

VOGTLE ELECTRIC GENERATING PLANT (VEGP) UNIT 1 CYCLE 5

CORE OPERATING LIMITS REPORT

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COLR for VEGP UNIT 1 CYCLE 5

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report (COLR) for VEGP UNIT 1 CYCLE 5 has been prepared in accordance with the requirements of Technical Specification 6.8.1.6.

The Technical Specifications affected by this report are listed below:

3/4.1.1.1	SHUTDOWN MARGIN - MODES 1 and 2
3/4.1.1.2	SHUTDOWN MARGIN - MODES 3, 4 and 5
3/4.1.1.3	Moderator Temperature Coefficient
3/4.1.3.5	Shutdown Rod Insertion Limit
3/4.1.3.6	Control Rod Insertion Limits
3/4.2.1	Axial Flux Difference
3/4.2.2	Heat Flux Hot Channel Factor - $F_q(Z)$
3/4.2.3	Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta h}^N$

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2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 6.8.1.6

2.1 SHUTDOWN MARGIN - MODES 1 AND 2 (Specification 3/4.1.1.1)

- 2.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.3 percent $\Delta k/k$.

2.2 SHUTDOWN MARGIN - MODES 3, 4 AND 5 (Specification 3/4.1.1.2)

- 2.2.1 The SHUTDOWN MARGIN shall be greater than or equal to the limits shown in figures 1 and 2.

2.3 Moderator Temperature Coefficient (Specification 3/4.1.1.3)

- 2.3.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO/HZP - MTC shall be less positive than $+0.7 \times 10^{-4} \Delta k/k/^{\circ}F$ for power levels up to 70 percent RTP with a linear ramp to 0 $\Delta k/k/^{\circ}F$ at 100 percent RTP.

The EOL/ARO/RTP-MTC shall be less negative than $-5.45 \times 10^{-4} \Delta k/k/^{\circ}F$.*

- 2.3.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to $-4.70 \times 10^{-4} \Delta k/k/^{\circ}F$.*

where: BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero THERMAL POWER
EOL stands for End of Cycle Life
RTP stands for RATED THERMAL POWER

2.4 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

- 2.4.1 The shutdown rods shall be withdrawn to a position greater than or equal to 225 steps.

2.5 Control Rod Insertion Limits (Specification 3/4.1.3.6)

- 2.5.1 The control rod banks shall be limited in physical insertion as shown in figure 3.

*Based on full-power T-average in the range of 583.4 to 586.4°F, inclusive.

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2.6 Axial Flux Difference (Specification 3/4.2.1) (relaxed axial offset control (RAOC) methodology)

2.6.1 The Axial Flux Difference (AFD) acceptable operation limits are provided in figure 4.

2.7 Heat Flux Hot Channel Factor - $F_o(Z)$ (Specification 3/4.2.2) (F_o methodology)

$$2.7.1 \quad F_o(Z) \leq \frac{F_o^{RTP}}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_o(Z) \leq \frac{F_o^{RTP}}{0.5} * K(Z) \quad \text{for } P \leq 0.5$$

$$\text{where: } P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

$$2.7.2 \quad F_o^{RTP} = 2.50$$

2.7.3 $K(Z)$ is provided in figure 5.

$$2.7.4 \quad F_o^C(Z) \leq \frac{F_o^{RTP}}{P * W(Z)} * K(Z) \quad \text{for } P > 0.5$$

$$F_o^C(Z) \leq \frac{F_o^{RTP}}{0.5 * W(Z)} * K(Z) \quad \text{for } P \leq 0.5$$

2.7.5 $W(Z)$ values are provided in figures 6 through 8.

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2.8 Nuclear Enthalpy Rise Hot Channel Factor - $F_{\Delta H}^N$ (Specification 3/4.2.3)

$$2.8.1 \quad F_{\Delta H}^N \leq F_{\Delta H}^{\text{RTP}} * (1 + PF_{\Delta H} * (1-P))$$

