

Y 3. At7

AEC

RESEARCH REPORTS

221. ORNL-3649

U.2  
See 2.6

ORNL-3649, Vol. 2  
UC-37 - Instruments  
TID-4500 (37th ed.)

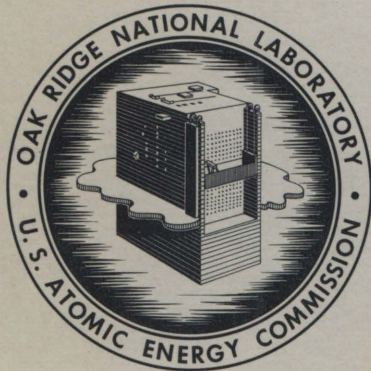
Section 2.6

SMOOTHED THERMOCOUPLE TABLES OF  
EXTENDED SIGNIFICANCE (°C)

Volume 2

Section 2.6 Chromel-Constantan Thermocouples

R. K. Adams  
E. G. Davisson



**OAK RIDGE NATIONAL LABORATORY**

operated by

UNION CARBIDE CORPORATION

for the

U.S. ATOMIC ENERGY COMMISSION

metadc100371

UNIVERSITY OF  
ARIZONA LIBRARY  
Documents Collection

Apr. 8 1965



Printed in USA. Price \$2.00. Available from the Clearinghouse for Federal  
Scientific and Technical Information, National Bureau of Standards,  
U.S. Department of Commerce, Springfield, Virginia

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

**ORNL-3649**  
**Vol. 2, Sect. 2.6**

Contract No. W-7405-eng-26

**INSTRUMENTATION AND CONTROLS DIVISION**

**SMOOTHED THERMOCOUPLE TABLES OF EXTENDED SIGNIFICANCE (°C)**

R. K. Adams and E. G. Davisson

Volume 2

**SECTION 2.6 CHROMEL-CONSTANTAN THERMOCOUPLES**

MARCH 1965

**OAK RIDGE NATIONAL LABORATORY**  
Oak Ridge, Tennessee  
operated by  
**UNION CARBIDE CORPORATION**  
for the  
**U. S. ATOMIC ENERGY COMMISSION**



# SMOOTHED THERMOCOUPLE TABLES OF EXTENDED SIGNIFICANCE (°C)

R. K. Adams      E. G. Davisson

## Volume 2

### SECTION 2.6 CHROMEL-CONSTANTAN THERMOCOUPLES

This section contains tables of emf (in absolute millivolts) vs temperature (in degrees Celsius on the International Temperature Scale of 1948) for Chromel-constantan thermocouples. The values in these tables, derived from those given in National Bureau of Standards Circular 561, Table 11,<sup>1</sup> are computed to more significant digits, that is, to the nearest 0.001  $\mu\text{V}$ . The techniques of computation are described in Vol. 1 of this report.

Figure 1, a plot of the difference in microvolts between the values in the smoothed table and those in the original table vs temperature, illustrates how the values in the smoothed table compare with those in the original table.

In Table 6 a smoothed emf value is tabulated in absolute millivolts for every degree Celsius in the range of the table.

In Table 6A the first two columns contain the same information as given in Table 6. To the right of these two columns is a difference table of the millivolt values in column 2. The difference table is expressed in thousandths of microvolts and contains orders 0 through 5. This difference table gives a convenient tabulation of differences for those engaged in temperature difference work.

Although these tables are expressed to the nearest 0.001  $\mu\text{V}$ , which is roughly equivalent to 0.00001°C, this in no way implies that temperature measurements to this accuracy are possible. The user of these tables is reminded of the accuracy tolerances on thermocouples published by the American Society for Testing and Materials<sup>2</sup> and the Instrument Society of America,<sup>3</sup> which state limits of error equivalent to about  $\pm 1.8^\circ\text{C}$  from 0 to 315°C,  $\pm 0.5\%$  of reading from 315 to 870°C for "standard" materials, and one-half these limits for "special" materials. Individual calibration of Chromel-constantan thermocouples in the ORNL Standards Laboratory can improve their accuracy to better than  $\pm 0.5^\circ\text{C}$  in the range of  $-200$  to 1100°C, and the reproducibility will be better than  $\pm 0.25^\circ\text{C}$ .

After a thermocouple has been used in the field to measure temperature, the reproducibility of the characteristic calibration curve for that thermocouple, previously standardized in the ORNL Standards Laboratory, depends on such factors as the temperatures to which the thermocouple had been exposed, the length of exposure to elevated or depressed temperatures, and the conditions of exposure.<sup>4</sup>

---

<sup>1</sup>H. Shenker *et al.*, "Reference Tables for Thermocouples," *Nat. Bur. Std. (U.S.) Circ. 561*, GPO, Washington, 1955.

<sup>2</sup>"Temperature Electromotive Force (EMF) Tables for Thermocouples, ASTM E 230-63," *Am. Soc. Testing Mater., ASTM Std. 1964*, Pt. 30, pp. 646-704; see Table XIII, p. 700.

<sup>3</sup>"Thermocouples and Thermocouple Extension Wires - Terminology, Limits of Error, and Wire Sizes," *Recommended Practice RP 1.3*, Instrument Society of America, Pittsburgh, Pa., 1959.

<sup>4</sup>"Temperature Electromotive Force (EMF) Tables for Thermocouples, ASTM E 230-63," *Am. Soc. Testing Mater., ASTM Std. 1964*, Pt. 30, pp. 646-704; see Note 3 to Table XIII, p. 700.



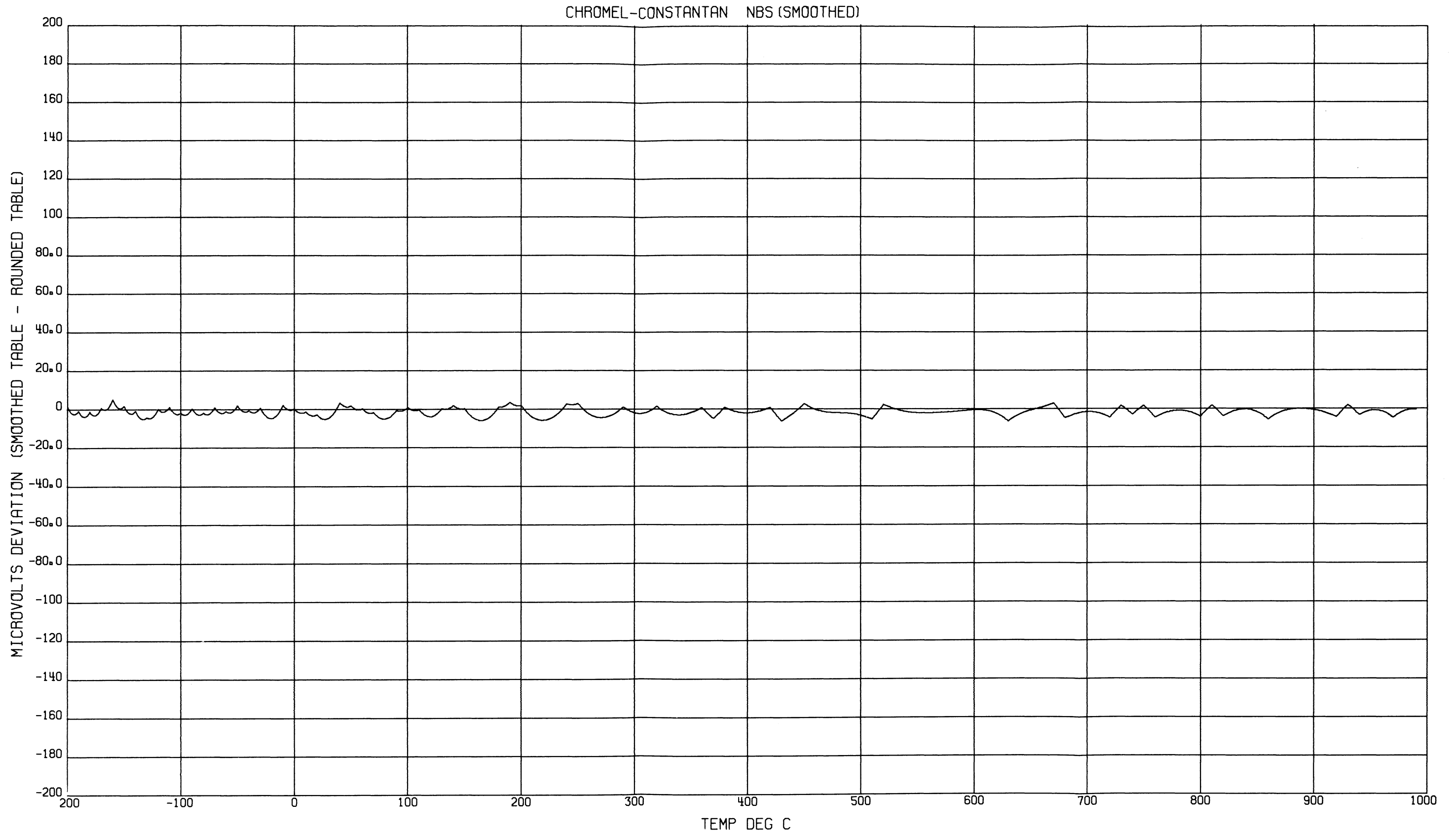


Fig. 1. Deviation of Original Table from Smoothed Table.





CHROMEL-CONSTANTAN NBS(SMOOTHED)  
TABLE NO. 6

TEMP=DEG C (INT.1948)  
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
	MILLIVOLTS									
-200	-8.708360									
-190	-8.451051	-8.477787	-8.504299	-8.530589	-8.556655	-8.582497	-8.608117	-8.633513	-8.658685	-8.683634
-180	-8.171402	-8.200372	-8.229119	-8.257642	-8.285942	-8.314019	-8.341872	-8.369502	-8.396908	-8.424091
-170	-7.869389	-7.900601	-7.931588	-7.962351	-7.992888	-8.023201	-8.053288	-8.083152	-8.112792	-8.142209
-160	-7.544941	-7.578390	-7.611617	-7.644621	-7.677403	-7.709961	-7.742295	-7.774405	-7.806291	-7.837952
-150	-7.198445	-7.234060	-7.269464	-7.304656	-7.339633	-7.374396	-7.408942	-7.443270	-7.477380	-7.511271
-140	-6.831042	-6.868678	-6.906120	-6.943365	-6.980412	-7.017259	-7.053906	-7.090349	-7.126588	-7.162620
-130	-6.444337	-6.483829	-6.523143	-6.562277	-6.601229	-6.639998	-6.678583	-6.716981	-6.755191	-6.793212
-120	-6.039902	-6.081106	-6.122144	-6.163015	-6.203718	-6.244251	-6.284614	-6.324805	-6.364824	-6.404668
-110	-5.618909	-5.661731	-5.704393	-5.746896	-5.789240	-5.831422	-5.873444	-5.915303	-5.957000	-5.998533
-100	-5.182066	-5.226451	-5.270681	-5.314756	-5.358676	-5.402439	-5.446047	-5.489498	-5.532793	-5.575930
-90	-4.729737	-4.775661	-4.821432	-4.867050	-4.912514	-4.957824	-5.002981	-5.047983	-5.092832	-5.137526
-80	-4.262089	-4.309540	-4.356839	-4.403986	-4.450980	-4.497822	-4.544510	-4.591046	-4.637430	-4.683660
-70	-3.779209	-3.828180	-3.877000	-3.925668	-3.974184	-4.022548	-4.070760	-4.118821	-4.166729	-4.214485
-60	-3.281193	-3.331672	-3.382000	-3.432178	-3.482206	-3.532084	-3.581811	-3.631387	-3.680812	-3.730086
-50	-2.768243	-2.820201	-2.872012	-2.923677	-2.975195	-3.026566	-3.077788	-3.128863	-3.179789	-3.230566
-40	-2.240757	-2.294144	-2.347390	-2.400496	-2.453460	-2.506283	-2.558963	-2.611499	-2.663892	-2.716140
-30	-1.699361	-1.754105	-1.808717	-1.863196	-1.917541	-1.971751	-2.025826	-2.079765	-2.133567	-2.187231
-20	-1.144844	-1.200862	-1.256756	-1.312526	-1.368171	-1.423689	-1.479081	-1.534345	-1.589480	-1.644486
-10	-.578086	-.635286	-.692373	-.749344	-.806200	-.862938	-.919559	-.976061	-1.032443	-1.088704
0	0	-.058293	-.116480	-.174562	-.232536	-.290402	-.348160	-.405808	-.463346	-.520772
****										
0	0	.058397	.116898	.175503	.234209	.293017	.351926	.410936	.470045	.529254
10	.588562	.647968	.707472	.767073	.826773	.886569	.946463	1.006453	1.066540	1.126724
20	1.187005	1.247383	1.307858	1.368430	1.429099	1.489866	1.550731	1.611694	1.672755	1.733915
30	1.795174	1.856532	1.917990	1.979549	2.041208	2.102968	2.164829	2.226791	2.288856	2.351022
40	2.413291	2.475663	2.538137	2.600714	2.663394	2.726177	2.789064	2.852052	2.915144	2.978339
50	3.041635	3.105034	3.168534	3.232136	3.295838	3.359640	3.423543	3.487544	3.551643	3.615840
60	3.680133	3.744523	3.809007	3.873585	3.938257	4.003021	4.067875	4.132820	4.197854	4.262976
70	4.328185	4.393480	4.458860	4.524324	4.589870	4.655498	4.721207	4.786997	4.852865	4.918811
80	4.984835	5.050935	5.117111	5.183363	5.249689	5.316089	5.382563	5.449109	5.515729	5.582420
90	5.649184	5.716020	5.782927	5.849906	5.916956	5.984078	6.051271	6.118536	6.185872	6.253281
100	6.320761	6.388314	6.455940	6.523639	6.591411	6.659256	6.727176	6.795170	6.863239	6.931383
110	6.999602	7.067898	7.136269	7.204717	7.273242	7.341844	7.410523	7.479280	7.548114	7.617025
120	7.686015	7.755082	7.824227	7.893449	7.962749	8.032126	8.101580	8.171111	8.240718	8.310401
130	8.380159	8.449993	8.519901	8.589882	8.659937	8.730064	8.800264	8.870534	8.940874	9.011284
140	9.081763	9.152310	9.222923	9.293603	9.364349	9.435159	9.506033	9.576970	9.647969	9.719031
150	9.790153	9.861336	9.932579	10.003881	10.075242	10.146661	10.218139	10.289674	10.361267	10.432917
160	10.504625	10.576389	10.648211	10.720090	10.792026	10.864019	10.936070	11.008179	11.080346	11.152571
170	11.224854	11.297197	11.369598	11.442060	11.514582	11.587164	11.659806	11.732510	11.805276	11.878103
180	11.950992	12.023944	12.096958	12.170035	12.243174	12.316376	12.389641	12.462968	12.536358	12.609810
190	12.683325	12.756900	12.830537	12.904235	12.977993	13.051811	13.125687	13.199622	13.273614	13.347663

