Indiana Michigan
Power Company
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Bridgman, MI 49106
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INDIANA
MICHIGAN
POWER

October 21, 2004

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U.S. Nuclear Regulatory Commission
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Donald C. Cook Nuclear Plant Unit 2
CORE OPERATING LIMITS REPORT

Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant Unit 2, is submitting the Core Operating Limits Report (COLR) for Unit 2 Cycle 15 in accordance with Technical Specification 6.9.1.9.4.

The Unit 2 Cycle 15 COLR is provided as an attachment to this letter.

This letter contains no new commitments. Should you have any questions, please contact Mr. John A. Zwolinski, Safety Assurance Director, at (269) 466-2428.

Sincerely,

Joseph N. Jensen
Site Vice President

DB/jen

Attachment

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ATTACHMENT TO AEP:NRC:4691-04

Unit 2 Cycle 15 Core Operating Limits Report

Donald C. Cook Nuclear Plant
Unit 2 Cycle 15

Core Operating Limits Report

1.0 CORE OPERATING LIMITS REPORT

This Core Operating Limits Report for the Donald C. Cook Nuclear Plant Unit 2 Cycle 15 has been prepared in accordance with the requirements of Technical Specification 6.9.1.9.

The Technical Specifications affected by this report are listed below:

3/4.1.1.4	Moderator Temperature Coefficient (MTC)
3/4.1.3.1	Movable Control Assemblies Group Height
3/4.1.3.4	Rod Drop Time
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 (AFD)
3/4.2.2	Heat Flux Hot Channel Factor ($F_Q(Z)$)
3/4.2.3	Nuclear Enthalpy Hot Channel Factor - ($F_{\Delta H}$)
3/4.2.6	Allowable Power Level (APL)

2.0 OPERATING LIMITS

The cycle-specific parameter limits 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 6.9.1.9.

2.1 Moderator Temperature Coefficient (Technical 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 or equal to the value given in Figure 1.

The EOL/ARO/RTP-MTC shall be less negative than or equal to -4.10E-4 Δk/k/°F.

This limit is based on a T_{avg} program with HFP vessel T_{avg} of 571 to 576 °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 or equal to -3.20E-4 Δk/k/°F at a HFP vessel T_{avg} of 571 to 576 °F

2.2 Rod Drop Time Drop Height (Specification 3/4.1.3.4)

2.2.1 All rods shall be dropped from 228 steps.

2.3 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.3.1 The shutdown rods shall be withdrawn to at least 228 steps.

2.4 Control Rod Insertion Limits (Specifications 3/4.1.3.6 and 3/4.1.3.1)

2.4.1 The control rod 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 is ±5% for a cycle average accumulated burnup of ≥ 0.0 MWD/MTU

