SAND-75-0041
Unlimited Distribution

3151

EBW1: A COMPUTER CODE FOR THE PREDICTION OF THE BEHAVIOR OF ELECTRICAL CIRCUITS CONTAINING EXPLODING WIRE ELEMENTS

T. J. Tucker and R. P. Toth

Prepared by Sandia Laboratories, Albuquerque, New Mexico 87115 and Livermore, California 94550 for the United States Atomic Energy Commission under Contract AT (29-1) 789

Printed April, 1975

Sandia Laboratories

DISCLAIMER

Issued by Sandia Laboratories, operated for the United States Energy Research and Development Administration by Sandia Corporation.

SAND 75-0041

EBW1: A COMPUTER CODE FOR THE PREDICTION OF THE BEHAVIOR OF ELECTRICAL CIRCUITS CONTAINING EXPLODING WIRE ELEMENTS*

T. J. Tucker
R. P. Toth
Explosives Physics Division 5131

Printed April 1975

ABSTRACT

Resistivity versus specific action data for 23 elemental metals and alloys are combined with a MIMIC language computer program to predict the behavior of electrical circuits containing exploding wire elements.

*This work was supported by the U. S. Energy Research and Development Administration, ERDA.

This page intentionally left blank.

CONTENTS

This page intentionally left blank.

INTRODUCTION

The analysis and prediction of the behavior of electrical circuits containing exploding wire circuit elements, i.e., conductors pulse heated to melt or vaporization temperatures, is of importance in a number of applied situations. Included are such diverse fields as electrical fuse design, EBW detonator studies, and the pulse generation of high magnetic fields. To meet the needs of investigators, particularly those working with EBW detonators, several computer-based circuit-modeling codes have been developed.[1,2,3,4] The two most widely used of these codes are those of Gold and Heinz (Ref. 2) and Blackburn and Muller (Refs. 3 anf 4). Although extremely useful within their range of applicability, each of these codes is limited by the lack of precise exploding wire resistance data for many metals.

Recently a general study on the behavior of metals at high temperatures using exploding wire techniques has begun to yield relatively accurate resistance profiles for a number of metals. It is the intent of this report to provide these data in a suitable format for use in computer circuit analysis. The form chosen is that of a Fortran subroutine (SR1) requiring only current and time inputs to produce a predicted exploding wire resistance as an output. To provide the greatest flexibility to the user, this subroutine has been combined with a "MIMIC" language main program providing a very simple representation of the electrical circuit differential equations.

EXPLODING WIRE BEHAVIOR

Experimental techniques for the measurement of the transient resistance behavior of exploding wires have been described elsewhere and will not be discussed in detail here.[1,5,6] Briefly summarized, the resistance data presented were obtained using a high current (8000 A maximum) square wave generator capable of vaporizing a 0.127 mm diameter (.005 in) by 6.0 mm long wire in about 4 microseconds. A simplified diagram of this experimental apparatus is shown in Fig. 1 and an example of a typical output waveform is shown in Fig. 2. It should be noted that wire voltages are determined using a four-terminal technique to minimize effects of contact resistance. To suppress early arc breakdown all tests were performed with the wire covered by a thin covering of common rubber cement.*

It has been previously demonstrated that exploding wire resistivity at fixed current density may be uniquely specified as a function of either of two parameters, energy density, $e = 1/V \int I^2 R dt$, or specific action, $g = 1/A^2 \int I^2 dt$, where V, I, R, A, and t are initial wire volume, current history, resistance history, initial area and time, respectively. From Fig. 2 the relationship between these two parameters is clearly demonstrated in that energy density is simply the resistivity-specific action integral. The concept of action is further discussed in Appendix 1. It is of importance to note that the above representations for e and g are only approximate; because of rate effects, at very high current densities ($j = \sim 10^8 A/cm^2$) wire resistivity appears to decrease and specific action and energy at wire burst appear to increase with increasing j.[1,6] The codes of Ref. 2 and Ref. 3 attempt to include this dependency, and

*Best Test paper cement, Union Rubber and Asbestos Company, Trenton, NJ.

it is hoped to ultimately expand this study to include current density effects. At present, however, the data presented here must be considered as those associated with current densities of about 10^7 A/cm^2 and that at higher current densities "anomalous" resistivity effects may occur.[6] The resistivity versus specific action plot shown in Fig. 2 is typical of that for a number of metals: copper, gold and aluminum, for example. As indicated in the figures, distinct (and some not so distinct) regions can be identified.

By comparison to published thermodynamic data and theoretical models of exploding wire behavior the following regions are evident.[7]

1. Solid heating - Simple heating of the metal to its melting point. The precise determination of the end of this region is often difficult to estimate from experimental data since no sharp discontinuity associated with the beginning of melting is observed.
2. Melting - The wire exists as a two-phase material of liquid and solid. The end of this region is generally well defined and may be precisely identified for all metals thus far tested.
3. Heating of the liquid - Typically a region of little curvature, in which the slope may be relatively large for such metals as gold and copper or approach zero for many refractory metals. Again, the actual transition point from heating of the liquid phase to vaporization is difficult to define and, in fact, evidence exists that superheating of the liquid commonly occurs.
4. Vaporization - The region is characterized by a very rapid increase of resistance associated with a decrease in wire cross-section. If system voltages are sufficiently high, the resistance rise is terminated by an arc breakdown through the wire vapor;[6] shunting of the current by this low resistance arc results in a resistance maximum often designated the "spike" or "burst" resistance.

5. Arc growth - Properties of this region are determined by complex arc breakdown phenomena and have not been studied in detail. The region is characterized by a rapid fall in resistivity associated with the growth of the arc channel; resistivity in this region depends upon both the current profile following burst and upon external confinement.* For the data presented here the current was relatively constant and external confinement was minimal consisting simply of a thin coating of rubber cement over the wire.

6. Extrapolated resistance - The indicated region is simply a continuation of the arc to times exceeding those normally monitored. In the data reported here extrapolated values of resistivity are generated by the function

$$\rho = \frac{K}{g^2}$$

where K is a constant selected to maintain continuity in ρ.

At present the extrapolation only applies to wire explosions under conditions of continued current flow and moderate confinement.

*The effect of confinement is particularly evident with high dielectric strength liquids, such as the 3M Company's Flourinert Electronic Liquids.

EBW1: EXPLODING WIRE CIRCUIT ANALYSIS CODE

Experimentally determined resistivity versus specific action and energy density plots for all metals thus far studied are presented in Appendix 2. It should be noted that phase transition points are also included in the figures. These transition points were obtained by inspection of the data to determine the clearly defined end of melt transition point for each metal. Utilizing the measured energies associated with the identifiable points, the melt transition points were estimated by subtracting handbook values of latent heat. Similarly, the vaporization transition points were estimated by adding the computed energy to heat the wire to vaporization temperature, i.e., e = liquid specific heat times the difference in vaporization and melting temperature. Finally, the arc (burst) transition was found by simple inspection of the data.

The general structure of the computer code EBW1 is indicated in Fig. 3. As indicated, all resistivity versus specific action data are contained in subroutine SR1. A complete listing of SR1 is presented in Appendix 3.

By inspection, SR1 can be seen to be primarily an array of metal resistivities (micro-ohm cm) versus specific action (amp^2 sec/mm^4). Subroutine SR1 computes the total specific action input into an exploding wire, based upon current and time input information from the main program, and determines from the tabulated data the associated instantaneous wire resistance to be returned. Since storage requirements for the wire data presently available are not prohibitively large, simple tabulation is possible. For the future, however, it is clear that the data bank could become excessively large, particularly in the case of describing resistivity as a function of both action and current density, and compaction of the data table will be required.

Existing spline fitting routines with knot placement at the transition points seem well suited for this purpose, and will be considered when time permits.

A summary list of all metals tested is presented in Table 1. Included in the table are the transition point values for the exploding wire data, which are compared to literature values of these parameters in Table 2. All metal specifications, i.e., wire diameter and purity, were assumed to be those stated by the supplier; a listing of these parameters is given in Table 3. As can be seen agreement is generally good; however, for a few metals, primarily those with a low melting and vaporization temperature, major differences are indicated. For these low temperature metals heating rate effects appear to be large even at moderate current densities. The majority of metals, however, exhibit burst energies below the handbook value of vaporization energy. This result is to be expected since not all of the wire is vaporized at the time of arc breakdown. It should be noted that tests reported here were done to survey the complete resistance profile, covering a range of several orders of magnitude. Considerably greater resolution is possible if testing is restricted to a more limited range such as early time solid and liquid behavior.

CIRCUIT DEFINITION

Although in principle any main program capable of describing the electric circuit equations and calling subroutine SR1 could be utilized to describe exploding wire systems, a "MIMIC" language description has been found to be particularly advantageous.[8] As an example of the simplicity of programming, consider the case of a capacitor discharge system. For this example the circuit equation is

$$L \frac{dI}{dt} + I(R+R_w) + \frac{1}{C} \int Idt = 0 \qquad (1)$$

where, as indicated in Fig. 4, R, L, and C are system resistance, inductance and capacitance, R_w and I are instantaneous wire resistance and current, and t is time.

A MIMIC description of this circuit is presented in Appendix 4. Also indicated in the Appendix are the required circuit parameter data cards and the single data input card required by subroutine SR1 to identify the exploding wire metal and dimensions. Control cards required to attach subroutines SR1 and SR2 (a plotting file) from permanent file are also listed.

Finally, tabular and graphic output resulting from the program for parameter values typical of EBW detonator systems (L = 0.1 μH, C = 1.0 μF, R = 0.1 Ω, V_o = 1000 volts, 1.5-mil diameter by 40-mil long gold wire) are shown. The effect of the exploding wire resistance spike upon the normal damped sinusoidal current waveform of a capacitive discharge is clearly indicated.

With regard to EBW detonator studies it should be recalled that the 50% firing threshold can be predicted using the threshold burst current equation[9,10]

$$I_{bth} = \frac{d}{\sqrt{\ell}} \left[850 + 35.5 \left[\frac{(\ell d S_o^P \times 10^{-3} - 120)^2}{(\ell d S_o^P \times 10^{-3})^{3/2}} \right] \left[\frac{1}{(1.88-\delta)^3} \right] \right] \qquad (2)$$

where d and ℓ are wire diemeter and length and S_o^P and δ are explosive specific surface and density. Computer threshold burst currents (I_{bth}) for the actual and the theoretical minimum predicted from Eq. 2 are included in the tabular printout shown in Table 3. By comparison of these threshold values to the predicted burst current, it can be seen that the circuit considered should, as is observed, initiate an EBW detonator.

SUMMARY

It has been the purpose of this report to describe a versatile and flexible computer code developed for analyzing the behavior of electrical circuits containing exploding wire elements. The code presented here (EBW1 and subroutine SR1) satisfies this requirement by combining the experimental results contained in an exploding wire study of 23 metals with a MIMIC language electrical circuit description. Although not described here, the code has also been found to be extremely useful in a complementary problem of predicting the transient resistance of metals carrying high surge currents. At present the data reported here cover only one current density, $\sim 10^7$ A/cm^2. Some differences in wire behavior may be encountered at current densities greatly in excess to those used. It is to be hoped that future studies will be able to remove this limitation.

REFERENCES

1. Tucker, T. J., A Survey of EBW System Analysis: Past, Present, and Future, SLA-73-0543, October 1973.
2. Gold, S. P. and Heinz, R. O., Scurge: A Fortran X-Unit Simulation, SCL-DR-64-45, August 1964, CRD.
3. Blackburn, J. H. and Muller, G. M., Exploding Wire Detonators: Resistivity Functions and Initiation Criteria for Circuit Calculations, SC-CR-69-3201, June 1969.
4. Blackburn, J. H. and Muller, G. M., Detonator Circuit Calculations: Resistivity Functions, SC-CR-68, May 1968.
5. Tucker, T. J., Square Wave Generator for the Study of Exploding Wires, Rev. Sci. Instruments, Vol. 31, No. 2, 165-168, February 1960.
6. Tucker, T. J., Behavior of Exploding Gold Wires, J. Appl. Phys., Vol. 32, No. 10, 1894-1900, October 1961.
7. Tucker, T. J., A Theoretical Model of the Resistance Behavior of Exploding Wires, SC-RR-71 0739, January 1972.
8. Sansom, F. J. and Petersen, H. E., Mimic Programming Manual, Tech. Rep. SEG-TR-67-31, Wright-Patterson Air Force Base, Ohio, July 1967.
9. Tucker, T. J., Exploding Wire Detonators: Threshold Burst Current Dependence Upon Detonator and Environmental Parameters, "Exploding Wires," Vol. 4, 211-232, W. G. Chace and H. K. Moore, eds., Plenum Press, New York, 1968.
10. Tucker, T. J., Explosive Initiators, "Proceedings Behavior and Utilization of Explosives in Engineering Design, New Mexico Sec. of the ASME, L. W. Davison and J. E. Kennedy, eds.

TABLE 1: EXPLODING WIRE DETERMINATION OF METAL PARAMETERS

Metal	ρ_o*	Melt Beginning			Melting End			Vapor Beginning			Burst		
	ρ_o*	ρ	e	g	ρ	e	g	ρ	e	g	ρ	e	g
	$\mu\Omega$-cm	$\mu\Omega$-cm	J/gm	$\frac{A^2 sec}{mm^4}$	$\mu\Omega$-cm	J/gm	$\frac{A^2 sec}{mm^4}$	$\mu\Omega$-cm	J/gm	$\frac{A^2 sec}{mm^4}$	$\mu\Omega$-cm	J/gm	$\frac{A^2 sec}{mm^4}$
Copper	1.77	9.9	459	80492	18.9	663	94228	26.3	1409	124008	620	5909	173000
Aluminum	2.82	11.2	623	25238	23.1	1021	32035	41.5	2981	48561	393	9782	65776
Gold	2.44	12.1	124	42816	26.0	189	50180	49.3	472	64950	1124	1897	83157
Silver	1.59	8.6	245	61682	15.9	356	71771	27.3	710	90132	859	3425	112290
Platinum	10.0	61.1	235	14701	89.6	347	17979	96.2	656	24979	649	2260	48947
Nickel	7.8	59.2	674	17233	79.6	974	21156	83.4	1812	30173	666	5492	56007
Iron	10.0	119.2	910	12806	123.6	1200	14681	125.8	2295	21568	547	5613	36105
Palladium	11.0	47.0	393	16187	70.8	555	19583	69.8	933	25979	614	3466	51366
Rhodium	4.8	60.4	613	33617	76.1	824	37597	84.4	1384	46139	540	4193	73983
Vanadium	22	116.3	1450	12286	120.9	1777	13971	120.7	2415	17189	428	8715	42786
Tungsten	5.6	90.3	495	24270	116.1	637	27831	123.6	1042	34175	230	3936	75081
Cadmium	7.54	19.6	71	4550	34.1	125	6348	37.5	242	9169	1223	2491	18049
Tin	11.5	27.6	49	1727	50.7	107	2870	100.7	632	8023	1076	2233	12447
Molybdenum	5.7	85.8	1075	30582	93.1	1328	33451	93.6	2281	43350	185	5645	73952
Zirconium	44	147.1	577	3043	158.1	801	3999	159.1	1355	6267	681	4890	16655
Titanium	41	156.0	816	3034	163.5	1218	4163	158	2255	7074	613	7460	19261
Bismuth	120	353.1	40	166	144.9	93	435	196.3	286	1550	1920	760	2654
Scandium	63	325.3	605	685	336.5	977	1020	312.8	1750	1730	790	5074	4194
Lead	22	48.7	37	1283	90.7	60	1674	139.4	254	3587	1385	1083	5980
Zinc	5.8	16.0	161	11260	31.6	263	14484	29.4	497	19990	925	4472	38945
Uranium	28.	96.6	298	6551	98.4	351	7582	100.9	681	14011	353	2410	34701
70Au-30Pt	30.8	42.9	187	10387	64.4	265	13391	75.9	561	21572	987	2400	42689

*Handbook of Chemistry and Physics, 48th ed.

TABLE 2: COMPARISON OF EXPLODING WIRE TO HANDBOOK PARAMETERS

Metal	Melt Begin			Burst		
	Handbook* J/gm	Measured J/gm	% Diff	Handbook** J/gm	Measured J/gm	% Diff
Copper	463	459	- .9	5217	5909	+ 13.3
Aluminum	663	623	- 6.0	10083	9782	- 3.0
Gold	147	124	-15.6	1861	1897	+ 1.9
Silver	245	245	0.	2627	3425	+ 30.4
Platinum	273	235	-13.9	2601	2260	- 13.1
Nickel	807	674	-16.5	6762	5492	- 18.8
Iron	1059	910	-14.1	6844	5613	- 18.0
Palladium	436	393	- 9.9	3653	3466	- 5.1
Rhodium	639	613	- 4.1	5605	4193	- 25.2
Vanadium	1202	1450	+20.6	9847	8715	- 11.5
Tungsten	558	445	-20.2	4539	3936	- 13.3
Cadmium	73	71	- 2.7	947	2491	+163.0
Tin	51	49	- 3.9	2535	2233	- 11.9
Molybdenum	850	1075	+27.6	6636	5633	- 15.1
Zirconium	784	577	-26.4	5728	4890	- 14.6
Titanium	1147	816	-28.9	9774	7460	- 23.7
Bismuth	33	41	+24.2	1000	760	- 24.0
Scandium	753	605	-19.7	8646	5074	- 41.3
Lead	41	37	- 9.8	912	1083	+ 18.7
Zinc	165	161	- 2.4	1925	4472	+132.3
Uranium	206	298	+44.7		2410	
70Au-30Pt		187			2400	

*Thermophysical Properties of High temperature Solid Materials, Y. S. Touloukin, ed., Macmillan Co., NY (1967).