CHROMEL-CONSTANTAN NBS(SMOOTHED)  
TABLE NO. 6

TEMP=DEG C (INT.1948)  
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
	MILLIVOLTS									
200	13.421767	13.495927	13.570140	13.644406	13.718724	13.793094	13.867513	13.941981	14.016497	14.091060
210	14.165669	14.240324	14.315022	14.389764	14.464548	14.539375	14.614242	14.689149	14.764097	14.839084
220	14.914109	14.989173	15.064275	15.139415	15.214593	15.289808	15.365060	15.440350	15.515677	15.591042
230	15.666445	15.741885	15.817364	15.892881	15.968437	16.044032	16.119666	16.195340	16.271054	16.346808
240	16.422603	16.498439	16.574317	16.650236	16.726197	16.802200	16.878245	16.954333	17.030462	17.106635
250	17.182849	17.259105	17.335404	17.411744	17.488126	17.564549	17.641012	17.717516	17.794060	17.870643
260	17.947265	18.023926	18.100623	18.177358	18.254129	18.330936	18.407778	18.484654	18.561563	18.638506
270	18.715480	18.792487	18.869524	18.946592	19.023690	19.100817	19.177973	19.255157	19.332369	19.409610
280	19.486877	19.564172	19.641494	19.718843	19.796219	19.873622	19.951051	20.028508	20.105992	20.183503
290	20.261042	20.338608	20.416203	20.493826	20.571477	20.649158	20.726868	20.804607	20.882377	20.960177
300	21.038008	21.115871	21.193765	21.271690	21.349648	21.427638	21.505660	21.583715	21.661804	21.739925
310	21.818079	21.896266	21.974487	22.052740	22.131026	22.209346	22.287697	22.366081	22.444498	22.522946
320	22.601425	22.679935	22.758477	22.837048	22.915649	22.994279	23.072938	23.151626	23.230340	23.309082
330	23.387851	23.466645	23.545465	23.624309	23.703178	23.782070	23.860985	23.939922	24.018882	24.097863
340	24.176864	24.255886	24.334928	24.413989	24.493069	24.572167	24.651283	24.730417	24.809569	24.888737
350	24.967922	25.047124	25.126342	25.205576	25.284825	25.364091	25.443372	25.522668	25.601980	25.681308
360	25.760651	25.840009	25.919383	25.998772	26.078177	26.157597	26.237033	26.316485	26.395953	26.475437
370	26.554937	26.634454	26.713987	26.793536	26.873102	26.952685	27.032285	27.111902	27.191536	27.271188
380	27.350857	27.430544	27.510248	27.589969	27.669709	27.749465	27.829240	27.909032	27.988841	28.068668
390	28.148513	28.228374	28.308253	28.388148	28.468061	28.547989	28.627934	28.707895	28.787872	28.867865
400	28.947872	29.027894	29.107931	29.187982	29.268047	29.348126	29.428217	29.508321	29.588437	29.668566
410	29.748705	29.828856	29.909018	29.989190	30.069373	30.149565	30.229767	30.309978	30.390199	30.470428
420	30.550667	30.630914	30.711169	30.791434	30.871707	30.951988	31.032279	31.112578	31.192887	31.273204
430	31.353532	31.433869	31.514216	31.594573	31.674941	31.755321	31.835712	31.916115	31.996531	32.076959
440	32.157401	32.237857	32.318327	32.398812	32.479312	32.559827	32.640359	32.720907	32.801472	32.882054
450	32.962653	33.043270	33.123905	33.204558	33.285229	33.365919	33.446626	33.527351	33.608095	33.688856
460	33.769634	33.850430	33.931242	34.012070	34.092914	34.173774	34.254647	34.335535	34.416436	34.497348
470	34.578272	34.659207	34.740151	34.821104	34.902064	34.983030	35.064002	35.144979	35.225959	35.306941
480	35.387925	35.468908	35.549891	35.630873	35.711851	35.792826	35.873796	35.954762	36.035721	36.116673
490	36.197618	36.278554	36.359482	36.440402	36.521312	36.602212	36.683102	36.763985	36.844853	36.925713
500	37.006563	37.087403	37.168234	37.249055	37.329867	37.410671	37.491466	37.572254	37.653035	37.733809
510	37.814578	37.895341	37.976100	38.056855	38.137608	38.218358	38.299108	38.379857	38.460606	38.541356
520	38.622108	38.702863	38.783621	38.864383	38.945150	39.025923	39.106701	39.187486	39.268278	39.349077
530	39.429885	39.510700	39.591524	39.672357	39.753198	39.834049	39.914909	39.995778	40.076656	40.157544
540	40.238440	40.319345	40.400259	40.481182	40.562112	40.643051	40.723997	40.804950	40.885910	40.966877
550	41.047849	41.128828	41.209812	41.290801	41.371794	41.452792	41.533793	41.614798	41.695807	41.776818
560	41.857832	41.938848	42.019867	42.100887	42.181909	42.262933	42.343958	42.424985	42.506013	42.587042
570	42.668072	42.749104	42.830136	42.911170	42.992205	43.073241	43.154279	43.235318	43.316358	43.397399
580	43.478442	43.559486	43.640531	43.721578	43.802626	43.883675	43.964726	44.045777	44.126828	44.207881
590	44.288933	44.369985	44.451037	44.532087	44.613136	44.694184	44.775228	44.856270	44.937307	45.018340

9

CHROMEL-CONSTANTAN NBS(SMOOTHED)  
TABLE NO. 6

TEMP=DEG C (INT.1948)  
VOLTAGE=MILLIVOLT ABSOLUTE

TEMP	0	1	2	3	4	5	6	7	8	9
					MILLIVOLTS					
600	45.099368	45.180390	45.261404	45.342411	45.423409	45.504398	45.585376	45.666342	45.747296	45.828236
610	45.909162	45.990072	46.070966	46.151843	46.232702	46.313542	46.394362	46.475162	46.555940	46.636697
620	46.717431	46.798142	46.878829	46.959493	47.040132	47.120747	47.201338	47.281904	47.362445	47.442962
630	47.523455	47.603925	47.684370	47.764793	47.845194	47.925573	48.005930	48.086268	48.166586	48.246886
640	48.327168	48.407434	48.487685	48.567921	48.648144	48.728355	48.808556	48.888747	48.968929	49.049104
650	49.129273	49.209437	49.289598	49.369755	49.449911	49.530066	49.610222	49.690379	49.770537	49.850698
660	49.930863	50.011032	50.091205	50.171382	50.251565	50.331754	50.411948	50.492147	50.572352	50.652563
670	50.732779	50.813000	50.893225	50.973454	51.053687	51.133924	51.214162	51.294402	51.374643	51.454884
680	51.535125	51.615364	51.695600	51.775832	51.856060	51.936283	52.016500	52.096709	52.176909	52.257101
690	52.337282	52.417453	52.497611	52.577757	52.657889	52.738007	52.818111	52.898199	52.978270	53.058325
700	53.138363	53.218384	53.298387	53.378372	53.458339	53.538287	53.618217	53.698129	53.778022	53.857897
710	53.937754	54.017593	54.097415	54.177219	54.257006	54.336777	54.416532	54.496270	54.575994	54.655702
720	54.735397	54.815077	54.894744	54.974399	55.054041	55.133671	55.213290	55.292898	55.372496	55.452084
730	55.531662	55.611232	55.690792	55.770345	55.849889	55.929425	56.008954	56.088475	56.167989	56.247496
740	56.326996	56.406489	56.485975	56.565454	56.644926	56.724391	56.803848	56.883298	56.962741	57.042175
750	57.121602	57.201020	57.280429	57.359830	57.439221	57.518603	57.597974	57.677336	57.756686	57.836026
760	57.915354	57.994671	58.073975	58.153267	58.232546	58.311811	58.391063	58.470300	58.549524	58.628732
770	58.707926	58.787104	58.866266	58.945413	59.024543	59.103656	59.182753	59.261833	59.340896	59.419942
780	59.498970	59.577980	59.656973	59.735948	59.814905	59.893845	59.972766	60.051669	60.130555	60.209422
790	60.288272	60.367103	60.445918	60.524714	60.603493	60.682254	60.760998	60.839725	60.918435	60.997128
800	61.075804	61.154464	61.233107	61.311734	61.390345	61.468939	61.547518	61.626081	61.704628	61.783160
810	61.861676	61.940177	62.018663	62.097134	62.175589	62.254029	62.332454	62.410863	62.489257	62.567636
820	62.645999	62.724346	62.802677	62.880992	62.959291	63.037573	63.115838	63.194086	63.272316	63.350528
830	63.428723	63.506898	63.585055	63.663192	63.741310	63.819407	63.897484	63.975539	64.053574	64.131586
840	64.209576	64.287543	64.365488	64.443409	64.521306	64.599179	64.677028	64.754851	64.832650	64.910424
850	64.988173	65.065896	65.143593	65.221265	65.298911	65.376532	65.454127	65.531696	65.609240	65.686759
860	65.764253	65.841722	65.919166	65.996587	66.073984	66.151358	66.228709	66.306038	66.383345	66.460630
870	66.537896	66.615141	66.692367	66.769574	66.846763	66.923935	67.001090	67.078229	67.155352	67.232460
880	67.309555	67.386635	67.463703	67.540759	67.617803	67.694835	67.771857	67.848869	67.925870	68.002863
890	68.079846	68.156821	68.233787	68.310746	68.387696	68.464639	68.541574	68.618501	68.695421	68.772334
900	68.849239	68.926137	69.003027	69.079909	69.156783	69.233649	69.310507	69.387356	69.464197	69.541028
910	69.617850	69.694663	69.771466	69.848259	69.925042	70.001814	70.078575	70.155324	70.232062	70.308788
920	70.385502	70.462203	70.538890	70.615564	70.692224	70.768870	70.845501	70.922116	70.998715	71.075299
930	71.151866	71.228415	71.304947	71.381460	71.457955	71.534430	71.610886	71.687323	71.763738	71.840132
940	71.916504	71.992853	72.069180	72.145482	72.221760	72.298013	72.374241	72.450442	72.526617	72.602765
950	72.678885	72.754978	72.831042	72.907077	72.983084	73.059061	73.135009	73.210927	73.286816	73.362674
960	73.438502	73.514300	73.590068	73.665806	73.741513	73.817189	73.892833	73.968447	74.044031	74.119585
970	74.195110	74.270605	74.346070	74.421505	74.496911	74.572287	74.647633	74.722949	74.798235	74.873492
980	74.948719	75.023916	75.099084	75.174221	75.249329	75.324407	75.399455	75.474474	75.549463	75.624422
990	75.699351									