$$\text{where: } P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

$$2.8.2a \quad F_{\Delta H}^{\text{RTP}} = 1.53 \text{ for LOPAR fuel and}$$

$$2.8.2b \quad F_{\Delta H}^{\text{RTP}} = 1.65 \text{ for VANTAGE 5 fuel}$$

$$2.8.3 \quad PF_{\Delta H} = 0.3 \text{ for LOPAR and VANTAGE 5 fuel}$$

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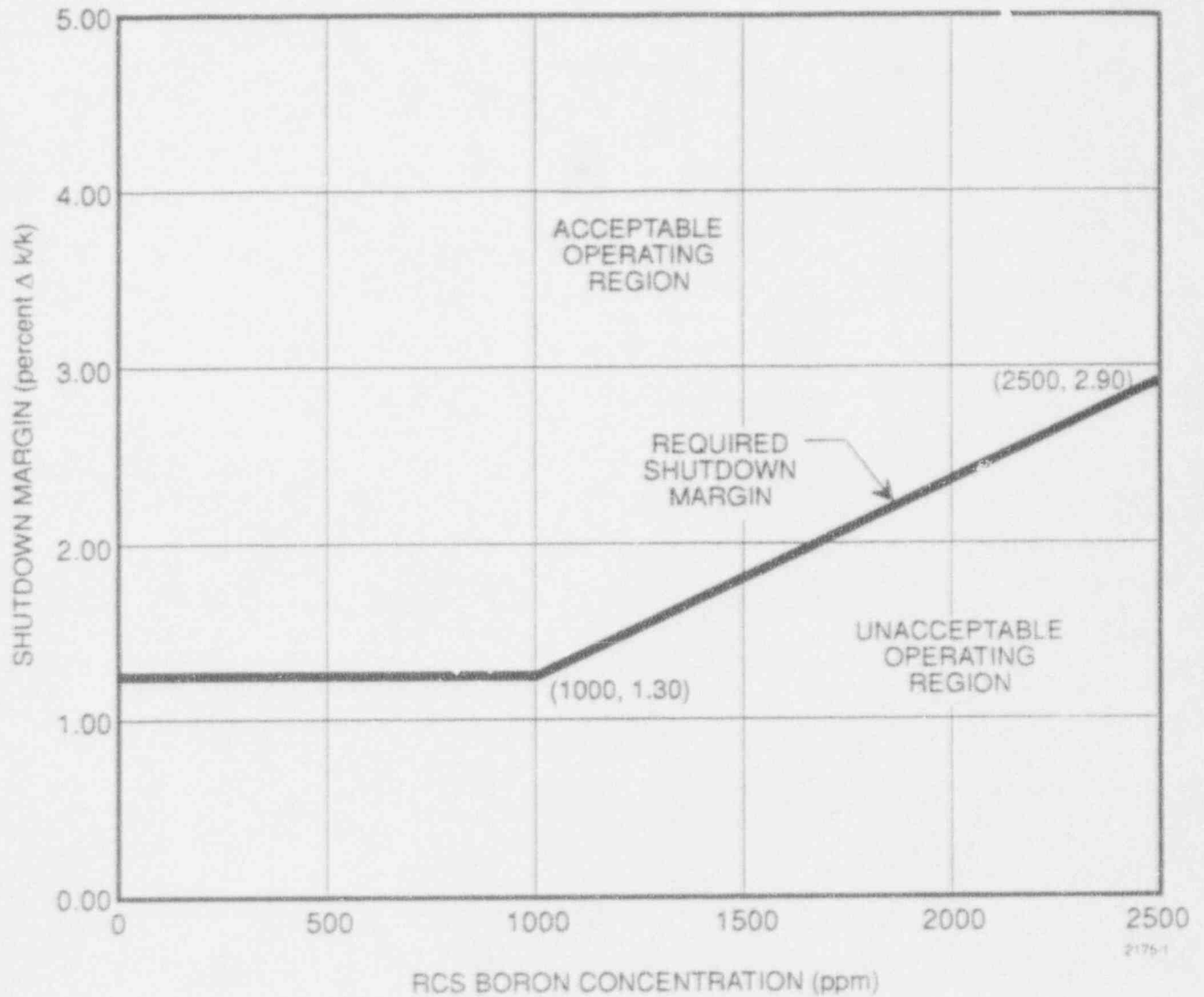


FIGURE 1

REQUIRED SHUTDOWN MARGIN FOR MODES 3 AND 4 (MODE 4 WITH AT LEAST ONE REACTOR COOLANT PUMP RUNNING)