*Contributions to the Data on Theoretical Metallurgy, X. High-Temperature Heat-Content, Heat-Capacity and Entropy Data for Inorganic Compounds, K. K. Kelley, Bureau of Mines Bulletin 476, 1949.

**Contributions to the Data on Theoretical Metallurgy, III. The Free Energies of Vaporization of Inorganic Substances, K. K. Kelley, Bureau of Mines Bulletin, 383, 1935.

**Introduction to Solid State Physics, 2nd Edition, C. Kittel, p. 99, Table 4.3, Cohesive Energy of Metals, John Wiley and Sons, NY, 1960.

TABLE 3: METALS SPECIFICATIONS

Metal Material	Diameter Mils	Purity %	Manufacturing Source
Copper	4	99.95	Sigmund Cohn Corp.
Aluminum	5	99.95	Permaluster, Inc.
Gold	5	99.99	Sigmund Cohn Corp.
Silver	5	99.99	Sigmund Cohn Corp.
Platinum	5	99.99	Engelhard Industries
Nickel	5	99.90	Permaluster, Inc.
Iron	6	99.90	Sigmund Cohn Corp.
Palladium	5	99.90	Engelhard Industries
Rhodium	5	99.90	Engelhard Industries
Vanadium	5	99.99	Leico Industries
Tungsten	5	99.90	General Electric
Cadmium	6	99.95	Leico Industries
Tin	7	99.90	Leico Industries
Molybdenum	4	99.90	General Electric
Zirconium	5	99.99	Leico Industries
Titanium	5	99.99	Leico Industries
Bismuth	6	99.90	Engelhard Industries
Scandium	10	99.90	Leico Industries
Lead	10	99.90	Leico Industries
Zinc	8	99.90	Leico Industries
Uranium	5	-----	*
70 Au-30 Pt	5	-----	Sigmund Cohn Corp.

Sigmund Cohn Corp., 121 So. Columbus Ave., Mt. Vernon, NY 10553
Permaluster, Inc., 1844 No. Keystone, Burbank, CA 91504
Engelhard Industries, 113 Astor St., Newark, NJ 07114
Leico Industries, 250 W. 57 St., New York, NY 10019
General Electric Co., 200 W. Broadway, Dover, OH 44622

*Obtained from LASL. Unknown purity and manufacturer.

EXPLODING BRIDGE WIRE STUDIES

using differential input oscilloscope technique

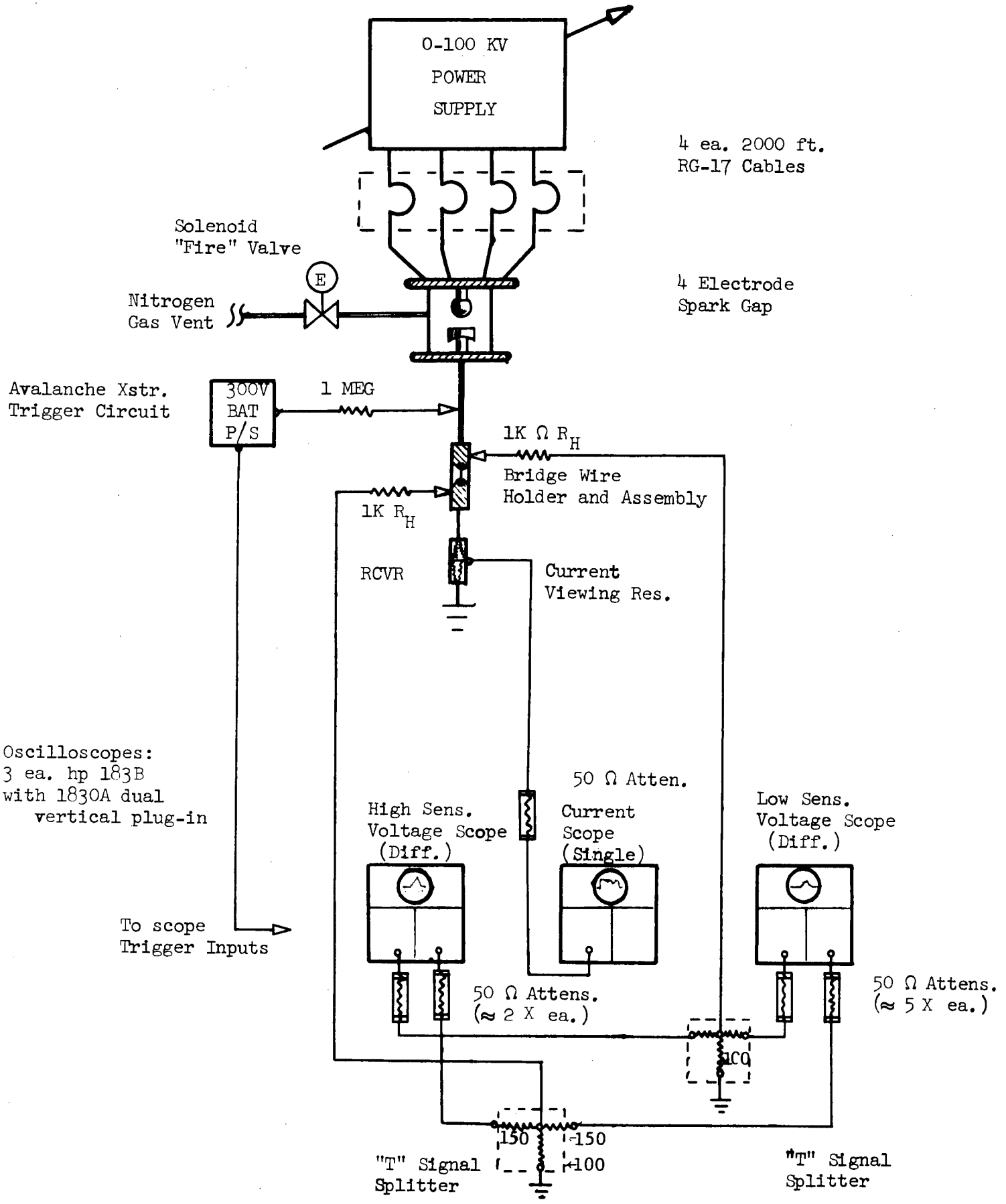


FIGURE 1.

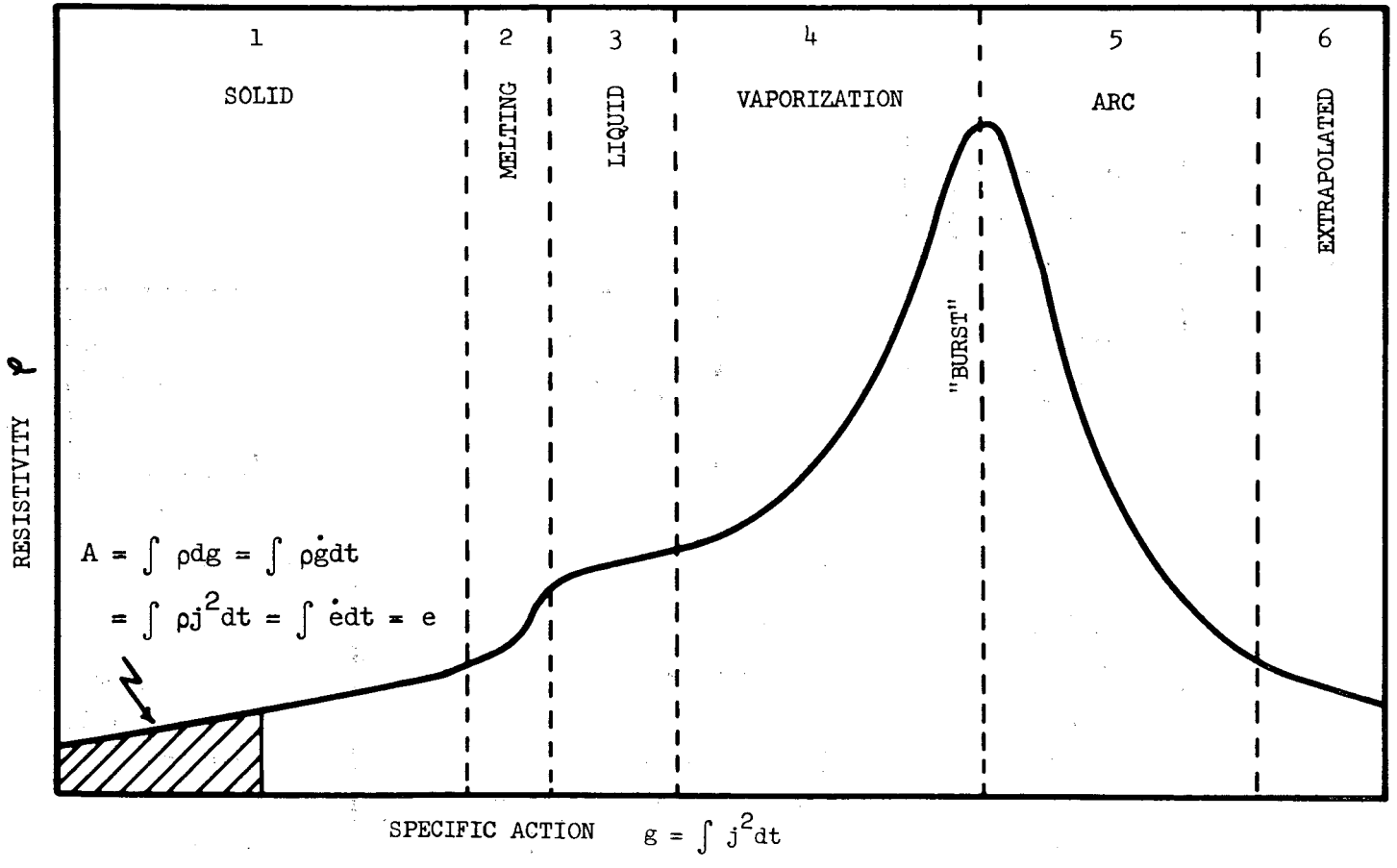


FIGURE 2.

Typical resistivity vs. specific action profile

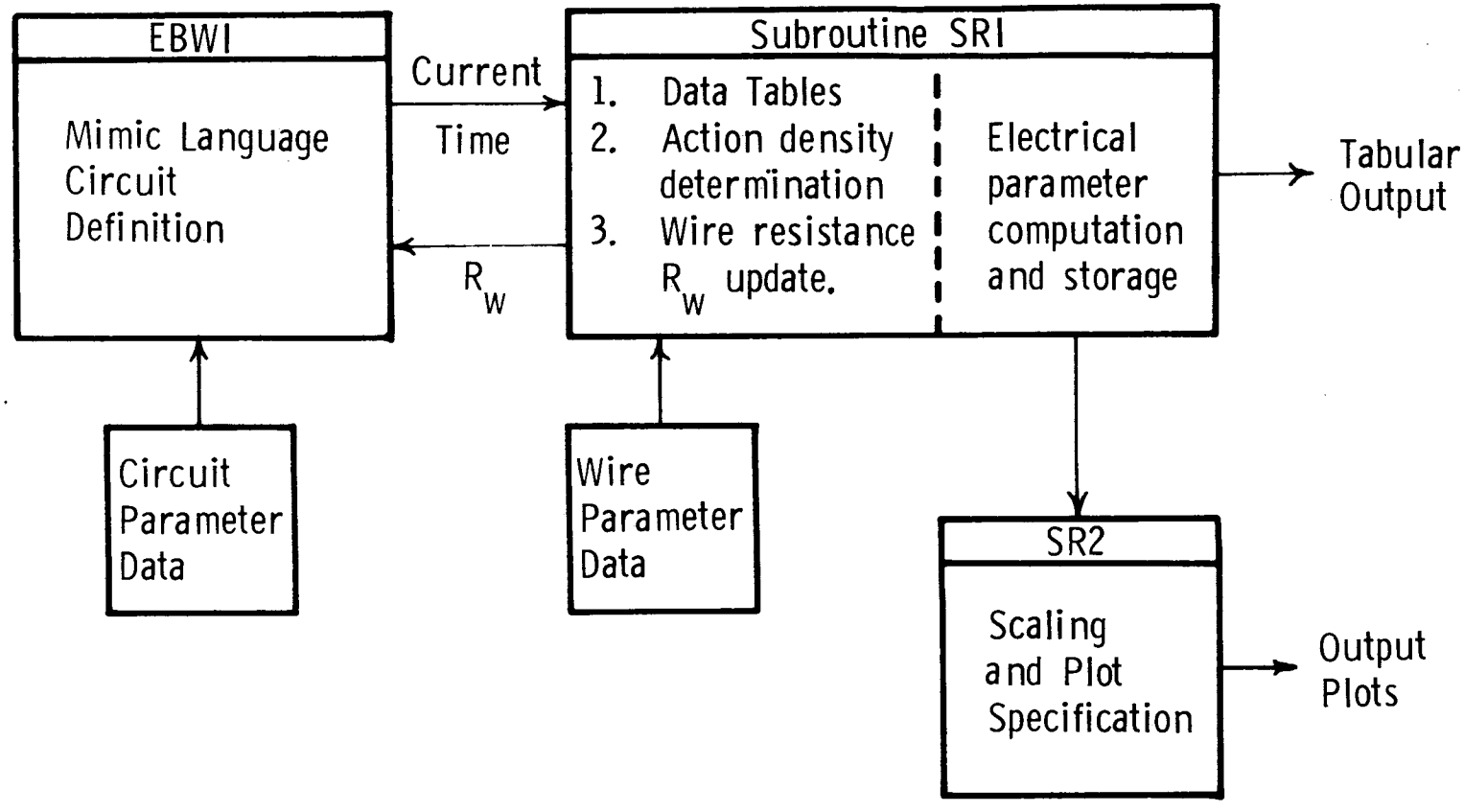


FIGURE 3.

Computer program EBW1 structure.

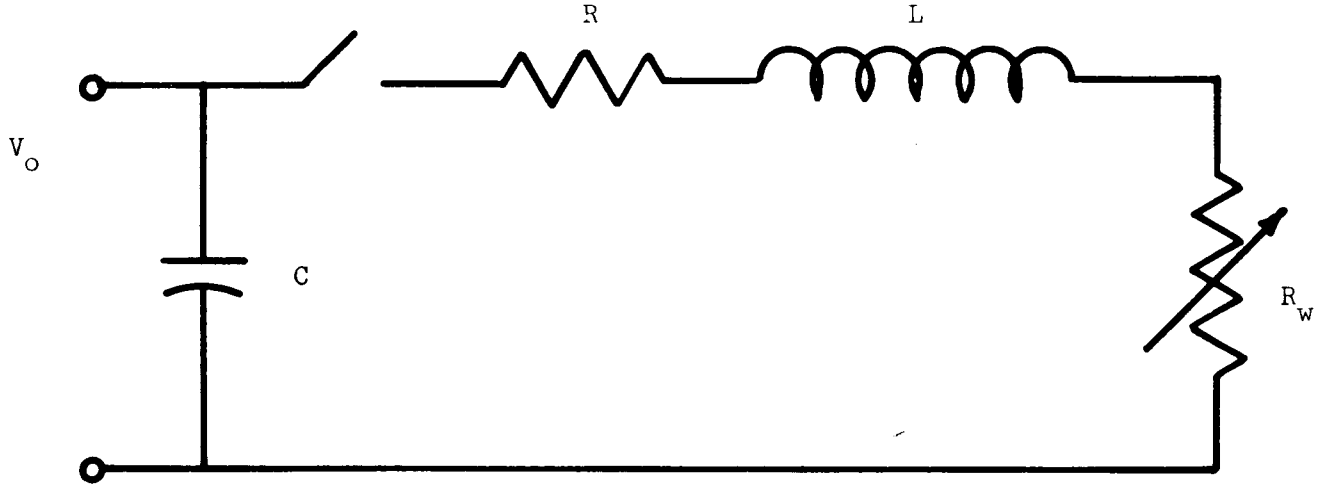


FIGURE 4.

LRC circuit

This page intentionally left blank.

APPENDIX 1

Theoretical Model of Exploding Wire Behavior

APPENDIX 1:

Theoretical Model of Exploding Wire Behavior

To illustrate general characteristics of exploding wire resistance behavior consider a simplification of the quasi-static theoretical model developed in Ref. 7. Assume resistance change can be described in terms of two basic processes, heating of a given phase and change of phase.

From conservation of energy the heating process is described by

$$(jA)^2 \frac{\rho \ell}{A} dt = CM d\tau \tag{1}$$

where j, A, ρ, ℓ, and t are current density, wire area, resistivity, length, and time and C, M, and τ are wire specific heat, mass and temperature. Rewriting Eq. 1 and integrating

$$g = \int j^2 dt = C\delta \int \frac{d\tau}{\rho} \tag{2}$$

where δ is the mass density of the metal.

