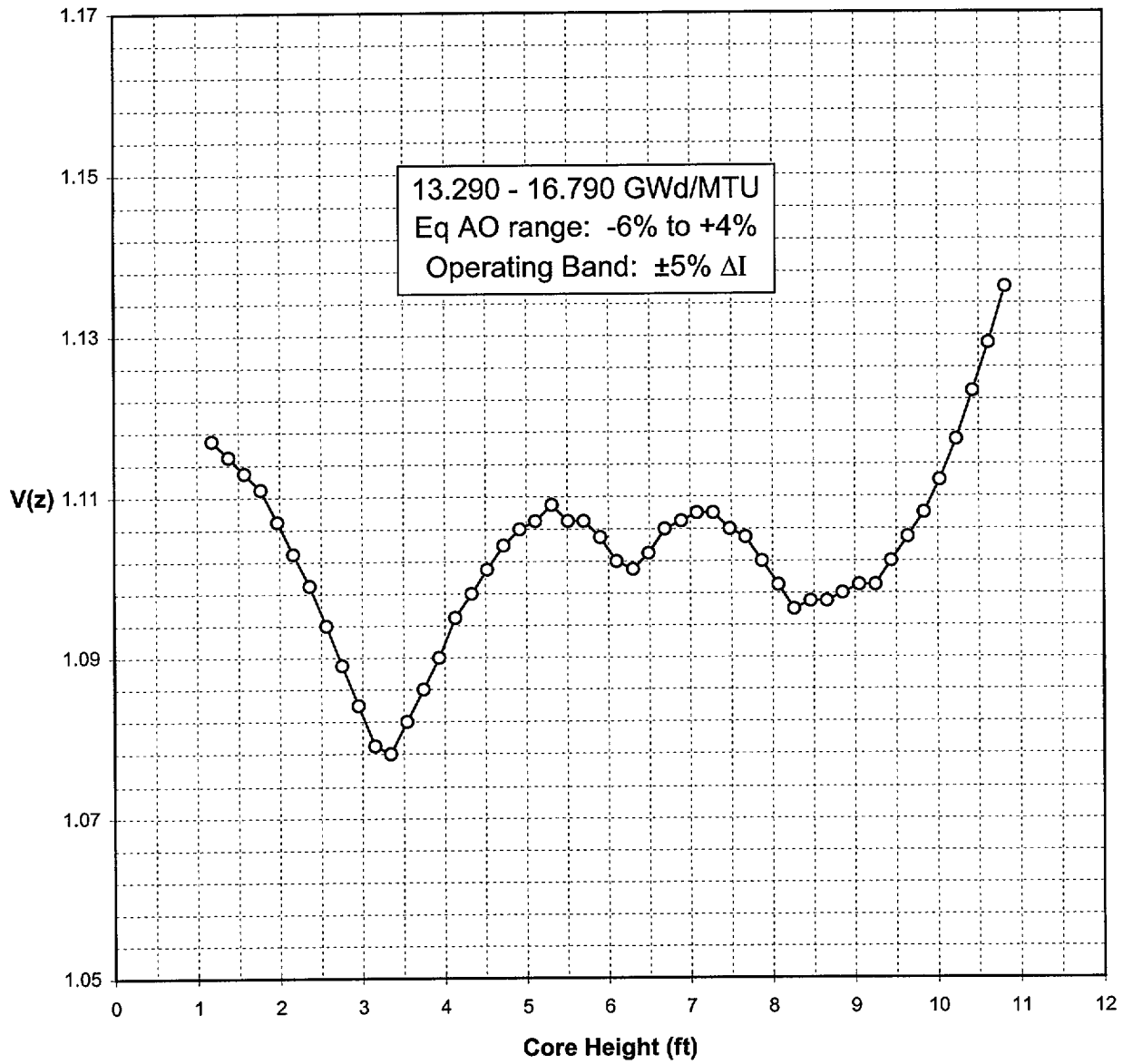
**Figure 2b: Bounding V(z) Values
From 1.529 - 4.290 GWd/MTU**



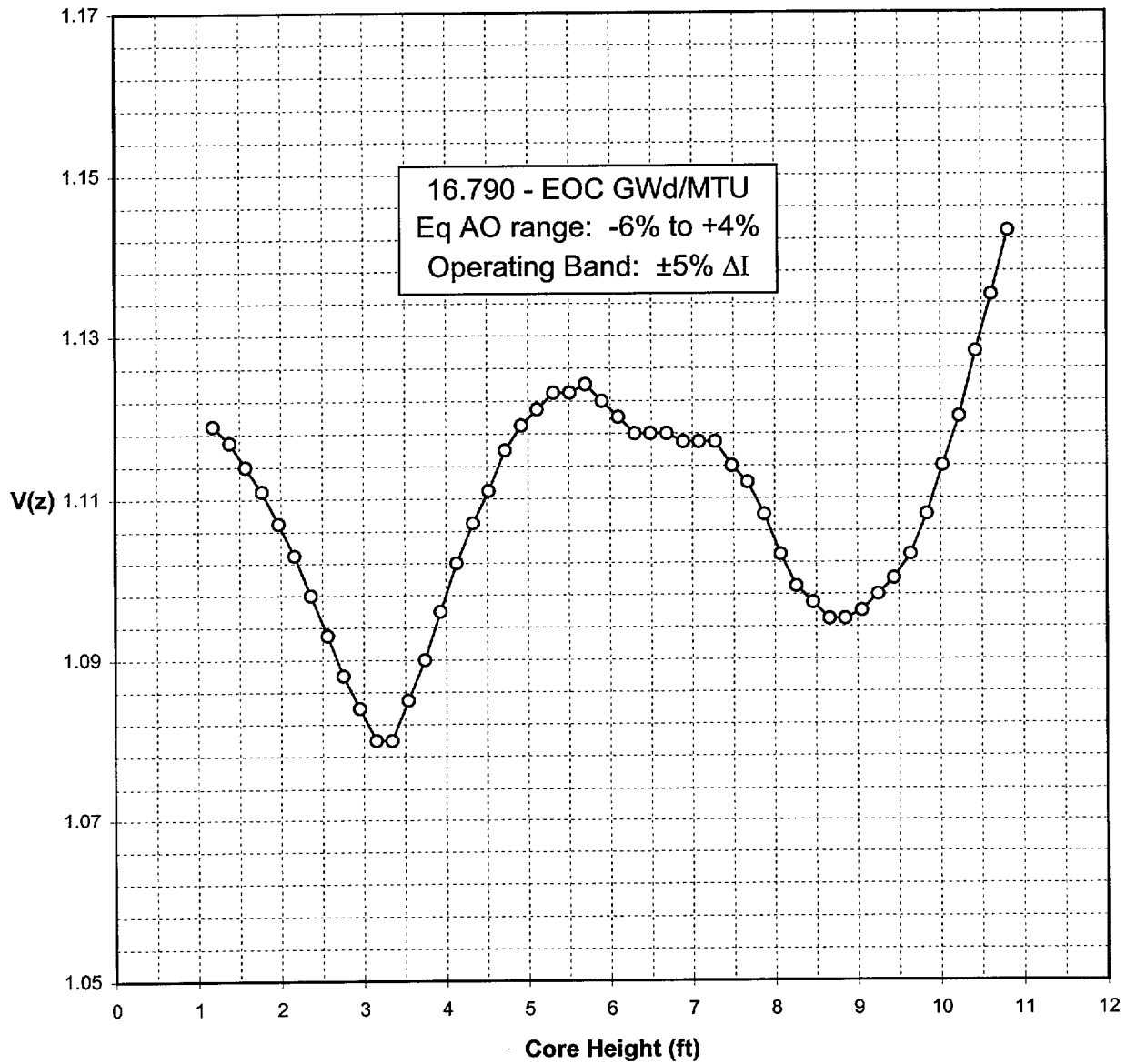
**Figure 2c: Bounding V(z) Values
From 4.290 - 8.290 GWd/MTU**



