

UNIT 1 CORE OPERATING LIMITS REPORT

9011010319 901029
PDR ADDCK 05000315
P PNU

DONALD C. COOK NCULEAR PLANT UNIT 1 CYCLE 11

CORE OPERATING LIMITS REPORT

Revision 0

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COLR for DONALD C. COOK NUCLEAR PLANT UNIT 1 CYCLE 11

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for Donald C. Cook Nuclear Plant Unit 1 Cycle 11 has been prepared in accordance with the requirements of Technical Specification 6.9.1.11.

The Technical Specifications affected by this report are listed below:

3/4.1.1.4	Moderator Temperature Coefficient
3/4.1.3.1	Movable Control Assemblies Group Height
3/4.1.3.3	Rod Drop Time
3/4.1.3.4	Shutdown Rod Insertion Limits
3/4.1.3.5	Control Rod Insertion Limits
3/4.2.1	Axial Flux Difference
3/4.2.2	Heat Flux Hot Channel Factor
3/4.2.3	Nuclear Enthalpy Hot Channel Factor
3/4.2.6	Allowable Power Level

COLR for Donald C. Cook Nuclear Plant Unit 1 Cycle 11

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 6.9.1.11.

2.1 Moderator Temperature Coefficient (Specification 3/4.1.1.4)

2.1.1 The Moderator Temperature Coefficient (MTC) Limits are:

The BOL/ARO -MTC shall be less positive than the value given in Figure 1.

The EOL/ARO/RTP-MTC shall be less negative than $-3.35\text{E-}4 \Delta\text{k/k/}^{\circ}\text{F}$.

This limit is based on a T_{avg} program with HFP
 T_{avg} of 550°F

where: ARO stands for All Rods Out
BOL stands for Beginning of Cycle Life
EOL stands for End of Cycle Life
RTP stands for Rated Thermal Power
HFP stands for Hot Full Thermal Power

2.1.2 The MTC Surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to $-2.75\text{E-}4 \Delta\text{k/k/}^{\circ}\text{F}$ at a vessel average temperature of 550°F .

COLR for Donald C. Cook Nuclear Plant Unit 1 Cycle 11

2.2 Rod Drop Time Drop Height (Specification 3/4.1.3.3)

2.2.1 All rods shall be dropped from 228 steps.

2.3 Shutdown Rod Insertion Limit (Specification 3/4.1.3.4)

2.3.1 The shutdown rods shall be withdrawn to 228 steps.

2.4 Control Rod Insertion Limits (Specification 3/4.1.3.5, and 3/4.1.3.1)

2.4.1 The control banks shall be limited in physical insertion as shown in Figure 2.

2.4.2 Successive Control Banks shall overlap by 100 steps. The sequence for Control Bank withdrawal shall be Control Bank A, Control Bank B, Control Bank C, and Control Bank D.

2.5 Axial Flux Difference (Specification 3/4.2.1)

2.5.1 The Allowable Operation Limits are provided in Figure 3.

2.5.2 The AXIAL FLUX DIFFERENCE (AFD) target band during base load operations is +3%, -3% (not applicable for this cycle).

2.5.3 The AFD target band is +5%, -5% for core average accumulated burnup ≥ 0.0 MWD/MTU

COLR for Donald C. Cook Nuclear Plant Unit 1 Cycle 11

2.6 Heat Flux Hot Channel Factor - $F_Q(Z)$ (Specifications 3.2.2)

$$F_Q(Z) \leq \frac{CFQ}{P} * K(Z) \quad \text{for } P > 0.5$$

$$F_Q(Z) \leq 2 * CFQ * K(Z) \quad \text{for } P \leq 0.5$$

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

2.6.1 $CFQ = 2.15$ for Westinghouse fuel

2.6.2 $K(Z)$ is provided in Figure 4 for Westinghouse fuel

COLR for Donald C. Cook Nuclear Plant Unit 1 Cycle 11 .