TABLE 6A  
CHROMEL-CONSTANTAN NBS(SMOOTHED)

TEMP	MV	DIFFERENCE ORDER					
		0 TH	1 ST	2 ND	3 RD	4 TH	5 TH
-200	-8.708360	-8708360					
-199	-8.683634	-8683634	24726	223			
-198	-8.658685	-8658685	24949	223	0		
-197	-8.633513	-8633513	25172	224	1	1	2
-196	-8.608117	-8608117	25396	224	0	1	1
-195	-8.582497	-8582497	25620	222	2	4	6
-194	-8.556655	-8556655	25842	224	2	2	6
-193	-8.530589	-8530589	26066	224	0	2	0
-192	-8.504299	-8504299	26290	222	2	4	6
-191	-8.477787	-8477787	26512	224	2	2	6
-190	-8.451051	-8451051	26736	224	0	1	1
-189	-8.424091	-8424091	26960	223	1	1	2
-188	-8.396908	-8396908	27183	223	0	1	0
-187	-8.369502	-8369502	27406	224	1	2	3
-186	-8.341872	-8341872	27630	223	1	2	4
-185	-8.314019	-8314019	27853	224	1	2	4
-184	-8.285942	-8285942	28077	223	1	1	3
-183	-8.257642	-8257642	28300	223	0	1	0
-182	-8.229119	-8229119	28523	224	1	2	3
-181	-8.200372	-8200372	28747	223	1	1	3
-180	-8.171402	-8171402	28970	223	0	1	0
-179	-8.142209	-8142209	29193	224	1	2	3
-178	-8.112792	-8112792	29417	223	1	2	4
-177	-8.083152	-8083152	29640	224	1	2	4
-176	-8.053288	-8053288	29864	223	1	4	6
-175	-8.023201	-8023201	30087	224	3	5	9
-174	-7.992888	-7992888	30313	224	2	4	9
-173	-7.962351	-7962351	30537	224	2	4	8
-172	-7.931588	-7931588	30763	224	2	3	7
-171	-7.900601	-7900601	30987	223	1	3	4
-170	-7.869389	-7869389	31212	223	0	1	0
-169	-7.837952	-7837952	31437	224	1	2	3
-168	-7.806291	-7806291	31661	223	1	2	4
-167	-7.774405	-7774405	31886	224	1	1	3
-166	-7.742295	-7742295	32110	224	0	0	1
-165	-7.709961	-7709961	32334	224	0	0	0
-164	-7.677403	-7677403	32558	224	0	0	2
			32782	224	2	2	5

-163	-7.644621	-7644621	222	3		
-162	-7.611617	-7611617	33004	223	1	-5
-161	-7.578390	-7578390	33227	222	-1	2
-160	-7.544941	-7544941	33449	222	1	1
-159	-7.511271	-7511271	33670	221	0	-3
-158	-7.477380	-7477380	33891	221	-2	3
-157	-7.443270	-7443270	34110	219	1	0
-156	-7.408942	-7408942	34328	218	0	-2
-155	-7.374396	-7374396	34546	218	1	-1
-154	-7.339633	-7339633	34763	217	-3	6
-153	-7.304656	-7304656	34977	214	1	-8
-152	-7.269464	-7269464	35192	215	-3	6
-151	-7.234060	-7234060	35404	212	1	-2
-150	-7.198445	-7198445	35615	211	1	-2
-149	-7.162620	-7162620	35825	210	-3	5
-148	-7.126588	-7126588	36032	207	0	-6
-147	-7.090349	-7090349	36239	207	-3	6
-146	-7.053906	-7053906	36443	204	0	-7
-145	-7.017259	-7017259	36647	204	-4	8
-144	-6.980412	-6980412	36847	200	0	-6
-143	-6.943365	-6943365	37047	198	-2	3
-142	-6.906120	-6906120	37245	198	1	-3
-141	-6.868678	-6868678	37442	197	-3	5
-140	-6.831042	-6831042	37636	194	0	-6
-139	-6.793212	-6793212	37830	194	-3	4
-138	-6.755191	-6755191	38021	191	-2	0
-137	-6.716981	-6716981	38210	189	1	-1
-136	-6.678583	-6678583	38398	188	-1	-2
-135	-6.639998	-6639998	38585	187	-3	4
-134	-6.601229	-6601229	38769	184	1	-2
-133	-6.562277	-6562277	38952	183	-1	-1
-132	-6.523143	-6523143	39134	182	-2	1
-131	-6.483829	-6483829	39314	180	-2	1
-130	-6.444337	-6444337	39492	178	1	-2
-129	-6.404668	-6404668	39669	177	-2	3
-128	-6.364824	-6364824	39844	175	0	-5
-127	-6.324805	-6324805	40019	175	-3	6
-126	-6.284614	-6284614	40191	172	0	-5
-125	-6.244251	-6244251	40363	172	-2	4
-124	-6.203718	-6203718	40533	170	0	-4
-123	-6.163015	-6163015	40703	170	-2	3
			40871	168	1	-1



-122	-6.122144	-6122144		167		0	0
-121	-6.081106	-6081106	41038	166	=1	0	0
-120	-6.039902	-6039902	41204	165	=1	0	0
-119	-5.998533	-5998533	41369	164	=1	0	1
-118	-5.957000	-5957000	41533	164	=0	1	=3
-117	-5.915303	-5915303	41697	162	=2	=2	5
-116	-5.873444	-5873444	41859	163	=1	3	=7
-115	-5.831422	-5831422	42022	160	=3	=4	9
-114	-5.789240	-5789240	42182	162	=2	5	=10
-113	-5.746896	-5746896	42344	162	=3	=5	8
-112	-5.704393	-5704393	42503	159	=0	3	=2
-111	-5.661731	-5661731	42662	159	=1	1	=5
-110	-5.618909	-5618909	42822	160	=3	=4	8
-109	-5.575930	-5575930	42979	157	=1	4	=5
-108	-5.532793	-5532793	43137	158	=0	=1	=1
-107	-5.489498	-5489498	43295	158	=2	=2	5
-106	-5.446047	-5446047	43451	156	=1	3	=6
-105	-5.402439	-5402439	43608	157	=2	=3	7
-104	-5.358676	-5358676	43763	155	=2	4	=8
-103	-5.314756	-5314756	43920	157	=2	=4	6
-102	-5.270681	-5270681	44075	155	=0	2	=2
-101	-5.226451	-5226451	44230	155	=0	0	0
-100	-5.182066	-5182066	44385	155	=0	0	=1
-99	-5.137526	-5137526	44540	155	=1	=1	5
-98	-5.092832	-5092832	44694	154	=1	2	=5
-97	-5.047983	-5047983	44849	155	=2	=3	7
-96	-5.002981	-5002981	45002	153	=2	4	=8
-95	-4.957824	-4957824	45157	155	=2	=4	7
-94	-4.912514	-4912514	45310	153	=1	3	=4
-93	-4.867050	-4867050	45464	154	=0	=1	0
-92	-4.821432	-4821432	45618	154	=0	=1	2
-91	-4.775661	-4775661	45771	153	=1	1	=1
-90	-4.729737	-4729737	45924	153	=0	0	0
-89	-4.683660	-4683660	46077	153	=0	0	1
-88	-4.637430	-4637430	46230	153	=1	1	=4
-87	-4.591046	-4591046	46384	154	=2	=3	5
-86	-4.544510	-4544510	46536	152	=0	2	0
-85	-4.497822	-4497822	46688	152	=2	2	=6
-84	-4.450980	-4450980	46842	154	=2	=4	7
-83	-4.403986	-4403986	46994	152	=1	3	=5
-82	-4.356839	-4356839	47147	153	=1	=2	3
			47299	152	=0	1	0

-81	-4,309540	-4309540		152		1	
-80	-4,262089	-4262089	47451	153		-2	*3
-79	-4,214485	-4214485	47604	152	*1	1	3
-78	-4,166729	-4166729	47756	152	0	1	0
-77	-4,118821	-4118821	47908	153			*4
-76	-4,070760	-4070760	48061	151	*2	3	6
-75	-4,022548	-4022548	48212	152	1	*1	*4
-74	-3,974184	-3974184	48364	152	0	0	1
-73	-3,925668	-3925668	48516	152	0	0	0
-72	-3,877000	-3877000	48668	152	0	*1	*1
-71	-3,828180	-3828180	48820	151	*1	2	3
-70	-3,779209	-3779209	48971	152	1	-2	*4
-69	-3,730086	-3730086	49123	151	*1	1	3
-68	-3,680812	-3680812	49274	151	0	0	*1
-67	-3,631387	-3631387	49425	151	0	0	0
-66	-3,581811	-3581811	49576	151	0	0	0
-65	-3,532084	-3532084	49727	151	0	*1	*1
-64	-3,482206	-3482206	49878	150	*1	1	2
-63	-3,432178	-3432178	50028	150	0	0	*1
-62	-3,382000	-3382000	50178	150	0	1	1
-61	-3,331672	-3331672	50328	151	1	*4	*5
-60	-3,281193	-3281193	50479	148	*3	5	9
-59	-3,230566	-3230566	50627	150	2	*3	*8
-58	-3,179789	-3179789	50777	149	*1	1	4
-57	-3,128863	-3128863	50926	149	0	-2	*3
-56	-3,077788	-3077788	51075	147	*2	4	6
-55	-3,026566	-3026566	51222	149	2	*4	*8
-54	-2,975195	-2975195	51371	147	*2	2	6
-53	-2,923677	-2923677	51518	147	0	1	*3
-52	-2,872012	-2872012	51665	146	*1	2	3
-51	-2,820201	-2820201	51811	147	1	*3	*5
-50	-2,768243	-2768243	51958	145	*2	2	5
-49	-2,716140	-2716140	52103	145	0	0	*2
-48	-2,663892	-2663892	52248	145	0	*2	*2
-47	-2,611499	-2611499	52393	143	*2	3	5
-46	-2,558963	-2558963	52536	144	1	*2	*5
-45	-2,506283	-2506283	52680	143	*1	*1	1
-44	-2,453460	-2453460	52823	141	*2	3	4
-43	-2,400496	-2400496	52964	141	1	*3	*6
-42	-2,347390	-2347390	53106	142	*2	3	6
-41	-2,294144	-2294144	53246	141	1	*3	*6
			53387	141	*2		4

-40	-2.240757	-2240757	53926	139	1	0
-39	-2.187231	-2187231	53664	138	1	-2
-38	-2.133567	-2133567	53802	138	1	1
-37	-2.079765	-2079765	53939	137	0	0
-36	-2.025826	-2025826	54075	136	0	1
-35	-1.971751	-1971751	54210	135	1	-2
-34	-1.917541	-1917541	54345	135	1	1
-33	-1.863196	-1863196	54479	134	0	0
-32	-1.808717	-1808717	54612	133	0	0
-31	-1.754105	-1754105	54744	132	0	1
-30	-1.699361	-1699361	54875	131	1	-3
-29	-1.644486	-1644486	55006	131	2	4
-28	-1.589480	-1589480	55135	129	2	-3
-27	-1.534345	-1534345	55264	129	1	0
-26	-1.479081	-1479081	55392	128	1	4
-25	-1.423689	-1423689	55518	126	3	-6
-24	-1.368171	-1368171	55645	127	-3	4
-23	-1.312526	-1312526	55770	125	1	0
-22	-1.256756	-1256756	55894	124	1	-3
-21	-1.200862	-1200862	56018	124	2	3
-20	-1.144844	-1144844	56140	122	1	0
-19	-1.088704	-1088704	56261	121	1	-2
-18	-1.032443	-1032443	56382	121	1	1
-17	-0.976061	-976061	56502	120	0	-1
-16	-0.919559	-919559	56621	119	1	4
-15	-0.862938	-862938	56738	117	3	-7
-14	-0.806200	-806200	56856	118	4	8
-13	-0.749344	-749344	56971	115	4	-8
-12	-0.692373	-692373	57087	116	4	8
-11	-0.635286	-635286	57200	113	4	-7
-10	-0.578086	-578086	57314	114	-3	5
-9	-0.520772	-520772	57426	112	2	-4
-8	-0.463346	-463346	57538	112	2	4
-7	-0.405808	-405808	57648	110	2	-4
-6	-0.348160	-348160	57758	110	2	4
-5	-0.290402	-290402	57866	108	2	-2
-4	-0.232536	-232536	57974	108	0	-3
-3	-0.174562	-174562	58082	108	-3	7
-2	-0.116480	-116480	58187	105	4	-7
-1	-0.058293	-58293	58293	106	-3	5
0	0	0	58397	104	2	-2