Assume the resistivity is linearly dependent upon temperature, i.e.,

$$\rho = \rho_i(1 + \alpha\tau) \tag{3}$$

and thus

$$d\rho = \rho_i \alpha d\tau. \tag{4}$$

Substituting Eq. 4 into Eq. 2 and integrating

$$g = \frac{C\delta}{\rho_i \alpha} \ell n \frac{\rho}{\rho_i} \tag{5}$$

and

$$\rho = \rho_i e^{\frac{\rho_i \alpha}{C\delta} g} . \tag{6}$$

Now note the limit of Eq. 5 is

$$g_{max} = \frac{C\delta}{\rho_i \alpha} \ell n \frac{\rho_{max}}{\rho_i} \tag{7}$$

where g_{max} and ρ_{max} are the end points of the heating phase, i.e., the melting or vaporization points. Substitution of Eq. 7 in Eq. 6 yields

$$\rho = \rho_i e^{g/g_{max} \ell n \frac{\rho_{max}}{\rho_i}} \qquad 0 \le g \le g_{max} \tag{8}$$

To first approximation then, for heating of a single phase, wire resistivity varies exponentially with specific action. The dependence of resistivity upon specific energy $\epsilon = E/V$ follows directly from the relationship

$$e = \int \rho dg \quad . \tag{9}$$

From Eq. (5)

$$dg = \frac{C\delta}{\rho_i \alpha} \cdot \frac{d\rho}{\rho} \quad . \tag{10}$$

Substituting Eq. 10 into Eq. 9 and integrating

$$e = \frac{C\delta}{\rho_i \alpha} (\rho - \rho_i) \tag{11}$$

or

$$\rho = \frac{\rho_i \alpha}{C\delta} e + \rho_i \quad , \tag{12}$$

and, as might be expected, resistivity varies linearly with specific energy.

For phase change processes energy conservation yields

$$G \equiv gA^2 = \int I^2 dt = H \int \frac{dM}{R} \tag{13}$$

where H = latent heat. Assume a radial melting mode so that

$$R = \frac{R_1 R_2}{R_1 + R_2} \tag{14}$$

where R_1 and R_2 are the resistances of phase 1 and phase 2 material respectively.

From Eq. 14 it follows that

$$R = \frac{\rho_1 \rho_2 \ell}{\rho_1 A_2 + \rho_2 A_1} = \frac{\rho_1 \rho_2 \ell}{\rho_1 A_2 + \rho_2 (A - A_2)} \tag{15}$$

where ρ_1, ρ_2 and A_1, A_2 are resistivities and areas of phases 1 and 2 and A is the initial area, i.e., $A = A_1 + A_2$.

By substitution of Eq. 15 into Eq. 13 and simplifying it can be shown that

$$G = \frac{H\delta}{\rho_1 \rho_2} \left[\frac{1}{2R^2(\rho_1 - \rho_2)} \right] \left[(\rho_2 \rho_1 \ell)^2 - (R\rho_2 A)^2 \right] \tag{16}$$

and

$$G_{max} = \frac{H\delta}{2\rho_1 \rho_2} \left[A^2 (\rho_1 + \rho_2) \right] \tag{17}$$

and thus

$$g_{max} = G_{max}/A^2 = \frac{H\delta}{2\rho_1 \rho_2} (\rho_1 + \rho_2) \quad . \tag{18}$$

Solving Eq. 16 for R

$$R = \frac{\rho_1 \rho_2 \ell}{\sqrt{\frac{2(\rho_1 - \rho_2)\rho_1 \rho_2 G}{W\delta} + \rho_2^2 A^2}} \tag{19}$$

or

$$\rho = \frac{\rho_1 \rho_2}{\sqrt{\frac{2(\rho_1 - \rho_2)\rho_1 \rho_2 g}{H\delta} + \rho_2^2}} \quad . \tag{20}$$

Combining Eqs. 18 and 20

$$\rho = \frac{\rho_1}{\sqrt{1 - \frac{\rho_2^2 - \rho_1^2}{\rho_2^2} \frac{g}{g_{max}}}} \qquad 0 \le g \le g_{max} \quad . \tag{21}$$

For most metals ρ_2 is typically greater than ρ_1 and the ρ vs g curve is concave upwards. If it is assumed that, prior to arcing, the resistivity of the metal vapor is very large, Eq. 21 becomes

$$\rho_{vapor} = \frac{\rho_{liquid}}{\sqrt{1 - \frac{g}{g_{max}}}} \tag{22}$$

and from the relationship $e = \int \rho dg$ it follows

$$\rho_{vapor} = 2\, g_{max} \rho_{liquid} \left(\sqrt{1 - g/g_{max}}\right) \quad . \tag{23}$$

For phase change processes the resistivity versus specific energy relationship can be shown to be

$$\rho = \frac{\rho_1}{1 - \left(\frac{\rho_2 - \rho_1}{\rho_2}\right) \frac{\epsilon}{H\delta}} \quad , \tag{24}$$

again a function concave upwards.

Finally, two additional equations predicting limits for vaporization are of value. From Eq. 22

$$g_{max} = \frac{g - g_v}{1 - (\rho_\ell/\rho)^2} \tag{25}$$

where

$$g_{total} = g_v + g_{max}$$

and from Eq. 23

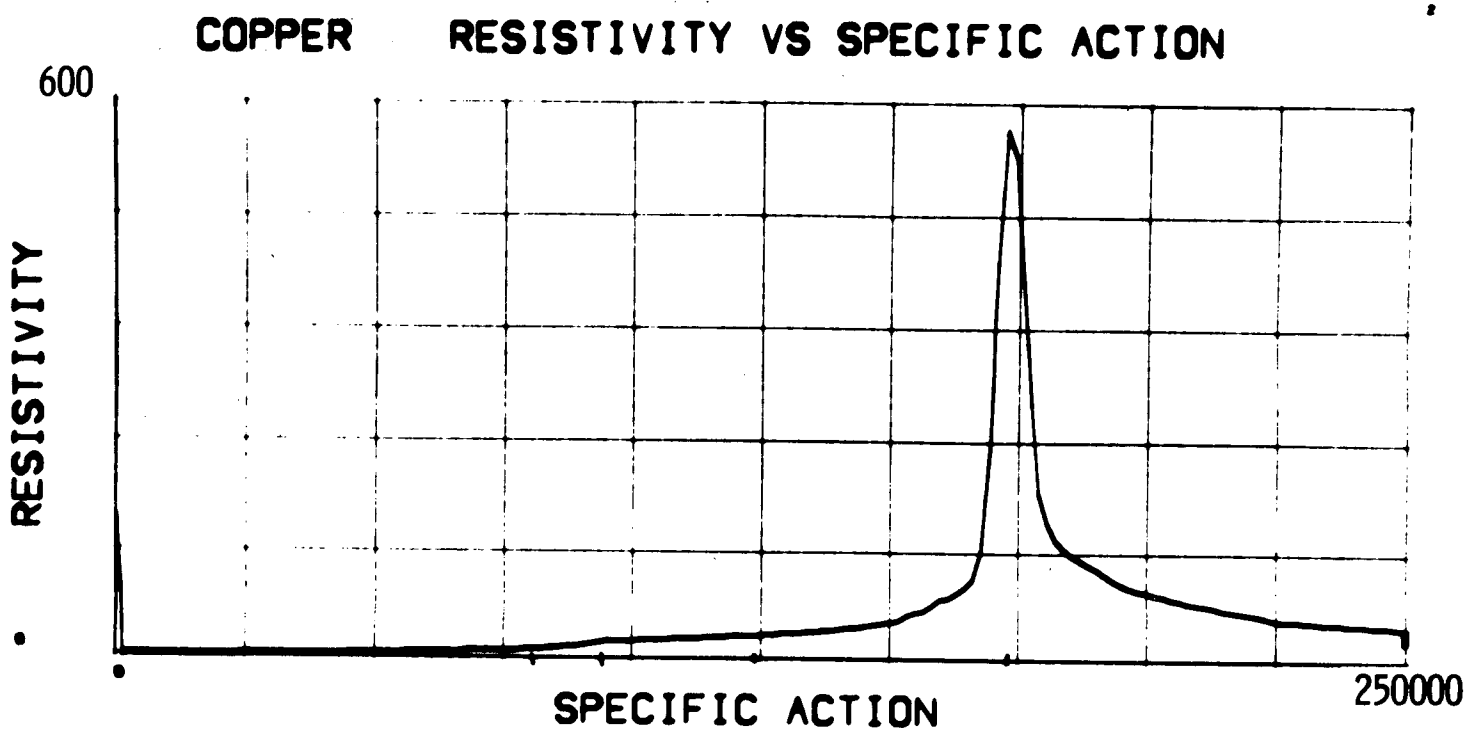
$$e_{max} = 2\, g_{max}\, \rho_{\ell} \quad . \tag{26}$$