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

$$F_{\Delta H}^N \leq \text{CFDH} * (1 + \text{PFDH} * (1-P))$$

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

2.7.1 CFDH - 1.49 for Westinghouse fuel

2.7.2 PFDH - 0.3

COLR for Donald C. Cook Nuclear Plant Unit 1 Cycle 11

2.8 Allowable Power Level - APL (Specification 3.2.6)

$$\text{APL} = \min \text{ over } Z \text{ for } \frac{\text{CFQ} * \text{K}(Z)}{\text{F}_Q(Z) * \text{V}(Z) * \text{F}_P}$$

2.8.1 V(Z) is provided in Table 1 for $\pm 5\%$ AFD target band

2.8.2 CFQ and K(Z) is provided in COLR Section 2.6.1

2.8.3 F_P is provided in Technical Specification 3.2.6

Moderator Temperature Coefficient (MTC)

MTC $\times 10^4$ $\Delta k/k/\text{deg.F}$

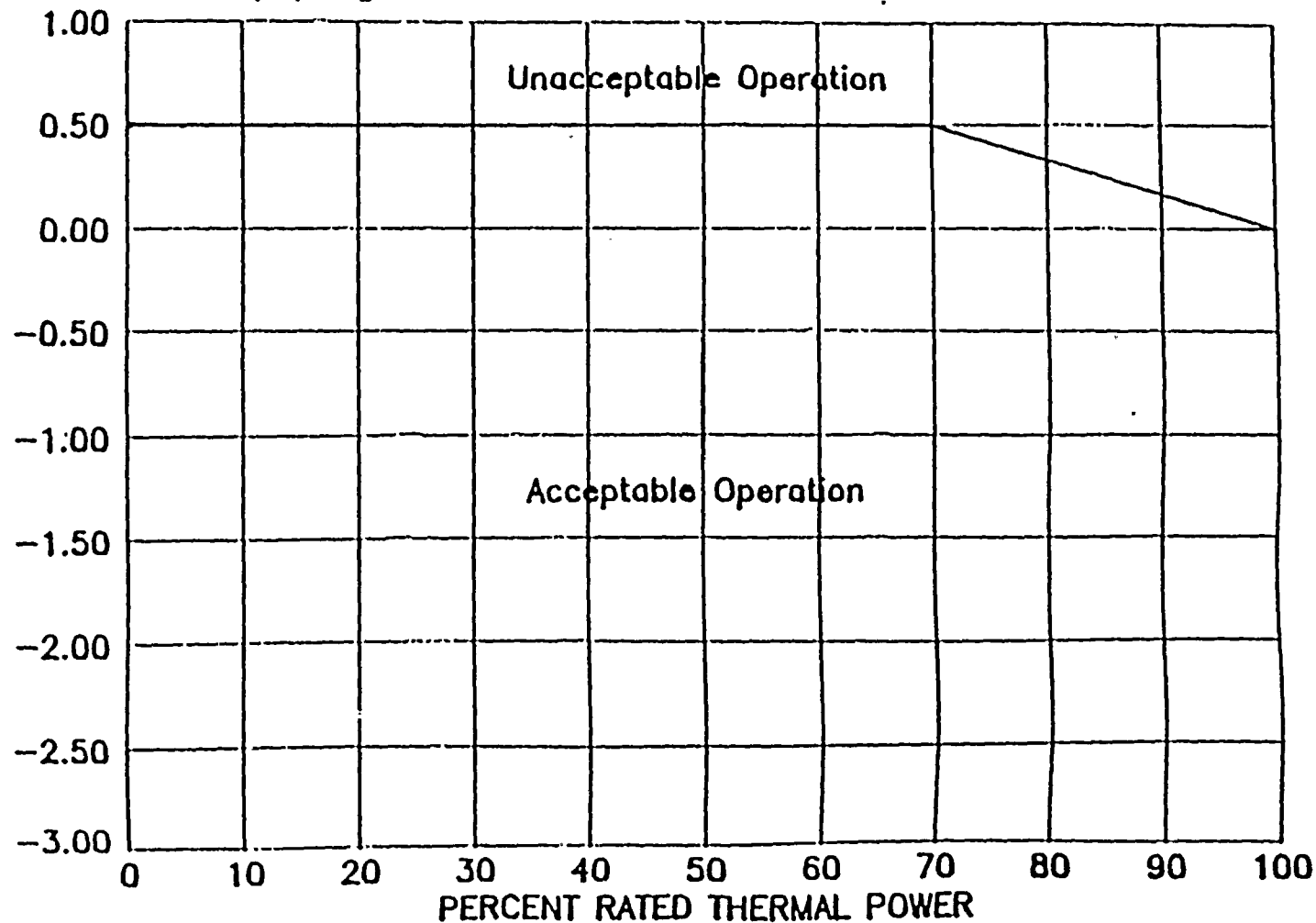


FIGURE 1

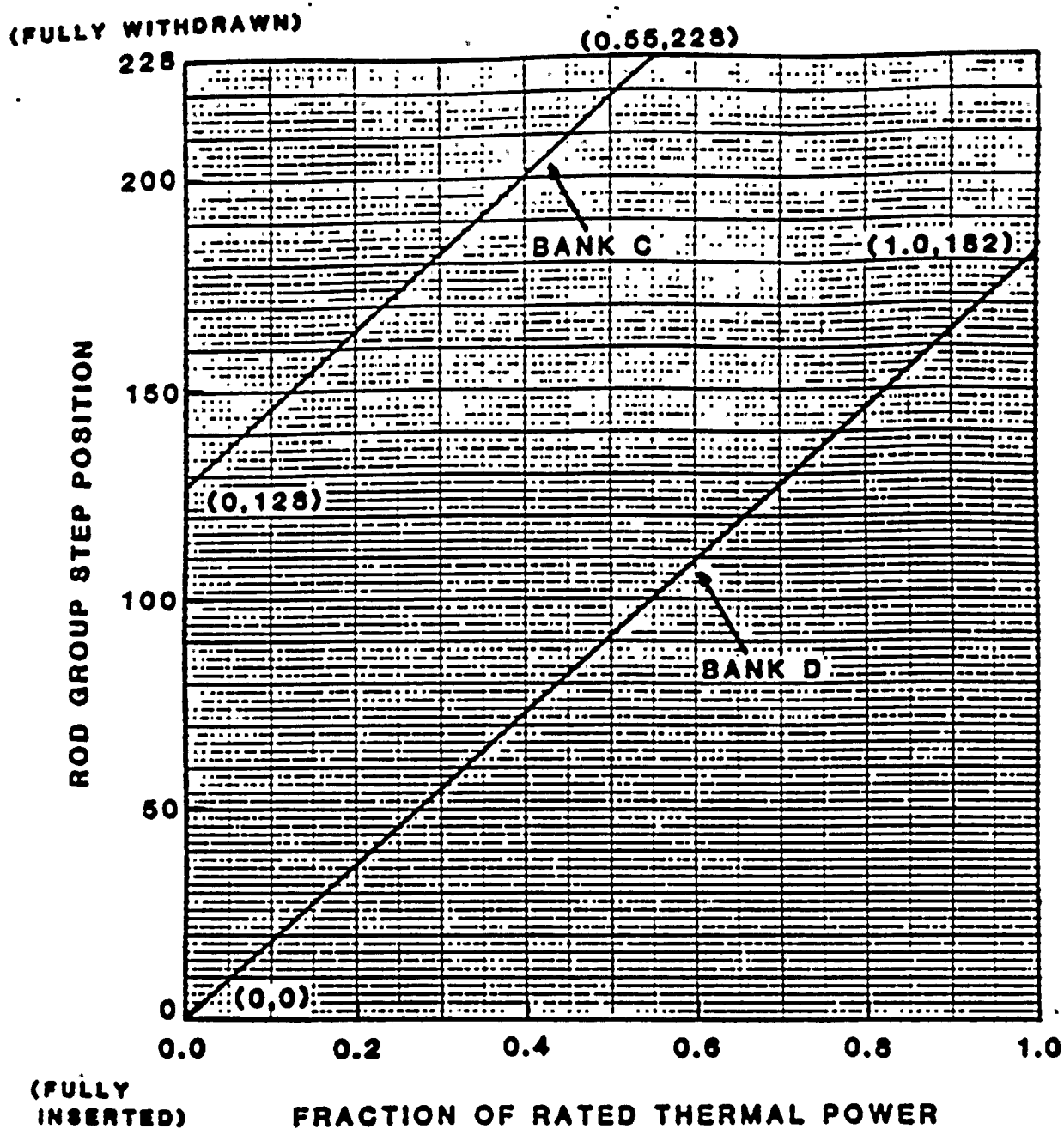


FIGURE 2

ROD INSERTION LIMITS VERSUS
THERMAL POWER 4 LOOP OPERATION

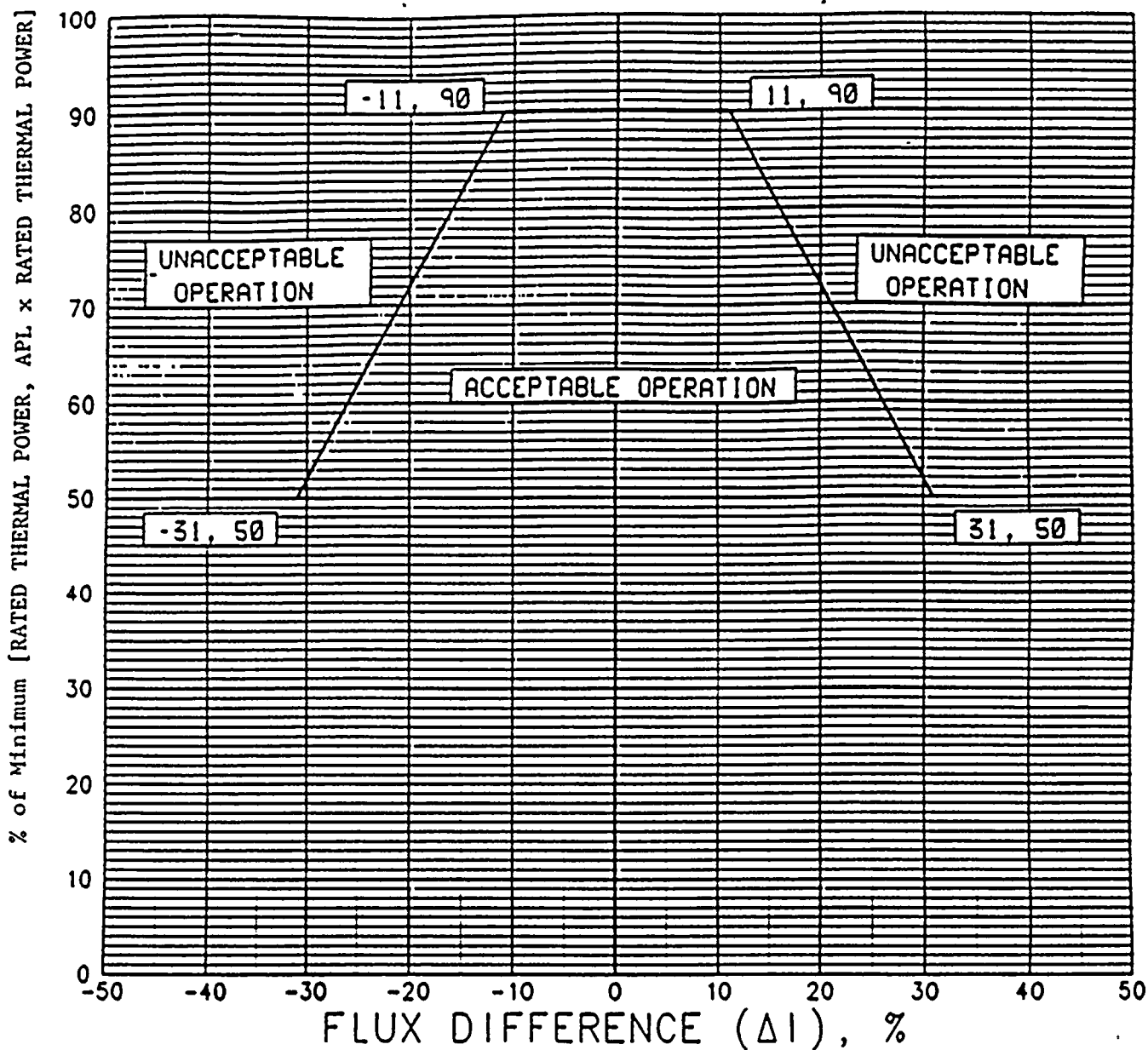