1	.058397	58397	58501	104	0	0	-3
2	.116898	116898	58605	104	-3	-3	7
3	.175503	175503	58706	101	1	4	-6
4	.234209	234209	58808	102	-1	-2	-3
5	.293017	293017	58909	101	0	1	-3
6	.351926	351926	59010	101	-2	-2	5
7	.410936	410936	59109	99	1	3	-5
8	.470045	470045	59209	100	-1	-2	2
9	.529254	529254	59308	99	-1	0	1
10	.588562	588562	59406	98	0	1	-2
11	.647968	647968	59504	98	-1	-1	4
12	.707472	707472	59601	97	2	3	-8
13	.767073	767073	59700	99	-3	-5	10
14	.826773	826773	59796	96	2	5	-9
15	.886569	886569	59894	98	-2	-4	7
16	.946463	946463	59990	96	1	3	-4
17	1.006453	1006453	60087	97	0	-1	1
18	1.066540	1066540	60184	97	0	0	0
19	1.126724	1126724	60281	97	0	0	0
20	1.187005	1187005	60378	97	0	0	0
21	1.247383	1247383	60475	97	0	0	0
22	1.307858	1307858	60572	97	0	0	1
23	1.368430	1368430	60669	97	1	1	-2
24	1.429099	1429099	60767	98	0	-1	1
25	1.489866	1489866	60865	98	0	0	0
26	1.550731	1550731	60963	98	0	0	1
27	1.611694	1611694	61061	98	1	1	-2
28	1.672755	1672755	61160	99	0	-1	1
29	1.733915	1733915	61259	99	0	0	1
30	1.795174	1795174	61358	99	1	1	-1
31	1.856532	1856532	61458	100	1	0	-2
32	1.917990	1917990	61559	101	-1	-2	4
33	1.979549	1979549	61659	100	1	2	-3
34	2.041208	2041208	61760	101	0	-1	1
35	2.102968	2102968	61861	101	0	0	2
36	2.164829	2164829	61962	101	2	2	-6
37	2.226791	2226791	62065	103	-2	-4	8
38	2.288856	2288856	62166	101	2	4	-6
39	2.351022	2351022	62269	103	0	-2	1
40	2.413291	2413291	62372	103	-1	-1	3
41	2.475663	2475663	62474	102	1	2	-3

42	2.538137	2538137	62577	103	0	=1	1
43	2.600714	2600714	62680	103	0	0	1
44	2.663394	2663394	62783	103	1	1	=5
45	2.726177	2726177	62887	104	=3	=4	10
46	2.789064	2789064	62988	101	3	6	=10
47	2.852052	2852052	63092	104	=1	=4	5
48	2.915144	2915144	63195	103	=2	=1	5
49	2.978339	2978339	63296	101	2	4	=8
50	3.041635	3041635	63399	103	=2	=4	7
51	3.105034	3105034	63500	101	1	3	=6
52	3.168534	3168534	63602	102	=2	=3	5
53	3.232136	3232136	63702	100	0	2	=1
54	3.295838	3295838	63802	100	1	1	=5
55	3.359640	3359640	63903	101	=3	=4	7
56	3.423543	3423543	64001	98	0	3	=3
57	3.487544	3487544	64099	98	0	0	=2
58	3.551643	3551643	64197	98	=2	=2	5
59	3.615840	3615840	64293	96	1	3	=7
60	3.680133	3680133	64390	97	=3	=4	7
61	3.744523	3744523	64484	94	0	3	=3
62	3.809007	3809007	64578	94	0	0	=2
63	3.873585	3873585	64672	94	=2	=2	2
64	3.938257	3938257	64764	92	=2	0	3
65	4.003021	4003021	64854	90	1	3	=6
66	4.067875	4067875	64945	91	=2	=3	4
67	4.132820	4132820	65034	89	=1	1	=1
68	4.197854	4197854	65122	88	=1	0	0
69	4.262976	4262976	65209	87	=1	0	0
70	4.328185	4328185	65295	86	=1	0	0
71	4.393480	4393480	65380	85	=1	0	=1
72	4.458860	4458860	65464	84	=2	=1	3
73	4.524324	4524324	65546	82	0	2	=3
74	4.589870	4589870	65628	82	=1	=1	2
75	4.655498	4655498	65709	81	0	1	=4
76	4.721207	4721207	65790	81	=3	=3	6
77	4.786997	4786997	65868	78	0	3	=5
78	4.852865	4852865	65946	78	0	0	=2
79	4.918811	4918811	66024	78	=2	=2	4
80	4.984835	4984835	66100	76	0	0	=2
81	5.050935	5050935	66176	76	0	0	=2
82	5.117111	5117111	66252	76	=2	=2	4



83	5.183363	5183363		74		2	
84	5.249689	5249689	66326	74	0	0	-2
85	5.316089	5316089	66400	74	0	0	-2
86	5.382563	5382563	66474	72	-2	4	6
87	5.449109	5449109	66546	74	2	-5	-9
88	5.515729	5515729	66620	71	-3	5	10
89	5.582420	5582420	66691	73	2	-3	-8
90	5.649184	5649184	66764	72	-1	0	3
91	5.716020	5716020	66836	71	-1	2	2
92	5.782927	5782927	66907	72	1	-2	-4
93	5.849906	5849906	66979	71	-1	2	4
94	5.916956	5916956	67050	72	1	-2	-4
95	5.984078	5984078	67122	71	-1	2	4
96	6.051271	6051271	67193	72	1	-2	-4
97	6.118536	6118536	67265	71	-1	3	5
98	6.185872	6185872	67336	73	2	-4	-7
99	6.253281	6253281	67409	71	-2	4	6
100	6.320761	6320761	67480	73	2	-2	2
101	6.388314	6388314	67553	73	0	0	0
102	6.455940	6455940	67626	73	0	0	0
103	6.523639	6523639	67699	73	0	0	0
104	6.591411	6591411	67772	73	0	2	2
105	6.659256	6659256	67845	75	2	-3	-5
106	6.727176	6727176	67920	74	-1	2	5
107	6.795170	6795170	67994	75	1	0	-3
108	6.863239	6863239	68069	75	0	0	1
109	6.931383	6931383	68144	75	0	2	2
110	6.999602	6999602	68219	77	2	-4	-6
111	7.067898	7067898	68296	75	-2	4	8
112	7.136269	7136269	68371	77	2	-2	-6
113	7.204717	7204717	68448	77	0	0	2
114	7.273242	7273242	68525	77	0	0	0
115	7.341844	7341844	68602	77	0	0	1
116	7.410523	7410523	68679	78	1	-2	-3
117	7.479280	7479280	68757	77	-1	1	3
118	7.548114	7548114	68834	77	0	1	1
119	7.617025	7617025	68911	79	2	-4	-6
120	7.686015	7686015	68990	77	-2	3	7
121	7.755082	7755082	69067	78	1	-2	-5
122	7.824227	7824227	69145	77	-1	2	4
123	7.893449	7893449	69222	78	1	-2	-4
			69300		-1	2	3

124	7.962749	7962749	69377	77		1	
125	8.032126	8032126	69454	77	0	0	=1
126	8.101580	8101580	69531	77	0	=1	=1
127	8.171111	8171111	69607	76	=1	1	2
128	8.240718	8240718	69683	76	0	=1	=2
129	8.310401	8310401	69758	75	=1	2	3
130	8.380159	8380159	69834	76	1	=3	=5
131	8.449993	8449993	69908	74	=2	1	4
132	8.519901	8519901	69981	73	=1	2	1
133	8.589882	8589882	70055	74	1	=3	=5
134	8.659937	8659937	70127	72	=2	3	6
135	8.730064	8730064	70200	73	1	=4	=7
136	8.800264	8800264	70270	70	=3	3	7
137	8.870534	8870534	70340	70	0	0	=3
138	8.940874	8940874	70410	70	0	=1	=1
139	9.011284	9011284	70479	69	=1	0	1
140	9.081763	9081763	70547	68	=1	=1	=1
141	9.152310	9152310	70613	68	=2	3	4
142	9.222923	9222923	70680	66	1	=2	=5
143	9.293603	9293603	70746	67	=1	=1	1
144	9.364349	9364349	70810	66	=2	=1	3
145	9.435159	9435159	70874	64	0	2	=3
146	9.506033	9506033	70937	64	=1	=1	1
147	9.576970	9576970	70999	63	=1	0	2
148	9.647969	9647969	71062	62	1	2	=6
149	9.719031	9719031	71122	63	=3	=4	8
150	9.790153	9790153	71183	60	1	4	=6
151	9.861336	9861336	71243	61	=1	=2	2
152	9.932579	9932579	71302	60	=1	0	1
153	10.003881	10003881	71361	59	0	1	=2
154	10.075242	10075242	71419	59	=1	=1	3
155	10.146661	10146661	71478	58	1	2	=5
156	10.218139	10218139	71535	59	=2	=3	6
157	10.289674	10289674	71593	57	1	3	=5
158	10.361267	10361267	71650	58	=1	=2	4
159	10.432917	10432917	71708	57	1	2	=5
160	10.504625	10504625	71764	58	=2	=3	7
161	10.576389	10576389	71822	56	2	4	=7
162	10.648211	10648211	71879	58	=1	=3	4
163	10.720090	10720090	71936	57	=1	=2	4
164	10.792026	10792026	71993	57	0	1	=1
					0	0	1
					1	1	=2

165	10.864019	10864019		58		=1	
166	10.936070	10936070	72051	58	0	0	1
167	11.008179	11008179	72109	58	0	0	0
168	11.080346	11080346	72167	58	0	0	0
169	11.152571	11152571	72225	58	0	2	2
170	11.224854	11224854	72283	60	2	=4	=6
171	11.297197	11297197	72343	58	=2	5	9
172	11.369598	11369598	72401	61	3	=4	=9
173	11.442060	11442060	72462	60	=1	1	5
174	11.514582	11514582	72522	60	0	0	=1
175	11.587164	11587164	72582	60	0	0	2
176	11.659806	11659806	72642	62	2	2	=4
177	11.732510	11732510	72704	62	0	-2	1
178	11.805276	11805276	72766	62	=1	=1	3
179	11.878103	11878103	72827	61	1	2	=2
180	11.950992	11950992	72889	62	1	0	=2
181	12.023944	12023944	72952	63	=1	=2	4
182	12.096958	12096958	73014	62	1	2	=4
183	12.170035	12170035	73077	63	=1	=2	4
184	12.243174	12243174	73139	62	1	2	=3
185	12.316376	12316376	73202	63	0	-1	0
186	12.389641	12389641	73265	63	=1	-1	3
187	12.462968	12462968	73327	62	1	2	=4
188	12.536358	12536358	73390	63	=1	-2	4
189	12.609810	12609810	73452	62	=1	2	=6
190	12.683325	12683325	73515	63	=3	=4	9
191	12.756900	12756900	73575	60	2	5	=8
192	12.830537	12830537	73637	62	2	-3	=8
193	12.904235	12904235	73698	61	=1	0	3
194	12.977993	12977993	73698	60	=1	0	1
195	13.051811	13051811	73758	60	0	1	-3
196	13.125687	13125687	73818	60	=2	-2	5
197	13.199622	13199622	73876	58	1	3	=6
198	13.273614	13273614	73935	59	=2	-3	5
199	13.347663	13347663	73992	57	=2	2	5
200	13.421767	13421767	73992	57	0	2	=4
201	13.495927	13495927	74049	57	=2	=2	5
202	13.570140	13570140	74104	55	=2	3	5
203	13.644406	13644406	74160	56	1	3	=7
204	13.718724	13718724	74213	53	=3	-4	7
205	13.793094	13793094	74266	53	0	3	7
			74318	53	0	=1	=4
			74370	52	=1	1	2
			74419	52	0	1	=4
				52	0	=3	6
				49	=3	3	6
					0	0	=4