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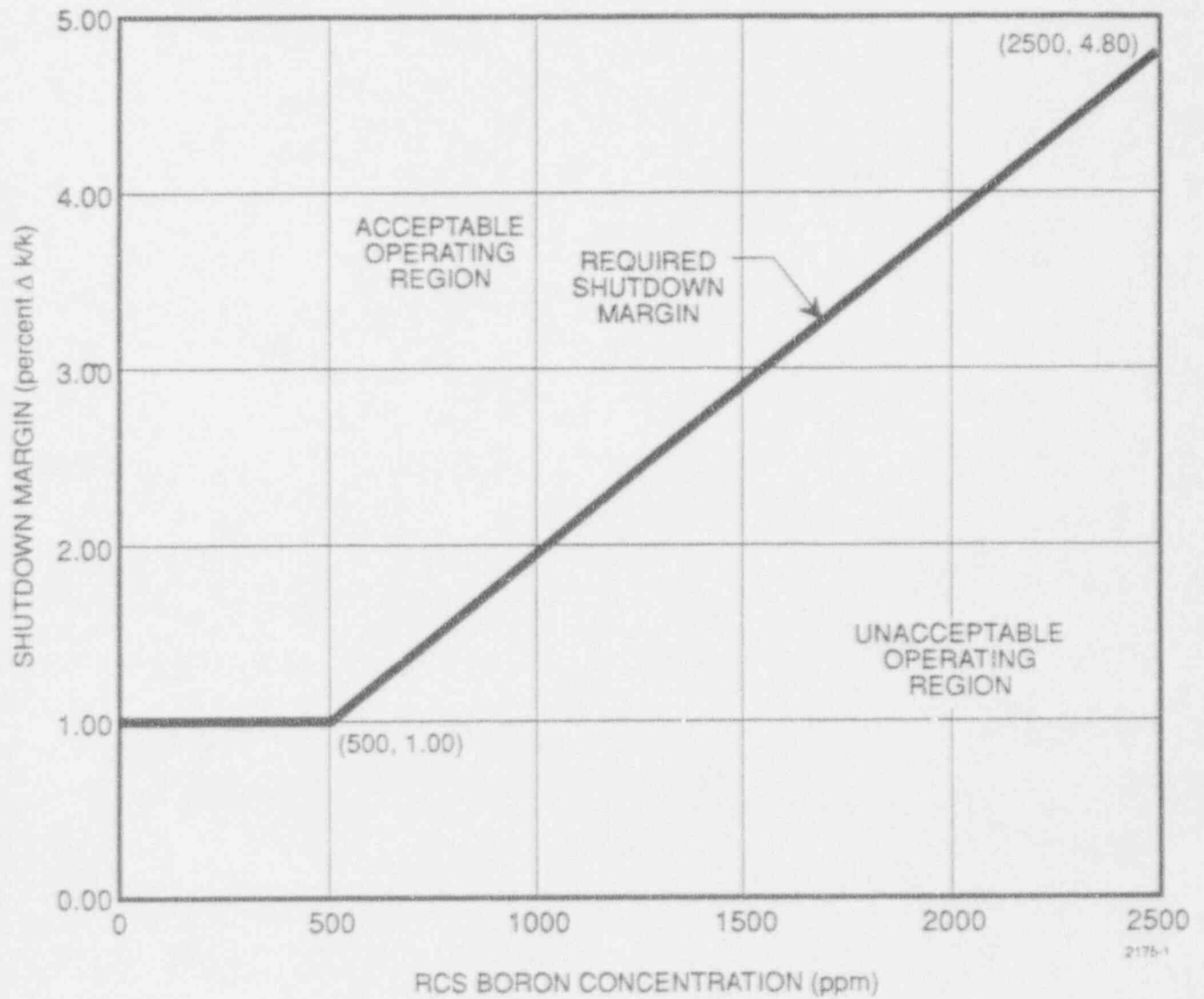
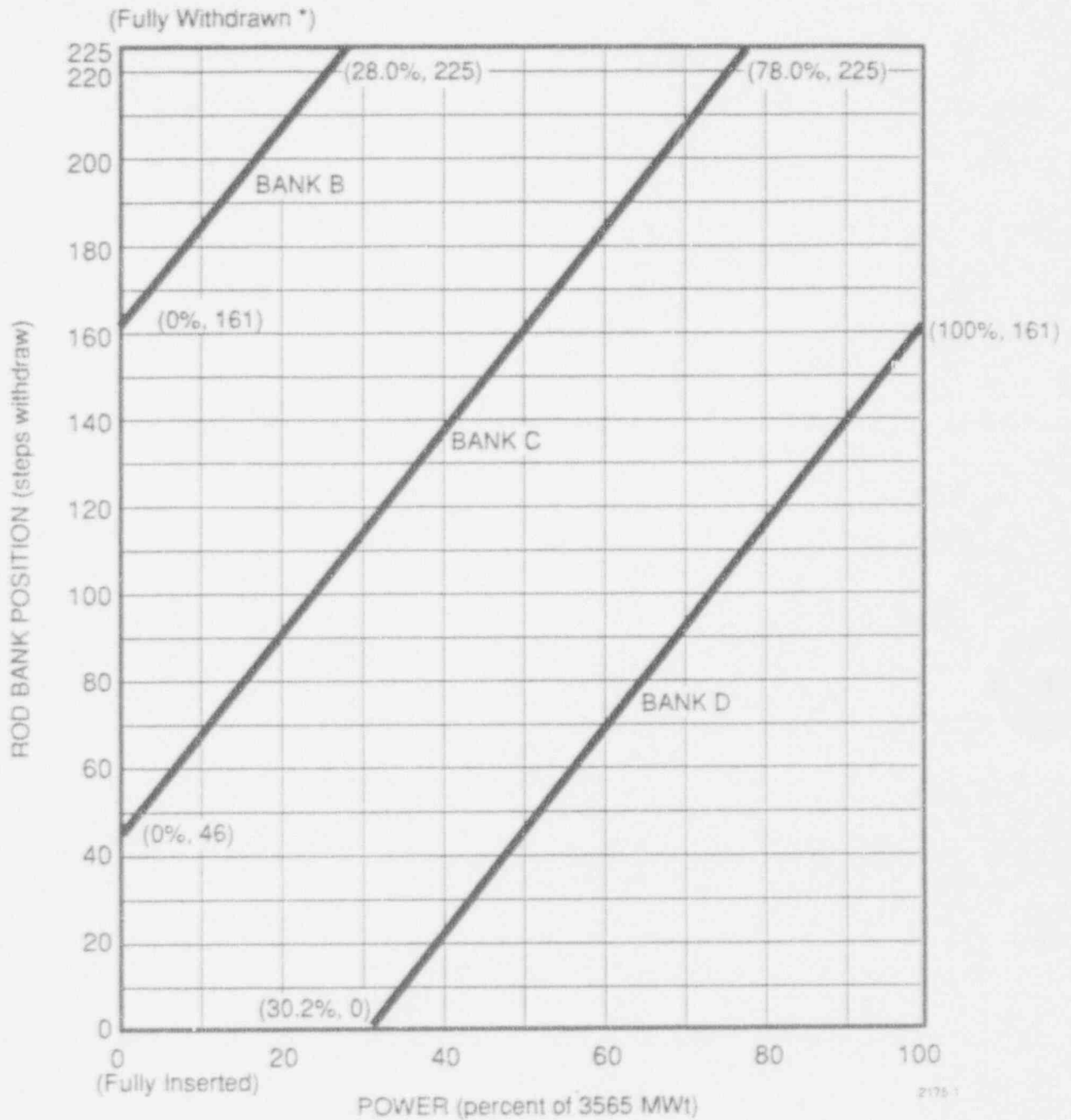