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

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

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

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

2.6.1 $CF_Q = 2.335$

2.6.2 K(Z) is provided in Figure 4.

2.7 Nuclear Enthalpy Rise Hot Channel Factor – $F^N_{\Delta H}$ (Specification 3/4.2.3)

$$F^N_{\Delta H} \leq CF_{\Delta H} * (1 + PF_{\Delta H} *(1-P))$$

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

2.7.1 $CF_{\Delta H} = 1.58$

2.7.2 $PF_{\Delta H} = 0.3$

2.8 Allowable Power Level - APL (Specification 3.2.6)

$$APL = \text{min over Z for } \frac{CF_Q * K(Z)}{F_Q(Z) * V(Z) * F_P} * 100\%$$

2.8.1 V(Z) is provided in Table 1 for ±5% AFD target band.

2.8.2 CF_Q and K(Z) are provided in COLR Sections 2.6.1 and 2.6.2, respectively

2.8.3 For Cycle 15, $F_P = 1.02$ for all burnups.

Figure 1

MODERATOR TEMPERATURE COEFFICIENT (MTC) LIMITS

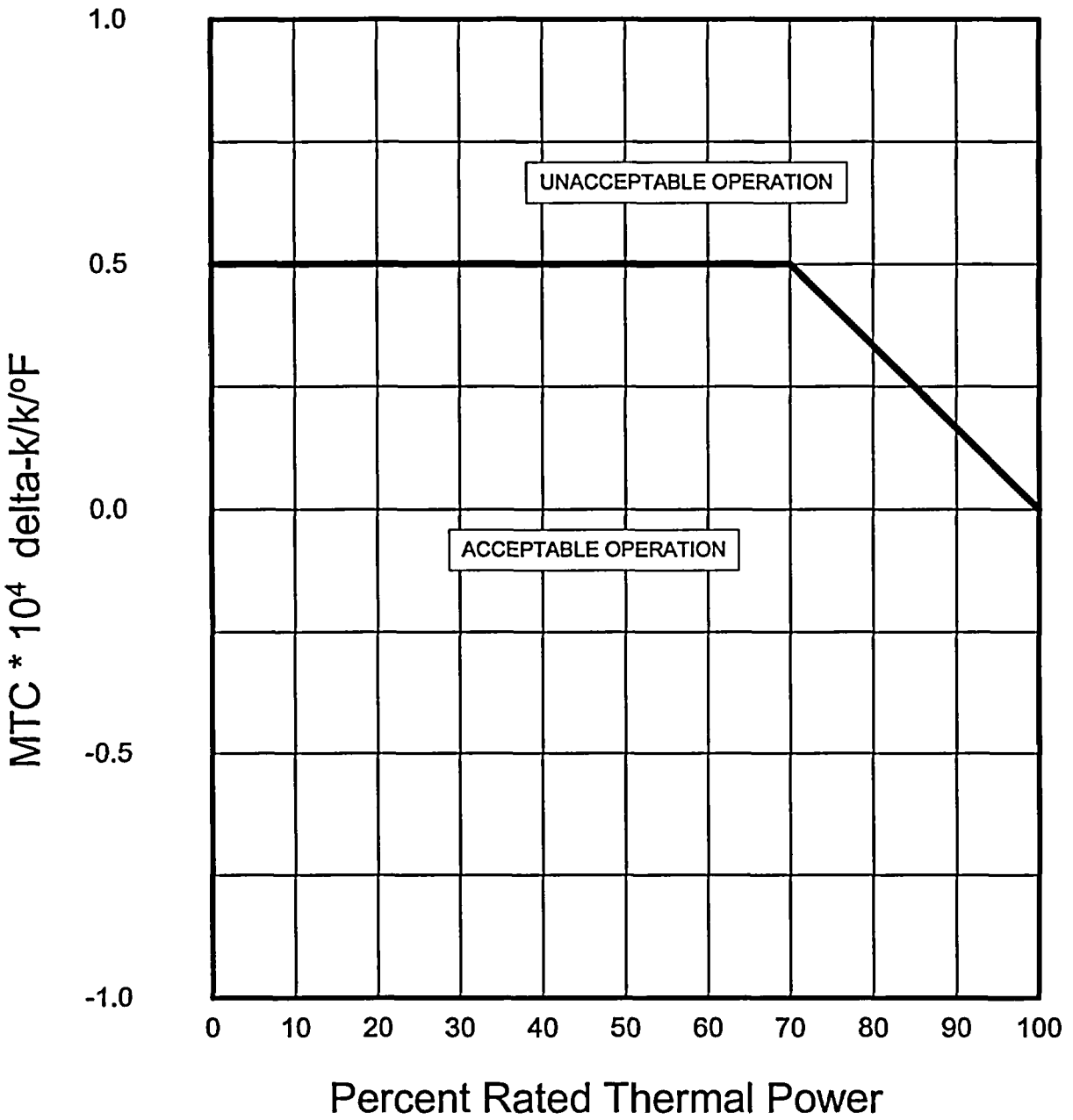

Figure 2
ROD BANK INSERTION LIMITS VERSUS THERMAL POWER FOUR-LOOP OPERATION

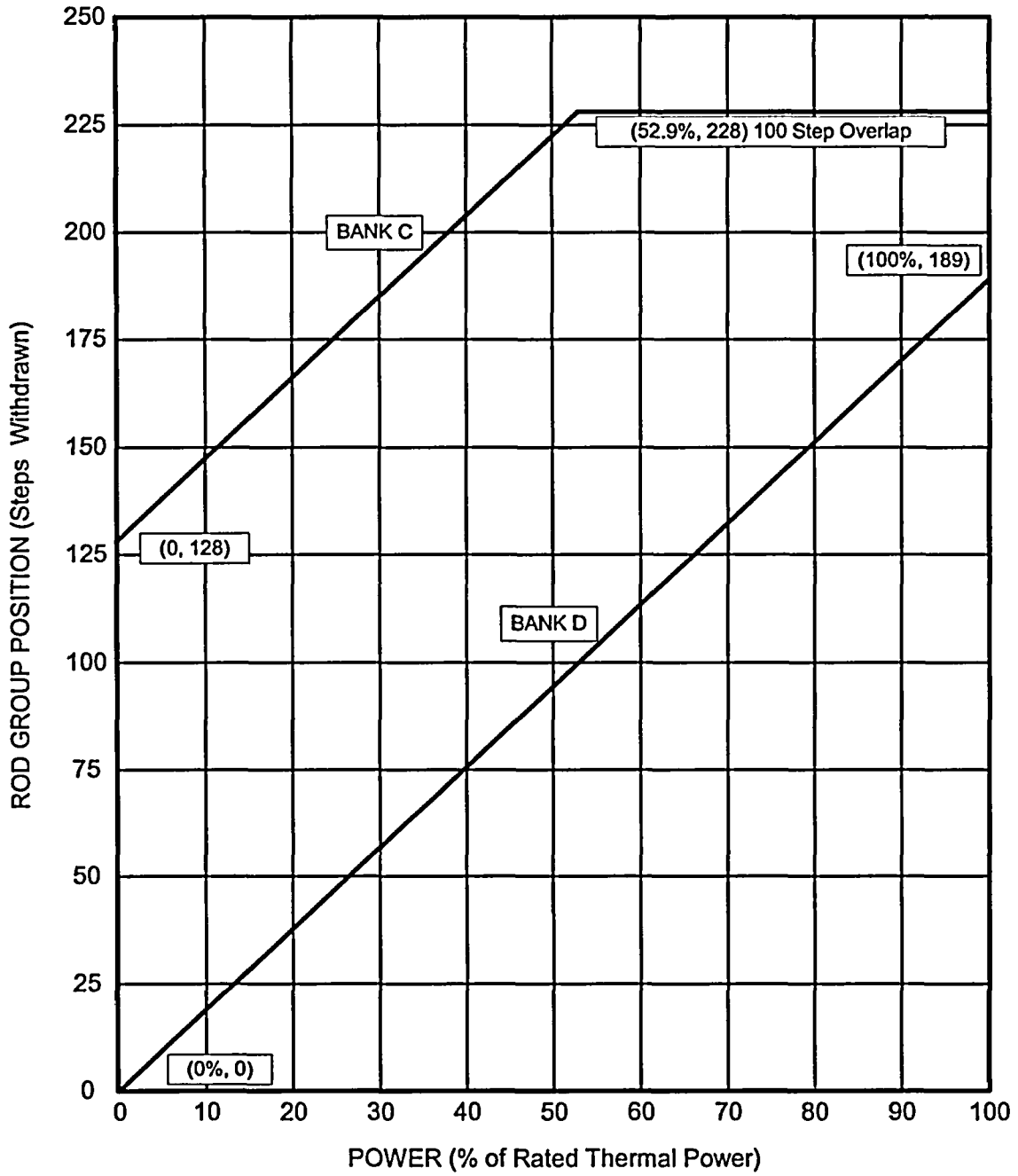

Figure 3

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER (RTP)