206	13.867513	13867513		49		=1	
207	13.941981	13941981	74468	48		0	
208	14.016497	14016497	74516	47		0	0
209	14.091060	14091060	74563	46			1
210	14.165669	14165669	74609	46	0	=3	=4
211	14.240324	14240324	74655	43	=3	4	7
212	14.315022	14315022	74698	44		=3	=7
213	14.389764	14389764	74742	42	=2	3	6
214	14.464548	14464548	74784	43		=4	=7
215	14.539375	14539375	74827	40	=3	3	7
216	14.614242	14614242	74867	40	0		=2
217	14.689149	14689149	74907	41		=3	=4
218	14.764097	14764097	74948	39	=2		4
219	14.839084	14839084	74987	38		2	
220	14.914109	14914109	75025	39		=2	=4
221	14.989173	14989173	75064	38			3
222	15.064275	15064275	75102	38	0	0	=1
223	15.139415	15139415	75140	38	0		=1
224	15.214593	15214593	75178	37			2
225	15.289808	15289808	75215	37	0		0
226	15.365060	15365060	75252	38		=2	=3
227	15.440350	15440350	75290	37	=1	2	4
228	15.515677	15515677	75327	38		=1	=3
229	15.591042	15591042	75365	38	0		0
230	15.666445	15666445	75403	37		3	4
231	15.741885	15741885	75440	39	2	=3	=6
232	15.817364	15817364	75479	38		2	5
233	15.892881	15892881	75517	39		=1	=3
234	15.968437	15968437	75556	39	0	0	
235	16.044032	16044032	75595	39	0		
236	16.119666	16119666	75634	40		=1	=2
237	16.195340	16195340	75674	40	0		
238	16.271054	16271054	75714	40	0		
239	16.346808	16346808	75754	41		=1	=2
240	16.422603	16422603	75795	41	0		2
241	16.498439	16498439	75836	42			=3
242	16.574317	16574317	75878	41		=2	4
243	16.650236	16650236	75919	42		=1	=3
244	16.726197	16726197	75961	42	0	0	
245	16.802200	16802200	76003	42	0		
246	16.878245	16878245	76045	42		=3	=4

247	16,954333	16954333	76088	-2	5	8
248	17,030462	17030462	76129	3	-6	-11
249	17,106635	17106635	76173	-3	4	-8
250	17,182849	17182849	76214		0	-4
251	17,259105	17259105	76256		-3	-3
252	17,335404	17335404	76299	-2	3	-6
253	17,411744	17411744	76340		-2	-5
254	17,488126	17488126	76382	=1	0	2
255	17,564549	17564549	76423	=1	2	2
256	17,641012	17641012	76463		-2	-4
257	17,717516	17717516	76504	=1	0	2
258	17,794060	17794060	76544	=1		
259	17,870643	17870643	76583	0	0	-1
260	17,947265	17947265	76622	0	-3	-3
261	18,023926	18023926	76661	-3	5	8
262	18,100623	18100623	76697	2	-4	-9
263	18,177358	18177358	76735	-2	2	-6
264	18,254129	18254129	76771	0	-1	-3
265	18,330936	18330936	76807	=1	0	
266	18,407778	18407778	76842	=1	0	0
267	18,484654	18484654	76876	=1	2	2
268	18,561563	18561563	76909		-4	-6
269	18,638506	18638506	76943	-3	5	-9
270	18,715480	18715480	76974	2	-5	-10
271	18,792487	18792487	77007	-3	4	9
272	18,869524	18869524	77037		-2	-6
273	18,946592	18946592	77068	=1	0	2
274	19,023690	19023690	77098	=1		
275	19,100817	19100817	77127	0	-1	-2
276	19,177973	19177973	77156	=1		2
277	19,255157	19255157	77184	0		0
278	19,332369	19332369	77212		-4	-5
279	19,409610	19409610	77241	-3	5	9
280	19,486877	19486877	77267	2	-3	-8
281	19,564172	19564172	77295	=1		4
282	19,641494	19641494	77322	0		-1
283	19,718843	19718843	77349	0	0	0
284	19,796219	19796219	77376	0	-1	-1
285	19,873622	19873622	77403	=1	3	4
286	19,951051	19951051	77429	2	-3	-6
287	20,028508	20028508	77457	=1		4



288	20.105992	20105992	77484	27	0	1	0
289	20.183503	20183503	77511	28	1	-2	-3
290	20.261042	20261042	77539	27	-1	3	5
291	20.338608	20338608	77566	29	2	-3	-6
292	20.416203	20416203	77595	28	-1	1	4
293	20.493826	20493826	77623	28	0	2	1
294	20.571477	20571477	77651	30	2	-3	-5
295	20.649158	20649158	77681	29	-1	1	4
296	20.726868	20726868	77710	29	0	2	1
297	20.804607	20804607	77739	31	2	-3	-5
298	20.882377	20882377	77770	30	-1	2	5
299	20.960177	20960177	77800	31	1	0	-2
300	21.038008	21038008	77831	32	1	-2	-2
301	21.115871	21115871	77863	31	-1	1	3
302	21.193765	21193765	77894	31	0	2	1
303	21.271690	21271690	77925	33	2	-3	-5
304	21.349648	21349648	77958	32	-1	1	4
305	21.427638	21427638	77990	32	0	1	0
306	21.505660	21505660	78022	33	1	0	-1
307	21.583715	21583715	78055	34	1	-3	-3
308	21.661804	21661804	78089	32	-2	3	6
309	21.739925	21739925	78121	33	1	-1	-4
310	21.818079	21818079	78154	33	0	1	2
311	21.896266	21896266	78187	34	1	-3	-4
312	21.974487	21974487	78221	32	-2	3	6
313	22.052740	22052740	78253	33	1	0	-3
314	22.131026	22131026	78286	34	1	-4	-4
315	22.209346	22209346	78320	31	-3	5	9
316	22.287697	22287697	78351	33	2	-2	-7
317	22.366081	22366081	78384	33	0	-2	0
318	22.444498	22444498	78417	31	-2	2	4
319	22.522946	22522946	78448	31	0	0	-2
320	22.601425	22601425	78479	31	0	1	1
321	22.679935	22679935	78510	32	1	-4	-5
322	22.758477	22758477	78542	29	-3	4	8
323	22.837048	22837048	78571	30	1	-2	-6
324	22.915649	22915649	78601	29	-1	1	3
325	22.994279	22994279	78630	29	0	0	-1
326	23.072938	23072938	78659	29	0	-3	-3
327	23.151626	23151626	78688	26	-3	5	8
328	23.230340	23230340	78714	28	2	-3	-8

329	23,309082	23309082	78742	27	*1	-1	2
330	23,387851	23387851	78769	25	*2	3	4
331	23,466645	23466645	78794	26		*3	*6
332	23,545465	23545465	78820	24	*2	3	6
333	23,624309	23624309	78844	25		*3	*6
334	23,703178	23703178	78869	25	*2		5
335	23,782070	23782070	78892	23	0	2	*3
336	23,860985	23860985	78915	22	*1	*1	3
337	23,939922	23939922	78937	22		2	*5
338	24,018882	24018882	78960	23	*2	*3	4
339	24,097863	24097863	78981	21	*1	1	1
340	24,176864	24176864	79001	20		2	*4
341	24,255886	24255886	79022	21	*1	*2	2
342	24,334928	24334928	79042	20	*1	0	1
343	24,413989	24413989	79061	19	0	1	*2
344	24,493069	24493069	79080	19	*1	*1	2
345	24,572167	24572167	79098	18	0	0	*1
346	24,651283	24651283	79116	18	0	0	0
347	24,730417	24730417	79134	18	0	*2	*2
348	24,809569	24809569	79152	16	*2	3	5
349	24,888737	24888737	79168	17			*4
350	24,967922	24967922	79185	17	0	*1	0
351	25,047124	25047124	79202	16	*1	1	2
352	25,126342	25126342	79218	16	0	*1	*2
353	25,205576	25205576	79234	16	*1	-1	4
354	25,284825	25284825	79249	15	2	3	*7
355	25,364091	25364091	79266	17	*2	*4	6
356	25,443372	25443372	79281	15	0	2	*1
357	25,522668	25522668	79296	15		1	*2
358	25,601980	25601980	79312	16	0	*1	0
359	25,681308	25681308	79328	16	*1	-1	2
360	25,760651	25760651	79343	15	0	1	0
361	25,840009	25840009	79358	15		1	*3
362	25,919383	25919383	79374	16	*1	*2	4
363	25,998772	25998772	79389	15		2	*4
364	26,078177	26078177	79405	16	*1	*2	4
365	26,157597	26157597	79420	15		2	*3
366	26,237033	26237033	79436	16	0	*1	1
367	26,316485	26316485	79452	16	0	0	0
368	26,395953	26395953	79468	16	0	0	0
369	26,475437	26475437	79484	16	0	0	1
			79500	16		1	*3

370	26.554937	26554937	79517	17	=1	=2	3
371	26.634454	26634454	79533	16	0	1	0
372	26.713987	26713987	79549	16	1	1	=2
373	26.793536	26793536	79566	17	0	=1	1
374	26.873102	26873102	79583	17	0	0	0
375	26.952685	26952685	79600	17	0	0	0
376	27.032285	27032285	79617	17	0	0	1
377	27.111902	27111902	79634	17	1	1	=3
378	27.191536	27191536	79652	18	=1	=2	4
379	27.271188	27271188	79669	17	1	2	=4
380	27.350857	27350857	79687	18	1	=2	3
381	27.430544	27430544	79704	17	0	1	1
382	27.510248	27510248	79721	17	2	2	=7
383	27.589969	27589969	79748	19	=3	=5	11
384	27.669709	27669709	79756	16	3	6	=11
385	27.749465	27749465	79775	19	=2	=5	7
386	27.829240	27829240	79792	17	0	2	=1
387	27.909032	27909032	79809	17	1	1	=2
388	27.988841	27988841	79827	18	0	=1	=1
389	28.068668	28068668	79845	18	=2	=2	6
390	28.148513	28148513	79861	16	2	4	=8
391	28.228374	28228374	79879	18	=2	=4	8
392	28.308253	28308253	79895	16	2	4	=9
393	28.388148	28388148	79913	18	=3	=5	10
394	28.468061	28468061	79928	15	2	5	=8
395	28.547989	28547989	79945	17	=1	=3	4
396	28.627934	28627934	79961	16	0	1	=1
397	28.707895	28707895	79977	16	0	0	=2
398	28.787872	28787872	79993	16	=2	=2	5
399	28.867865	28867865	80007	14	1	3	=4
400	28.947872	28947872	80022	15	0	=1	0
401	29.027894	29027894	80037	15	=1	=1	2
402	29.107931	29107931	80051	14	0	1	=1
403	29.187982	29187982	80065	14	0	0	=2
404	29.268047	29268047	80079	14	=2	=2	5
405	29.348126	29348126	80091	12	1	3	=5
406	29.428217	29428217	80104	13	=1	=2	4
407	29.508321	29508321	80116	12	1	2	=6
408	29.588437	29588437	80129	13	=3	=4	9
409	29.668566	29668566	80139	10	2	5	=8
410	29.748705	29748705	80151	12	=1	=3	3

411	29.828856	29828856		11		0	
412	29.909018	29909018	80162	10	-1	2	2
413	29.989190	29989190	80172	11		-3	-5
414	30.069373	30069373	80183	9	-2	3	6
415	30.149565	30149565	80192	10		-2	-5
416	30.229767	30229767	80202	9	-1	2	4
417	30.309978	30309978	80211	10		-3	-5
418	30.390199	30390199	80221	8	-2	4	7
419	30.470428	30470428	80229	10	2	-4	-8
420	30.550667	30550667	80239	8	-2	2	6
421	30.630914	30630914	80247	8	0	2	0
422	30.711169	30711169	80255	10	2	-4	-6
423	30.791434	30791434	80265	8	-2	2	6
424	30.871707	30871707	80273	8	0	2	0
425	30.951988	30951988	80281	10	2	-4	-6
426	31.032279	31032279	80291	8	-2	4	0
427	31.112578	31112578	80299	10	2	-4	-8
428	31.192887	31192887	80309	8	-2	5	9
429	31.273204	31273204	80317	11	3	-5	-10
430	31.353532	31353532	80328	9	-2	3	8
431	31.433869	31433869	80337	10		-1	-4
432	31.514216	31514216	80347	10	0		2
433	31.594573	31594573	80357	11		0	-1
434	31.674941	31674941	80368	12		-2	-2
435	31.755321	31755321	80380	11	-1	2	4
436	31.835712	31835712	80391	12		0	-2
437	31.916115	31916115	80403	12		-2	-2
438	31.996531	31996531	80416	13	-1	-2	5
439	32.076959	32076959	80428	12	2	3	-5
440	32.157401	32157401	80442	14	0	-2	2
441	32.237857	32237857	80456	14	0	0	
442	32.318327	32318327	80470	14		1	-2
443	32.398812	32398812	80485	15	0	-1	
444	32.479312	32479312	80500	15	0	0	2
445	32.559827	32559827	80515	15	2	2	-5
446	32.640359	32640359	80532	17	-1	-3	5
447	32.720907	32720907	80548	16		2	-3
448	32.801472	32801472	80565	17		-1	
449	32.882054	32882054	80582	17	0	0	1
450	32.962653	32962653	80599	17		1	-2
451	33.043270	33043270	80617	18		-1	1
			80635	18	0	0	0