FIGURE 3
AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER

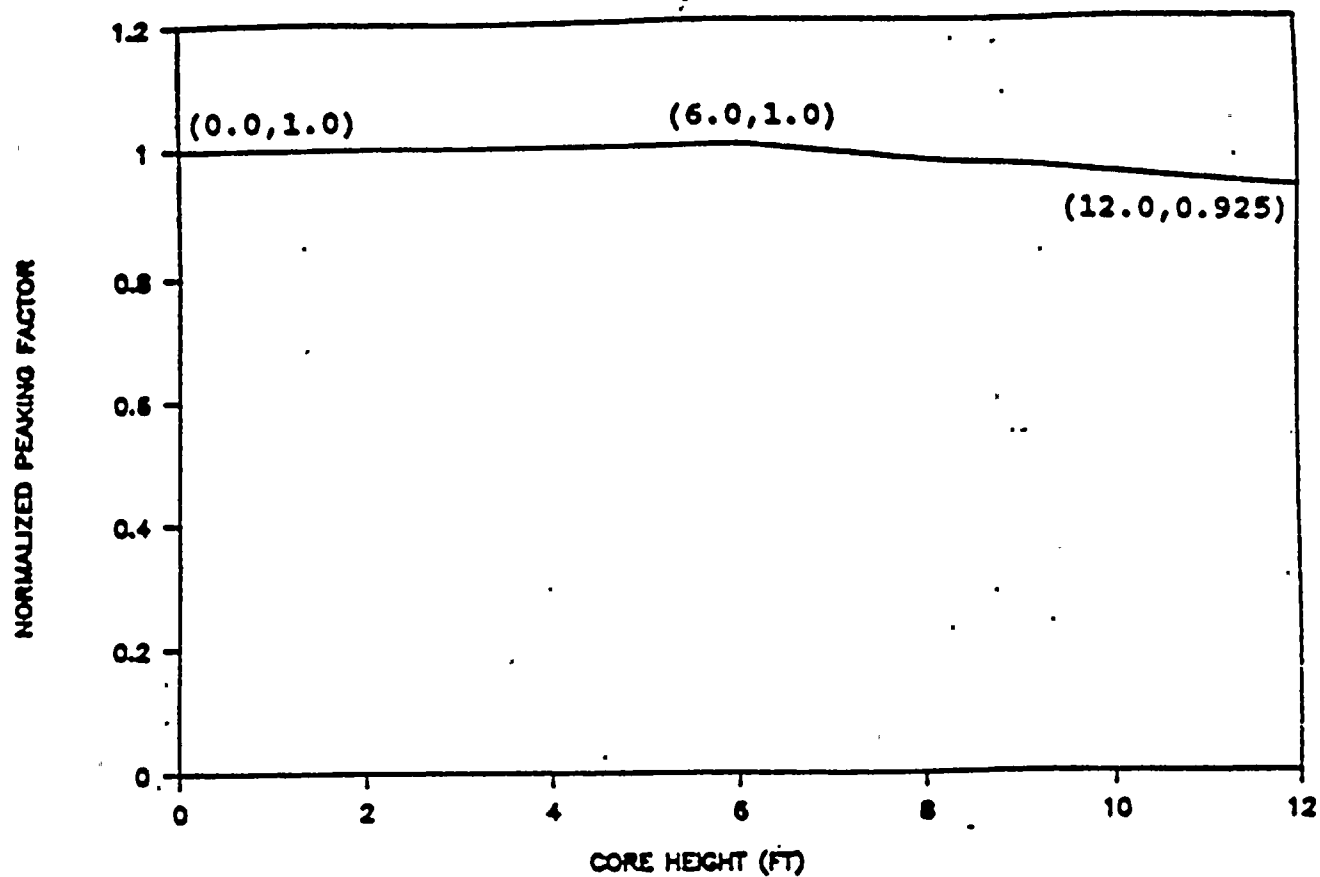


FIGURE 4

$K(z)$ - NORMALIZED $F_Q(z)$ AS A FUNCTION
OF CORE HEIGHT FOR WESTINGHOUSE FUEL

TABLE 1

D. C. COOK UNIT 1 CYCLE 11
V(2) FUNCTION

MESH NO.	AXIAL HEIGHT	BURNUP RANGES (MWD/MTU)								
		0 150	150 1000	1000 2000	2000 4000	4000 6000	6000 8000	8000 10000	10000 12000	12000 EOL
1.	0.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2.	0.20	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3.	0.40	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4.	0.60	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5.	0.80	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.	1.00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7.	1.20	1.0798	1.0798	1.0798	1.0813	1.0845	1.0892	1.0957	1.1038	1.1137
8.	1.40	1.0774	1.0778	1.0780	1.0800	1.0833	1.0880	1.0942	1.1018	1.1107
9.	1.60	1.0750	1.0754	1.0762	1.0785	1.0819	1.0865	1.0922	1.0991	1.1070