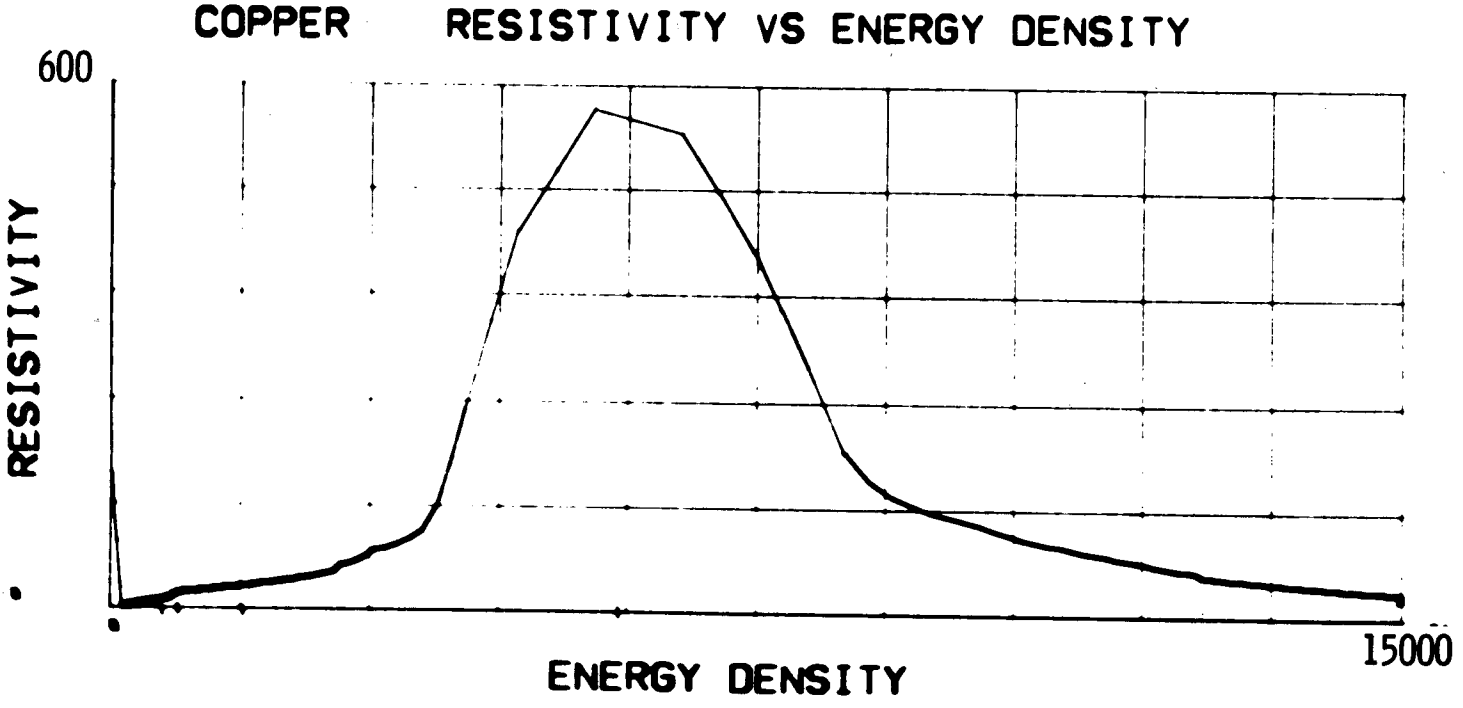
Thus

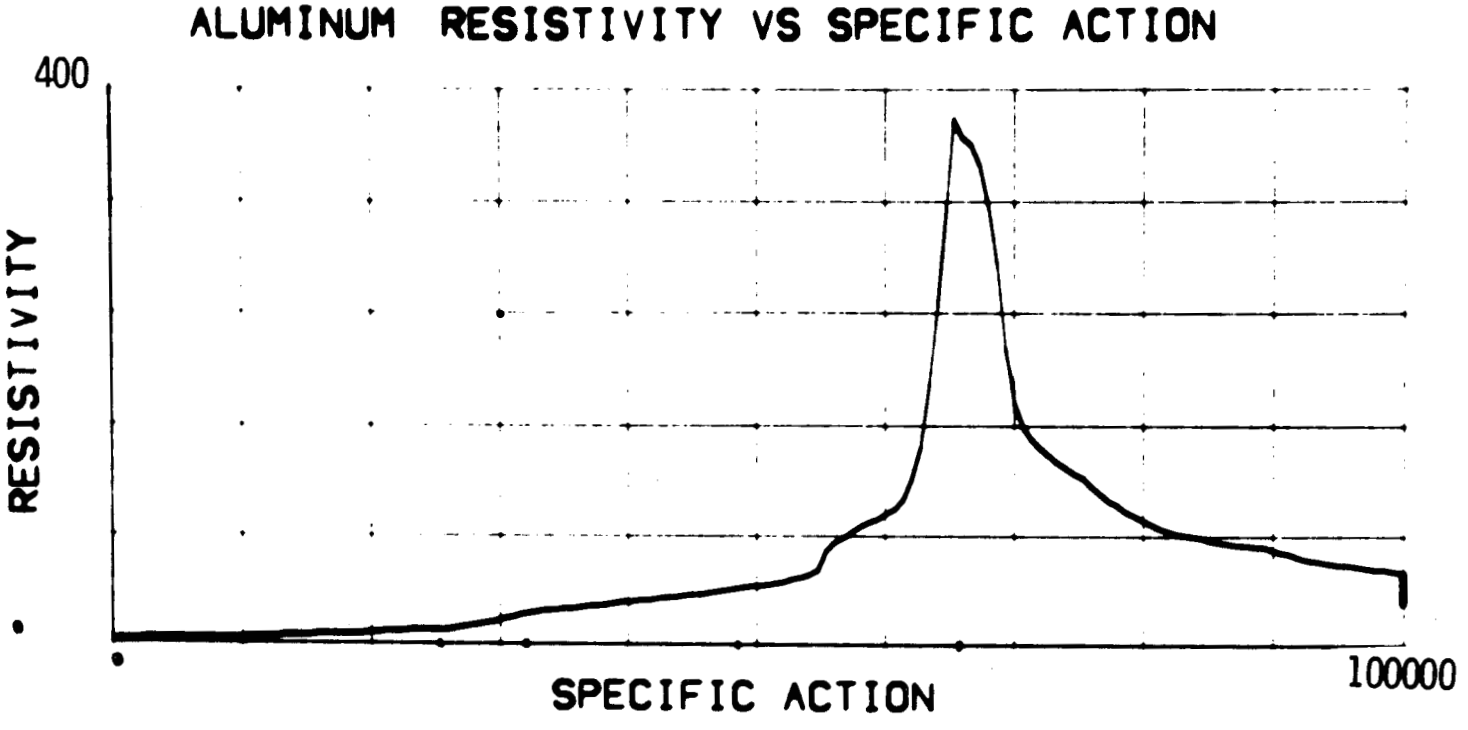
$$e_{total} = e_{v} + e_{max} \quad .$$

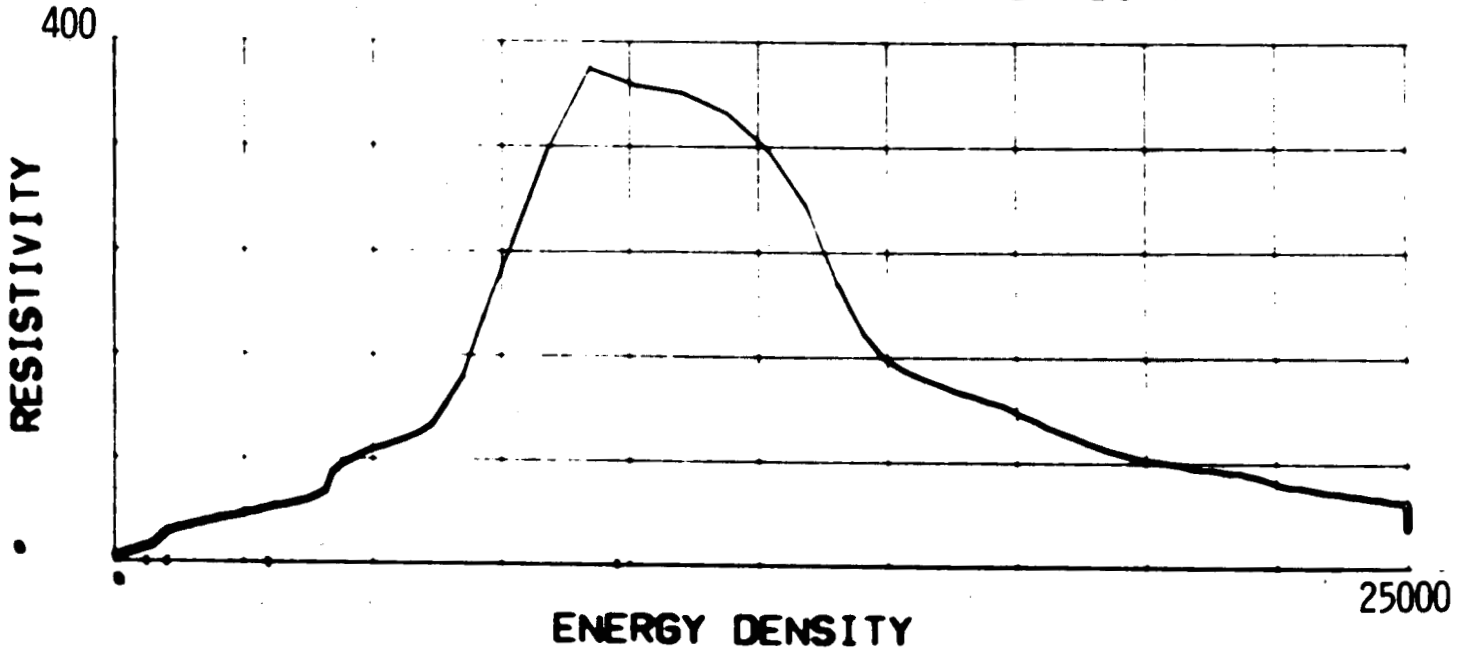
APPENDIX 2

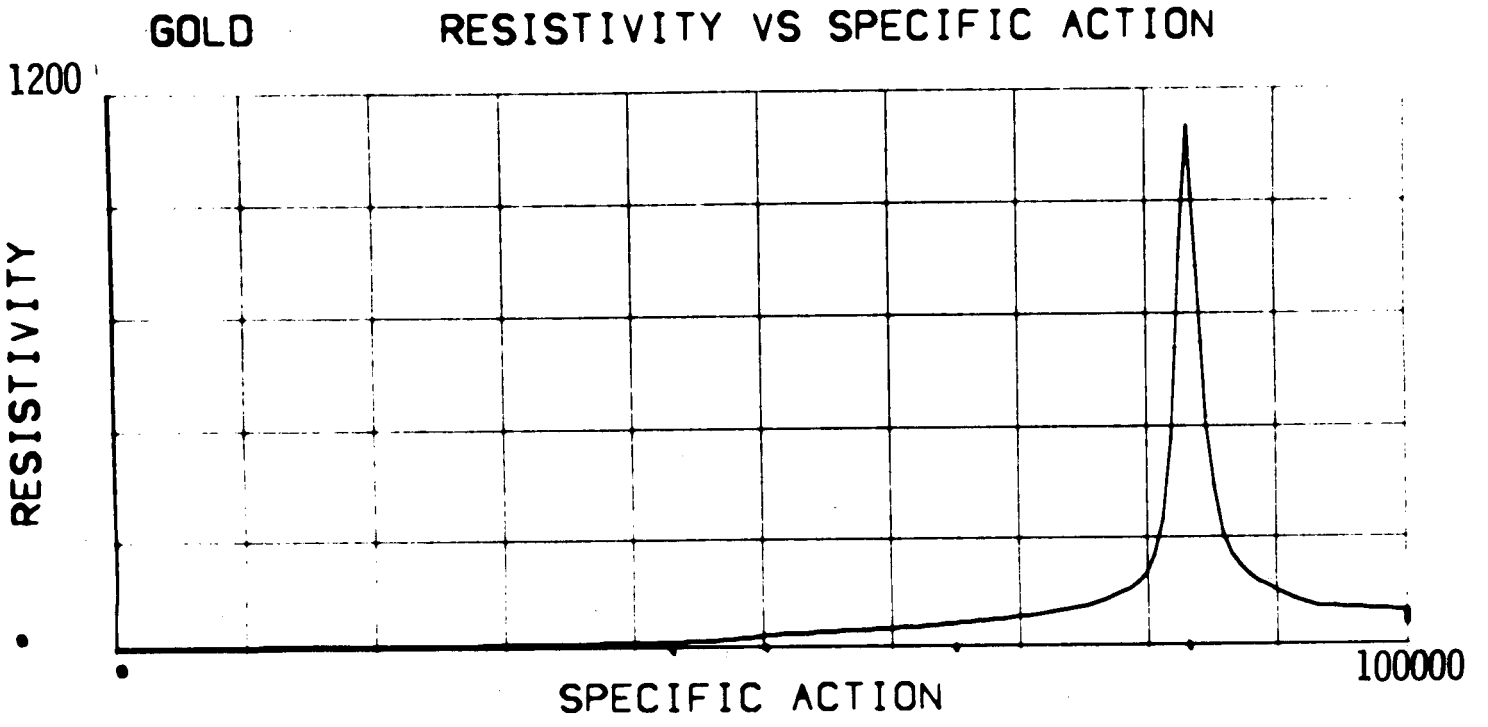
Metal Resistivity $\mu\Omega$-cm versus Specific Action ($amp^2 sec/mm^4$) and Energy Density (joules/gram)