FIGURE 2

REQUIRED SHUTDOWN MARGIN FOR MODES 4 AND 5 (MODE 4 WITH NO REACTOR COOLANT PUMPS RUNNING)

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* Fully withdrawn shall be the condition where control rods are at a position within the interval ≥ 225 and ≤ 231 steps withdrawn.

FIGURE 3
ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

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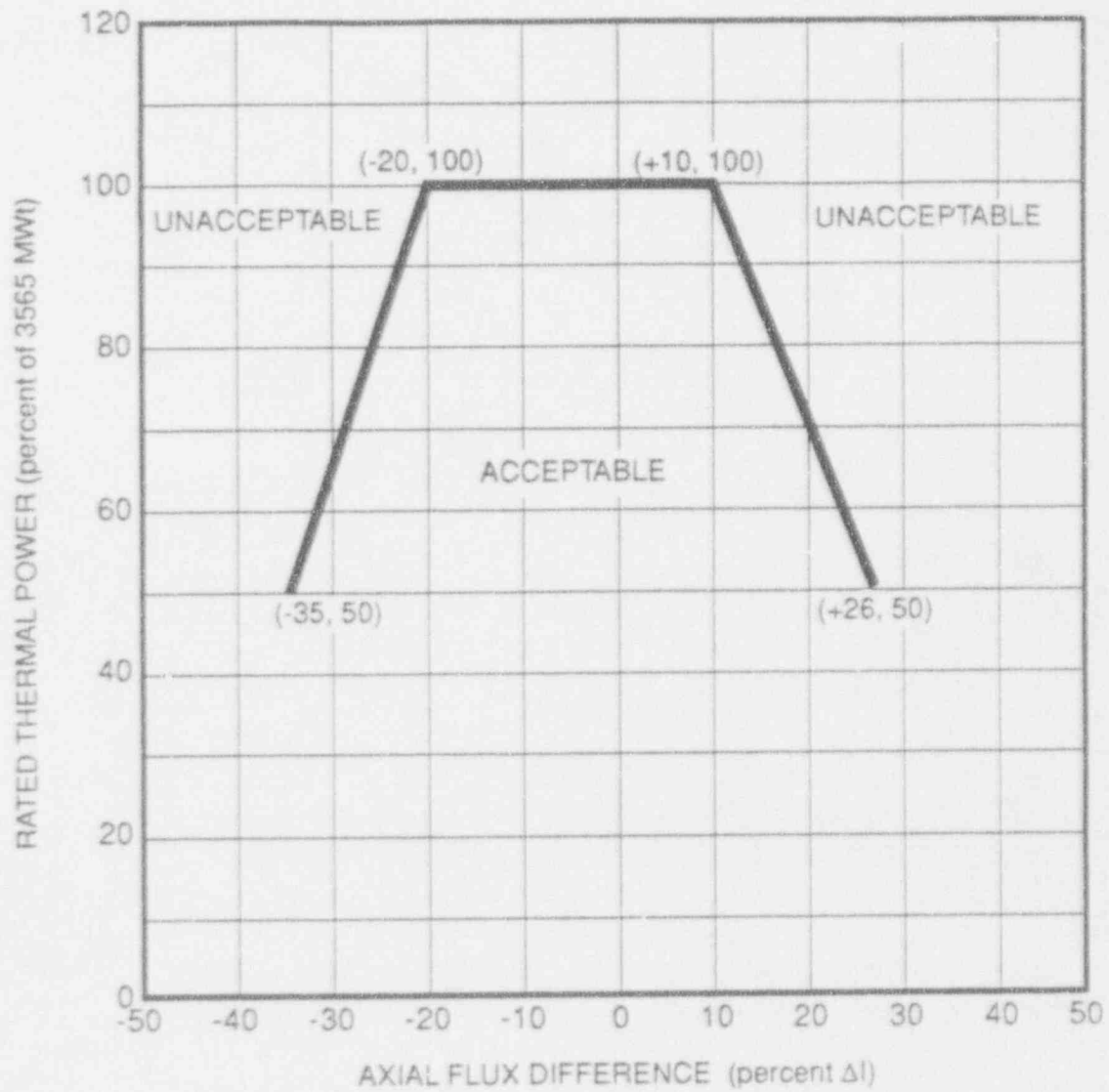