**Figure 2d: Bounding V(z) Values
From 8.290 - 13.290 GWd/MTU**



**Figure 2e: Bounding V(z) Values
From 13.290 - 16.790 GWd/MTU**



**Figure 2f: Bounding V(z) Values
From 16.790 - EOC GWd/MTU**

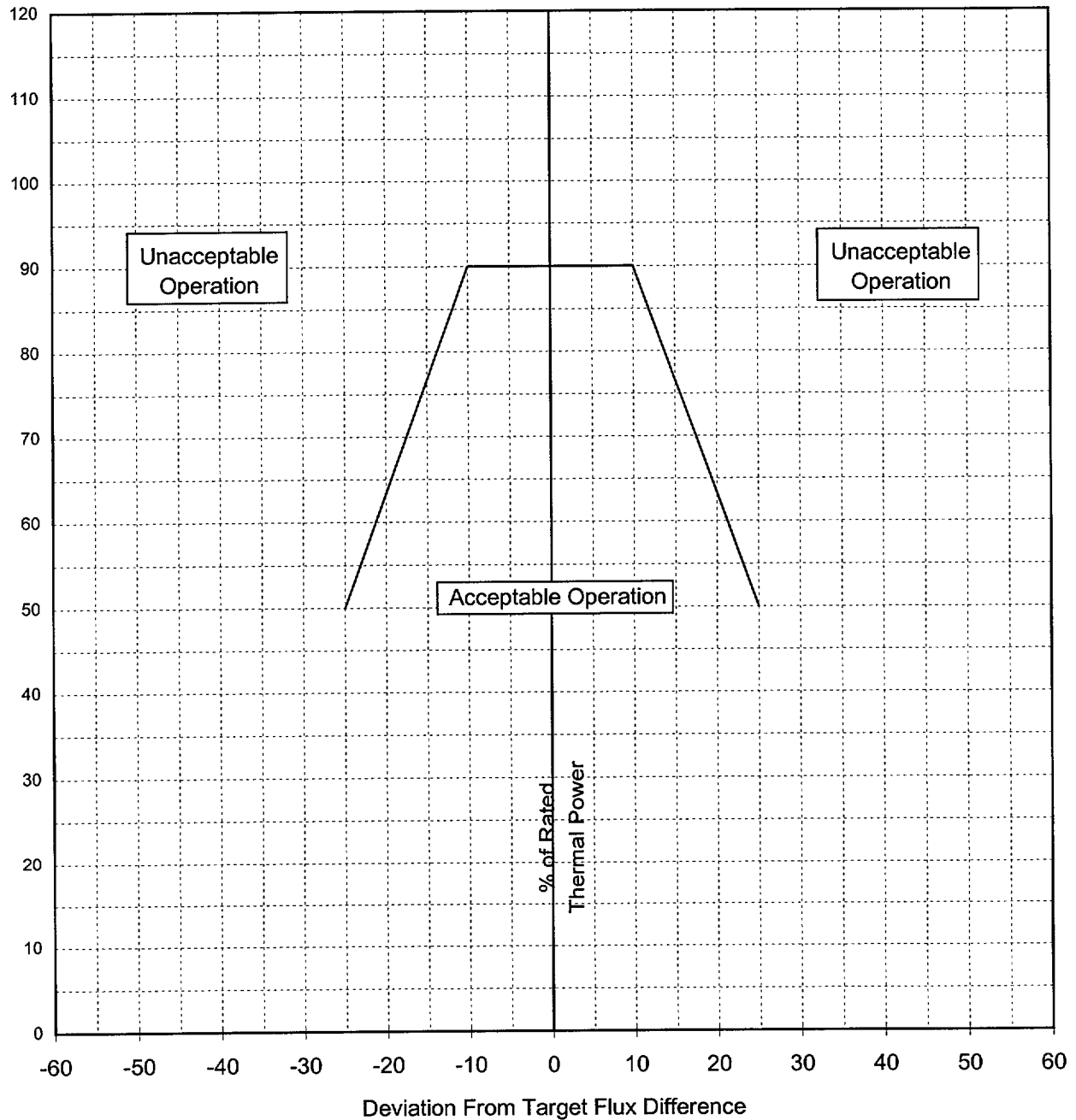


Figure 3: Deviation From Target Flux Difference as a Function of Thermal Power

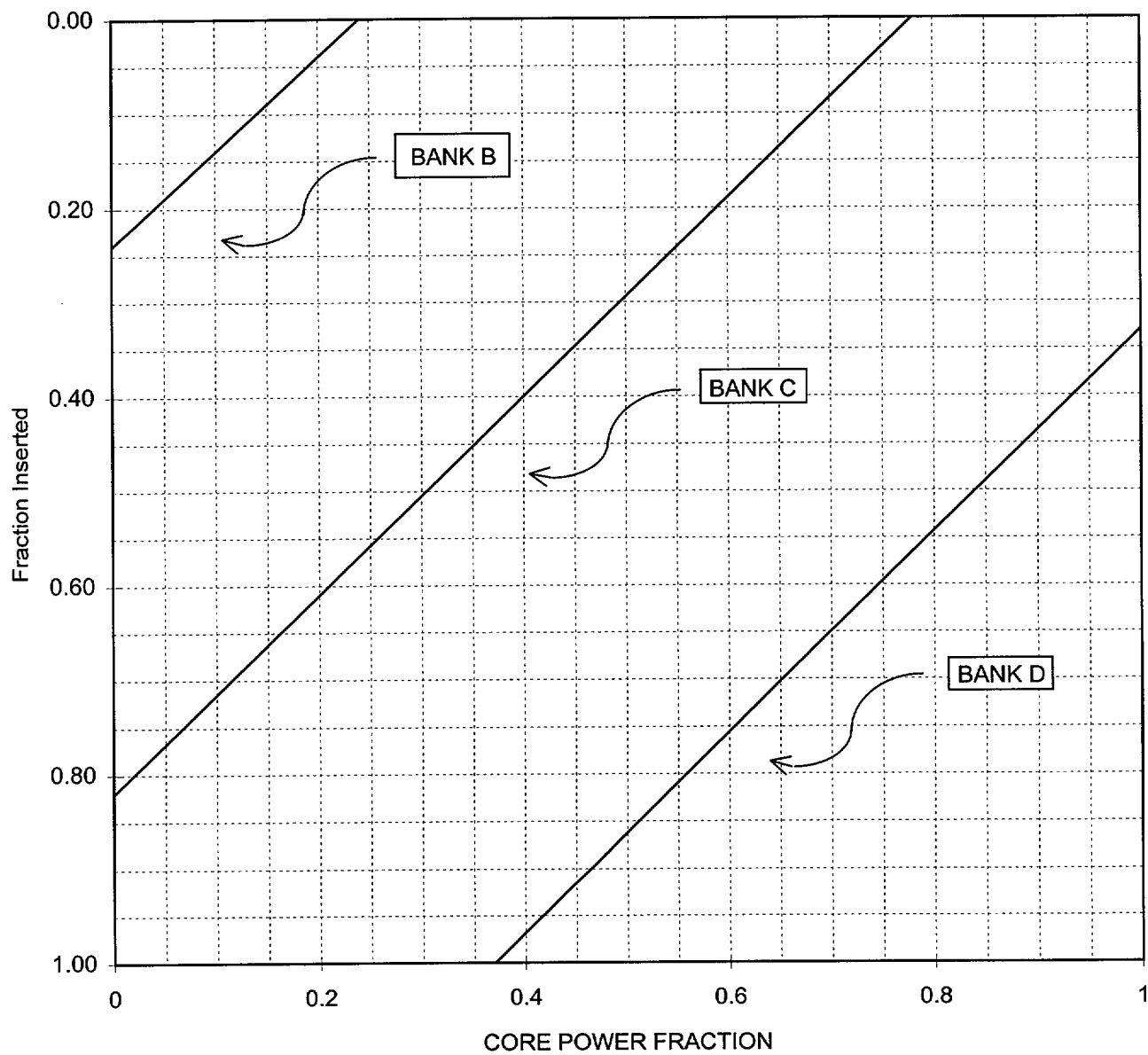


Figure 4: Control Bank Insertion Limits

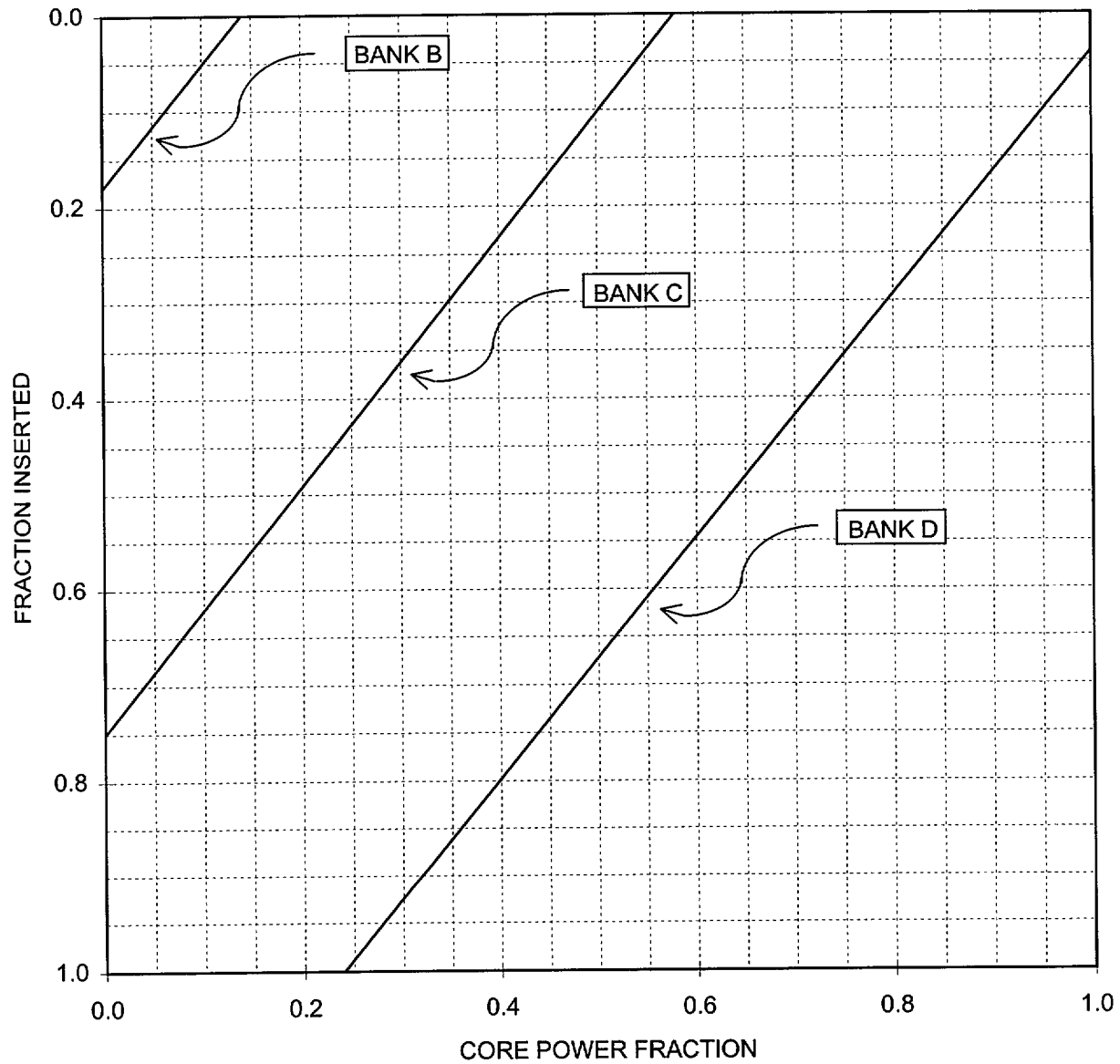


Figure 5: Insertion Limits
100 Step Overlap With One Bottomed Rod
(Technical Specification 3.10.G.3)