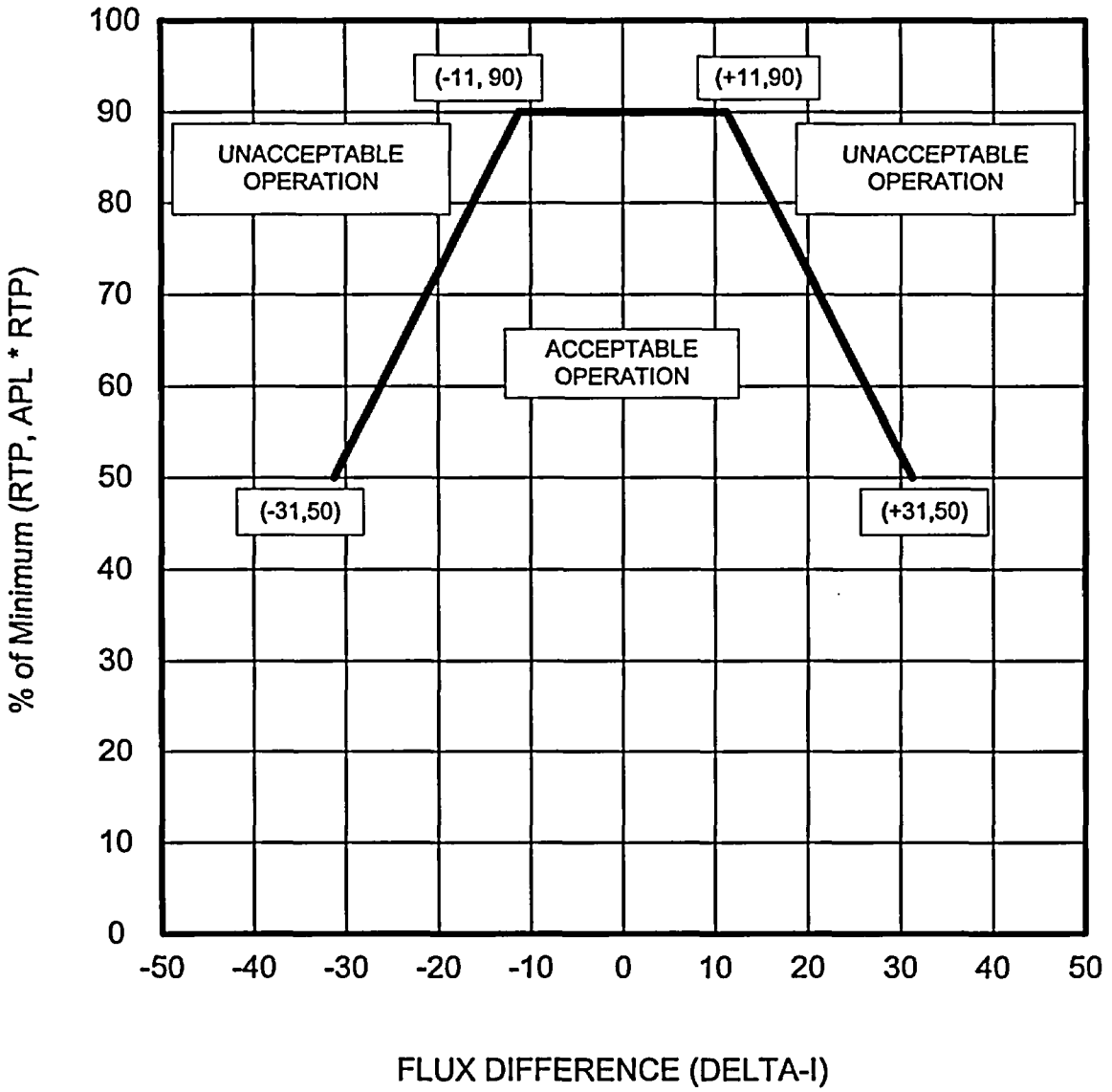

Figure 4

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

Cycle Burnups > 0 MWD/MTU

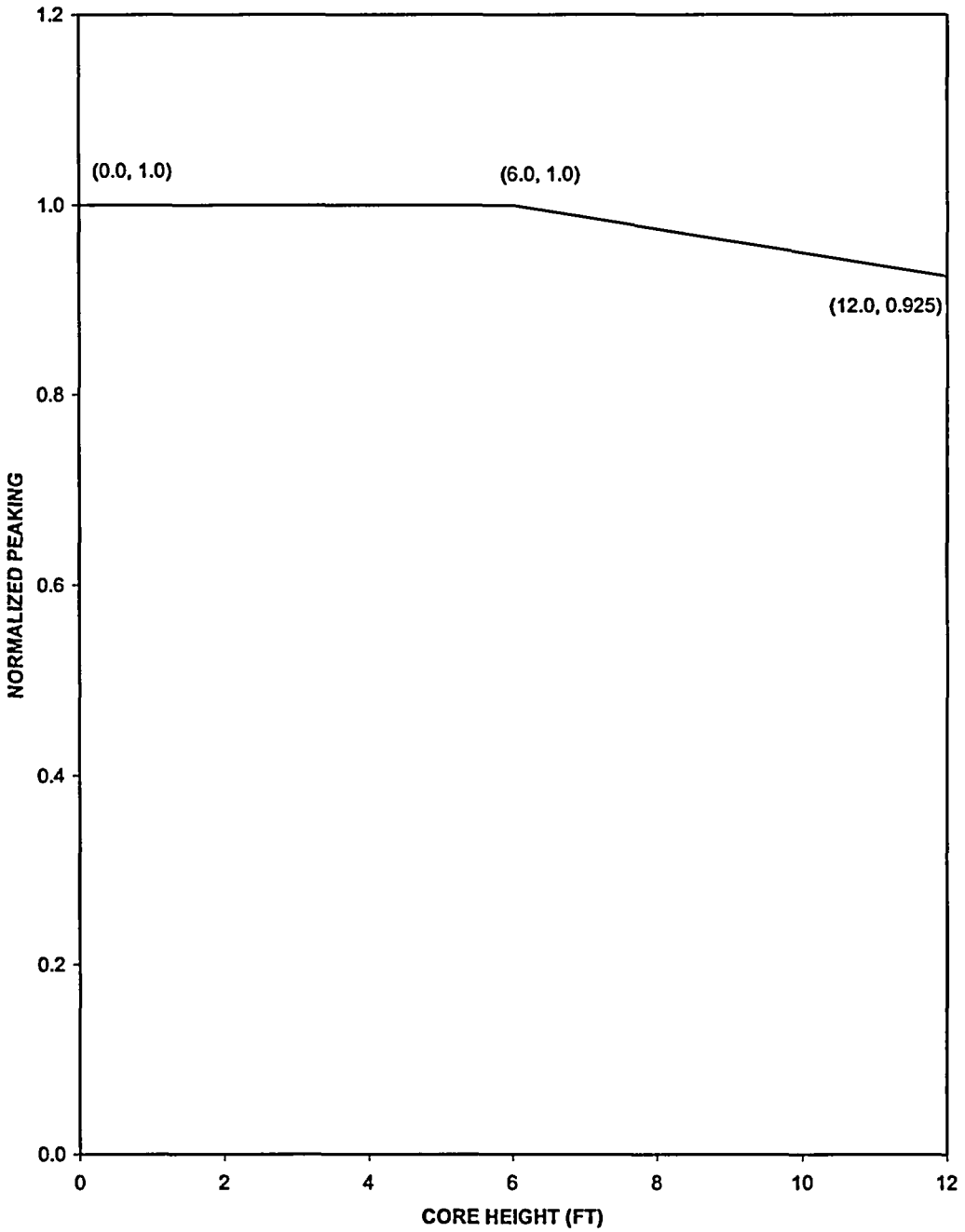

Table 1
D. C. Cook Unit 2, Cycle 15
3468 MWt, As-Burned Cycle 14
V(Z) Function

PT	Height (Ft.)	Burnup (MWD/MTU) 150	1000	2000	4000	6000	8000	10000	12000	14000	16000	18000	20000	20650
1	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	0.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	0.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.2000	1.1012	1.1007	1.1005	1.1015	1.1046	1.1097	1.1159	1.1221	1.1281	1.1342	1.1405	1.1466	1.1486
8	1.4000	1.1013	1.1009	1.1008	1.1018	1.1047	1.1095	1.1153	1.1210	1.1266	1.1322	1.1379	1.1435	1.1454
9	1.6000	1.1012	1.1008	1.1008	1.1018	1.1045	1.1090	1.1143	1.1195	1.1246	1.1297	1.1348	1.1400	1.1417
10	1.8000	1.1008	1.1005	1.1005	1.1014	1.1039	1.1080	1.1128	1.1175	1.1220	1.1265	1.1311	1.1356	1.1371
11	2.0000	1.1001	1.0999	1.0999	1.1008	1.1030	1.1066	1.1108	1.1149	1.1188	1.1226	1.1265	1.1304	1.1317
12	2.2000	1.0991	1.0990	1.0990	1.0998	1.1017	1.1048	1.1084	1.1118	1.1151	1.1182	1.1213	1.1246	1.1256
13	2.4000	1.0978	1.0977	1.0978	1.0985	1.1001	1.1027	1.1056	1.1083	1.1108	1.1132	1.1155	1.1180	1.1188
14	2.6000	1.0963	1.0962	1.0963	1.0969	1.0982	1.1002	1.1024	1.1043	1.1060	1.1076	1.1091	1.1107	1.1113
15	2.8000	1.0945	1.0945	1.0946	1.0950	1.0959	1.0972	1.0987	1.0999	1.1008	1.1016	1.1023	1.1031	1.1034