10.	1.80	1.0724	1.0730	1.0741	1.0767	1.0802	1.0845	1.0897	1.0958	1.1028
11.	2.00	1.0711	1.0718	1.0728	1.0752	1.0784	1.0822	1.0867	1.0920	1.0979
12.	2.20	1.0707	1.0712	1.0720	1.0739	1.0764	1.0795	1.0833	1.0878	1.0925
13.	2.40	1.0700	1.0703	1.0708	1.0723	1.0741	1.0768	1.0794	1.0827	1.0866
14.	2.60	1.0691	1.0693	1.0698	1.0704	1.0716	1.0731	1.0751	1.0775	1.0803
15.	2.80	1.0681	1.0681	1.0680	1.0682	1.0687	1.0698	1.0706	1.0720	1.0737
16.	3.00	1.0667	1.0667	1.0665	1.0665	1.0659	1.0658	1.0655	1.0657	1.0661
17.	3.20	1.0655	1.0655	1.0650	1.0648	1.0634	1.0626	1.0620	1.0617	1.0617
18.	3.40	1.0651	1.0651	1.0639	1.0630	1.0611	1.0602	1.0610	1.0628	1.0632
19.	3.60	1.0653	1.0653	1.0638	1.0620	1.0602	1.0604	1.0632	1.0677	1.0739
20.	3.80	1.0652	1.0652	1.0634	1.0618	1.0614	1.0628	1.0674	1.0740	1.0827
21.	4.00	1.0648	1.0648	1.0633	1.0619	1.0635	1.0657	1.0717	1.0802	1.0910
22.	4.20	1.0645	1.0645	1.0629	1.0617	1.0656	1.0681	1.0757	1.0861	1.0980