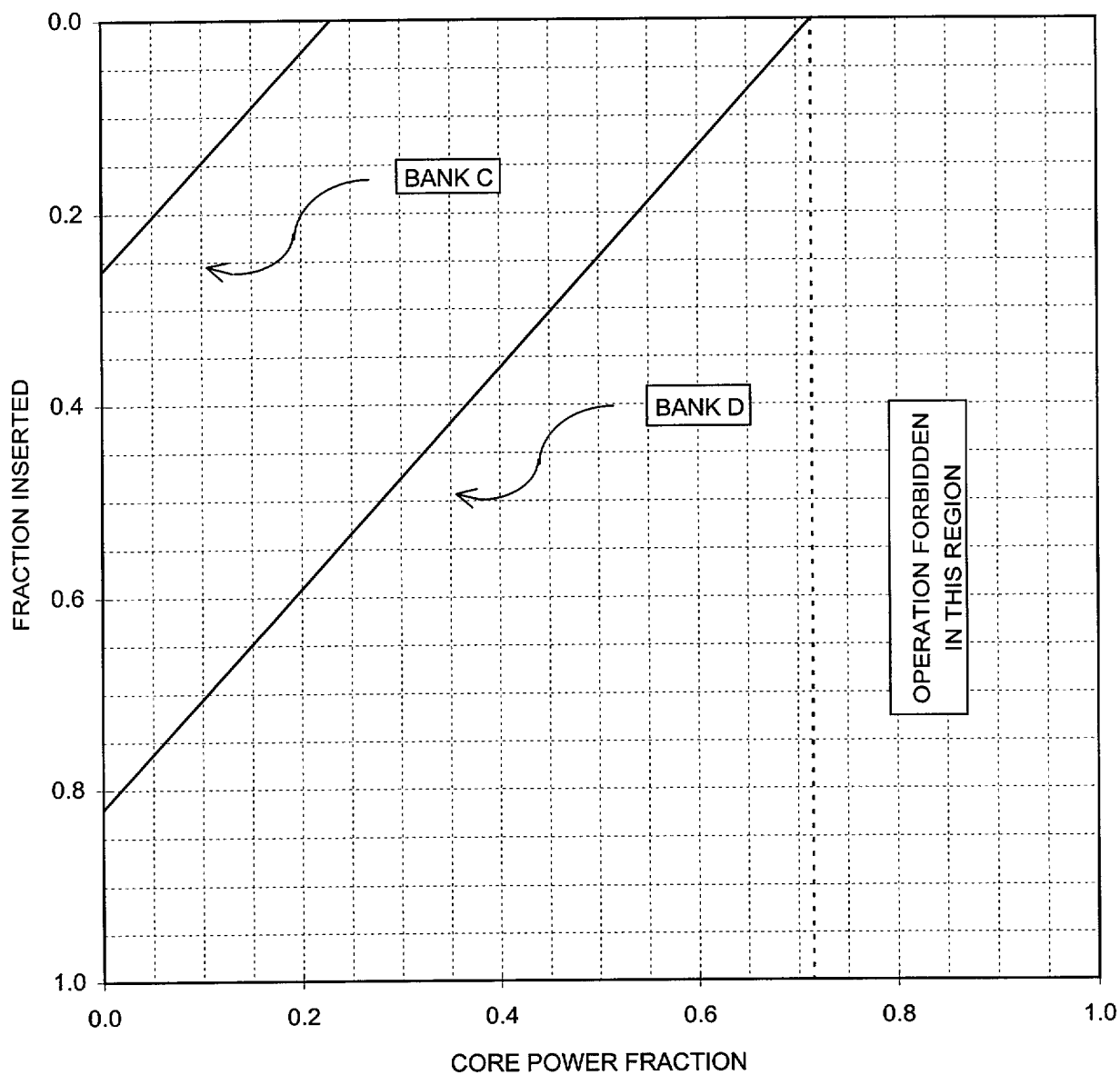


Figure 6: Insertion Limits
100 Step Overlap With One Inoperable Rod
(Technical Specification 3.10.G.4)

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Reviewed By: Eugene Eckholt
Eugene Eckholt
Licensing Project Manager
Prairie Island

8/4/00
Date

Approved By: Joel P. Sorensen
Joel Sorensen
Site General Manager
Prairie Island

8/4/00
Date

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

CORE OPERATING LIMITS REPORT

UNIT 2 – CYCLE 20

REVISION 1

Note: This report is not part of the Technical Specifications
This report is referenced in the Technical Specifications

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
CORE OPERATING LIMITS REPORT
UNIT 2- CYCLE 20
REVISION 1

This report provides the values of the limits for Unit 2 Cycle 20 as required by Technical Specification Section 6.7.A.6. These values have been established using NRC approved methodology and are established such that all applicable limits of the plant safety analysis are met.

Heat Flux Hot Channel Factor Limits

$$F_Q^{RTP} = 2.40$$

$K(z)$ values are provided in Figure 1.

$V(z)$ values are provided in Figures 2a through 2g and Table 1 and Table 2.

Reference Technical Specification sections: 3.10.B.1 and 3.10.B.2

Nuclear Enthalpy Rise Hot Channel Factor Limits

$$F_{\Delta H}^{RTP} = 1.77$$

$$PFDH = 0.3$$

If the nuclear enthalpy rise hot channel factor exceeds its limit in Technical Specification 3.10.B.1, reduce reactor power and the high neutron flux trip setpoint by 3.33% for each percent that the measured nuclear enthalpy rise hot channel factor exceeds the 3.10.B.1 limit.

Reference Technical Specification sections: 3.10.B.1, 3.10.B.2, and 3.10.B.3

Linear Heat Generation Rate

The 95% probability level ECCS analysis calculation utilized a peak linear heat generation rate of 14.788 kW/ft.

The Appendix K ECCS analysis calculation utilized a peak linear heat generation rate of 15.167 kW/ft for the F_Q limit of 2.40.

Reference Technical Specification section: 3.10.B

Axial Flux Difference Limits

The axial flux difference limits are provided in Figure 3.

The axial flux difference target band is $\pm 5\%$ when using figures 2a through 2f and Table 1. The axial flux difference target band is $\pm 5\%$ when equal to or above 90% power and $\pm 10\%$ below 90% power when using figure 2g and Table 2.

Reference Technical Specification sections: 3.10.B.4 through 3.10.B.9

Shutdown Rod Insertion Limits

The shutdown rods shall be fully withdrawn.

Reference Technical Specification section: 3.10.D

Control Rod Insertion Limits

The control rod banks shall be limited in physical insertion as shown in Figures 4, 5, and 6.

Reference Technical Specification sections: 3.10.D and 3.10.G

Reactor Coolant Flow Limit

The reactor coolant system flow shall be $\geq 178,000$ gpm.

Reference Technical Specification section: 3.10.J

Shutdown Margin Requirements

Minimum Shutdown Margin requirements are shown in Table 3.

Reference Technical Specification Sections: Table TS.1-1 and Specifications 3.10.A and 3.10.D.3.

Penalty on F_Q for Small Break LOCA – $K(z)$

The small and large break LOCA analyses performed for this cycle are valid for $F_Q \leq 2.80$ and $F_Q \leq 2.40$, respectively. The F_Q limit for the large break LOCA analysis is more limiting than the F_Q limit for the small break LOCA analysis. The small break LOCA analysis incorporates the $K(z)$ methodology. However, since the small break LOCA is less limiting than the large break LOCA, no $K(z)$ penalty needs to be applied to calculations of most limiting F_Q values. Thus for the equation in Technical Specification 3.10.B, $K(z)$ is equal to 1. $K(z)$ is shown graphically in Figure 1.

Transient Power Distribution Penalty for F_Q – $V(z)$

Table 1 summarizes the bounding $V(z)$ values for the middle 80% of the core for Prairie Island unit 2, cycle 20 with an operating band of $\pm 5\% \Delta I$. The $V(z)$ penalty takes the form of straight lines connecting data points determined as a function of core height. A particular $V(z)$ curve is valid over a given exposure range and equilibrium axial offset range as noted in Table 1. The $V(z)$ penalty for small break LOCA and axial offset range is shown graphically in Figures 2a–2f.

Table 1
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
0.0 - 1.986 GWd/MTU Eq AO range: -3% to +8% Operating band: $\pm 5\%$ ΔI (Startup)	0.20	1.000	6.30	1.079
	0.39	1.000	6.49	1.077
	0.59	1.000	6.69	1.074
	0.79	1.000	6.89	1.069
	0.98	1.000	7.08	1.065
	1.18	1.106	7.28	1.061
	1.38	1.103	7.48	1.062
	1.57	1.100	7.67	1.063
	1.77	1.097	7.87	1.066
	1.97	1.094	8.07	1.069
	2.16	1.091	8.26	1.073
	2.36	1.089	8.46	1.076
	2.56	1.088	8.66	1.079
	2.75	1.087	8.85	1.082
	2.95	1.086	9.05	1.085
	3.15	1.085	9.25	1.088
	3.34	1.084	9.44	1.092
	3.54	1.083	9.64	1.095
	3.74	1.082	9.84	1.099
	3.93	1.082	10.03	1.103
	4.13	1.082	10.23	1.107
	4.33	1.082	10.43	1.111
	4.52	1.083	10.62	1.115
	4.72	1.084	10.82	1.121
	4.92	1.085	11.02	1.000
	5.11	1.085	11.21	1.000
	5.31	1.085	11.41	1.000
	5.51	1.085	11.61	1.000
	5.70	1.084	11.80	1.000
	5.90	1.083	12.00	1.000
	6.10	1.081		

Table 1
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
1.986 - 4.586 GWd/MTU Eq AO range: -6% to +6% Operating band: $\pm 5\%$ ΔI	0.20	1.000	6.30	1.077
	0.39	1.000	6.49	1.075
	0.59	1.000	6.69	1.072
	0.79	1.000	6.89	1.070
	0.98	1.000	7.08	1.069
	1.18	1.101	7.28	1.069
	1.38	1.099	7.48	1.072
	1.57	1.096	7.67	1.075
	1.77	1.094	7.87	1.078
	1.97	1.093	8.07	1.081
	2.16	1.093	8.26	1.083
	2.36	1.092	8.46	1.085
	2.56	1.090	8.66	1.087
	2.75	1.089	8.85	1.089
	2.95	1.087	9.05	1.091
	3.15	1.085	9.25	1.094
	3.34	1.084	9.44	1.096
	3.54	1.082	9.64	1.098
	3.74	1.081	9.84	1.101
	3.93	1.081	10.03	1.105
	4.13	1.081	10.23	1.109
	4.33	1.081	10.43	1.115
	4.52	1.082	10.62	1.122
	4.72	1.083	10.82	1.130
	4.92	1.083	11.02	1.000
	5.11	1.084	11.21	1.000
	5.31	1.084	11.41	1.000
	5.51	1.083	11.61	1.000
	5.70	1.082	11.80	1.000
	5.90	1.081	12.00	1.000
	6.10	1.079		

Table 1
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
4.586 - 8.586 GWd/MTU Eq AO range: -6% to +4% Operating band: $\pm 5\%$ ΔI	0.20	1.000	6.30	1.077
	0.39	1.000	6.49	1.074
	0.59	1.000	6.69	1.071
	0.79	1.000	6.89	1.072
	0.98	1.000	7.08	1.073
	1.18	1.101	7.28	1.076
	1.38	1.099	7.48	1.079
	1.57	1.097	7.67	1.082
	1.77	1.095	7.87	1.084
	1.97	1.093	8.07	1.086
	2.16	1.092	8.26	1.088
	2.36	1.091	8.46	1.090
	2.56	1.089	8.66	1.091
	2.75	1.087	8.85	1.092
	2.95	1.085	9.05	1.095
	3.15	1.083	9.25	1.097
	3.34	1.081	9.44	1.099
	3.54	1.080	9.64	1.101
	3.74	1.078	9.84	1.104
	3.93	1.079	10.03	1.107
	4.13	1.080	10.23	1.111
	4.33	1.081	10.43	1.117
	4.52	1.081	10.62	1.123
	4.72	1.082	10.82	1.131
	4.92	1.083	11.02	1.000
	5.11	1.083	11.21	1.000
	5.31	1.083	11.41	1.000
	5.51	1.082	11.61	1.000
	5.70	1.082	11.80	1.000
	5.90	1.080	12.00	1.000
	6.10	1.079		