452	33.123905	33123905		18		0	
453	33.204558	33204558	80653	18	0	1	1
454	33.285229	33285229	80671	19	1	-3	-4
455	33.365919	33365919	80690	17	-2	3	6
456	33.446626	33446626	80707	18	1	0	-3
457	33.527351	33527351	80725	19	1	-3	-3
458	33.608095	33608095	80744	17	-2	2	5
459	33.688856	33688856	80761	17	0	1	-1
460	33.769634	33769634	80778	18	1	-3	-4
461	33.850430	33850430	80796	16	-2	2	5
462	33.931242	33931242	80812	16	0	0	-2
463	34.012070	34012070	80828	16	0	0	0
464	34.092914	34092914	80844	16	0	-3	-3
465	34.173774	34173774	80860	13	-3	5	8
466	34.254647	34254647	80873	15	2	-4	-9
467	34.335535	34335535	80888	13	-2	0	4
468	34.416436	34416436	80901	11	-2	3	3
469	34.497348	34497348	80912	12	1	-2	-5
470	34.578272	34578272	80924	11	-1	-1	1
471	34.659207	34659207	80935	9	-2	2	3
472	34.740151	34740151	80944	9	0	-2	-4
473	34.821104	34821104	80953	7	-2	1	3
474	34.902064	34902064	80960	6	-1	1	0
475	34.983030	34983030	80966	6	0	-1	-2
476	35.064002	35064002	80972	5	-1	1	0
477	35.144979	35144979	80977	3	-2	1	2
478	35.225959	35225959	80980	2	-1	1	0
479	35.306941	35306941	80982	2	0	-3	-4
480	35.387925	35387925	80984	-1	-3	4	7
481	35.468908	35468908	80983	0	1	-2	-6
482	35.549891	35549891	80983	-1	-1	-2	0
483	35.630873	35630873	80982	-1	-3	4	6
484	35.711851	35711851	80978	-4	1	-3	-7
485	35.792826	35792826	80975	-3	-2	3	6
486	35.873796	35873796	80970	-5	1	-4	-7
487	35.954762	35954762	80966	-4	-3	3	7
488	36.035721	36035721	80959	-7	0	0	-3
489	36.116673	36116673	80952	-7	0	-2	-2
490	36.197618	36197618	80945	-7	-2	3	5
491	36.278554	36278554	80936	-9	1	-1	-4
492	36.359482	36359482	80928	-8	0	-2	-1
			80920	-8	-2	4	4



493	36.440402	36440402		-10		2	
494	36.521312	36521312	80910	-10	0	0	-2
495	36.602212	36602212	80900	-10	0	1	1
496	36.683102	36683102	80890	-9	1	-3	-4
497	36.763983	36763983	80881	-11	-2	3	6
498	36.844853	36844853	80870	-10	1	-1	-4
499	36.925713	36925713	80860	-10	0	0	1
500	37.006563	37006563	80850	-10	0	1	1
501	37.087403	37087403	80840	-9	1	-2	-3
502	37.168234	37168234	80831	-10	-1	2	4
503	37.249055	37249055	80821	-9	1	0	-2
504	37.329867	37329867	80812	-8	1	-2	-2
505	37.410671	37410671	80804	-9	-1	3	5
506	37.491466	37491466	80795	-7	2	-2	-5
507	37.572254	37572254	80788	-7	0	0	2
508	37.653035	37653035	80781	-7	0	0	2
509	37.733809	37733809	80774	-5	2	-3	-5
510	37.814578	37814578	80769	-6	-1	3	6
511	37.895341	37895341	80763	-4	2	-2	-5
512	37.976100	37976100	80759	-4	0	2	4
513	38.056855	38056855	80755	-2	2	-3	-5
514	38.137608	38137608	80753	-3	-1	4	7
515	38.218358	38218358	80750	0	3	-4	-8
516	38.299108	38299108	80750	-1	-1	2	6
517	38.379857	38379857	80749	0	1	0	-2
518	38.460606	38460606	80749	1	1	0	0
519	38.541356	38541356	80750	2	1	0	0
520	38.622108	38622108	80752	3	1	-1	-1
521	38.702863	38702863	80755	3	0	1	2
522	38.783621	38783621	80758	4	1	0	-1
523	38.864383	38864383	80762	5	1	0	0
524	38.945150	38945150	80767	6	1	-2	-2
525	39.025923	39025923	80773	5	-1	3	5
526	39.106701	39106701	80778	7	2	-2	-5
527	39.187486	39187486	80785	7	0	0	2
528	39.268278	39268278	80792	7	0	2	2
529	39.349077	39349077	80799	9	2	-4	-6
530	39.429885	39429885	80808	7	-2	4	8
531	39.510700	39510700	80815	9	2	-2	-6
532	39.591524	39591524	80824	9	0	-1	1
533	39.672357	39672357	80833	8	-1	3	4
			80841	8	2	3	-6

534	39.753198	39753198		10		-3	
535	39.834049	39834049	80851	9	=1	1	4
536	39.914909	39914909	80860	9	0	0	=1
537	39.995778	39995778	80869	9	0	1	1
538	40.076656	40076656	80878	10	1	=3	=4
539	40.157544	40157544	80888	8	=2	3	6
540	40.238440	40238440	80896	9	1	=1	=4
541	40.319345	40319345	80905	9	0	0	1
542	40.400259	40400259	80914	9	0	=2	=2
543	40.481182	40481182	80923	9	=2	6	6
544	40.562112	40562112	80930	7	2	4	=8
545	40.643051	40643051	80939	9	=2	=4	6
546	40.723997	40723997	80946	7	0	2	=2
547	40.804950	40804950	80953	7	0	0	0
548	40.885910	40885910	80960	7	0	0	=2
549	40.966877	40966877	80967	7	=2	=2	6
550	41.047849	41047849	80972	5	2	4	=8
551	41.128828	41128828	80979	7	=2	=4	6
552	41.209812	41209812	80984	5	0	2	=3
553	41.290801	41290801	80989	5	=1	=1	3
554	41.371794	41371794	80993	4	1	2	=5
555	41.452792	41452792	80998	5	=2	=3	6
556	41.533793	41533793	81001	3	3	3	=4
557	41.614798	41614798	81005	4	1	=1	=4
558	41.695807	41695807	81009	4	0	=2	=1
559	41.776818	41776818	81011	4	=2	5	5
560	41.857832	41857832	81014	2	1	=2	4
561	41.938848	41938848	81016	2	1	=2	=5
562	42.019867	42019867	81019	3	=2	=3	6
563	42.100887	42100887	81020	1	3	3	=4
564	42.181909	42181909	81022	2	1	=1	0
565	42.262933	42262933	81024	2	0	=1	0
566	42.343958	42343958	81025	1	=1	2	=4
567	42.424985	42424985	81027	2	1	=2	3
568	42.506013	42506013	81028	1	=1	1	3
569	42.587042	42587042	81028	1	0	0	=1
570	42.668072	42668072	81029	1	0	0	1
571	42.749104	42749104	81030	1	1	1	=4
572	42.830136	42830136	81032	2	1	=3	=4
573	42.911170	42911170	81032	2	=2	4	7
574	42.992205	42992205	81034	0	2	=3	=7
			81035	1	=1	4	4
				1	0	1	0

575	43.073241	43073241	81036	2	1	=2	=3
576	43.154279	43154279	81038	1	=1	1	3
577	43.235318	43235318	81039	1	0	0	=1
578	43.316358	43316358	81040	1	0	1	1
579	43.397399	43397399	81041	2	1	=2	=3
580	43.478442	43478442	81043	1	=1	1	3
581	43.559486	43559486	81044	1	0	1	0
582	43.640531	43640531	81045	2	1	=2	=3
583	43.721578	43721578	81047	1	=1	1	3
584	43.802626	43802626	81048	1	0	1	0
585	43.883675	43883675	81049	2	1	=3	=4
586	43.964726	43964726	81051	0	=2	2	5
587	44.045777	44045777	81051	0	0	2	0
588	44.126828	44126828	81051	2	2	=5	=7
589	44.207881	44207881	81053	=1	=3	4	9
590	44.288933	44288933	81052	0	1	=1	=5
591	44.369985	44369985	81052	0	0	=2	=1
592	44.451037	44451037	81052	=2	=2	3	5
593	44.532087	44532087	81050	=1	1	=1	=4
594	44.613136	44613136	81049	=1	0	=3	=2
595	44.694184	44694184	81048	=4	=3	5	8
596	44.775228	44775228	81044	=2	2	=5	=10
597	44.856270	44856270	81042	=5	=3	4	9
598	44.937307	44937307	81037	=4	1	=2	=6
599	45.018340	45018340	81033	=4	=1	=2	2
600	45.099368	45099368	81028	=5	=1	0	=1
601	45.180390	45180390	81022	=6	=2	=1	4
602	45.261404	45261404	81014	=8	1	3	=6
603	45.342411	45342411	81007	=7	=2	=3	5
604	45.423409	45423409	80998	=9	0	2	=4
605	45.504398	45504398	80989	=9	=2	=2	3
606	45.585376	45585376	80978	=11	=1	1	0
607	45.666342	45666342	80966	=12	0	1	=3
608	45.747296	45747296	80954	=12	=2	=2	4
609	45.828236	45828236	80948	=14	0	2	=4
610	45.909162	45909162	80926	=14	=2	=2	4
611	45.990072	45990072	80910	=16	0	2	=3
612	46.070966	46070966	80894	=16	=1	=1	1
613	46.151843	46151843	80877	=17	=1	0	0
614	46.232702	46232702	80859	=18	=1	0	0
615	46.313542	46313542	80840	=19	=1	0	1
			80820	=20	0	1	=3

616	46.394362	46394362	80800	-20	=2	=2	5
617	46.475162	46475162	80778	-22		3	=6
618	46.555940	46555940	80757	-21	=2	=3	5
619	46.636697	46636697	80734	-23	0	2	=3
620	46.717431	46717431	80711	-23	=1	=1	3
621	46.798142	46798142	80687	-24		2	=5
622	46.878829	46878829	80664	-23	=2	=3	6
623	46.959493	46959493	80639	-25		3	=4
624	47.040132	47040132	80615	-24	0	=1	0
625	47.120747	47120747	80591	-24	=1	=1	2
626	47.201338	47201338	80566	-25	0		0
627	47.281904	47281904	80541	-25			=2
628	47.362445	47362445	80517	-24	0	=1	2
629	47.442962	47442962	80493	-24			=4
630	47.523455	47523455	80470	-23	=2	=3	8
631	47.603925	47603925	80445	-25	3	5	=8
632	47.684370	47684370	80423	-22	0	=3	3
633	47.764793	47764793	80401	-22	0	0	0
634	47.845194	47845194	80379	-22	0	0	3
635	47.925573	47925573	80357	-22	3	3	=7
636	48.005930	48005930	80338	-19	=1	=4	7
637	48.086268	48086268	80318	-20	2	3	=5
638	48.166586	48166586	80300	-18	0	=2	4
639	48.246886	48246886	80282	-18	2	2	=3
640	48.327168	48327168	80266	-16		=1	0
641	48.407434	48407434	80251	-15	0	=1	3
642	48.487685	48487685	80236	-15	2	2	=3
643	48.567921	48567921	80223	-13		=1	2
644	48.648144	48648144	80211	-12	2		=3
645	48.728355	48728355	80201	-10	0	=2	3
646	48.808556	48808556	80191	-10			0
647	48.888747	48888747	80182	-9	2		=2
648	48.968929	48968929	80175	-7		=1	
649	49.049104	49049104	80169	=6		0	
650	49.129273	49129273	80164	-5			=4
651	49.209437	49209437	80161	-3	=1	=3	7
652	49.289598	49289598	80157	-4	3	4	=7
653	49.369755	49369755	80156	=1	0	=3	5
654	49.449911	49449911	80155	=1	2	2	=4
655	49.530066	49530066	80156		0	-2	2
656	49.610222	49610222	80157		0	0	2