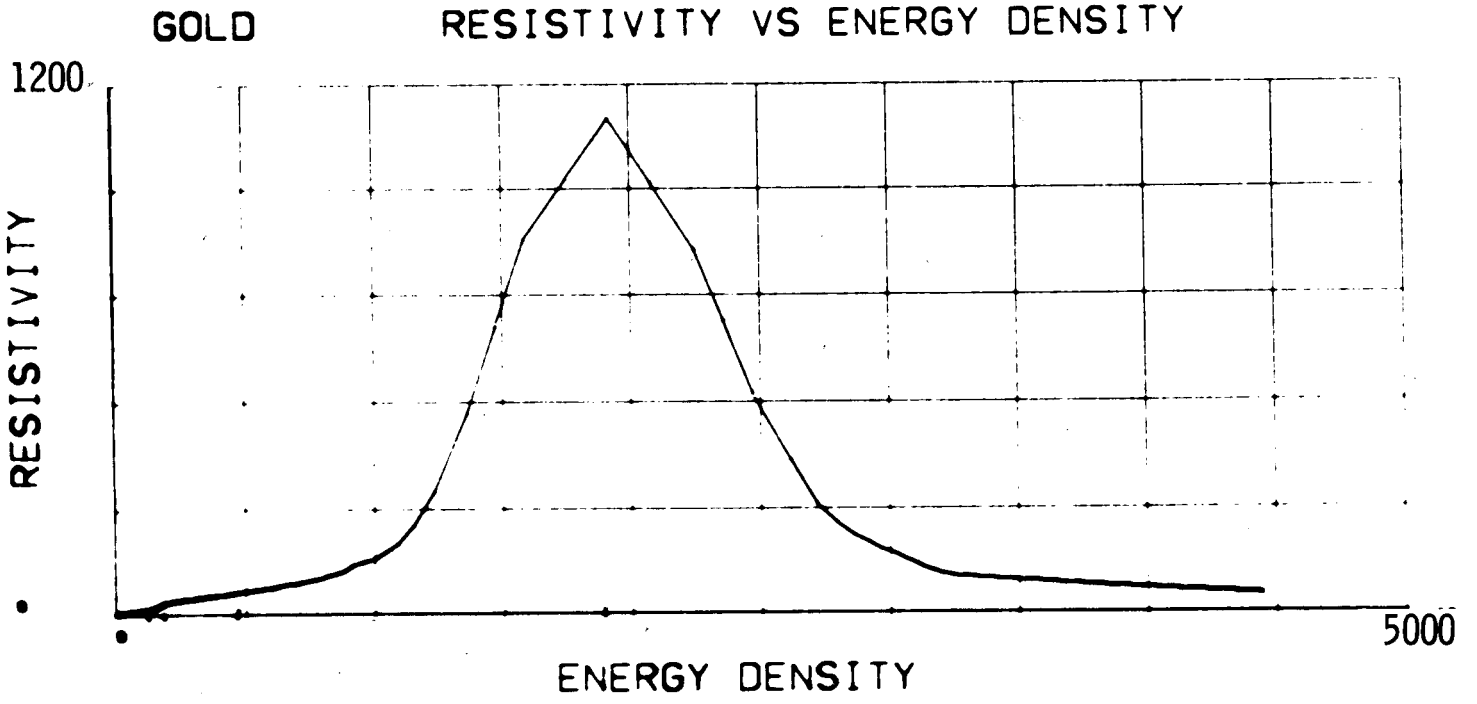

COPPER RESISTIVITY VS SPECIFIC ACTION
600
RESISTIVITY
250000
SPECIFIC ACTION

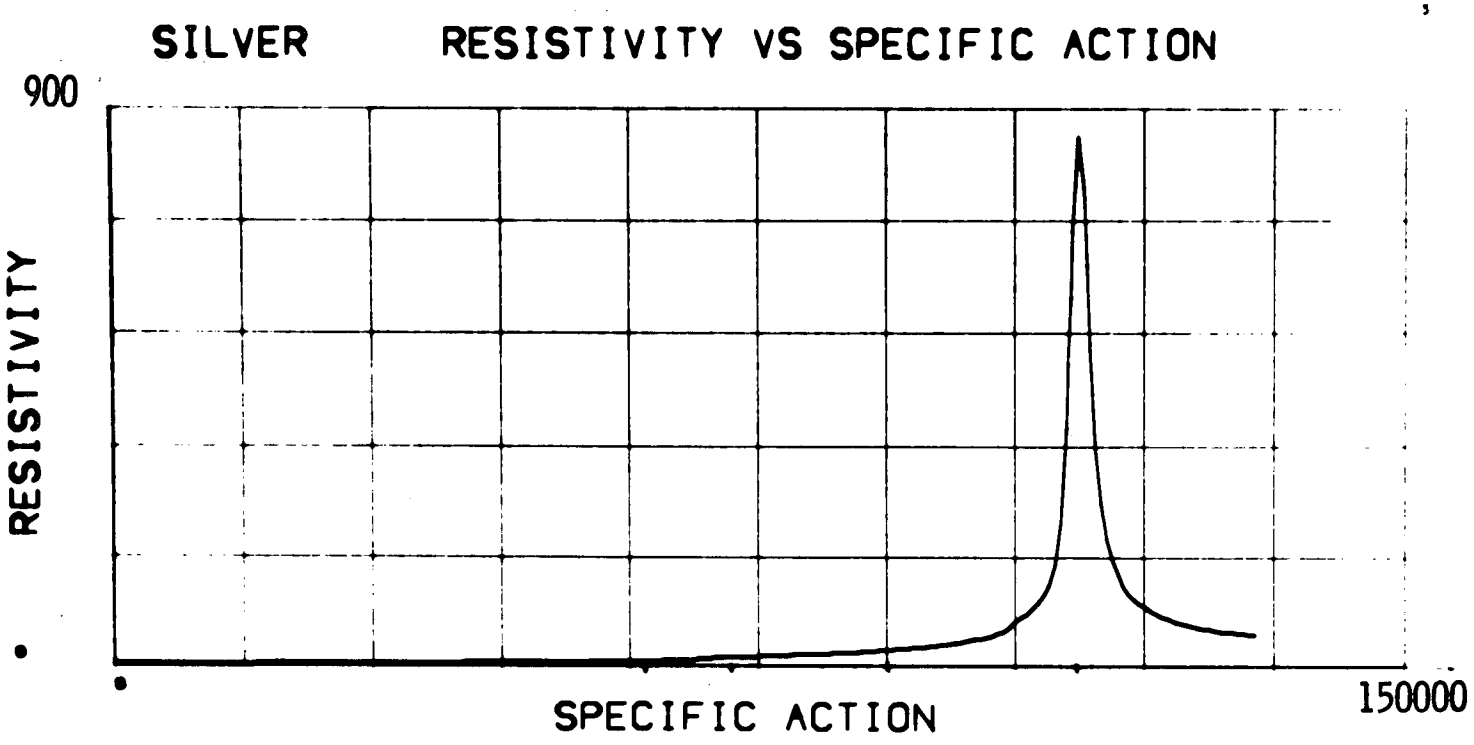

COPPER RESISTIVITY VS ENERGY DENSITY
600
RESISTIVITY
15000
ENERGY DENSITY

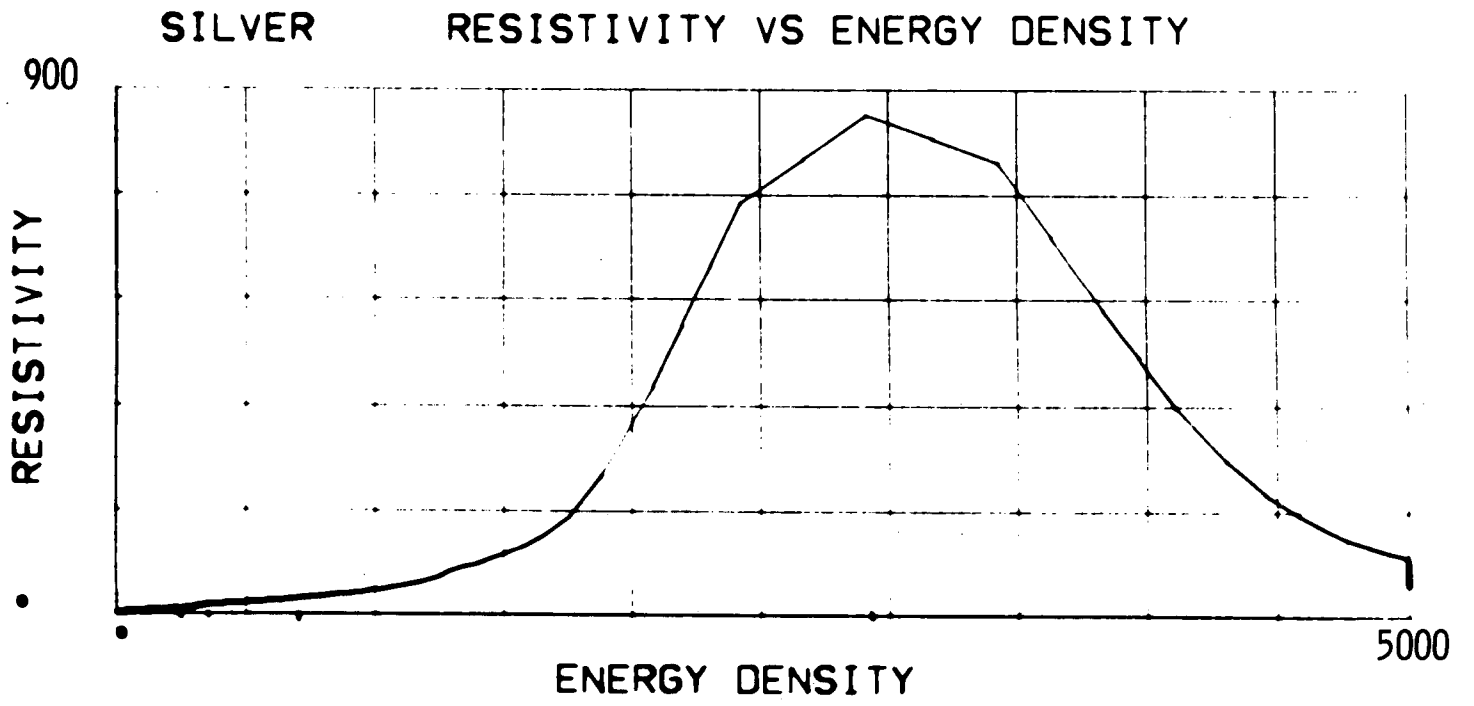

ALUMINUM RESISTIVITY VS SPECIFIC ACTION
400
RESISTIVITY
100000
SPECIFIC ACTION

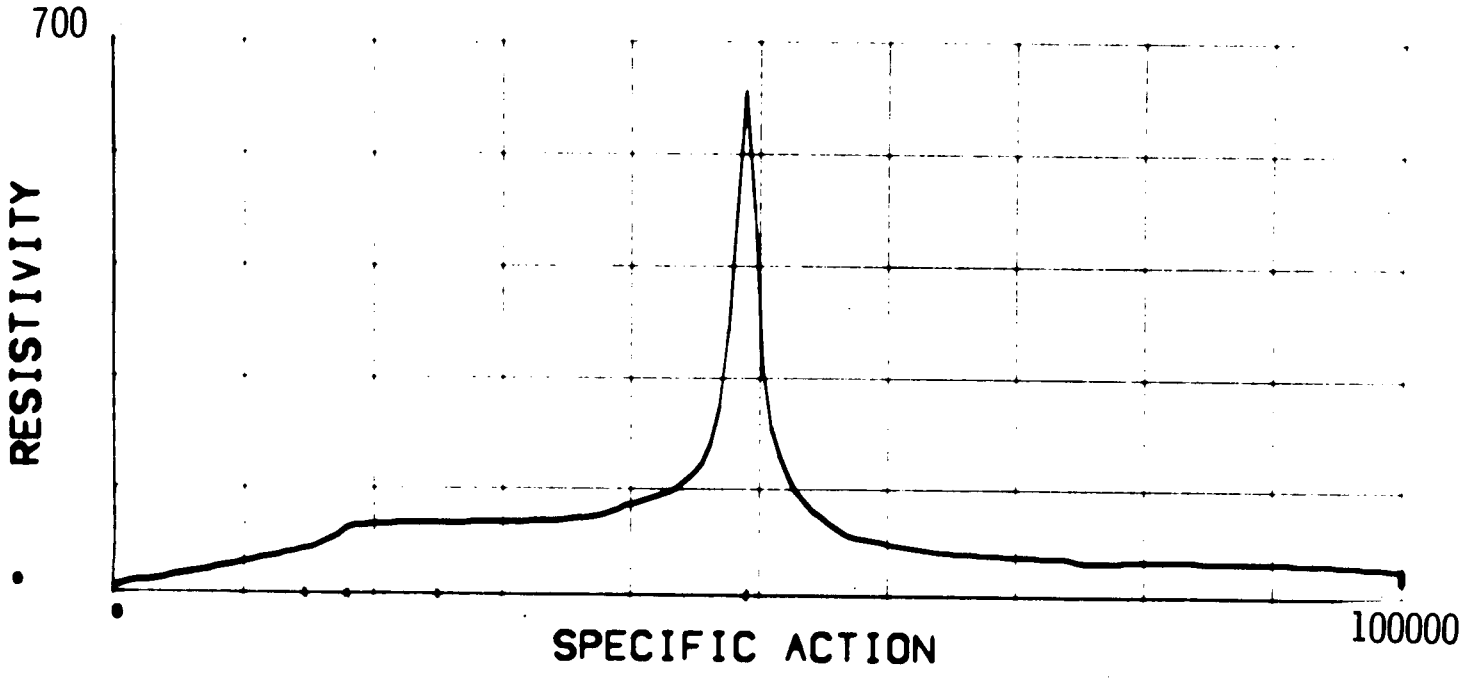

ALUMINUM RESISTIVITY VS ENERGY DENSITY
400
RESISTIVITY
25000
ENERGY DENSITY

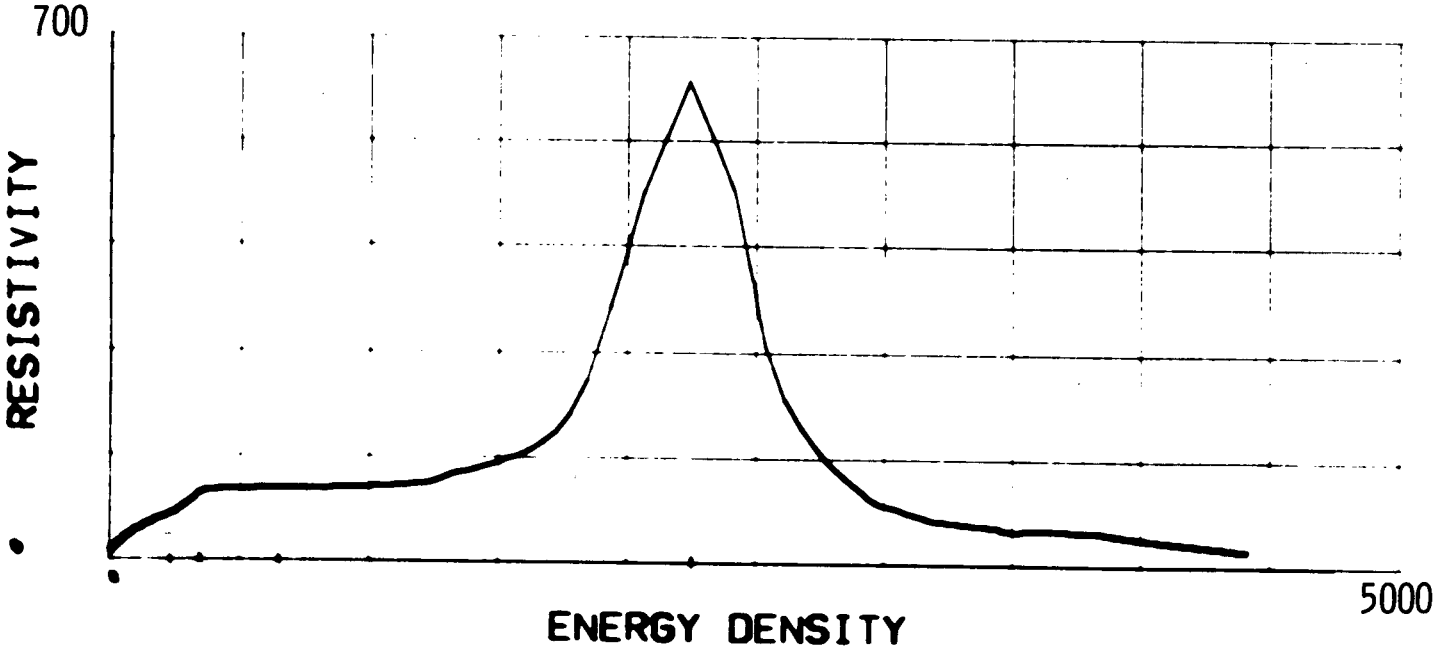

GOLD
RESISTIVITY VS SPECIFIC ACTION
1200
RESISTIVITY
100000
SPECIFIC ACTION

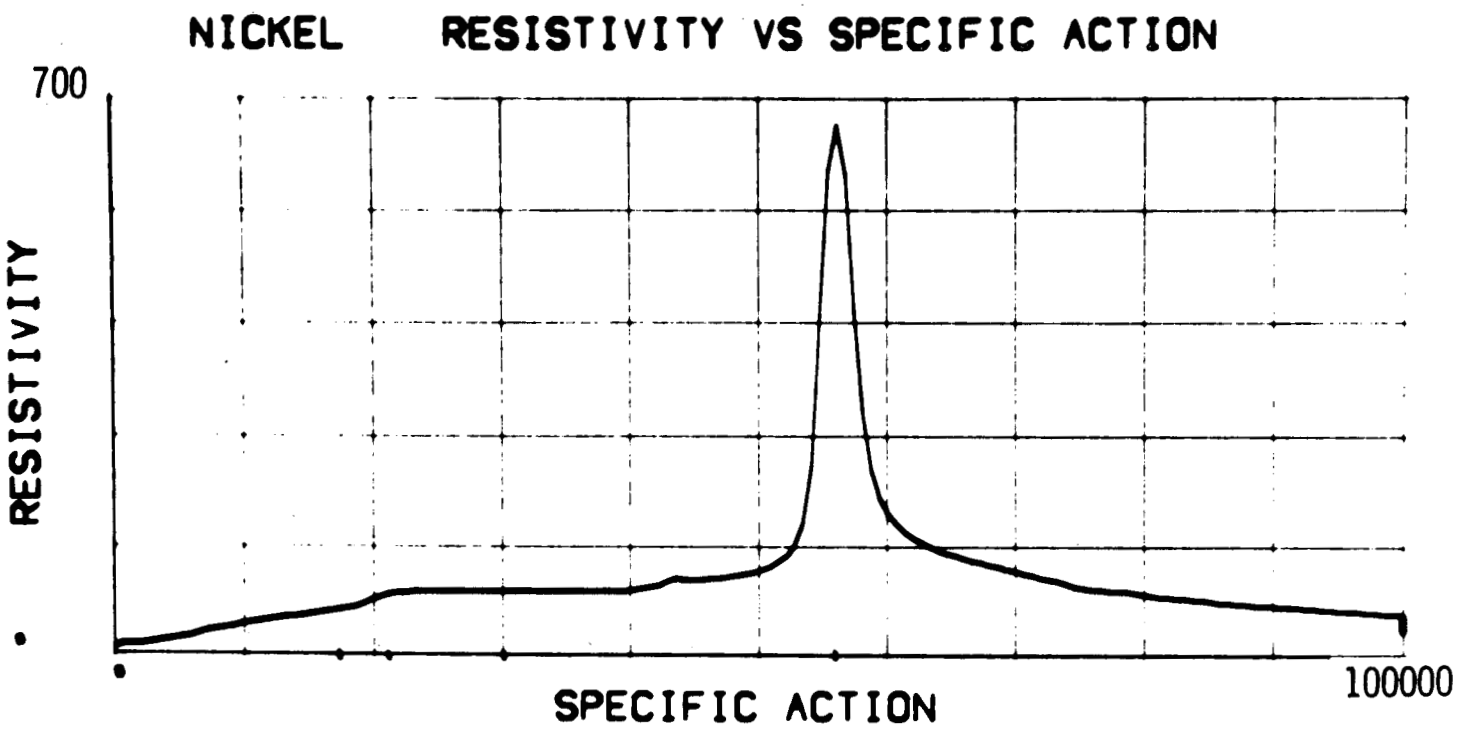

GOLD
RESISTIVITY VS ENERGY DENSITY
1200
RESISTIVITY
5000
ENERGY DENSITY

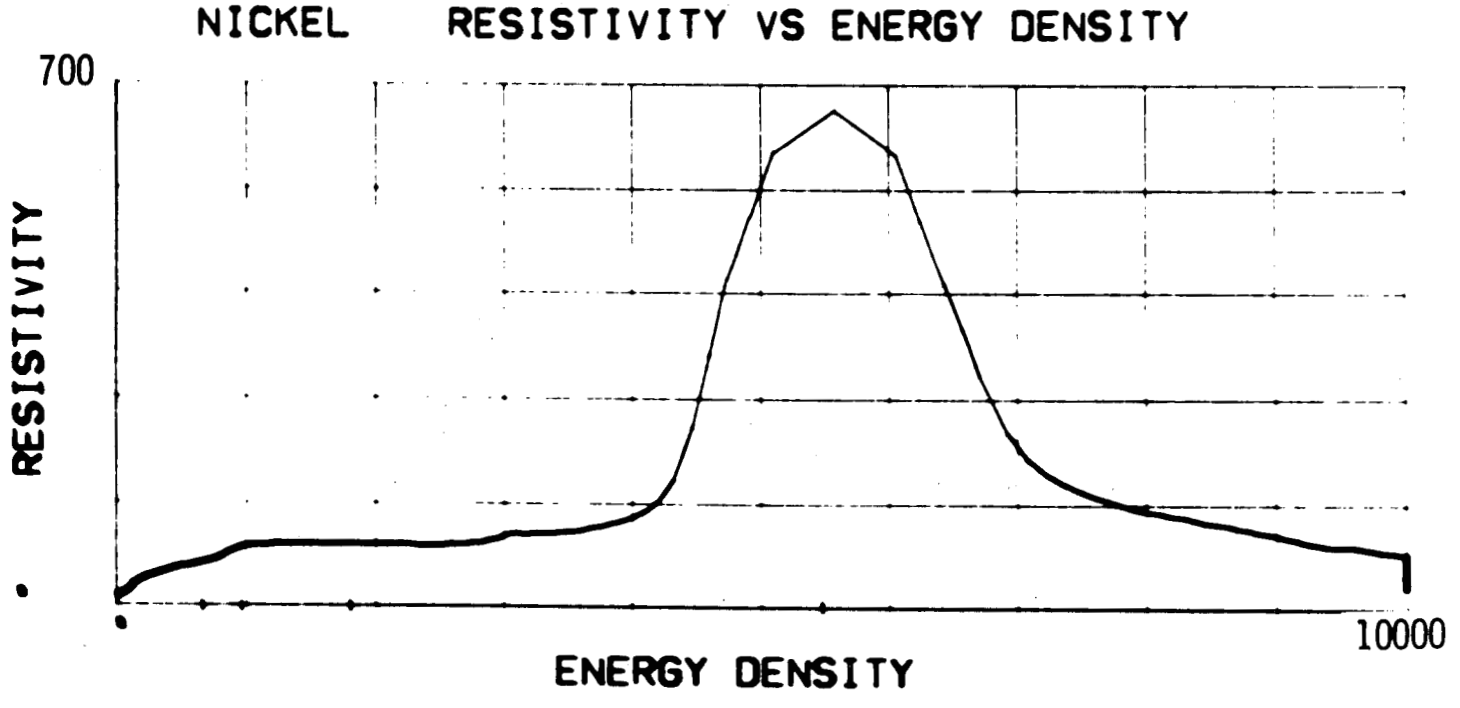

SILVER RESISTIVITY VS SPECIFIC ACTION
900
RESISTIVITY
150000
SPECIFIC ACTION