Table 1
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
8.586 - 13.586 GWd/MTU Eq AO range: -6% to +2% Operating band: $\pm 5\%$ ΔI	0.20	1.000	6.30	1.074
	0.39	1.000	6.49	1.072
	0.59	1.000	6.69	1.070
	0.79	1.000	6.89	1.072
	0.98	1.000	7.08	1.076
	1.18	1.101	7.28	1.080
	1.38	1.101	7.48	1.083
	1.57	1.100	7.67	1.086
	1.77	1.099	7.87	1.088
	1.97	1.098	8.07	1.091
	2.16	1.096	8.26	1.092
	2.36	1.094	8.46	1.093
	2.56	1.091	8.66	1.094
	2.75	1.088	8.85	1.095
	2.95	1.085	9.05	1.097
	3.15	1.082	9.25	1.098
	3.34	1.080	9.44	1.099
	3.54	1.077	9.64	1.100
	3.74	1.075	9.84	1.103
	3.93	1.075	10.03	1.107
	4.13	1.076	10.23	1.111
	4.33	1.077	10.43	1.117
	4.52	1.079	10.62	1.123
	4.72	1.080	10.82	1.130
	4.92	1.080	11.02	1.000
	5.11	1.081	11.21	1.000
	5.31	1.081	11.41	1.000
	5.51	1.080	11.61	1.000
	5.70	1.079	11.80	1.000
	5.90	1.078	12.00	1.000
	6.10	1.076		

Table 1
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
13.586 - 17.086 GWd/MTU Eq AO range: -6% to +4% Operating band: $\pm 5\%$ ΔI	0.20	1.000	6.30	1.105
	0.39	1.000	6.49	1.107
	0.59	1.000	6.69	1.110
	0.79	1.000	6.89	1.111
	0.98	1.000	7.08	1.111
	1.18	1.116	7.28	1.112
	1.38	1.114	7.48	1.110
	1.57	1.112	7.67	1.109
	1.77	1.110	7.87	1.106
	1.97	1.106	8.07	1.103
	2.16	1.103	8.26	1.100
	2.36	1.099	8.46	1.099
	2.56	1.094	8.66	1.098
	2.75	1.090	8.85	1.098
	2.95	1.085	9.05	1.099
	3.15	1.080	9.25	1.100
	3.34	1.079	9.44	1.102
	3.54	1.083	9.64	1.103
	3.74	1.087	9.84	1.106
	3.93	1.092	10.03	1.110
	4.13	1.096	10.23	1.114
	4.33	1.101	10.43	1.119
	4.52	1.104	10.62	1.124
	4.72	1.108	10.82	1.131
	4.92	1.110	11.02	1.000
	5.11	1.111	11.21	1.000
	5.31	1.112	11.41	1.000
	5.51	1.112	11.61	1.000
	5.70	1.112	11.80	1.000
	5.90	1.109	12.00	1.000
	6.10	1.107		

Table 1
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
17.086 - EOC GWd/MTU Eq AO range: -6% to +4% Operating band: $\pm 5\%$ ΔI	0.20	1.000	6.30	1.127
	0.39	1.000	6.49	1.124
	0.59	1.000	6.69	1.120
	0.79	1.000	6.89	1.119
	0.98	1.000	7.08	1.120
	1.18	1.122	7.28	1.119
	1.38	1.120	7.48	1.117
	1.57	1.118	7.67	1.115
	1.77	1.115	7.87	1.112
	1.97	1.112	8.07	1.108
	2.16	1.108	8.26	1.104
	2.36	1.104	8.46	1.100
	2.56	1.099	8.66	1.097
	2.75	1.094	8.85	1.096
	2.95	1.089	9.05	1.098
	3.15	1.084	9.25	1.100
	3.34	1.084	9.44	1.101
	3.54	1.089	9.64	1.103
	3.74	1.094	9.84	1.106
	3.93	1.100	10.03	1.111
	4.13	1.107	10.23	1.117
	4.33	1.113	10.43	1.123
	4.52	1.118	10.62	1.129
	4.72	1.123	10.82	1.135
	4.92	1.126	11.02	1.000
	5.11	1.129	11.21	1.000
	5.31	1.131	11.41	1.000
	5.51	1.132	11.61	1.000
	5.70	1.133	11.80	1.000
	5.90	1.131	12.00	1.000
	6.10	1.129		

Table 2
Bounding V(z) Values

Exposure Range	z(ft)	V(z)	z(ft)	V(z)
<u>BOC to EOC</u>	0.20	1.000	6.30	1.187
Eq AO range: -6% to +4%	0.39	1.000	6.49	1.182
Operationg Band	0.59	1.000	6.69	1.178
± 5% ΔI at or above 90% power	0.79	1.000	6.89	1.175
± 10% ΔI below 90% power	0.98	1.000	7.08	1.172
	1.18	1.133	7.28	1.170
	1.38	1.130	7.48	1.165
	1.57	1.127	7.67	1.161
	1.77	1.124	7.87	1.155
	1.97	1.118	8.07	1.147
	2.16	1.113	8.26	1.140
	2.36	1.107	8.46	1.130
	2.56	1.100	8.66	1.119
	2.75	1.094	8.85	1.113
	2.95	1.089	9.05	1.109
	3.15	1.085	9.25	1.105
	3.34	1.084	9.44	1.103
	3.54	1.096	9.64	1.103
	3.74	1.107	9.84	1.106
	3.93	1.118	10.03	1.111
	4.13	1.130	10.23	1.117
	4.33	1.141	10.43	1.123
	4.52	1.151	10.62	1.129
	4.72	1.161	10.82	1.135
	4.92	1.168	11.02	1.000
	5.11	1.175	11.21	1.000
	5.31	1.181	11.41	1.000
	5.51	1.185	11.61	1.000
	5.70	1.188	11.80	1.000
	5.90	1.189	12.00	1.000
	6.10	1.188		

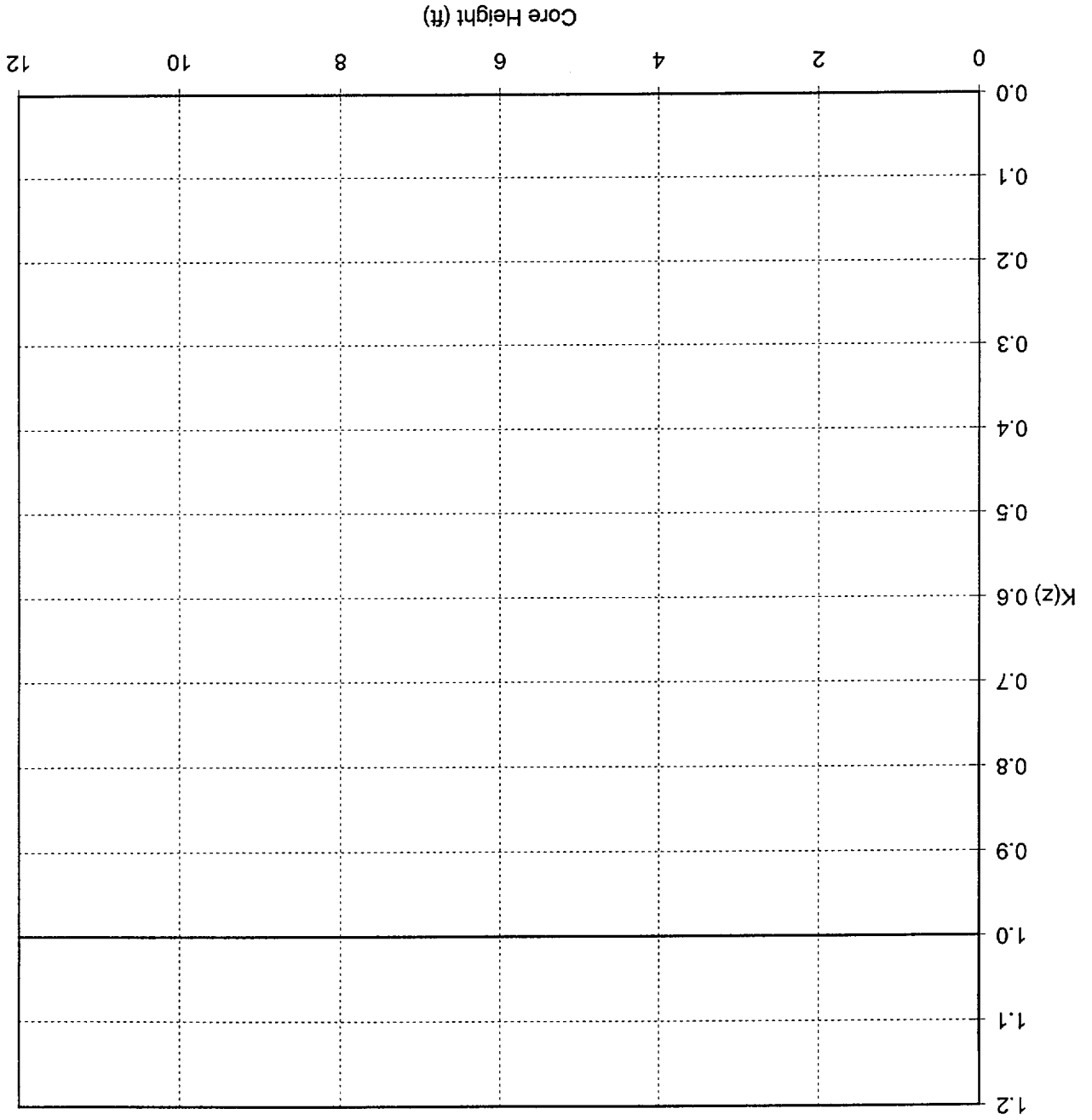
Table 3
Minimum Required Shutdown Margin