23.	4.40	1.0640	1.0640	1.0625	1.0617	1.0675	1.0705	1.0795	1.0916	1.1063
24.	4.60	1.0633	1.0633	1.0621	1.0620	1.0693	1.0726	1.0830	1.0966	1.1133
25.	4.80	1.0623	1.0623	1.0622	1.0622	1.0708	1.0743	1.0860	1.1010	1.1194
26.	5.00	1.0612	1.0621	1.0621	1.0622	1.0720	1.0760	1.0886	1.1048	1.1246
27.	5.20	1.0603	1.0618	1.0618	1.0618	1.0729	1.0771	1.0906	1.1079	1.1289
28.	5.40	1.0597	1.0612	1.0612	1.0613	1.0733	1.0777	1.0920	1.1101	1.1320
29.	5.60	1.0588	1.0604	1.0604	1.0617	1.0733	1.0779	1.0926	1.1114	1.1341
30.	5.80	1.0576	1.0593	1.0593	1.0619	1.0729	1.0775	1.0926	1.1117	1.1349
31.	6.00	1.0561	1.0581	1.0581	1.0616	1.0719	1.0765	1.0918	1.1111	1.1344
32.	6.20	1.0543	1.0565	1.0565	1.0608	1.0703	1.0749	1.0902	1.1094	1.1327
33.	6.40	1.0521	1.0544	1.0544	1.0598	1.0681	1.0727	1.0877	1.1066	1.1298
34.	6.60	1.0495	1.0519	1.0519	1.0579	1.0653	1.0697	1.0843	1.1027	1.1248
35.	6.80	1.0465	1.0491	1.0491	1.0552	1.0614	1.0657	1.0800	1.0982	1.1202