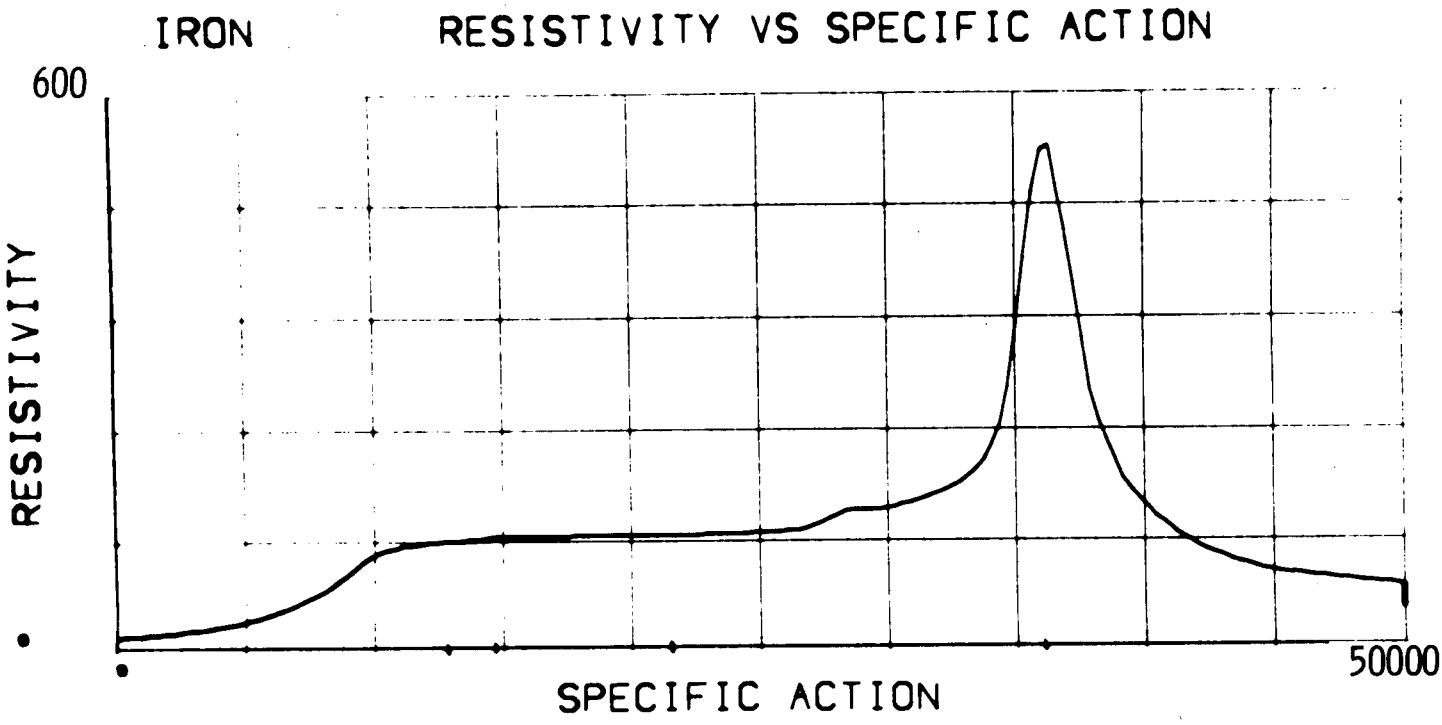

SILVER RESISTIVITY VS ENERGY DENSITY
900
RESISTIVITY
5000
ENERGY DENSITY

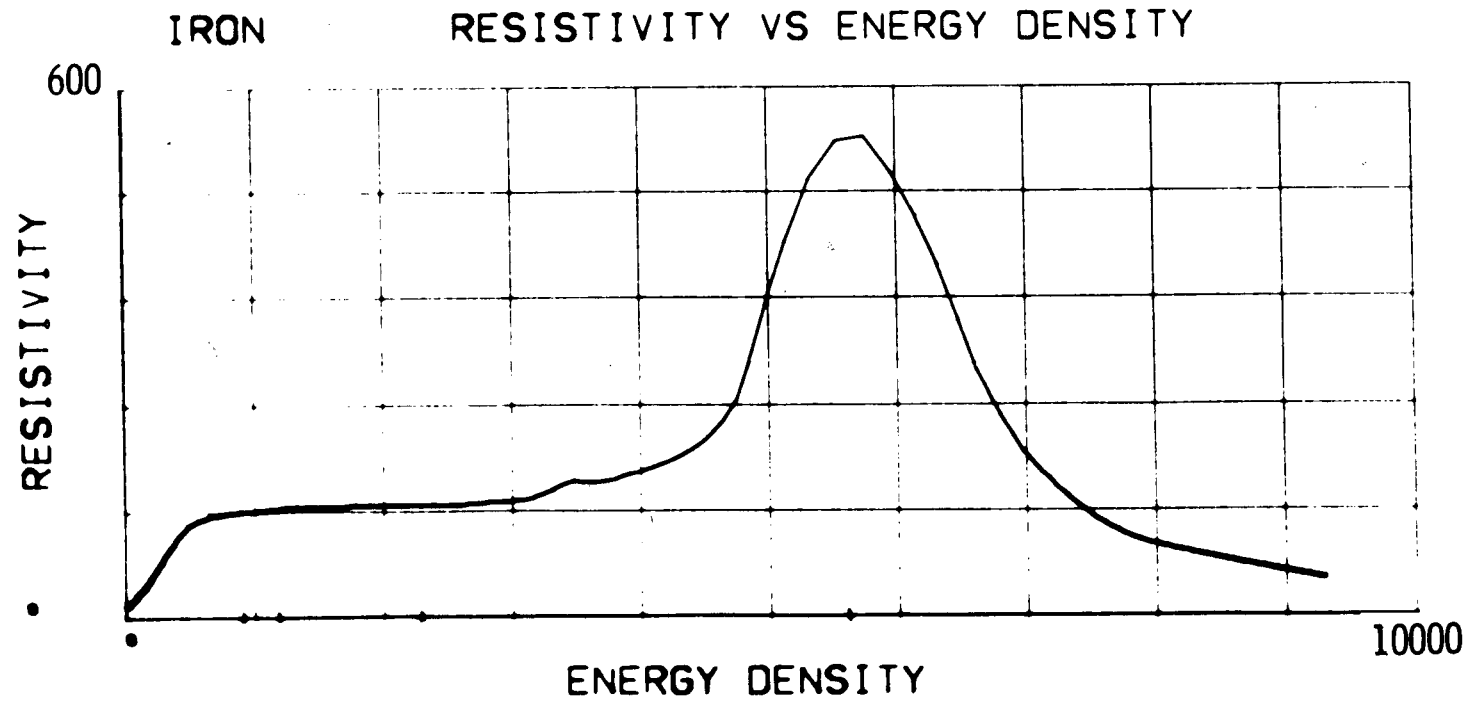

PLATINUM RESISTIVITY VS SPECIFIC ACTION
700
RESISTIVITY
100000
SPECIFIC ACTION


PLATINUM RESISTIVITY VS ENERGY DENSITY
700
RESISTIVITY
5000
ENERGY DENSITY

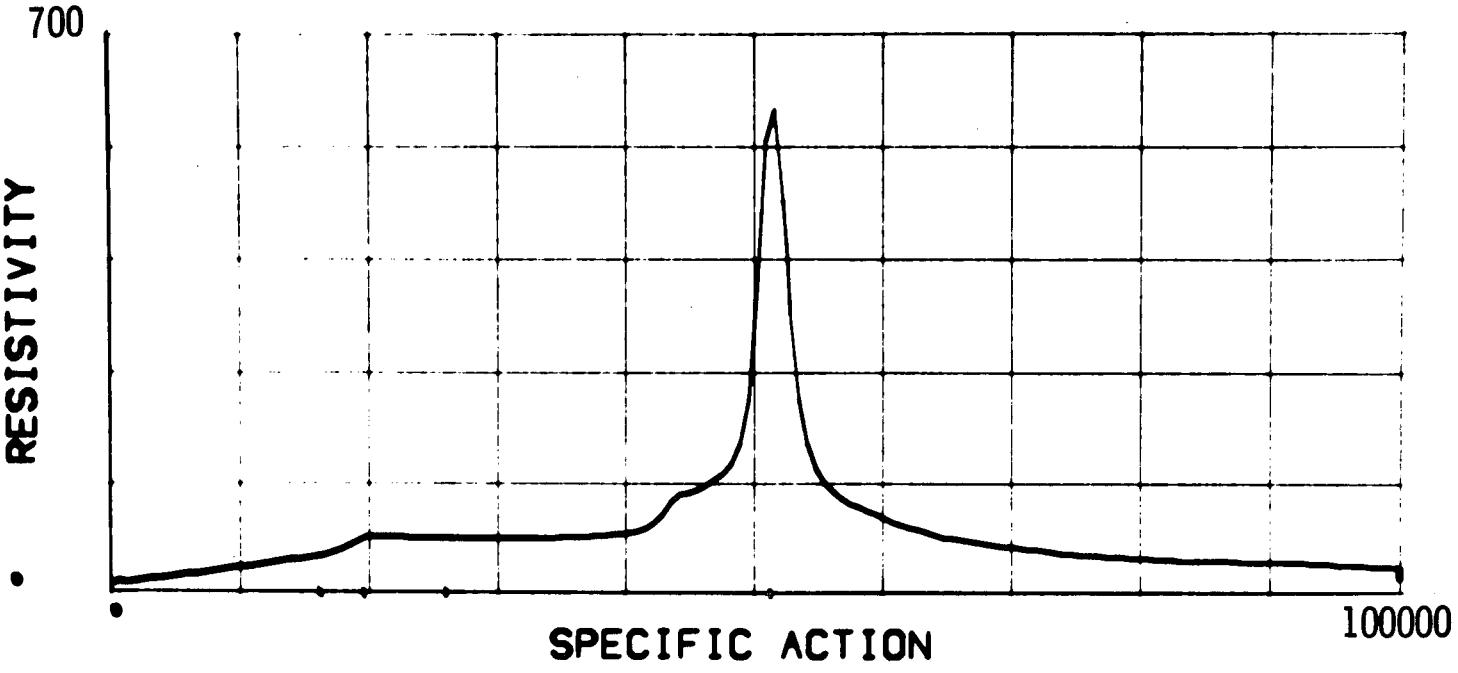

NICKEL RESISTIVITY VS SPECIFIC ACTION
700
RESISTIVITY
100000
SPECIFIC ACTION


NICKEL RESISTIVITY VS ENERGY DENSITY
700
RESISTIVITY
10000
ENERGY DENSITY

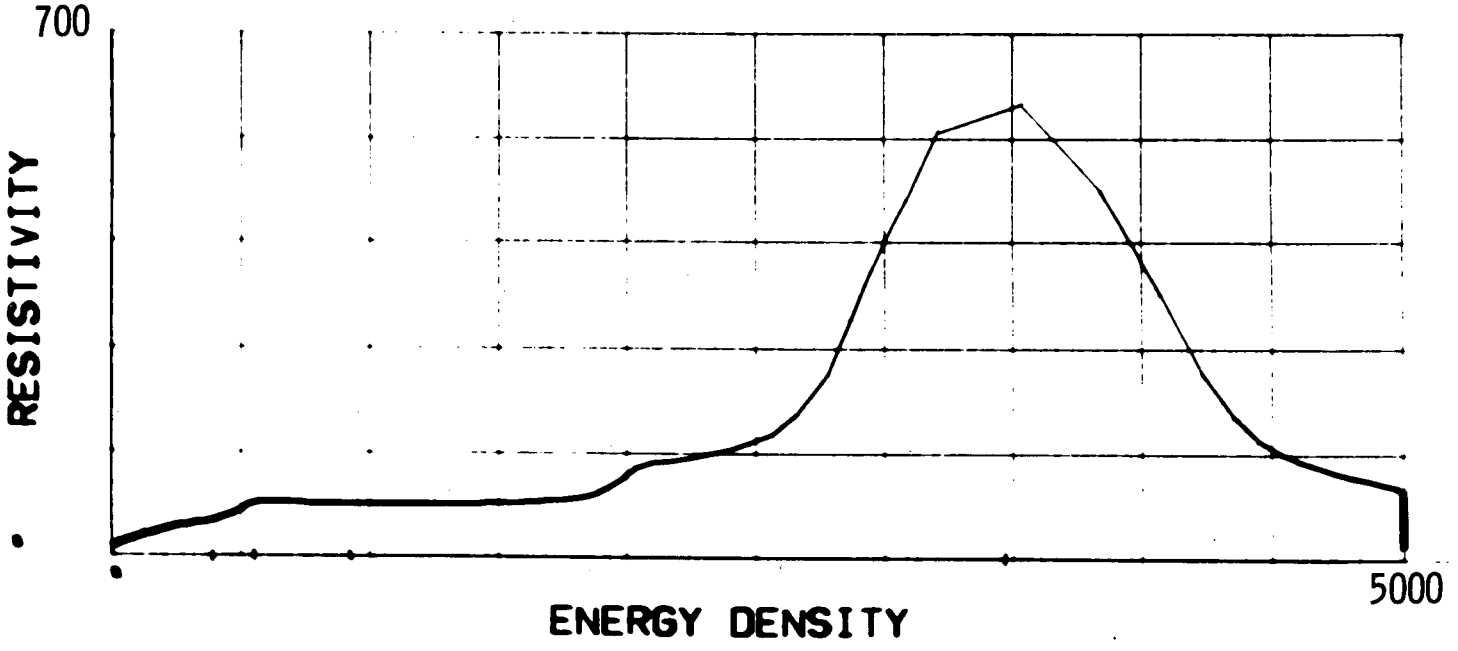

IRON
RESISTIVITY VS SPECIFIC ACTION
600
RESISTIVITY
50000
SPECIFIC ACTION

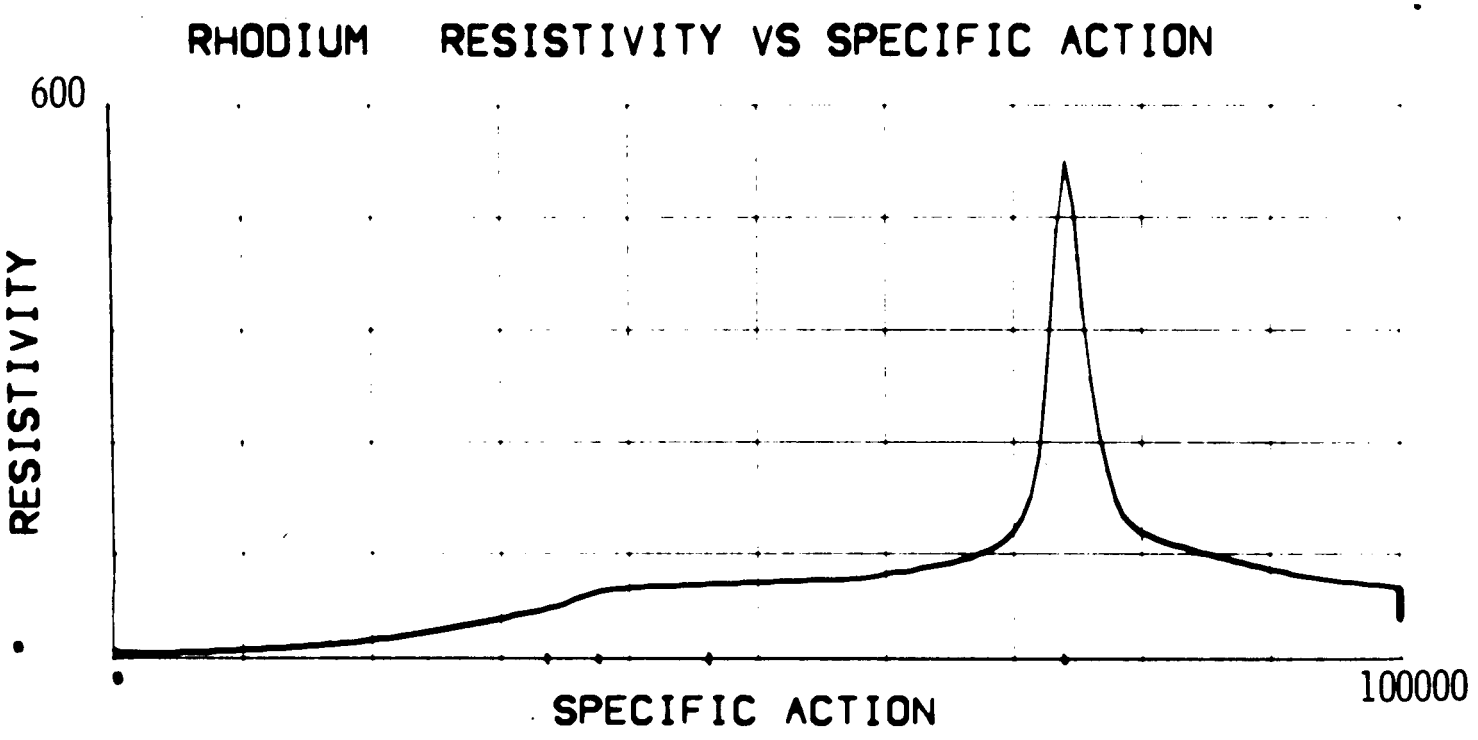

IRON
RESISTIVITY VS ENERGY DENSITY
600
RESISTIVITY
10000
ENERGY DENSITY

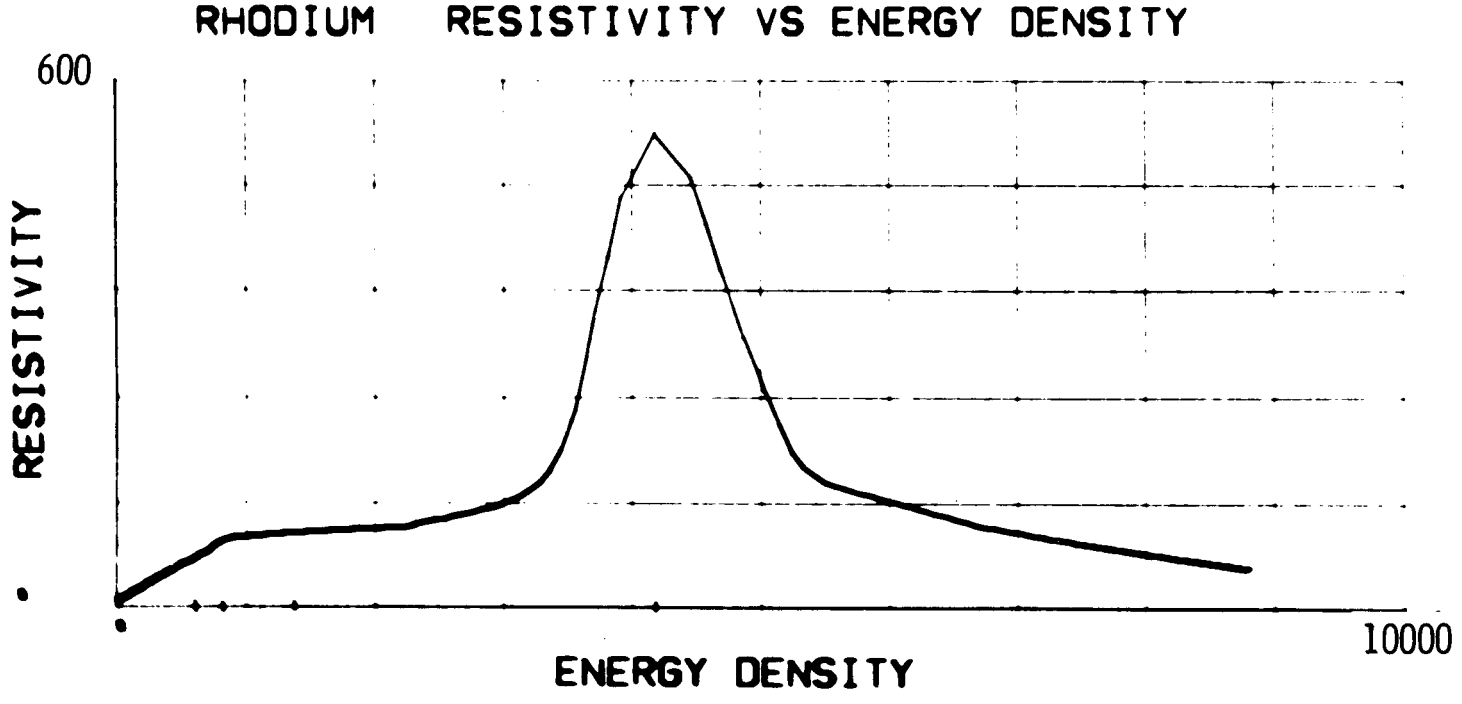
PALLADIUM RESISTIVITY VS SPECIFIC ACTION