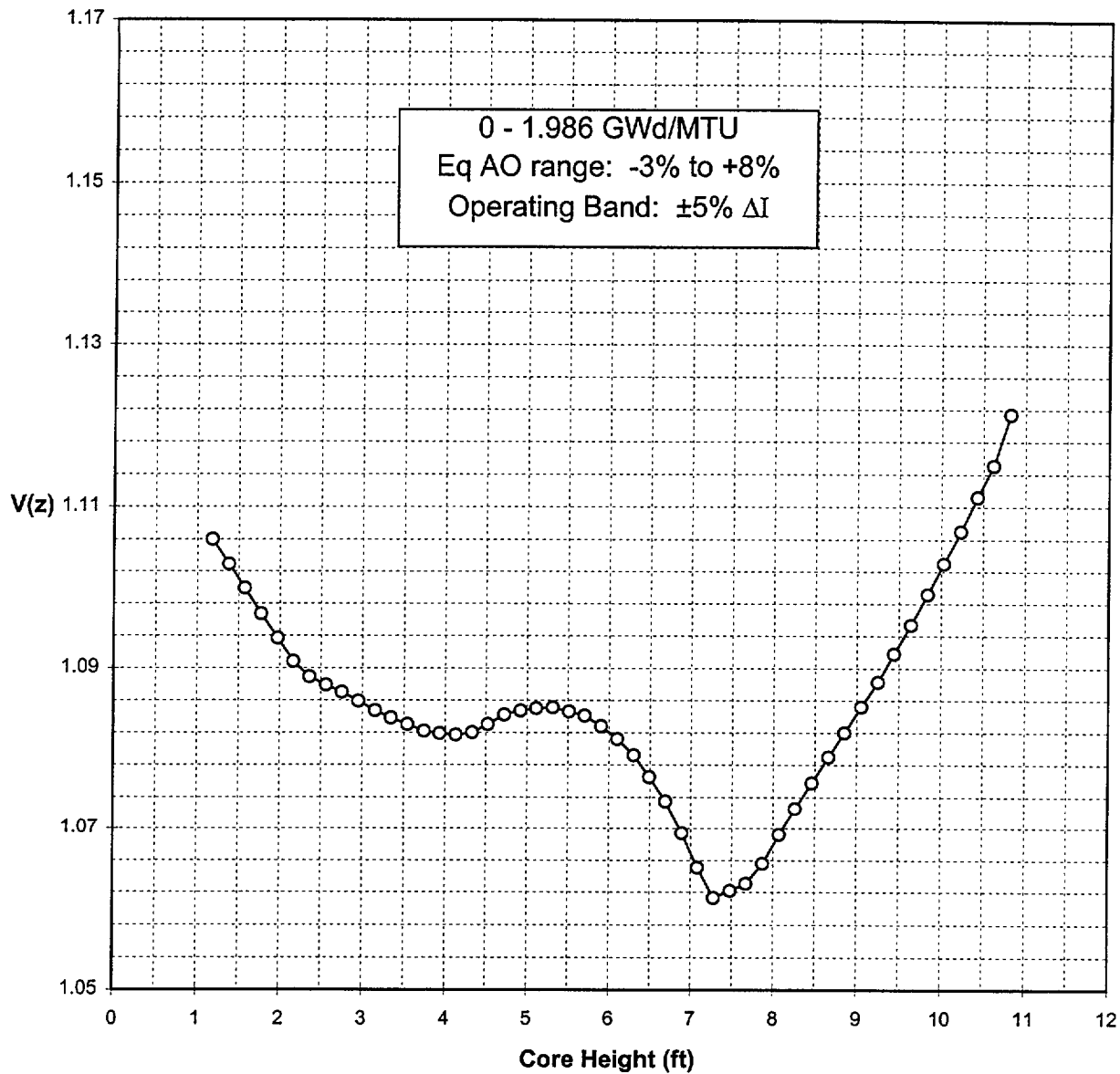
Plant Conditions	Number of Charging Pumps in Service **		
	0 or 1 Pump	2 Pumps	3 Pumps
Modes 1 and 2	2%*	2%*	2%*
Mode 3, $T_{ave} \geq 520^{\circ}\text{F}$	2%	2%	2%
Mode 3, $T_{ave} < 520^{\circ}\text{F}$ $> 350^{\circ}\text{F}$	2%	2%	2.5%
Mode 4	2.5%	5%	8%
Mode 5	2.5%	5%	8%
Mode 6, ARI	5.26%	5.26%	8%
Mode 6, ARO	5.26%	6%	9.5%

* For Modes 1 and 2, minimum shutdown margin requirements are provided by the Rod Insertion Limits.

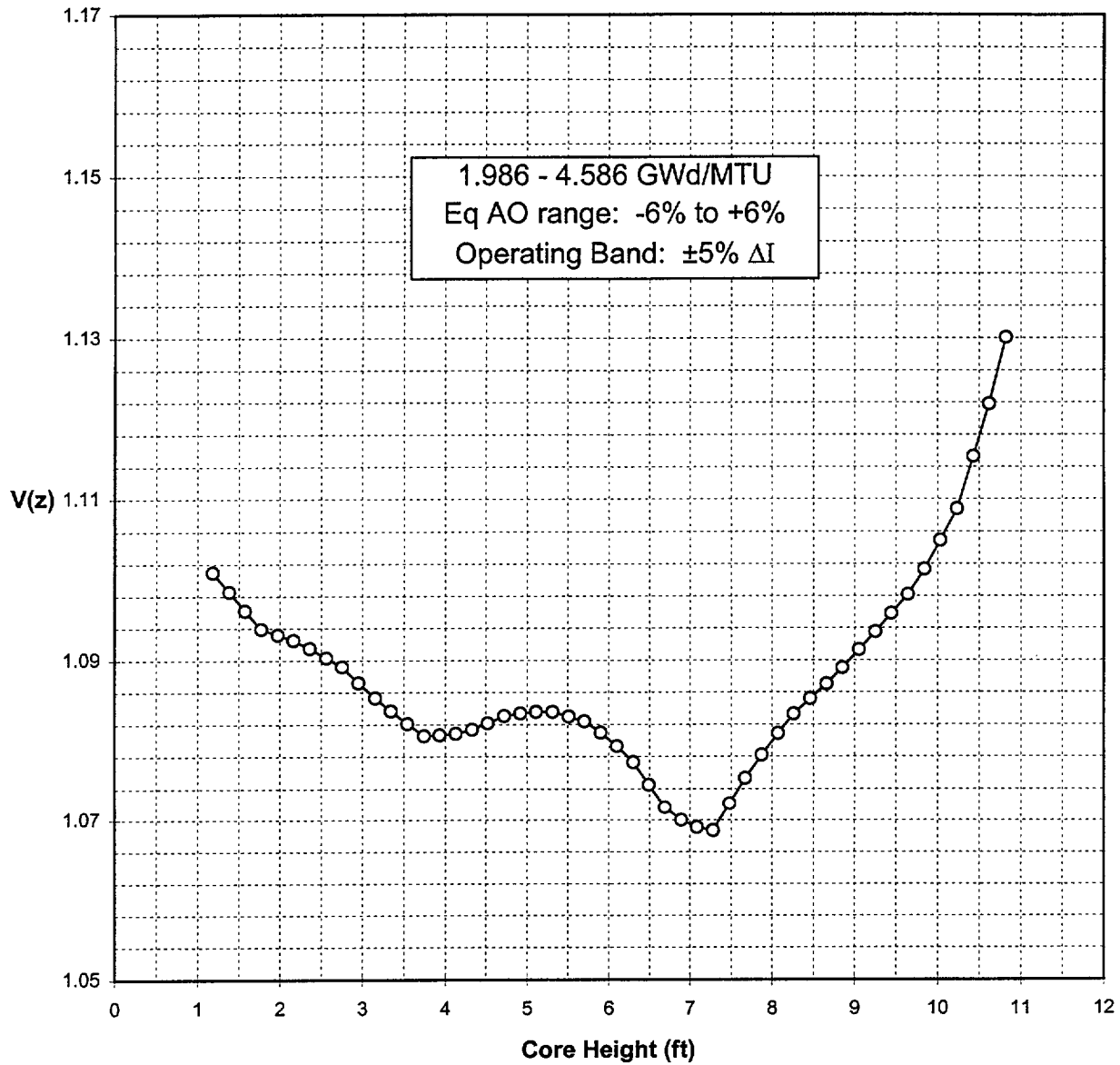
** Charging pump(s) in service only pertains to steady state operations. It does not include transitory operations. For example, operations such as starting a second charging pump in order to secure the operating pump would fall under the one pump in service column.