16	3.0000	1.0923	1.0924	1.0924	1.0928	1.0934	1.0942	1.0950	1.0955	1.0956	1.0955	1.0952	1.0953	1.0953
17	3.2000	1.0901	1.0902	1.0903	1.0905	1.0908	1.0911	1.0913	1.0911	1.0905	1.0897	1.0886	1.0880	1.0878
18	3.4000	1.0886	1.0887	1.0888	1.0888	1.0886	1.0881	1.0876	1.0872	1.0868	1.0865	1.0862	1.0858	1.0857
19	3.6000	1.0880	1.0880	1.0880	1.0879	1.0873	1.0863	1.0856	1.0861	1.0876	1.0900	1.0928	1.0946	1.0952
20	3.8000	1.0873	1.0870	1.0868	1.0863	1.0857	1.0851	1.0852	1.0869	1.0902	1.0949	1.1003	1.1041	1.1054
21	4.0000	1.0864	1.0859	1.0854	1.0848	1.0845	1.0845	1.0856	1.0886	1.0933	1.0996	1.1069	1.1122	1.1139
22	4.2000	1.0853	1.0848	1.0844	1.0840	1.0844	1.0854	1.0877	1.0918	1.0976	1.1049	1.1132	1.1196	1.1216
23	4.4000	1.0843	1.0838	1.0836	1.0838	1.0849	1.0870	1.0903	1.0954	1.1020	1.1100	1.1189	1.1261	1.1284
24	4.6000	1.0839	1.0834	1.0831	1.0835	1.0851	1.0882	1.0927	1.0987	1.1060	1.1147	1.1241	1.1319	1.1345
25	4.8000	1.0839	1.0832	1.0827	1.0830	1.0852	1.0893	1.0949	1.1017	1.1097	1.1188	1.1286	1.1370	1.1397
26	5.0000	1.0837	1.0828	1.0821	1.0825	1.0851	1.0901	1.0967	1.1044	1.1128	1.1222	1.1323	1.1412	1.1440
27	5.2000	1.0833	1.0822	1.0813	1.0816	1.0846	1.0905	1.0982	1.1065	1.1154	1.1250	1.1351	1.1443	1.1473
28	5.4000	1.0827	1.0813	1.0803	1.0805	1.0839	1.0907	1.0992	1.1081	1.1173	1.1269	1.1370	1.1464	1.1495
29	5.6000	1.0817	1.0803	1.0793	1.0796	1.0833	1.0906	1.0997	1.1090	1.1183	1.1279	1.1378	1.1474	1.1505
30	5.8000	1.0805	1.0790	1.0780	1.0783	1.0823	1.0900	1.0996	1.1092	1.1185	1.1279	1.1376	1.1471	1.1502