657	49.690379	49690379		1		2	
658	49.770537	49770537	80158	3		2	-3
659	49.850698	49850698	80161	4	1	-1	0
660	49.930863	49930863	80165	4	0	-1	1
661	50.011032	50011032	80169	4	0	0	0
662	50.091205	50091205	80173	4	0	0	2
663	50.171382	50171382	80177	4	2	2	-4
664	50.251565	50251565	80183	6	0	-2	1
665	50.331754	50331754	80189	6	-1	-1	2
666	50.411948	50411948	80194	5	0	1	0
667	50.492147	50492147	80199	5	1	1	-2
668	50.572352	50572352	80205	6	0	-1	0
669	50.652563	50652563	80211	6	-1	-1	2
670	50.732779	50732779	80216	5	0	1	-2
671	50.813000	50813000	80221	5	-1	-1	2
672	50.893225	50893225	80225	4	0	1	-1
673	50.973454	50973454	80229	4	0	0	0
674	51.053687	51053687	80233	4	0	0	-3
675	51.133924	51133924	80237	4	-3	-3	7
676	51.214162	51214162	80238	1	1	4	-6
677	51.294402	51294402	80240	2	-1	-2	2
678	51.374643	51374643	80241	1	-1	0	1
679	51.454884	51454884	80241	0	0	1	-3
680	51.535125	51535125	80241	0	-2	-2	3
681	51.615364	51615364	80239	-2	-2	1	-1
682	51.695600	51695600	80236	-3	-1	0	1
683	51.775832	51775832	80232	-4	-1	1	-2
684	51.856060	51856060	80228	-4	0	-1	1
685	51.936283	51936283	80223	-5	-1	0	-1
686	52.016500	52016500	80217	-6	-1	-1	2
687	52.096709	52096709	80209	-8	-2	1	1
688	52.176909	52176909	80200	-9	-1	2	1
689	52.257101	52257101	80192	-8	1	-4	-6
690	52.337282	52337282	80181	-8	-3	-4	8
691	52.417453	52417453	80171	-10	1	-4	-8
692	52.497611	52497611	80158	-10	-3	-4	8
693	52.577757	52577757	80146	-13	1	4	-7
694	52.657889	52657889	80132	-12	-2	-3	5
695	52.738007	52738007	80118	-14	0	2	-2
696	52.818111	52818111	80104	-14	0	0	-2
697	52.898199	52898199	80088	-14	-2	-2	3
698	52.978270	52978270	80071	-16	-1	1	1
			80055	-17	1	2	-4
				-16	-1	-2	3

699	53.058325	53058325		-17		1	
700	53.138363	53138363	80038	-17	0	*1	*2
701	53.218384	53218384	80021	-18	*1		2
702	53.298387	53298387	80003	-18	0	1	*1
703	53.378372	53378372	79985	-18	0	0	*1
704	53.458339	53458339	79967	-18	*1	*1	3
705	53.538287	53538287	79948	-19		2	*3
706	53.618217	53618217	79930	-18	0	*1	0
707	53.698129	53698129	79912	-18	*1	*1	3
708	53.778022	53778022	79893	-19		2	*3
709	53.857897	53857897	79875	-18		*1	1
710	53.937754	53937754	79857	-18	0	0	1
711	54.017593	54017593	79839	-18	0	1	*3
712	54.097415	54097415	79822	-17		*2	4
713	54.177219	54177219	79804	-18	*1	2	*2
714	54.257006	54257006	79787	-17		0	*1
715	54.336777	54336777	79771	-16		*1	0
716	54.416532	54416532	79755	-16	0	0	0
717	54.496270	54496270	79738	-16	*1	*1	5
718	54.575994	54575994	79724	-17		4	*9
719	54.655702	54655702	79708	-14	3	-5	10
720	54.735397	54735397	79695	-16	*2	5	*10
721	54.815077	54815077	79680	-13	*2	-5	9
722	54.894744	54894744	79667	-15		4	*5
723	54.974399	54974399	79655	-13	2	*1	*1
724	55.054041	55054041	79642	-12		*2	4
725	55.133671	55133671	79630	-13	*1	2	2
726	55.213290	55213290	79619	-12	1	0	*2
727	55.292898	55292898	79608	-11		*1	*1
728	55.372496	55372496	79598	-11	0	1	2
729	55.452084	55452084	79588	-10		0	1
730	55.531662	55531662	79580	-10	0	0	2
731	55.611232	55611232	79570	-10	0	2	*6
732	55.690792	55690792	79560	-8	2	*4	9
733	55.770345	55770345	79553	-10	*2	5	*10
734	55.849889	55849889	79544	-7		*5	8
735	55.929425	55929425	79536	-9	*2	3	*3
736	56.008954	56008954	79529	-8		0	*2
737	56.088475	56088475	79521	-7		*2	4
738	56.167989	56167989	79514	-7	*1	2	*3
739	56.247496	56247496	79507	-7		*1	1
740	56.326996	56326996	79500	-7	0	0	0
			79493	-7	0	0	0

741	56,406489	56406489		-7	0	0
			79486		0	0
742	56,485975	56485975		-7	0	0
			79479		0	0
743	56,565454	56565454		-7	0	0
			79472		0	-1
744	56,644926	56644926		-7	-1	-1
			79465		-1	3
745	56,724391	56724391		-8		2
			79457			-3
746	56,803848	56803848		-7	-1	-1
			79450		0	-1
747	56,883298	56883298		-7	-2	6
			79443		-2	6
748	56,962741	56962741		-9		4
			79434		2	-8
749	57,042175	57042175		-7	-2	-4
			79427		-2	6
750	57,121602	57121602		-9		2
			79418		0	-1
751	57,201020	57201020		-9		1
			79409			-4
752	57,280429	57280429		-8	-2	-3
			79401		-2	6
753	57,359830	57359830		-10		3
			79391			-6
754	57,439221	57439221		-9	-2	-3
			79382		-2	7
755	57,518603	57518603		-11		4
			79371		2	-9
756	57,597974	57597974		-9	-3	-5
			79362		-3	10
757	57,677336	57677336		-12		5
			79350		2	-9
758	57,756686	57756686		-10	-2	-4
			79340		-2	7
759	57,836026	57836026		-12		3
			79328			-6
760	57,915354	57915354		-11	-2	-3
			79317		-2	6
761	57,994671	57994671		-13		3
			79304			-5
762	58,073975	58073975		-12	-1	-2
			79292		-1	2
763	58,153267	58153267		-13		0
			79279		-1	2
764	58,232546	58232546		-14		2
			79265			-5
765	58,311811	58311811		-13	-2	-3
			79252		-2	7
766	58,391063	58391063		-15		4
			79237		2	-9
767	58,470300	58470300		-13	-3	-5
			79224		-3	10
768	58,549524	58549524		-16		5
			79208		2	-9
769	58,628732	58628732		-14	-2	-4
			79194		-2	6
770	58,707926	58707926		-16		2
			79178		0	-1
771	58,787104	58787104		-16		1
			79162			-4
772	58,866266	58866266		-15	-2	-3
			79147		-2	5
773	58,945413	58945413		-17		2
			79130		0	-1
774	59,024543	59024543		-17		1
			79113			-3
775	59,103656	59103656		-16	-1	-2
			79097		-1	3
776	59,182753	59182753		-17		1
			79080		0	-1
777	59,261833	59261833		-17		0
			79063		0	-1
778	59,340896	59340896		-17	-1	-1
			79046		-1	2
779	59,419942	59419942		-18		1
			79028		0	0
780	59,498970	59498970		-18		1
			79010			-3
781	59,577980	59577980		-17	-1	-2
			78993		-1	3

782	59.656973	59656973		-18		1	
783	59.735948	59735948	78975	-18	0	1	0
784	59.814905	59814905	78957	-17	1	3	4
785	59.893845	59893845	78940	-19	2	3	6
786	59.972766	59972766	78921	-18	1	0	3
787	60.051669	60051669	78903	-17	1	3	3
788	60.130555	60130555	78886	-19	2	4	7
789	60.209422	60209422	78867	-17	2	4	8
790	60.288272	60288272	78850	-19	2	5	9
791	60.367103	60367103	78831	-16	3	5	11
792	60.445918	60445918	78815	-19	3	5	11
793	60.524714	60524714	78796	-17	2	3	8
794	60.603493	60603493	78779	-18	1	2	5
795	60.682254	60682254	78761	-17	1	1	3
796	60.760998	60760998	78744	-17	0	0	1
797	60.839725	60839725	78727	-17	0	0	0
798	60.918435	60918435	78710	-17	0	0	0
799	60.997128	60997128	78693	-17	0	1	1
800	61.075804	61075804	78676	-16	1	2	3
801	61.154464	61154464	78660	-17	1	2	4
802	61.233107	61233107	78643	-16	1	1	3
803	61.311734	61311734	78627	-16	0	1	0
804	61.390345	61390345	78611	-16	1	1	4
805	61.468939	61468939	78594	-17	1	3	6
806	61.547518	61547518	78579	-15	2	3	4
807	61.626081	61626081	78579	-16	1	1	4
808	61.704628	61704628	78563	-16	0	1	0
809	61.783160	61783160	78547	-16	1	1	3
810	61.861676	61861676	78532	-15	1	2	4
811	61.940177	61940177	78516	-16	1	2	3
812	62.018663	62018663	78501	-15	0	0	1
813	62.097134	62097134	78486	-15	0	0	1
814	62.175589	62175589	78471	-15	1	1	3
815	62.254029	62254029	78455	-16	1	2	3
816	62.332454	62332454	78440	-15	0	1	0
817	62.410863	62410863	78425	-15	1	1	3
818	62.489257	62489257	78409	-16	1	2	3
819	62.567636	62567636	78394	-15	0	1	0
820	62.645999	62645999	78379	-15	1	1	2
821	62.724346	62724346	78363	-16	0	1	1
822	62.802677	62802677	78347	-16	0	0	0
			78331	-16	0	0	0
			78315	-16	0	0	1



823	62.880992	62880992	78299	-16	"1	"1	2
824	62.959291	62959291	78282	-17	0	0	"1
825	63.037573	63037573	78265	-17	0	0	"1
826	63.115838	63115838	78248	-17	"1	"1	2
827	63.194086	63194086	78230	-18	0	0	0
828	63.272316	63272316	78212	-18	0	0	"5
829	63.350528	63350528	78195	-17	"3	"4	9
830	63.428723	63428723	78175	-20	2	5	"9
831	63.506898	63506898	78157	-18	"2	"4	7
832	63.585055	63585055	78137	-20	0	3	"6
833	63.663192	63663192	78118	-19	"2	"3	6
834	63.741310	63741310	78097	-21	0	3	"6
835	63.819407	63819407	78077	-20	"2	"3	7
836	63.897484	63897484	78055	-22	2	4	"9
837	63.975539	63975539	78035	-20	"3	"5	9
838	64.053574	64053574	78012	-23	0	4	"6
839	64.131586	64131586	77990	-22	"1	"2	4
840	64.209576	64209576	77967	-23	0	2	"5
841	64.287543	64287543	77945	-22	"2	"3	5
842	64.365488	64365488	77921	-24	0	2	"2
843	64.443409	64443409	77897	-24	0	0	0
844	64.521306	64521306	77873	-24	0	0	"2
845	64.599179	64599179	77849	-24	"2	"2	6
846	64.677028	64677028	77823	-26	2	4	"7
847	64.754851	64754851	77799	-24	"1	"3	4
848	64.832650	64832650	77774	-25	0	0	"2
849	64.910424	64910424	77749	-25	"1	"1	2
850	64.988173	64988173	77723	-26	0	0	0
851	65.065896	65065896	77697	-26	0	0	"3
852	65.143593	65143593	77672	-25	"1	"2	4
853	65.221265	65221265	77646	-26	0	2	"4
854	65.298911	65298911	77621	-25	"1	"2	3
855	65.376532	65376532	77595	-26	0	0	0
856	65.454127	65454127	77569	-26	0	0	"2
857	65.531696	65531696	77544	-25	0	"1	1
858	65.609240	65609240	77519	-25	0	0	0
859	65.686759	65686759	77494	-25	0	0	0
860	65.764253	65764253	77469	-25	0	0	2
861	65.841722	65841722	77444	-25	2	2	"5
862	65.919166	65919166	77421	-23	"1	"3	5
863	65.996587	65996587	77397	-24	0	2	"3
864	66.073984	66073984	77374	-23	0	"1	2