FIGURE 4

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER
FOR RAOC

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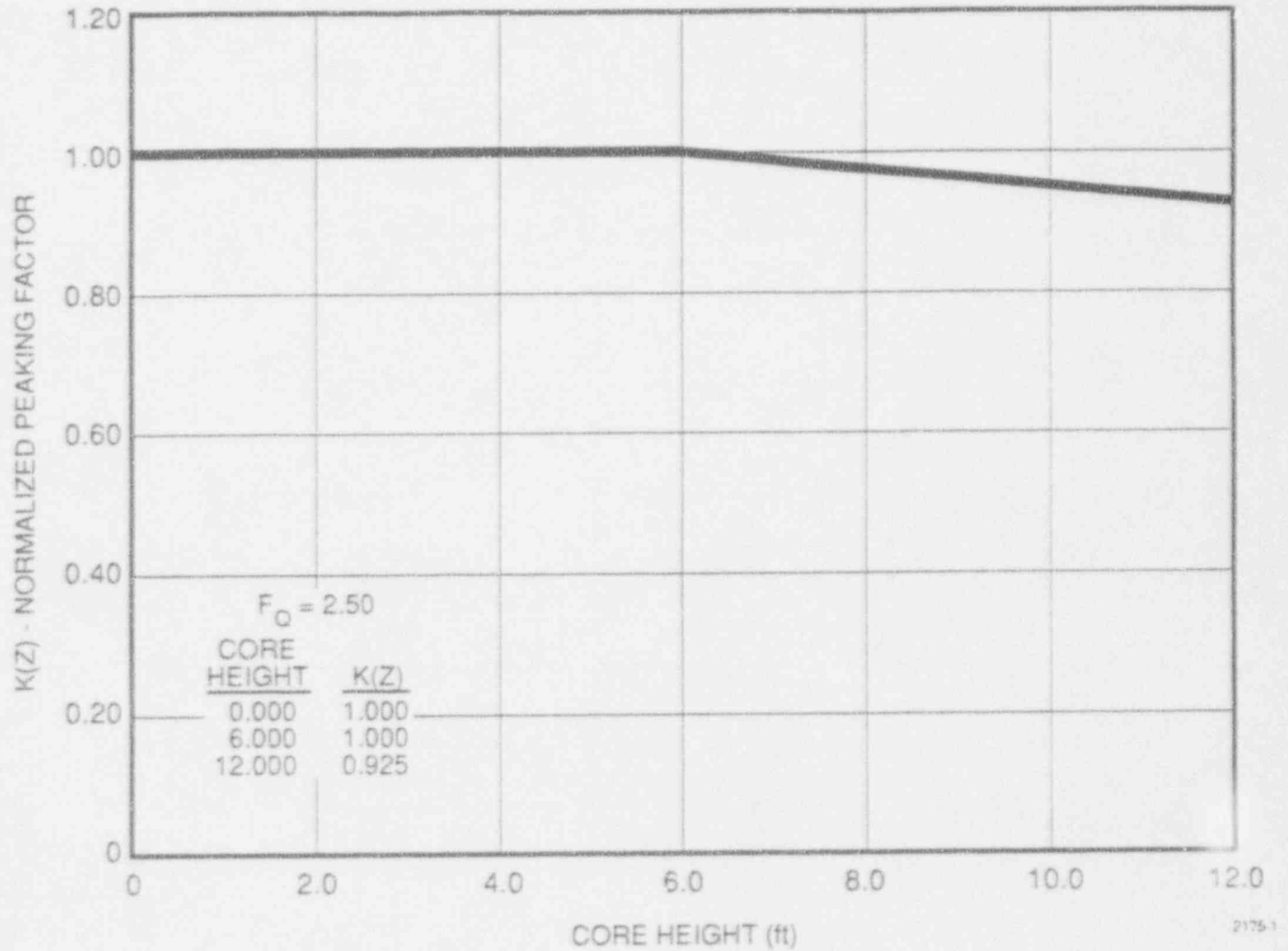