31	6.0000	1.0791	1.0776	1.0765	1.0768	1.0809	1.0890	1.0990	1.1086	1.1178	1.1269	1.1363	1.1456	1.1487
32	6.2000	1.0777	1.0760	1.0748	1.0749	1.0791	1.0874	1.0976	1.1072	1.1162	1.1249	1.1338	1.1429	1.1458
33	6.4000	1.0758	1.0740	1.0727	1.0728	1.0770	1.0853	1.0955	1.1049	1.1136	1.1218	1.1302	1.1388	1.1416
34	6.6000	1.0734	1.0720	1.0709	1.0713	1.0753	1.0832	1.0927	1.1016	1.1097	1.1176	1.1255	1.1336	1.1363
35	6.8000	1.0704	1.0691	1.0682	1.0686	1.0724	1.0798	1.0886	1.0968	1.1043	1.1115	1.1187	1.1262	1.1287
36	7.0000	1.0677	1.0672	1.0671	1.0685	1.0723	1.0787	1.0861	1.0933	1.1002	1.1070	1.1138	1.1208	1.1230
37	7.2000	1.0678	1.0686	1.0698	1.0727	1.0763	1.0808	1.0860	1.0919	1.0983	1.1053	1.1127	1.1194	1.1216
38	7.4000	1.0715	1.0721	1.0731	1.0757	1.0793	1.0840	1.0892	1.0945	1.0999	1.1054	1.1111	1.1166	1.1184
39	7.6000	1.0749	1.0753	1.0761	1.0784	1.0819	1.0866	1.0918	1.0966	1.1012	1.1056	1.1100	1.1146	1.1161
40	7.8000	1.0777	1.0780	1.0787	1.0808	1.0841	1.0888	1.0937	1.0981	1.1019	1.1053	1.1085	1.1122	1.1134
41	8.0000	1.0803	1.0804	1.0809	1.0827	1.0858	1.0904	1.0953	1.0992	1.1021	1.1043	1.1061	1.1088	1.1097
42	8.2000	1.0824	1.0824	1.0826	1.0841	1.0871	1.0916	1.0963	1.0997	1.1017	1.1027	1.1032	1.1049	1.1055
43	8.4000	1.0841	1.0839	1.0839	1.0850	1.0877	1.0922	1.0968	1.0996	1.1007	1.1005	1.0997	1.1004	1.1007
44	8.6000	1.0852	1.0848	1.0847	1.0854	1.0879	1.0923	1.0967	1.0989	1.0990	1.0973	1.0949	1.0944	1.0943