865	66.151358	66151358		-23		1	
866	66.228709	66228709	77351	-22	1	*1	*2
867	66.306038	66306038	77329	-22	0	0	1
868	66.383345	66383345	77307	-22	0	3	3
869	66.460630	66460630	77285	-19	3	*5	*8
870	66.537896	66537896	77266	-21	*2	4	9
871	66.615141	66615141	77245	-19	2	*2	*6
872	66.692367	66692367	77226	-19	0	1	3
873	66.769574	66769574	77207	-18	1	0	*1
874	66.846763	66846763	77189	-17	1	*1	*1
875	66.923935	66923935	77172	-17	0	1	2
876	67.001090	67001090	77155	-16	1	*1	*2
877	67.078229	67078229	77139	-16	0	1	2
878	67.155352	67155352	77123	-15	1	1	0
879	67.232460	67232460	77108	-13	2	*4	*5
880	67.309555	67309555	77095	-15	*2	5	9
881	67.386635	67386635	77080	-12	3	*3	*8
882	67.463703	67463703	77068	-12	0	0	3
883	67.540759	67540759	77056	-12	0	0	0
884	67.617803	67617803	77044	-12	0	2	2
885	67.694835	67694835	77032	-10	2	*2	*4
886	67.771857	67771857	77022	-10	0	*1	1
887	67.848869	67848869	77012	-11	*1	4	5
888	67.925870	67925870	77001	-8	3	*5	*9
889	68.002863	68002863	76993	-10	*2	4	9
890	68.079846	68079846	76983	-8	2	*3	*7
891	68.156821	68156821	76975	-9	*1	3	6
892	68.233787	68233787	76966	-7	2	*4	*7
893	68.310746	68310746	76959	-9	*2	4	8
894	68.387696	68387696	76950	-7	2	*3	*7
895	68.464639	68464639	76943	-8	*1	1	4
896	68.541574	68541574	76935	-8	0	1	0
897	68.618501	68618501	76927	-7	1	*1	*2
898	68.695421	68695421	76920	-7	0	*1	0
899	68.772334	68772334	76913	-8	*1	2	3
900	68.849239	68849239	76905	-7	1	*2	*4
901	68.926137	68926137	76898	-8	*1	1	3
902	69.003027	69003027	76890	-8	0	0	*1
903	69.079909	69079909	76882	-8	0	0	0
904	69.156783	69156783	76874	-8	0	0	0
905	69.233649	69233649	76866	-8	0	*1	*1
906	69.310507	69310507	76858	-9	*1	2	3

			76849				*5
907	69.387356	69387356		-8		*3	
			76841		*2		6
908	69.464197	69464197		-10		3	
			76831				*4
909	69.541028	69541028		-9		*1	
			76822		0		0
910	69.617850	69617850		-9		*1	
			76813		*1		2
911	69.694663	69694663		-10		1	
			76803		0		*1
912	69.771466	69771466		-10		0	
			76793		0		*1
913	69.848259	69848259		-10		*1	
			76783		*1		2
914	69.925042	69925042		-11		1	
			76772		0		*2
915	70.001814	70001814		-11		*1	
			76761		*1		3
916	70.078575	70078575		-12		2	
			76749				*4
917	70.155324	70155324		-11		*2	
			76738		*1		3
918	70.232062	70232062		-12		1	
			76726		0		*2
919	70.308788	70308788		-12		*1	
			76714		*1		1
920	70.385502	70385502		-13		0	
			76701		*1		2
921	70.462203	70462203		-14		2	
			76687				*4
922	70.538890	70538890		-13		*2	
			76674		*1		3
923	70.615564	70615564		-14		1	
			76660		0		*2
924	70.692224	70692224		-14		*1	
			76646		*1		
925	70.768870	70768870		-15		0	
			76631		*1		
926	70.845501	70845501		-16		1	
			76615		0		0
927	70.922116	70922116		-16		1	
			76599				*4
928	70.998715	70998715		-15		*3	
			76584		*2		4
929	71.075299	71075299		-17		1	
			76567		*1		
930	71.151866	71151866		-18		2	
			76549				*5
931	71.228415	71228415		-17		*3	
			76532		*2		6
932	71.304947	71304947		-19		3	
			76513				*6
933	71.381460	71381460		-18		*3	
			76495		*2		6
934	71.457955	71457955		-20		3	
			76475				*4
935	71.534430	71534430		-19		*1	
			76456		0		*2
936	71.610886	71610886		-19		*3	
			76437		*3		7
937	71.687323	71687323		-22		4	
			76415				*6
938	71.763738	71763738		-21		*2	
			76394		*1		2
939	71.840132	71840132		-22		0	
			76372		*1		2
940	71.916504	71916504		-23		2	
			76349				*6
941	71.992853	71992853		-22		*4	
			76327		*3		8
942	72.069180	72069180		-25		4	
			76302				*6
943	72.145482	72145482		-24		*2	
			76278		*1		3
944	72.221760	72221760		-25		1	
			76253		0		*3
945	72.298013	72298013		-25		*2	
			76228		*2		5
946	72.374241	72374241		-27		3	
			76201				*5
947	72.450442	72450442		-26		*2	
			76175		*1		2

948	72,526617	72526617	76148	-27		0	2
949	72,602765	72602765	76120	-28		2	-5
950	72,678885	72678885	76093	-27	*2	=3	-5
951	72,754978	72754978	76064	-29	0	2	-1
952	72,831042	72831042	76035	-29		1	-4
953	72,907077	72907077	76007	-28	*2	=3	-6
954	72,983084	72983084	75977	-30		3	-5
955	73,059061	73059061	75948	-29	*1	*2	-4
956	73,135009	73135009	75918	-30		2	-5
957	73,210927	73210927	75889	-29	*2	=3	-6
958	73,286816	73286816	75858	-31		3	-4
959	73,362674	73362674	75828	-30	0	-1	-1
960	73,438502	73438502	75798	-30	0	0	0
961	73,514300	73514300	75768	-30	0	0	-1
962	73,590068	73590068	75738	-30	*1	-1	-2
963	73,665806	73665806	75707	-31	0	1	-2
964	73,741513	73741513	75676	-31	*1	-1	-4
965	73,817189	73817189	75644	-32	2	3	-5
966	73,892833	73892833	75614	-30	0	-2	-2
967	73,968447	73968447	75584	-30	0	0	-1
968	74,044031	74044031	75554	-30		1	-3
969	74,119585	74119585	75525	-29	*1	*2	-3
970	74,195110	74195110	75495	-30	0	1	-1
971	74,270605	74270605	75465	-30	0	0	-1
972	74,346070	74346070	75435	-30		1	-3
973	74,421505	74421505	75406	-29	*1	*2	-3
974	74,496911	74496911	75376	30	0	1	-1
975	74,572287	74572287	75346	-30	0	0	0
976	74,647633	74647633	75316	-30	0	0	-1
977	74,722949	74722949	75286	-30		1	-5
978	74,798235	74798235	75257	-29		=2	-3
979	74,873492	74873492	75227	-30	0	1	0
980	74,948719	74948719	75197	-30		1	-4
981	75,023916	75023916	75168	-29	*2	*3	-7
982	75,099084	75099084	75137	-31	2	4	-7
983	75,174221	75174221	75108	-29	*1	*3	-4
984	75,249329	75249329	75078	-30	0	1	0
985	75,324407	75324407	75048	-30		1	-3
986	75,399455	75399455	75019	-29	*1	*2	-3
987	75,474474	75474474	74989	-30	0	1	-1
988	75,549463	75549463	74959	-30	0	0	
989	75,624422	75624422	74929	-30	0		
990	75,699351	75699351					

INTERNAL DISTRIBUTION

1. Biology Library
- 2–4. Central Research Library
5. Reactor Division Library
- 6–7. ORNL – Y-12 Technical Library  
Document Reference Section
- 8–75. Laboratory Records Department
76. Laboratory Records, ORNL R.C.
- 77–86. R. K. Adams
87. E. T. Arakawa
88. J. A. Auxier
89. C. D. Baumann
90. T. V. Blalock
91. R. E. Biggers
92. R. D. Birkhoff
93. N. H. Briggs
94. R. D. Bundy
95. Charles T. Butler
96. T. A. Butler
97. R. M. Carroll
98. R. O. Chester
99. J. A. Conlin, Jr.
100. J. L. Cook
- 101–110. E. G. Davisson
111. C. W. Dollins
112. I. T. Dudley
113. J. R. Engel
114. R. B. Fitts
115. H. A. Friedman
116. E. L. Fuller
117. W. R. Gambill
118. Robert A. Gilbert
119. L. O. Gilpatrick
120. Glenn W. Greene
121. C. W. Hancher
122. R. W. Hendricks
123. N. E. Hinkle
124. D. O. Hobson
125. H. W. Hoffman
126. C. A. Horton
127. E. D. Hudson
128. Geo. Kidd
129. G. W. Keilholtz
130. Charles Klabunde
131. C. E. Larson
132. M. E. LaVerne
133. A. W. Longest
134. A. L. Lotts
135. H. G. MacPherson
136. H. E. McCoy
137. H. C. McCurdy
138. H. F. McDuffie
139. F. R. McQuilkin
140. A. P. Malinauskas
141. C. D. Martin
142. W. J. Martin
143. R. E. Minturn
144. J. G. Morgan
145. A. H. Narten
146. F. H. Neill
147. A. A. Palko
- 148–149. R. B. Parker
150. L. R. Phillips
151. J. C. Pigg
152. J. C. Posey
153. Paul E. Reagan
154. J. L. Redford
155. J. T. Stanley
156. S. T. Sekula
157. R. L. Senn
158. C. E. Sessions
159. W. J. Stelzner
160. Oscar Sisman
161. W. A. Sibley
162. M. J. Skinner
163. G. P. Smith
164. W. L. Stirling
165. O. E. Schow III
166. J. L. Scott
167. D. B. Trauger
168. R. W. Tucker
169. A. M. Weinberg
170. R. C. Weir
171. R. P. Wichner
172. J. M. Williams
173. Robin Williams
174. H. D. Wills
175. Richard E. Whitt
176. Henry Zeldes

## EXTERNAL DISTRIBUTION

177. R. H. Cook, The Foxboro Company, Foxboro, Massachusetts
178. C. L. Guettel, Driver-Harris Company, Harrison, New Jersey
179. R. C. Stroud, Leeds & Northrup Company, Philadelphia, Pennsylvania
180. G. W. Burns, National Bureau of Standards, Washington, D.C.
181. F. S. Sibley, Hoskins Manufacturing Company, Detroit, Michigan
182. W. H. Schneider, Barber Column Company, Rockford, Illinois
183. W. J. Hammond, Claud S. Gordon Company, Richmond, Illinois
184. E. D. Zysk, Engelhard Industries Inc., Newark, New Jersey
185. A. I. Dahl, General Electric Company, Schenectady, New York
186. B. Brenner, Sigmund Cohn Corporation, Mount Vernon, New York
187. J. F. Carlson, Hoskins Manufacturing Company, Detroit, Michigan
188. R. H. Brice, Pyro Electric Inc., Walkerton, Indiana
189. J. J. Sullivan, QAO-U.S. Naval Weapons Plant, Washington, D.C.
190. R. A. Pustell, General Electric Company, Instrument Department, West Lynn, Massachusetts
191. R. P. Benedict, Westinghouse Electric Corp., Philadelphia, Pennsylvania
192. N. R. Corallo, Thermo Electric Company, Saddle Brook, New Jersey
193. J. D. Sine, Honeywell, Philadelphia, Pennsylvania
194. C. A. Vogelsang, SAMA (Honeywell), Philadelphia, Pennsylvania
195. A. Gottlieb, Wilbur B. Driver Company, Newark, New Jersey
196. J. A. Bard, J. Bishop & Company, Malvern, Pennsylvania
197. D. I. Finch, Leeds & Northrup Company, Philadelphia, Pennsylvania
198. W. H. Rector, Satec Corporation, Grove City, Pennsylvania
199. J. F. Swindells, National Bureau of Standards, Washington, D.C.
200. P. O. Johansson, The Kanthal Corporation, Stamford, Connecticut
201. T. J. Williams, Monsanto Chemical Company, St. Louis, Missouri
202. E. Y. Kung, Jones & Laughlin Steel, Pittsburgh, Pennsylvania
203. H. M. Paynter, Massachusetts Institute of Technology, Cambridge, Massachusetts
204. Fred Woods, Union Carbide Olefins Company, Charleston, West Virginia
205. Robert Gray, Union Carbide Corporation, New York, New York
206. J. L. Gabbard, Union Carbide Corporation, New York, New York
207. L. R. Turner, NASA Lewis Research Center, Cleveland, Ohio
208. A. S. Lough, Division of Biology and Medicine, AEC, Washington, D.C.
209. S. G. Nordlinger, Division of Reactor Development, AEC, Washington, D.C.
210. F. C. Legler, Division of Reactor Development, AEC, Washington, D.C.
211. J. Hitch, Office of Isotope Development, AEC, Washington, D.C.
212. Ohio State University (Professor of Naval Science)
213. R. Hofstadter, Stanford University
214. J. C. Nance, Consolidate-Vultee Aircraft Corporation
215. E. A. Rollor, ANP Project Office, Fort Worth
216. R. N. Keller, University of Colorado
217. L. J. Rogers, Union Carbide Olefins Company, South Charleston, West Virginia
218. Research and Development Division, AEC, ORO
- 219-863. Given distribution as shown in TID-4500 (37th ed.) under Instruments category (100 copies – CFSTI)