FIGURE 5

$K(Z)$ - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

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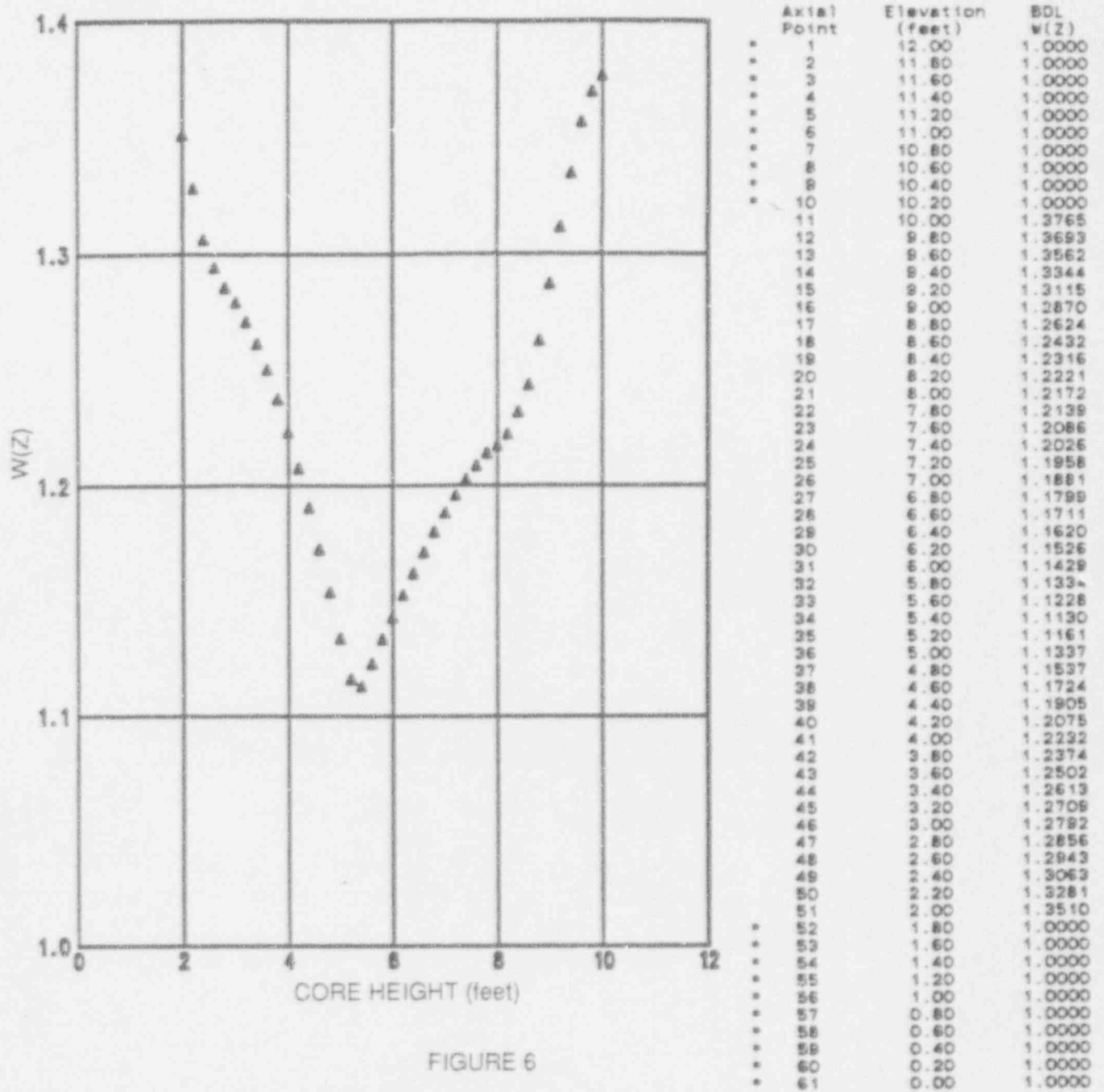


FIGURE 6

RAOC W(Z) AT 150 MWD/MTU

* Top and Bottom 15%
Excluded per Technical
Specification 4.2.2.2.