45	8.8000	1.0861	1.0855	1.0852	1.0855	1.0877	1.0918	1.0959	1.0981	1.0986	1.0977	1.0960	1.0961	1.0961
46	9.0000	1.0866	1.0861	1.0858	1.0862	1.0882	1.0919	1.0959	1.0987	1.1004	1.1011	1.1015	1.1029	1.1033
47	9.2000	1.0878	1.0878	1.0881	1.0893	1.0916	1.0951	1.0987	1.1015	1.1034	1.1047	1.1056	1.1074	1.1079
48	9.4000	1.0911	1.0915	1.0920	1.0936	1.0963	1.1000	1.1037	1.1064	1.1081	1.1090	1.1096	1.1110	1.1115
49	9.6000	1.0954	1.0957	1.0963	1.0980	1.1008	1.1046	1.1083	1.1110	1.1126	1.1134	1.1137	1.1151	1.1155
50	9.8000	1.0996	1.0999	1.1005	1.1022	1.1049	1.1087	1.1125	1.1151	1.1166	1.1172	1.1173	1.1185	1.1189
51	10.0000	1.1035	1.1038	1.1044	1.1061	1.1088	1.1126	1.1163	1.1189	1.1202	1.1207	1.1207	1.1218	1.1221
52	10.2000	1.1071	1.1075	1.1081	1.1097	1.1124	1.1160	1.1196	1.1221	1.1236	1.1242	1.1244	1.1256	1.1260
53	10.4000	1.1104	1.1108	1.1113	1.1130	1.1155	1.1189	1.1223	1.1248	1.1263	1.1270	1.1274	1.1287	1.1291
54	10.6000	1.1132	1.1134	1.1139	1.1154	1.1179	1.1215	1.1250	1.1275	1.1289	1.1295	1.1297	1.1309	1.1313
55	10.8000	1.1154	1.1156	1.1160	1.1175	1.1200	1.1235	1.1271	1.1295	1.1309	1.1314	1.1315	1.1326	1.1329
56	11.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	11.2000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
58	11.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
59	11.6000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
60	11.8000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
61	120000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000