**Figure 1: Hot Channel Factor
Normalized Operating Envelope**

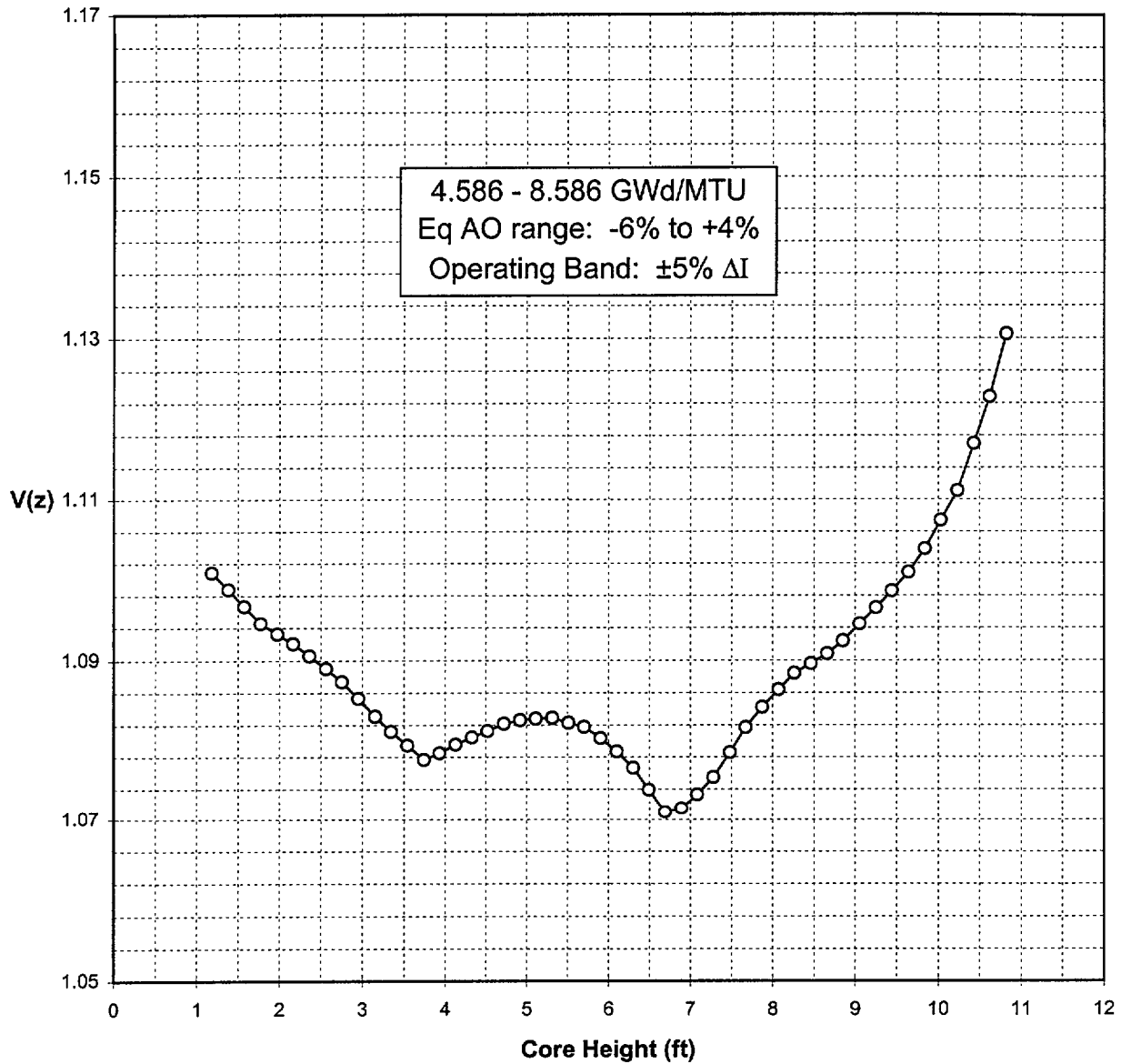




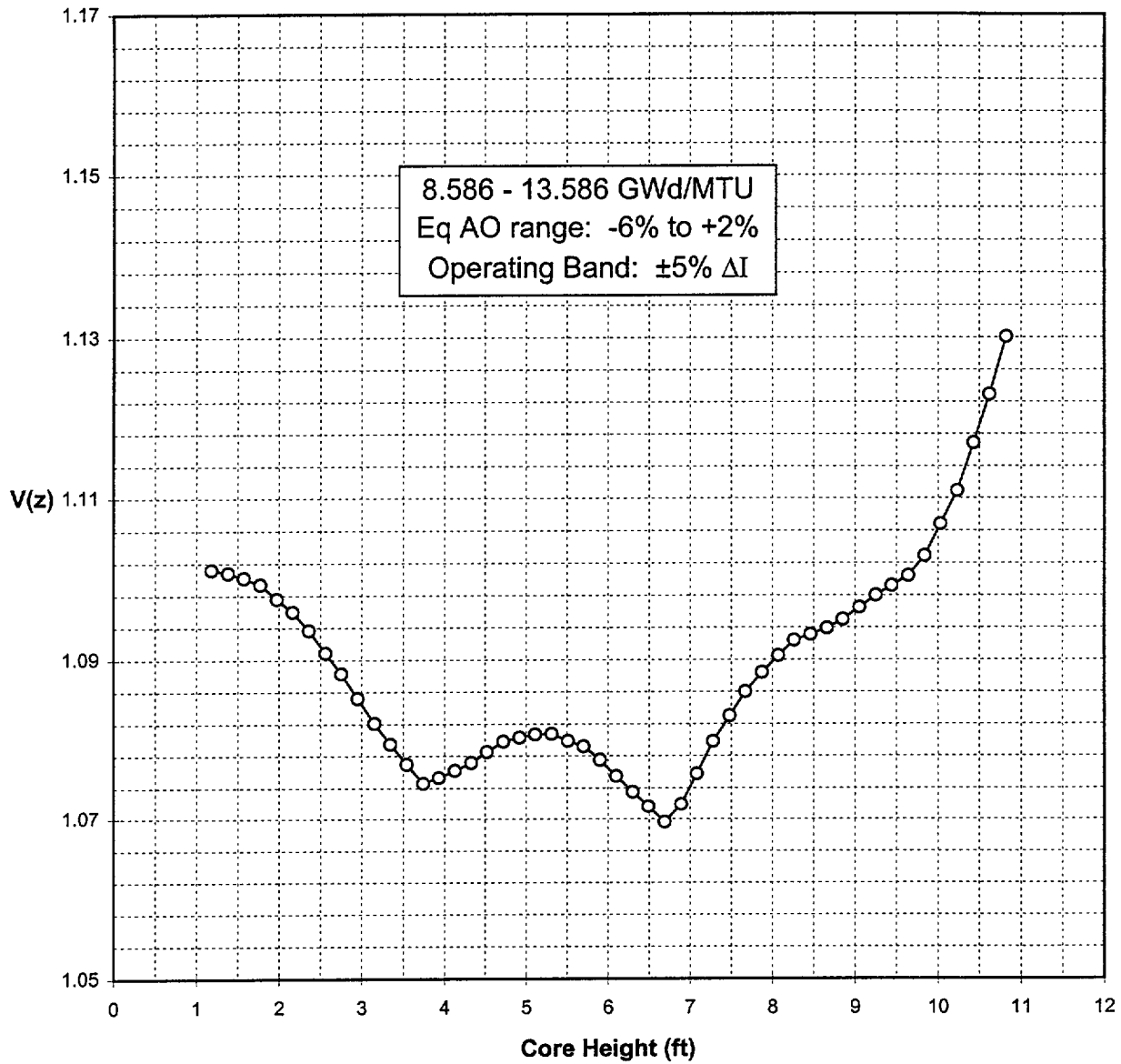
**Figure 2a: Bounding V(z) Values
From 0 - 1.986 GWd/MTU
(Startup)**



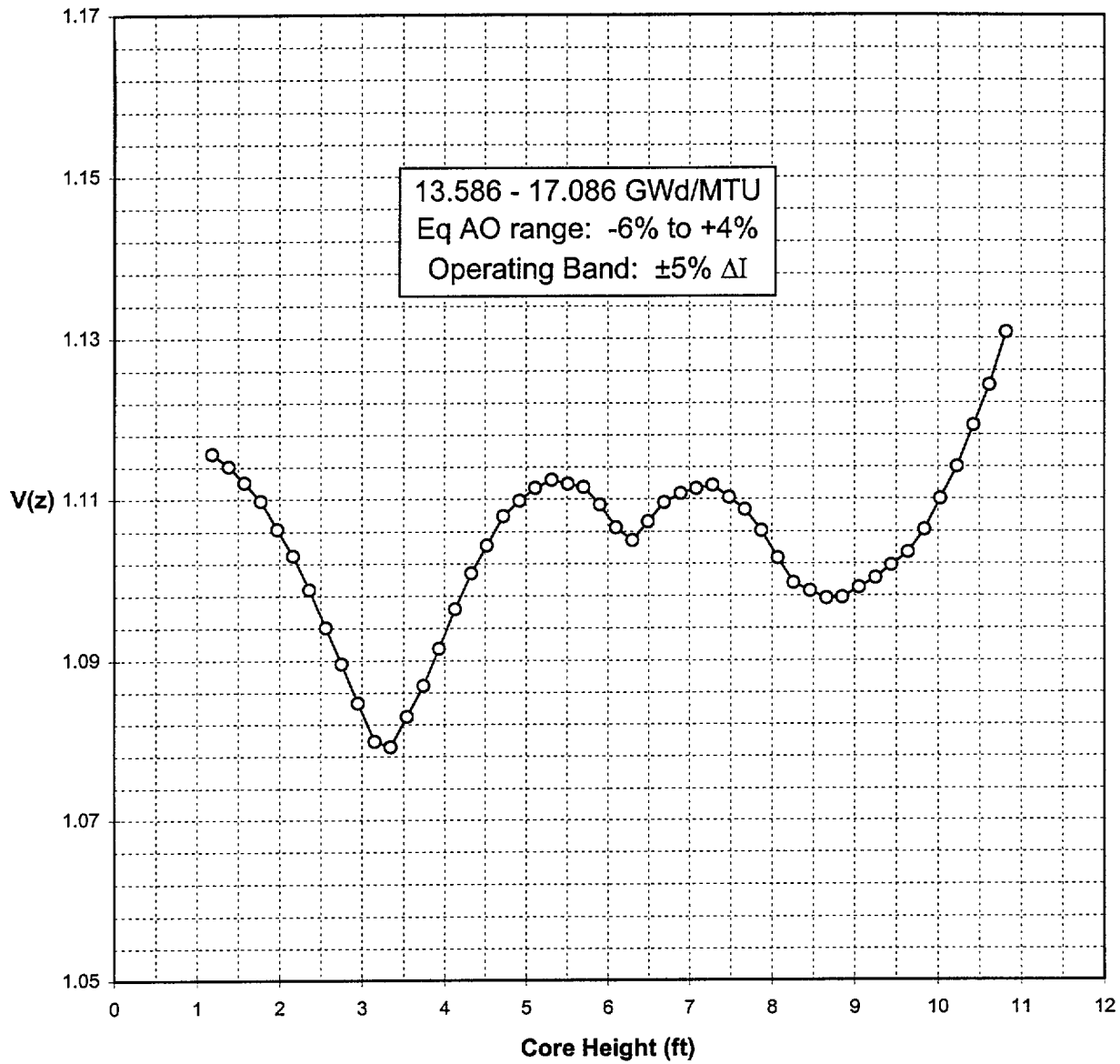
**Figure 2b: Bounding V(z) Values
From 1.986 - 4.586 GWd/MTU**



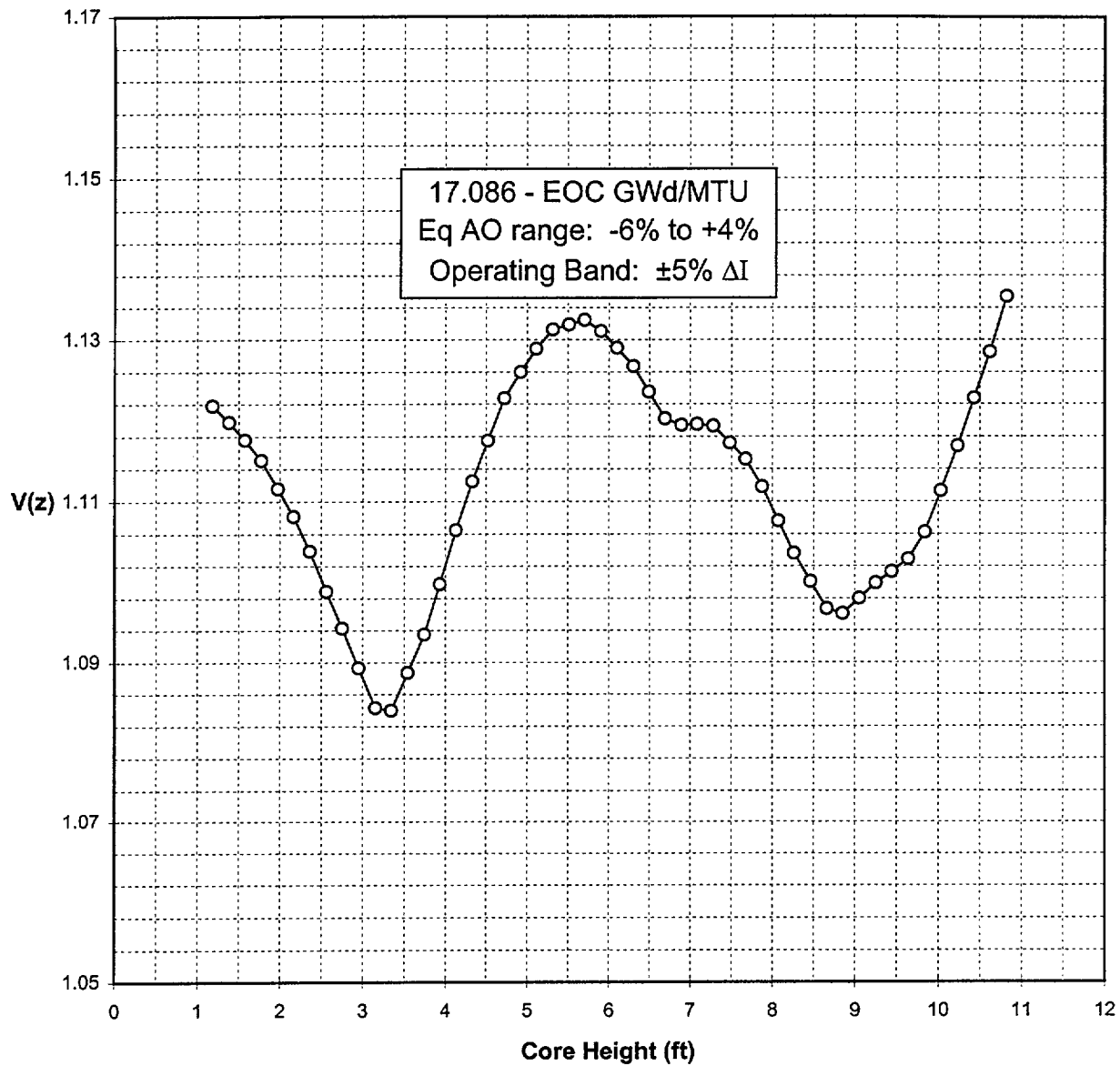
**Figure 2c: Bounding V(z) Values
From 4.586 - 8.586 GWd/MTU**