This figure is referred to by Technical Specifications 4.2.2.2d, B3/4.2.2

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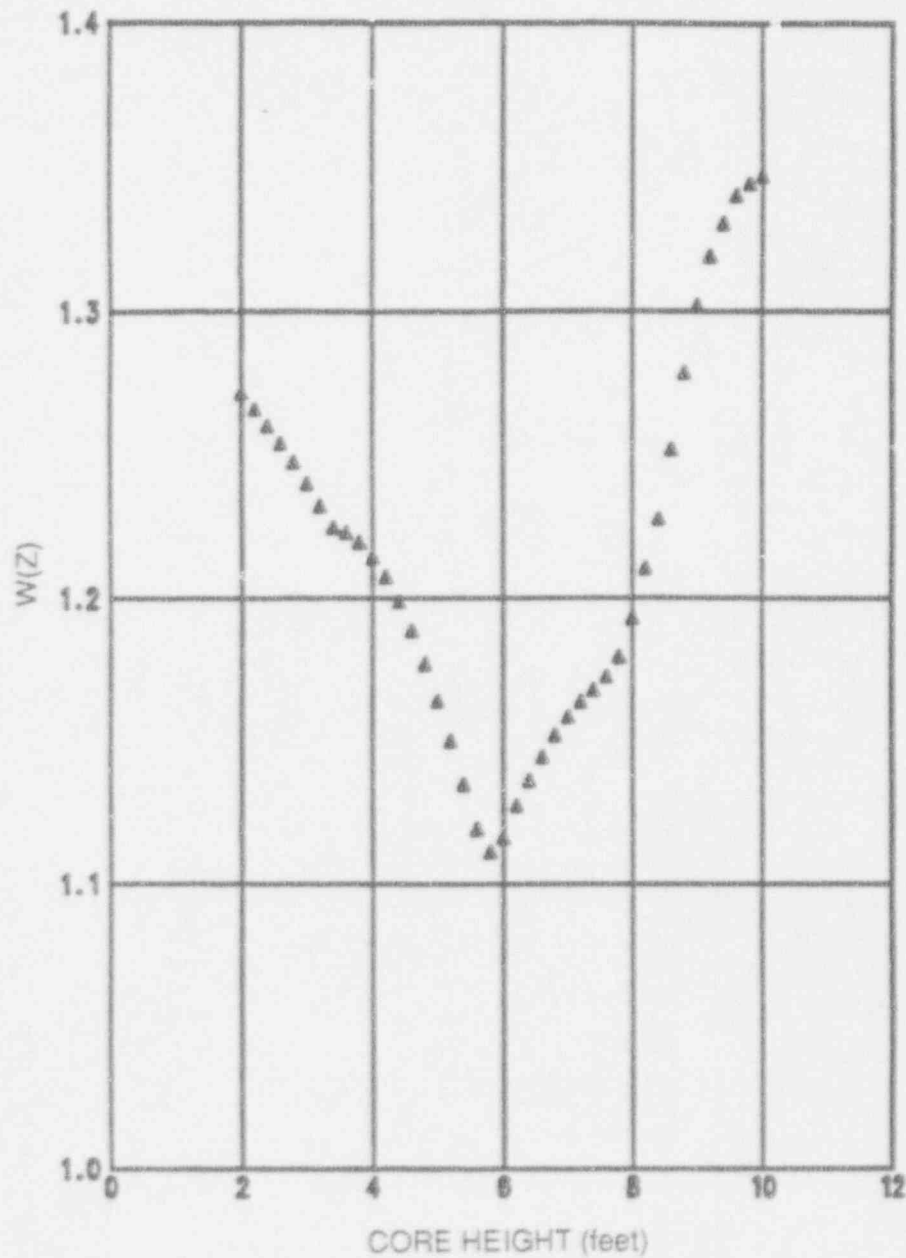


FIGURE 7

RAOC W(Z) AT 9000 MWD/MTU

Axial Point	Elevation (feet)	MDL W(Z)
* 1	12.00	1.0000
* 2	11.80	1.0000
* 3	11.60	1.0000
* 4	11.40	1.0000
* 5	11.20	1.0000
* 6	11.00	1.0000
* 7	10.80	1.0000
* 8	10.60	1.0000
* 9	10.40	1.0000
* 10	10.20	1.0000
* 11	10.00	1.3462
12	9.80	1.3435
13	9.60	1.3394
14	9.40	1.3300
15	9.20	1.3188
16	9.00	1.3020
17	8.80	1.2785
18	8.60	1.2518
19	8.40	1.2276
20	8.20	1.2103
21	8.00	1.1931
22	7.80	1.1795
23	7.60	1.1726
24	7.40	1.1679
25	7.20	1.1638
26	7.00	1.1585
27	6.80	1.1521
28	6.60	1.1446
29	6.40	1.1363
30	6.20	1.1276
31	6.00	1.1162
32	5.80	1.1112
33	5.60	1.1193
34	5.40	1.1349
35	5.20	1.1500
36	5.00	1.1640
37	4.80	1.1770
38	4.60	1.1887
39	4.40	1.1989
40	4.20	1.2075
41	4.00	1.2143
42	3.80	1.2196
43	3.60	1.2229
44	3.40	1.2246
45	3.20	1.2322
46	3.00	1.2398
47	2.80	1.2473
48	2.60	1.2539
49	2.40	1.2599
50	2.20	1.2658
51	2.00	1.2715
* 52	1.80	1.0000
* 53	1.60	1.0000
* 54	1.40	1.0000
* 55	1.20	1.0000
* 56	1.00	1.0000
* 57	0.80	1.0000
* 58	0.60	1.0000
* 59	0.40	1.0000
* 60	0.20	1.0000
* 61	0.00	1.0000

* Top and Bottom 15%
Excluded per Technical
Specification 4.2.2.2.