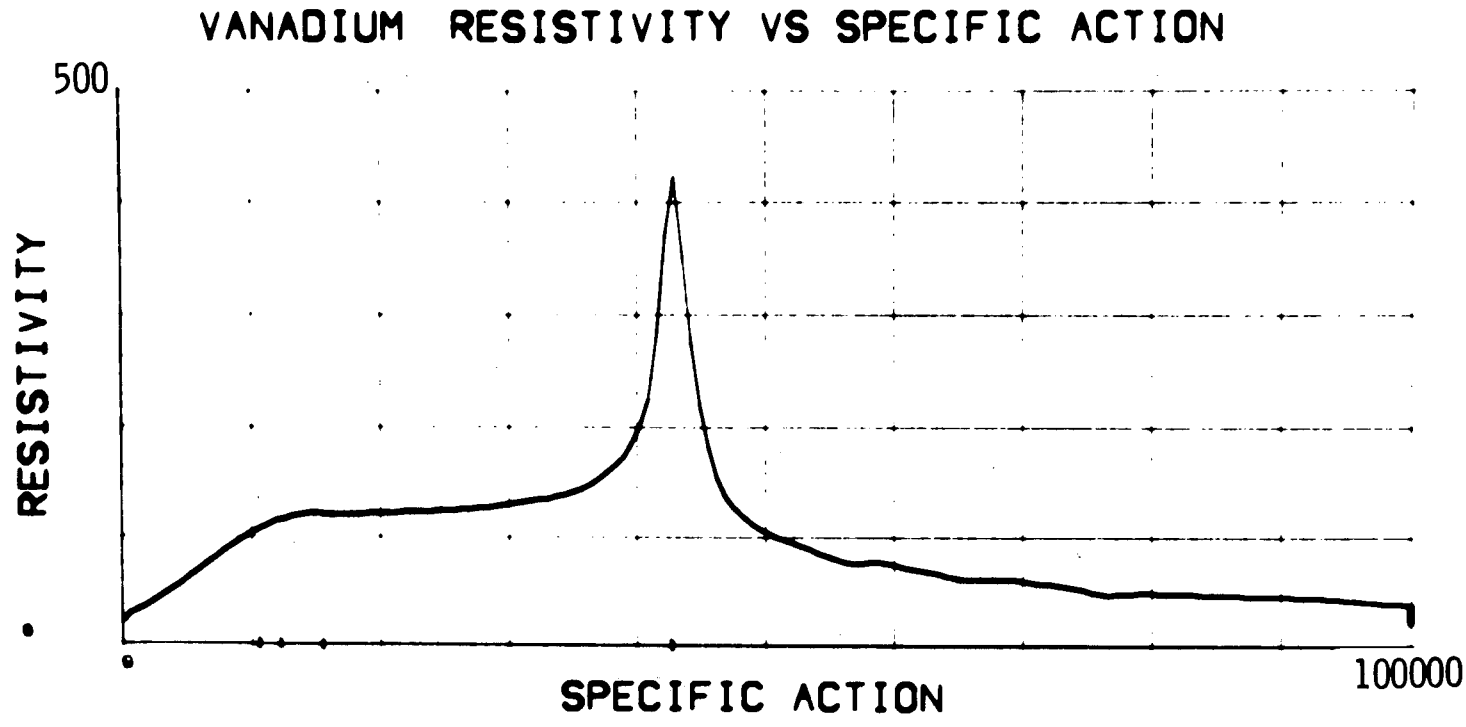


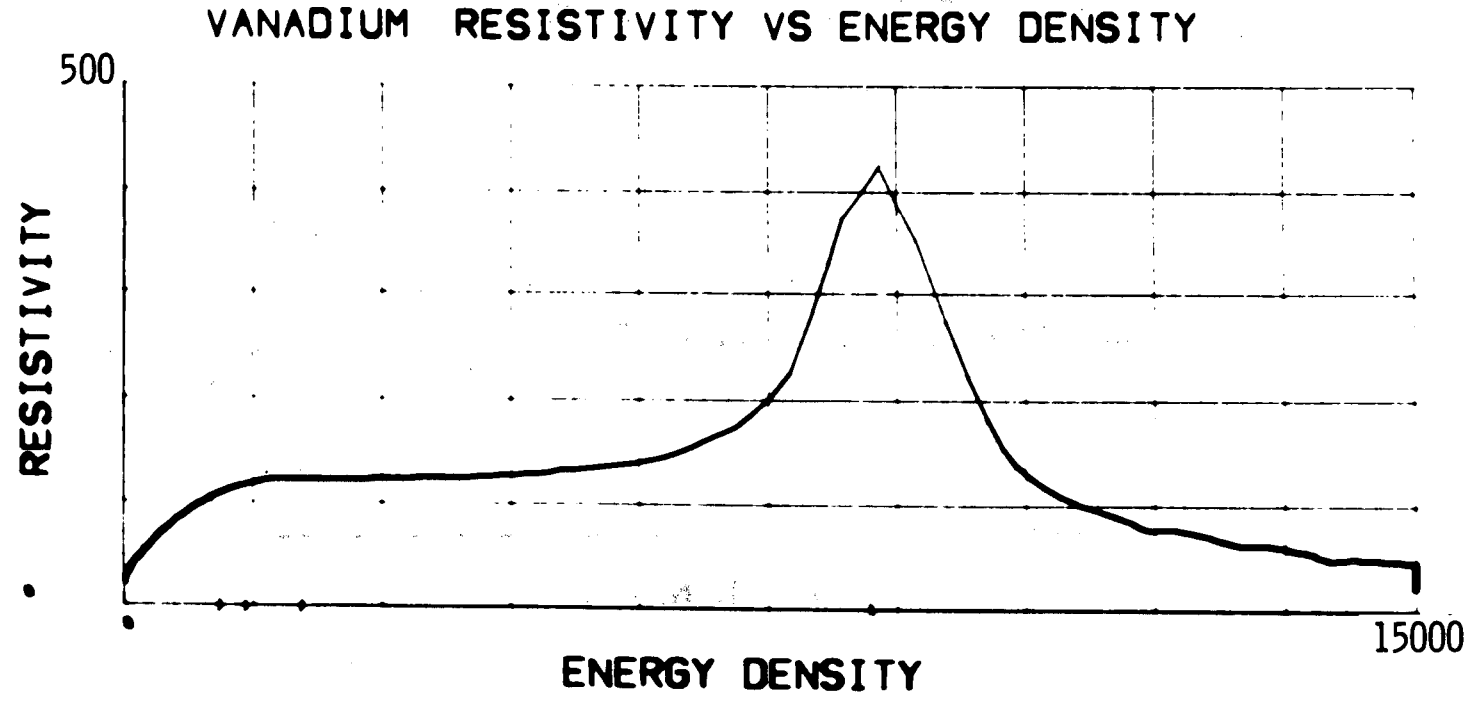
PALLADIUM RESISTIVITY VS ENERGY DENSITY

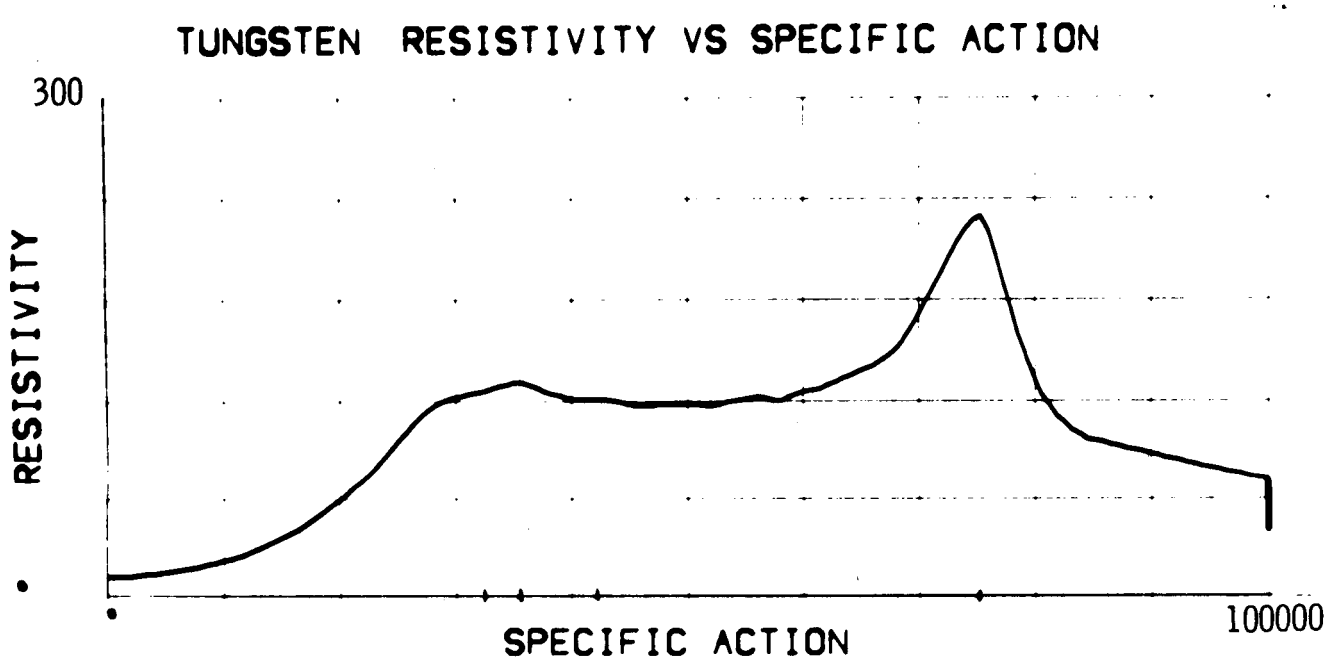


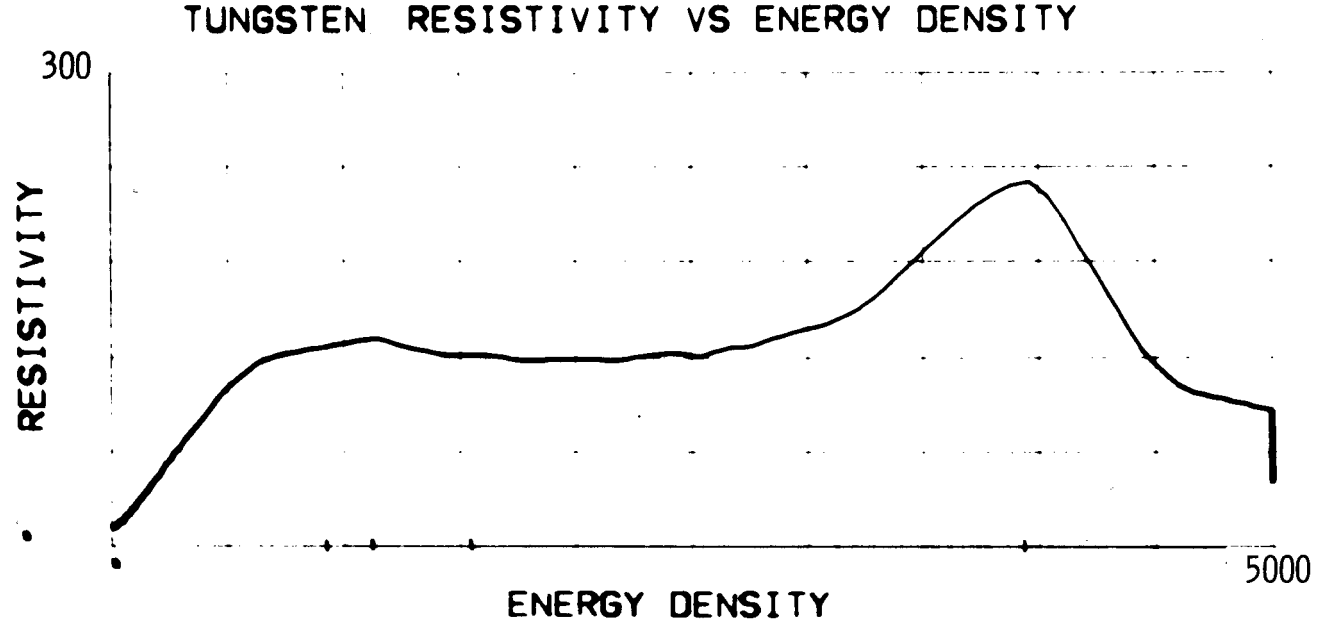

RHODIUM RESISTIVITY VS SPECIFIC ACTION
600
RESISTIVITY
100000
SPECIFIC ACTION

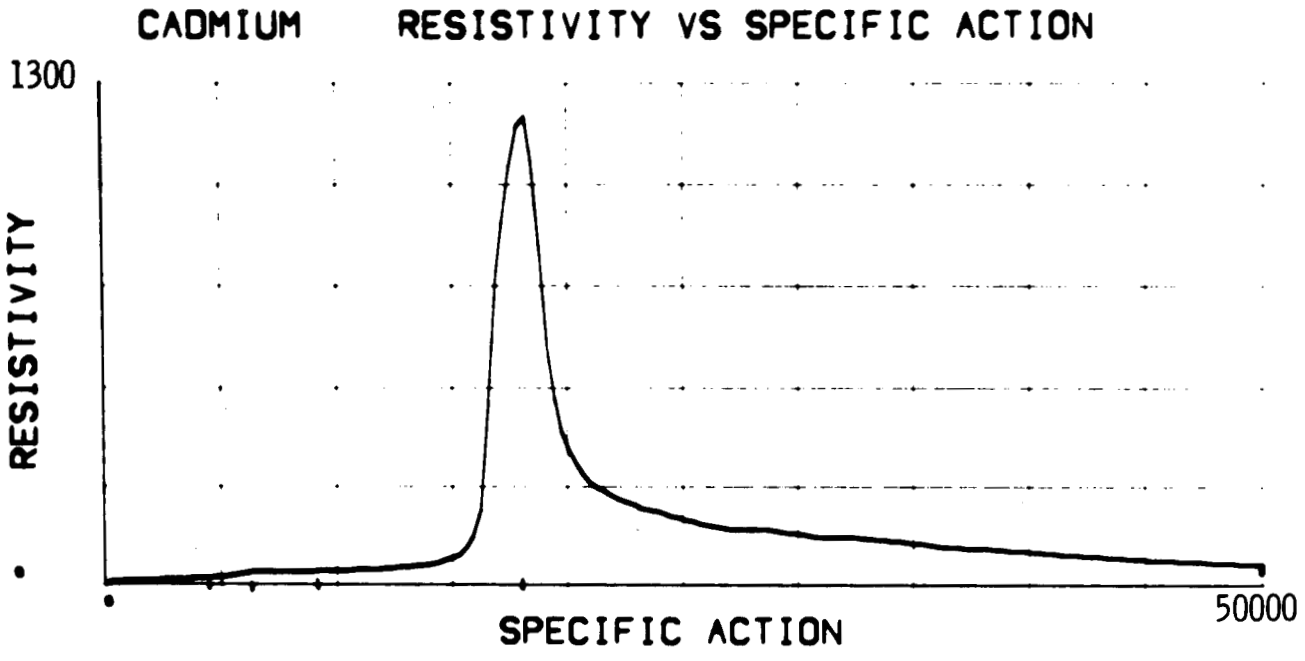

RHODIUM RESISTIVITY VS ENERGY DENSITY
600
RESISTIVITY
10000
ENERGY DENSITY

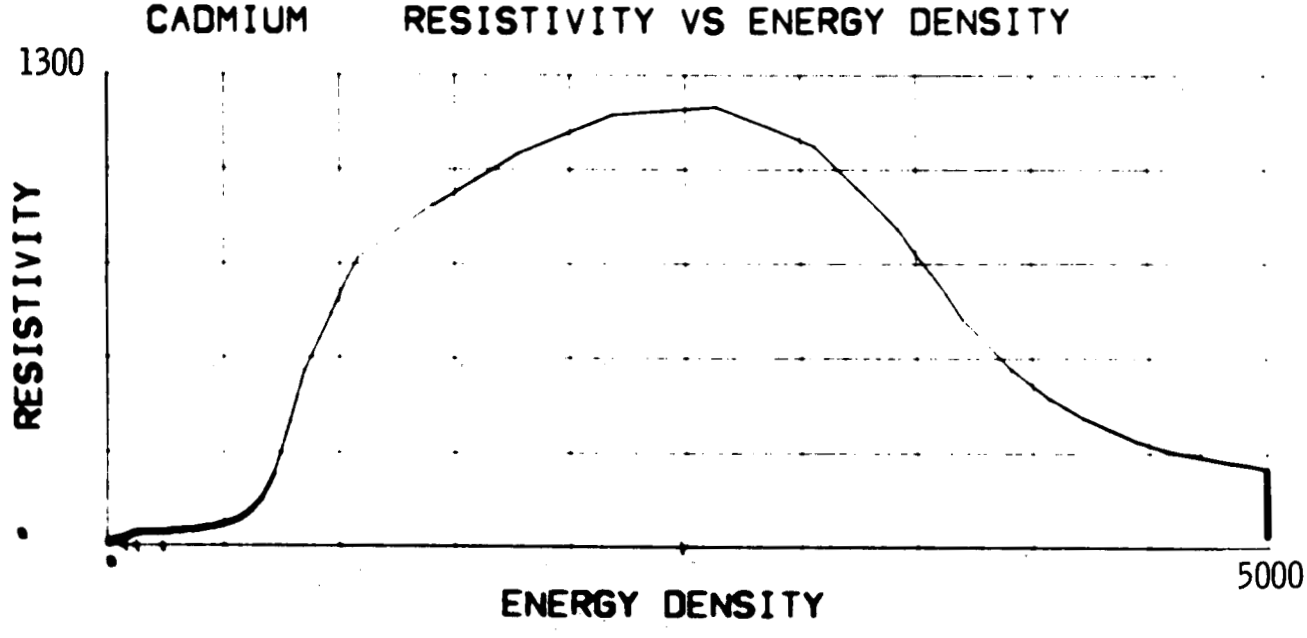

VANADIUM RESISTIVITY VS SPECIFIC ACTION
500
RESISTIVITY
0
100000
SPECIFIC ACTION

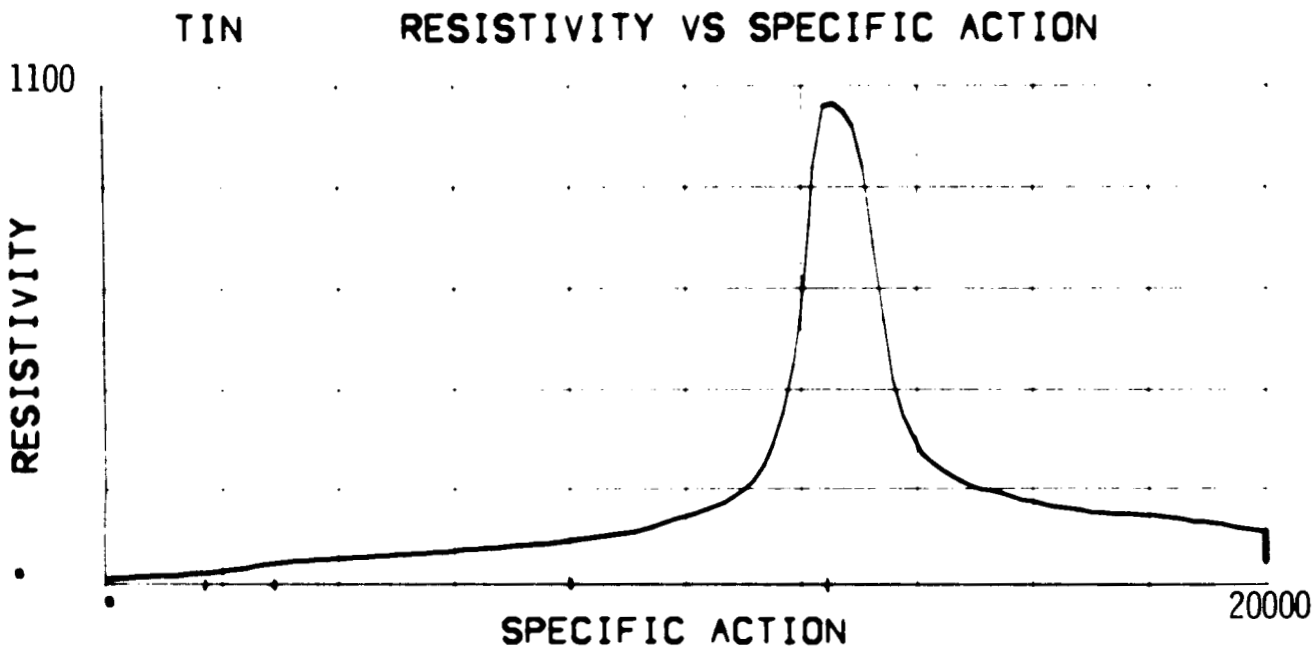

VANADIUM RESISTIVITY VS ENERGY DENSITY
500
RESISTIVITY