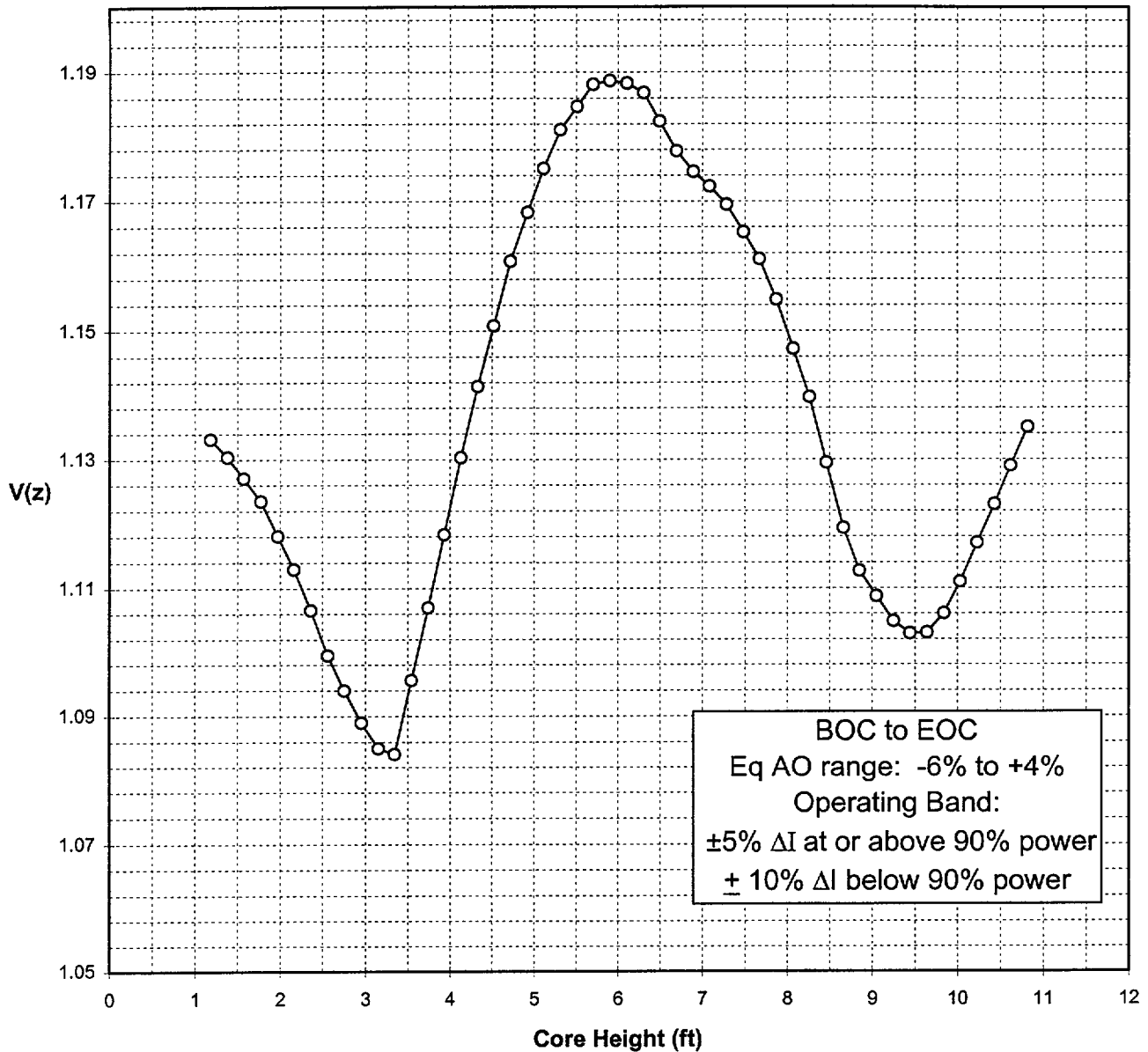
**Figure 2d: Bounding V(z) Values
From 8.586 - 13.586 GWd/MTU**