36.	7.00	1.0430	1.0450	1.0460	1.0537	1.0590	1.0626	1.0768	1.0947	1.1164
37.	7.20	1.0385	1.0425	1.0462	1.0535	1.0578	1.0605	1.0743	1.0915	1.1121
38.	7.40	1.0377	1.0441	1.0468	1.0526	1.0555	1.0575	1.0706	1.0869	1.1064
39.	7.60	1.0392	1.0460	1.0469	1.0511	1.0525	1.0537	1.0656	1.0809	1.0984
40.	7.80	1.0402	1.0475	1.0475	1.0491	1.0491	1.0508	1.0612	1.0746	1.0911
41.	8.00	1.0421	1.0487	1.0487	1.0463	1.0463	1.0512	1.0592	1.0695	1.0821
42.	8.20	1.0460	1.0493	1.0493	1.0474	1.0497	1.0532	1.0579	1.0638	1.0708
43.	8.40	1.0509	1.0512	1.0515	1.0525	1.0536	1.0549	1.0564	1.0581	1.0600
44.	8.60	1.0556	1.0563	1.0570	1.0583	1.0593	1.0600	1.0604	1.0606	1.0606
45.	8.80	1.0602	1.0610	1.0619	1.0634	1.0646	1.0654	1.0658	1.0659	1.0659
46.	9.00	1.0648	1.0656	1.0665	1.0680	1.0693	1.0702	1.0709	1.0712	1.0712
47.	9.20	1.0692	1.0701	1.0710	1.0726	1.0739	1.0750	1.0757	1.0761	1.0763
48.	9.40	1.0735	1.0744	1.0753	1.0770	1.0784	1.0795	1.0804	1.0810	1.0813
49.	9.60	1.0777	1.0784	1.0793	1.0809	1.0824	1.0838	1.0851	1.0862	1.0873
50.	9.80	1.0816	1.0822	1.0829	1.0844	1.0859	1.0876	1.0893	1.0911	1.0929
51.	10.0	1.0853	1.0858	1.0864	1.0879	1.0895	1.0914	1.0934	1.0956	1.0979
52.	10.2	1.0886	1.0892	1.0899	1.0915	1.0933	1.0953	1.0975	1.0999	1.1025
53.	10.4	1.0917	1.0923	1.0931	1.0948	1.0967	1.0988	1.1012	1.1037	1.1064
54.	10.6	1.0943	1.0950	1.0959	1.0977	1.0997	1.1019	1.1043	1.1068	1.1096
55.	10.8	1.0965	1.0972	1.0981	1.1000	1.1021	1.1044	1.1069	1.1096	1.1125
56.	11.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57.	11.2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58.	11.4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59.	11.6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60.	11.8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61.	12.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Top and bottom 10% of core are excluded as per Technical Specifications.