This figure is referred to by Technical Specifications 4.2.2.2d, B3/4.2.2

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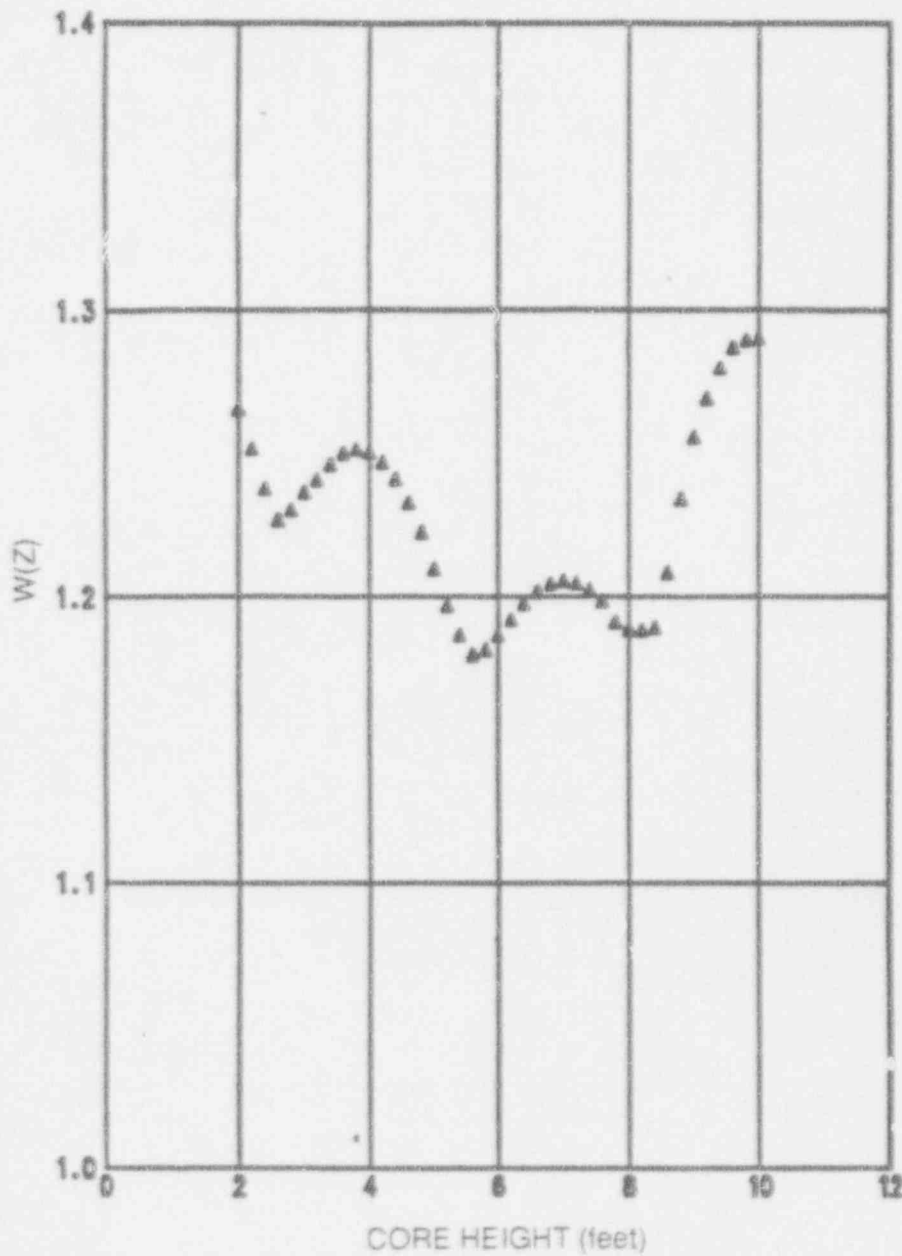


FIGURE 8

RAOC W(Z) AT 17000 MWD/MTU

Axial Point	Elevation (feet)	EOL W(Z)
* 1	12.00	1.0000
* 2	11.80	1.0000
* 3	11.60	1.0000
* 4	11.40	1.0000
* 5	11.20	1.0000
* 6	11.00	1.0000
* 7	10.80	1.0000
* 8	10.60	1.0000
* 9	10.40	1.0000
* 10	10.20	1.0000
11	10.00	1.2801
12	9.80	1.2893
13	9.60	1.2868
14	9.40	1.2786
15	9.20	1.2689
16	9.00	1.2554
17	8.80	1.2340
18	8.60	1.2083
19	8.40	1.1892
20	8.20	1.1883
21	8.00	1.1886
22	7.80	1.1911
23	7.60	1.1985
24	7.40	1.2025
25	7.20	1.2048
26	7.00	1.2055
27	6.80	1.2043
28	6.60	1.2017
29	6.40	1.1976
30	6.20	1.1920
31	6.00	1.1867
32	5.80	1.1815
33	5.60	1.1787
34	5.40	1.1866
35	5.20	1.1969
36	5.00	1.2087
37	4.80	1.2225
38	4.60	1.2328
39	4.40	1.2411
40	4.20	1.2470
41	4.00	1.2504
42	3.80	1.2514
43	3.60	1.2499
44	3.40	1.2460
45	3.20	1.2406
46	3.00	1.2363
47	2.80	1.2303
48	2.60	1.2268
49	2.40	1.2375
50	2.20	1.2516
51	2.00	1.2655
* 52	1.80	1.0000
* 53	1.60	1.0000
* 54	1.40	1.0000
* 55	1.20	1.0000
* 56	1.00	1.0000
* 57	0.80	1.0000
* 58	0.60	1.0000
* 59	0.40	1.0000
* 60	0.20	1.0000
* 61	0.00	1.0000

* Top and Bottom 15%
Excluded per Technical
Specification 4.2.2.2.

This figure is referred to by Technical Specifications 4.2.2.2d, B3/4.2.2