**Figure 2e: Bounding V(z) Values
From 13.586 - 17.086 GWd/MTU**



**Figure 2f: Bounding V(z) Values
From 17.086 - EOC GWd/MTU**



**Figure 2g: Bounding $V(z)$ Values
BOC to EOC**

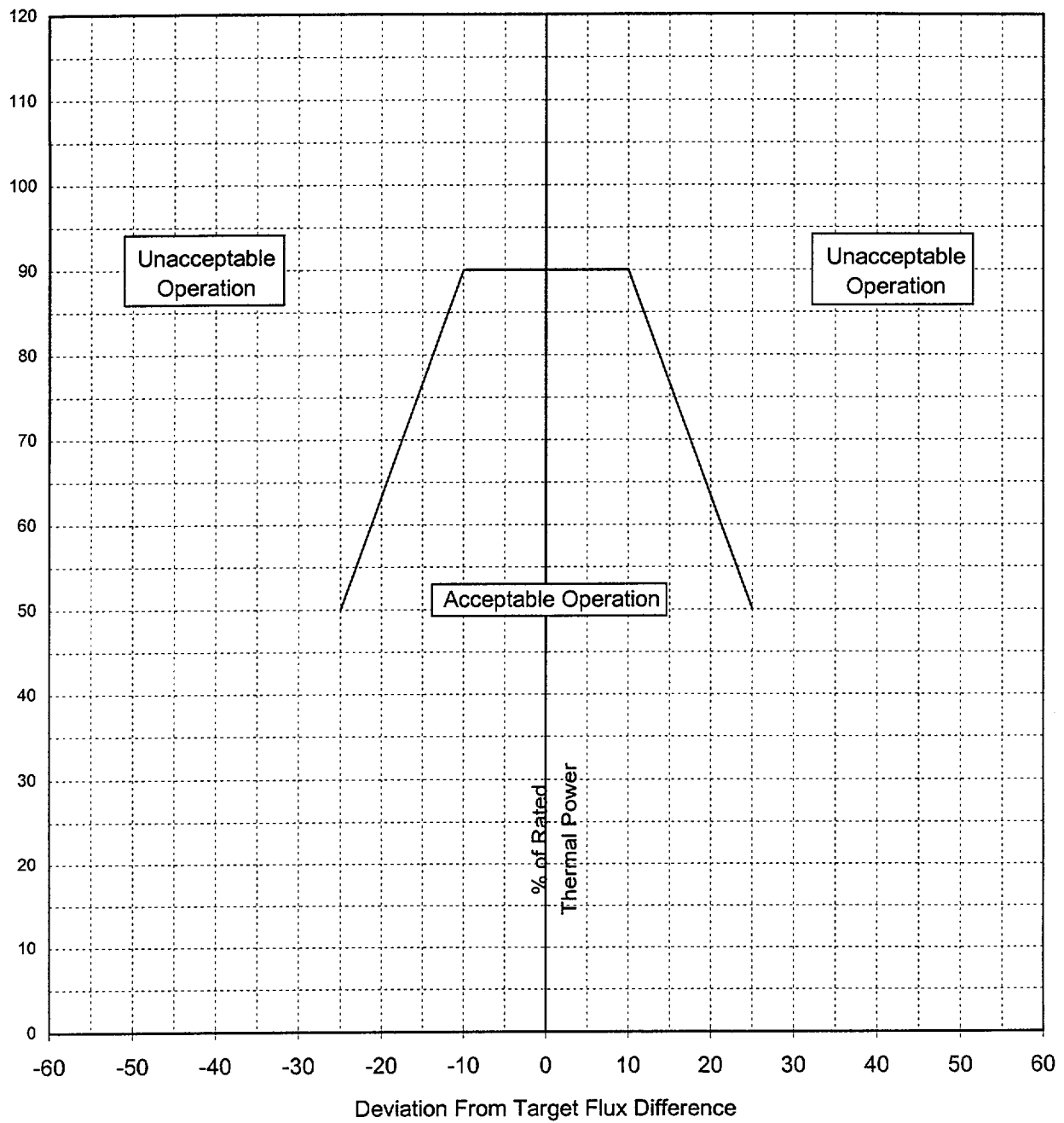


Figure 3: Deviation From Target Flux Difference as a Function of Thermal Power

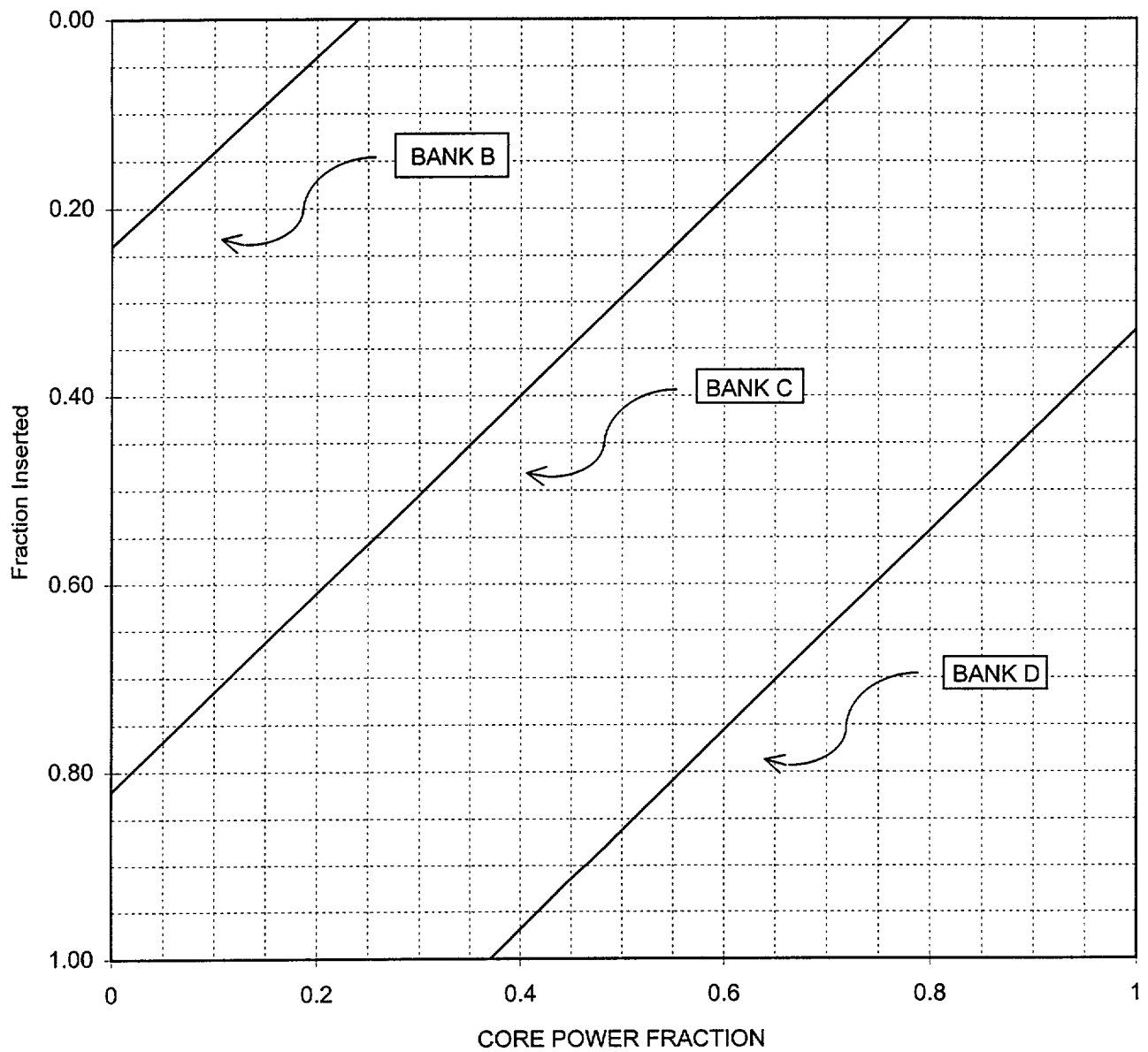


Figure 4: Control Bank Insertion Limits

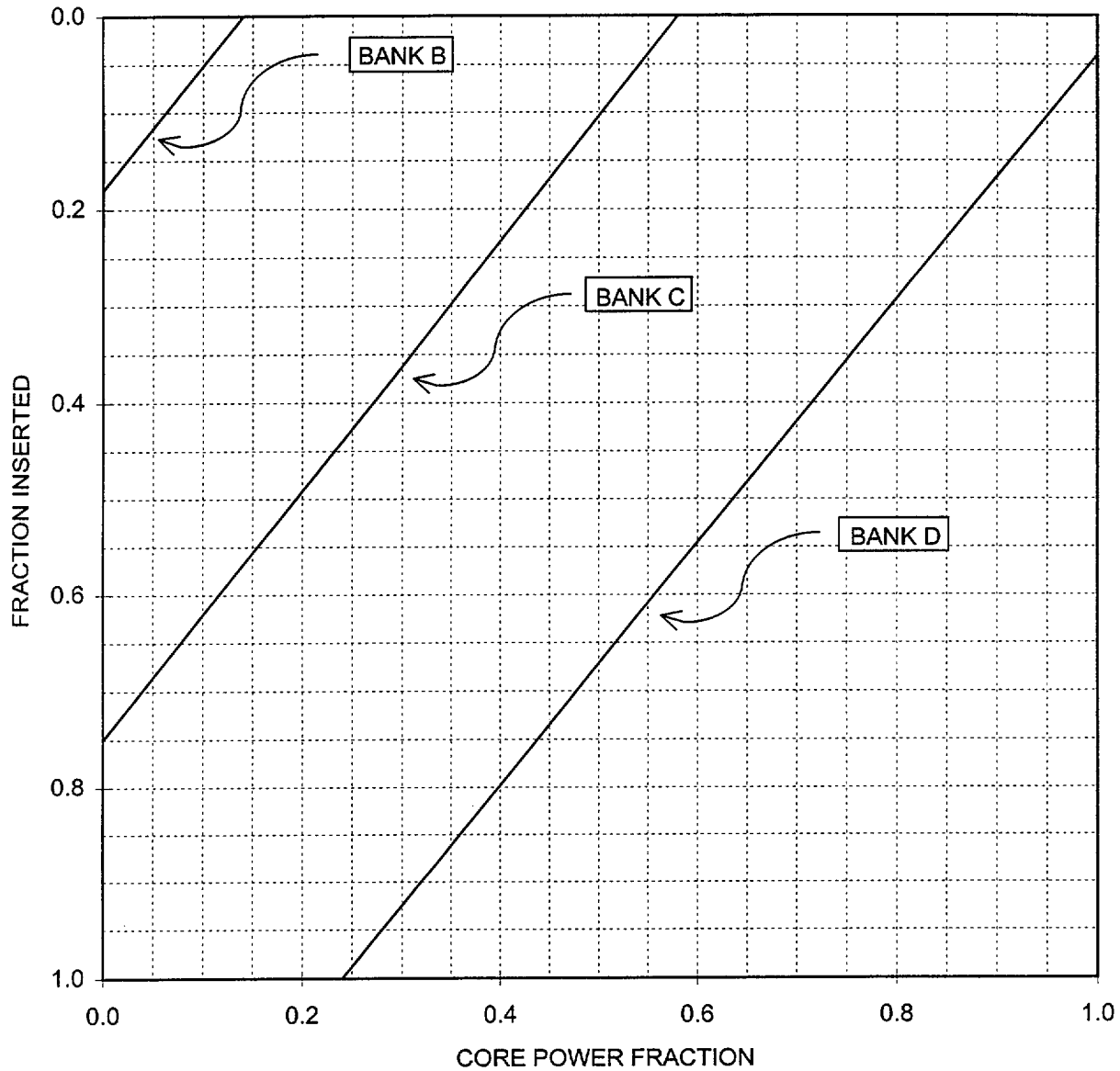


Figure 5: Insertion Limits
100 Step Overlap With One Bottomed Rod
(Technical Specification 3.10.G.3)

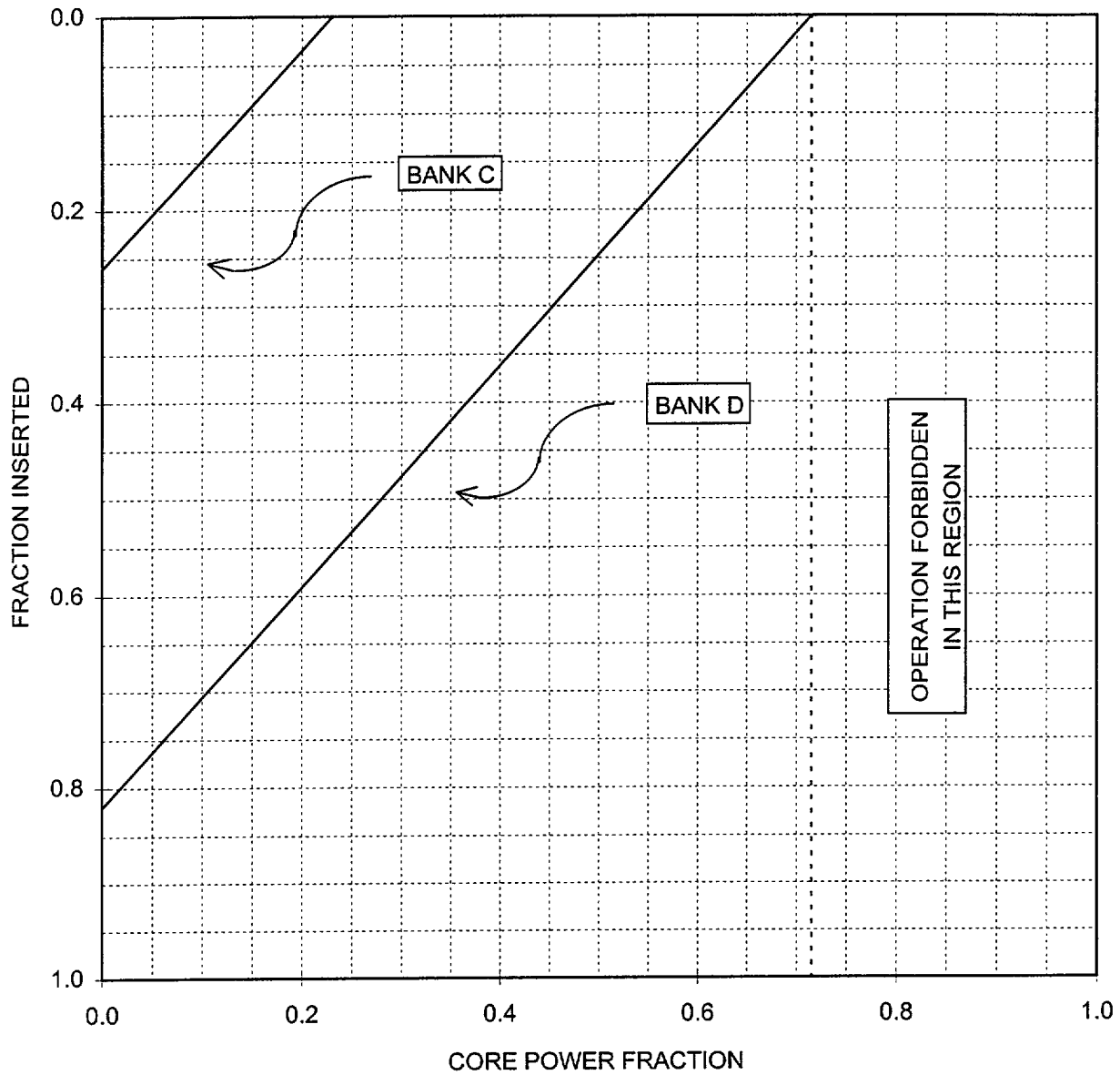


Figure 6: Insertion Limits
100 Step Overlap With One Inoperable Rod
(Technical Specification 3.10.G.4)

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