0
15000
ENERGY DENSITY

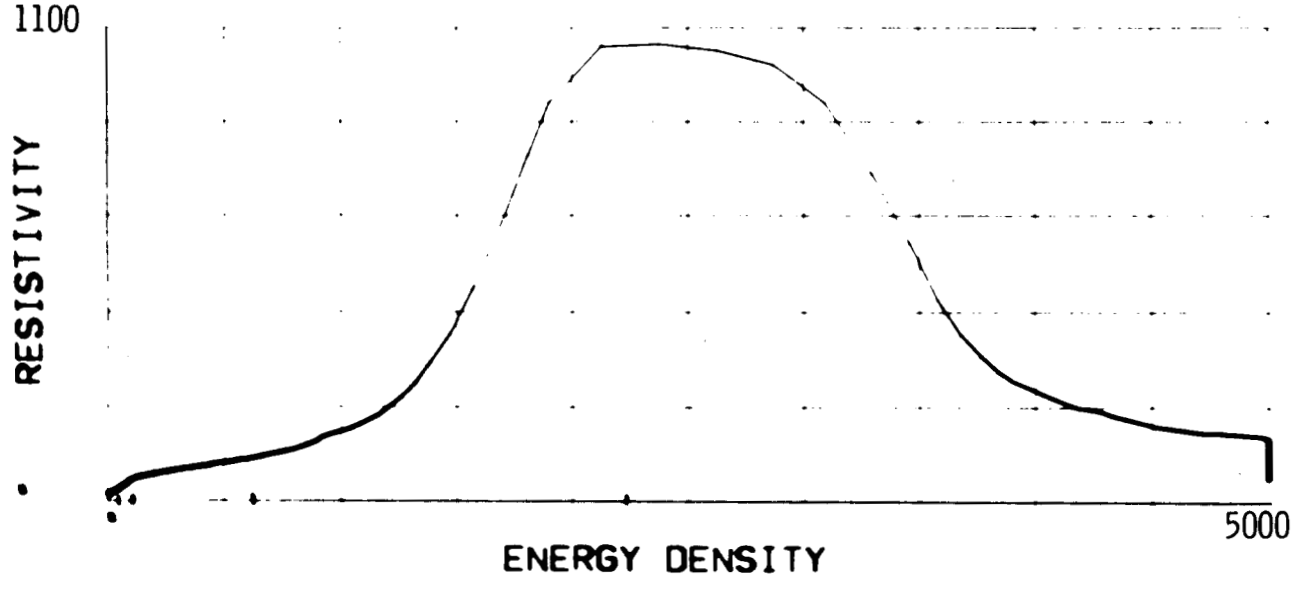

TUNGSTEN RESISTIVITY VS SPECIFIC ACTION
300
RESISTIVITY
100000
SPECIFIC ACTION

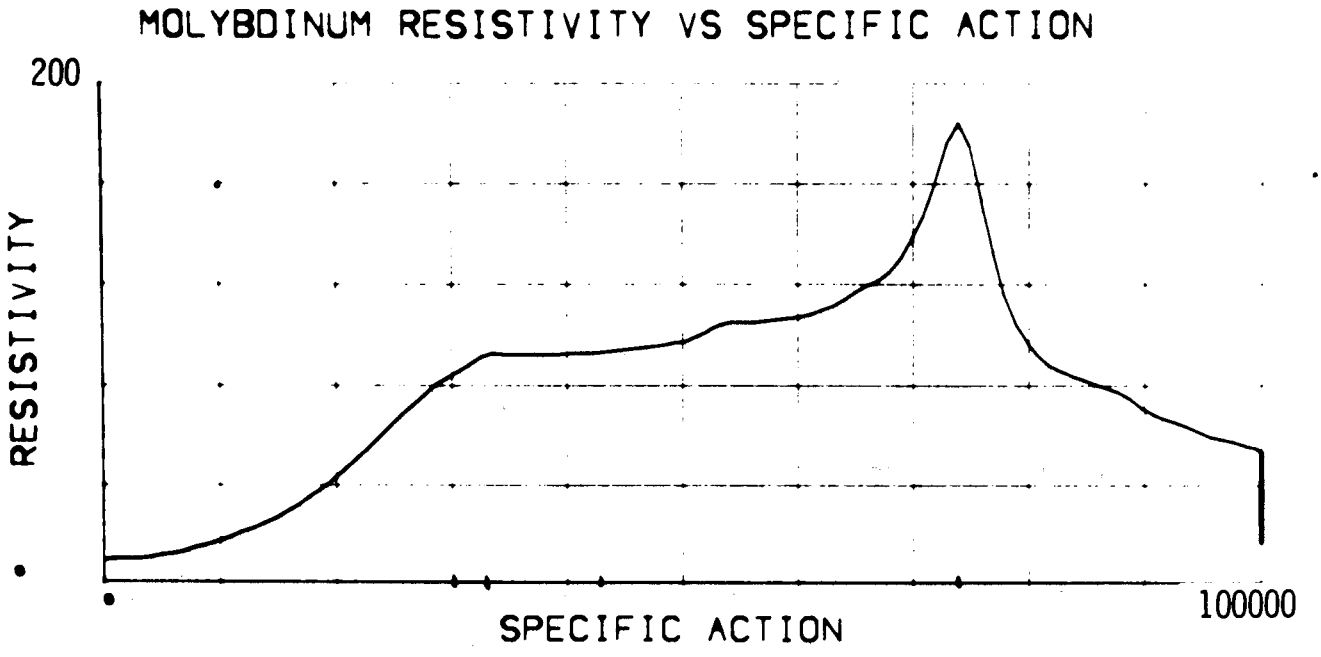

TUNGSTEN RESISTIVITY VS ENERGY DENSITY
300
RESISTIVITY
5000
ENERGY DENSITY

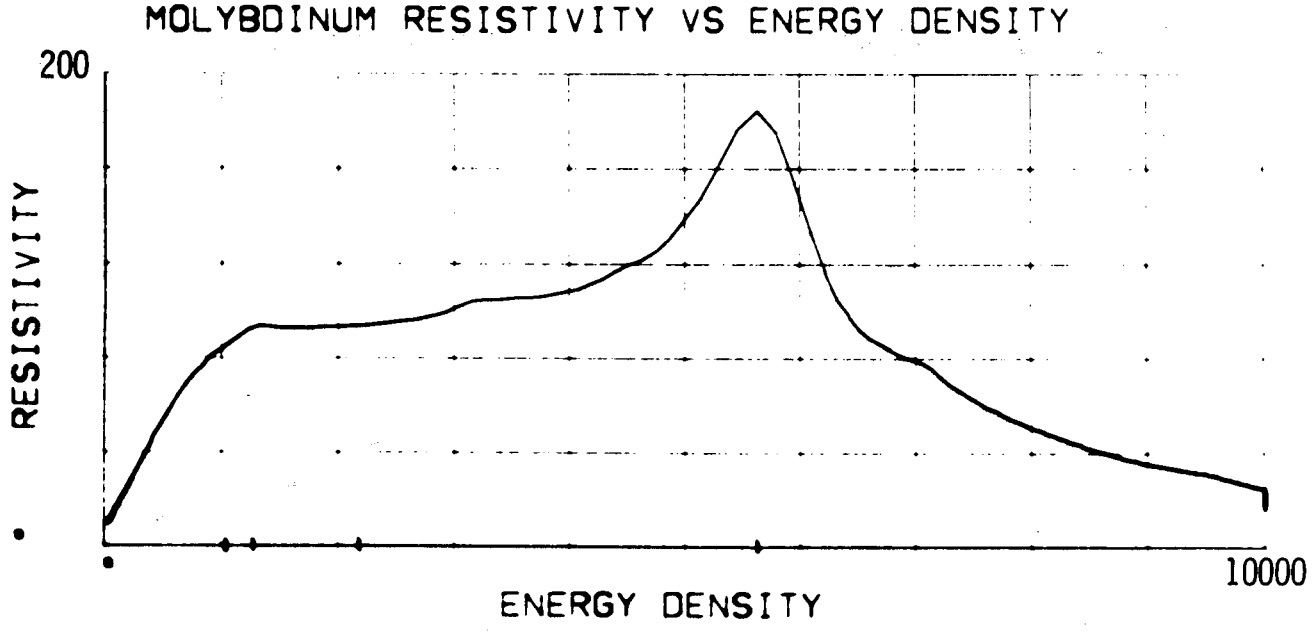

CADMIUM RESISTIVITY VS SPECIFIC ACTION
1300
RESISTIVITY
50000
SPECIFIC ACTION

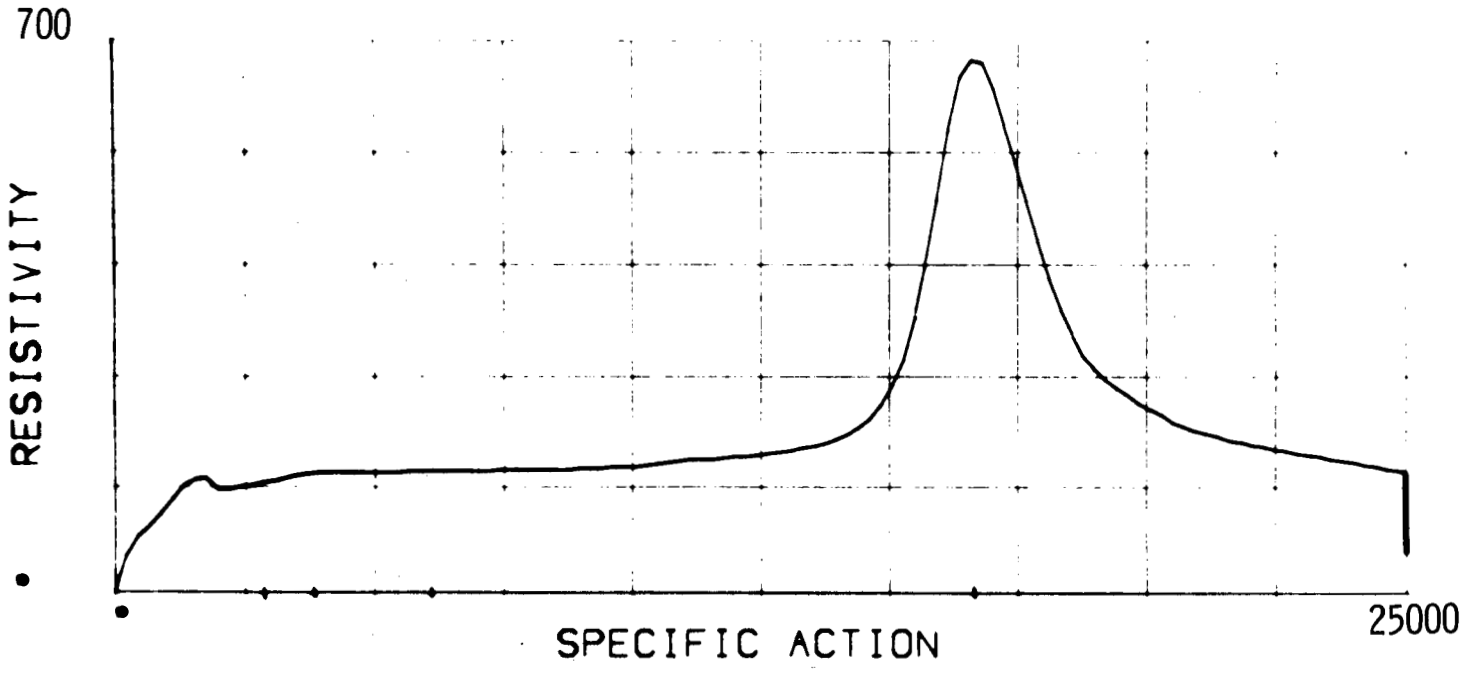

CADMIUM RESISTIVITY VS ENERGY DENSITY
1300
RESISTIVITY
5000
ENERGY DENSITY

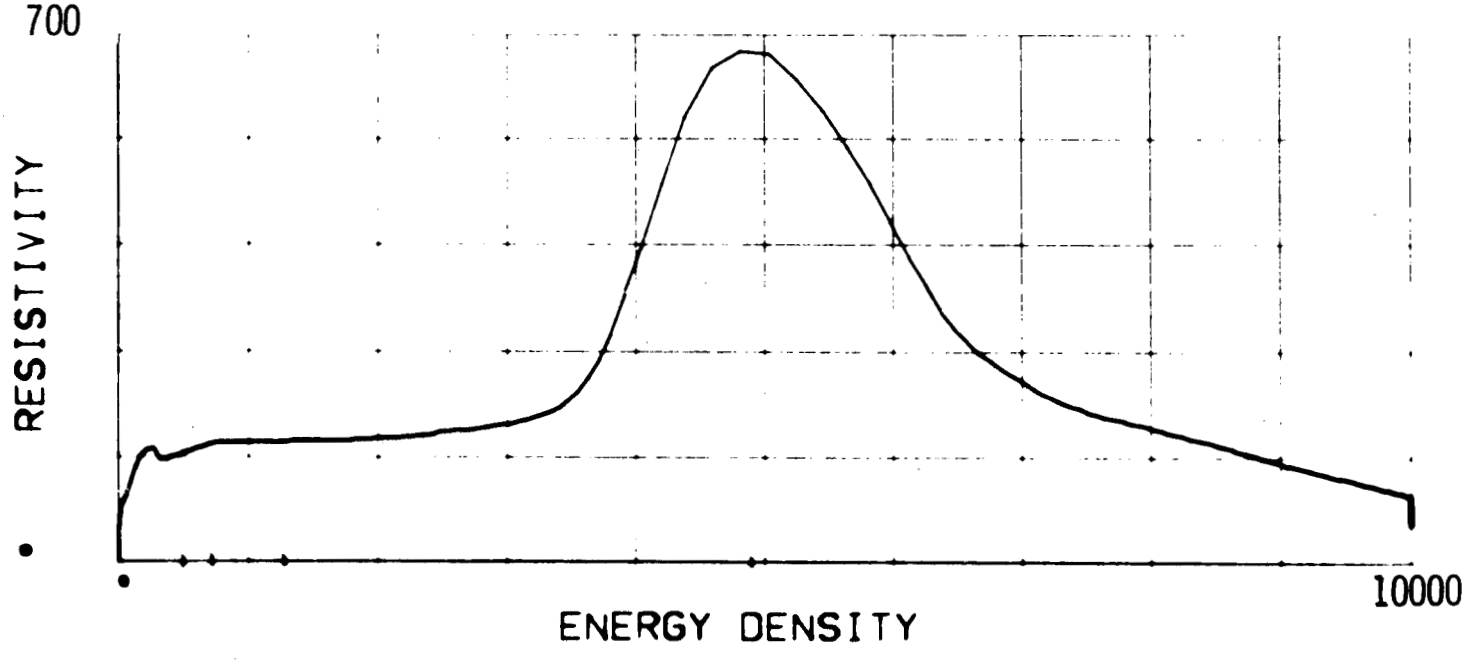

TIN RESISTIVITY VS SPECIFIC ACTION
1100
RESISTIVITY
20000
SPECIFIC ACTION

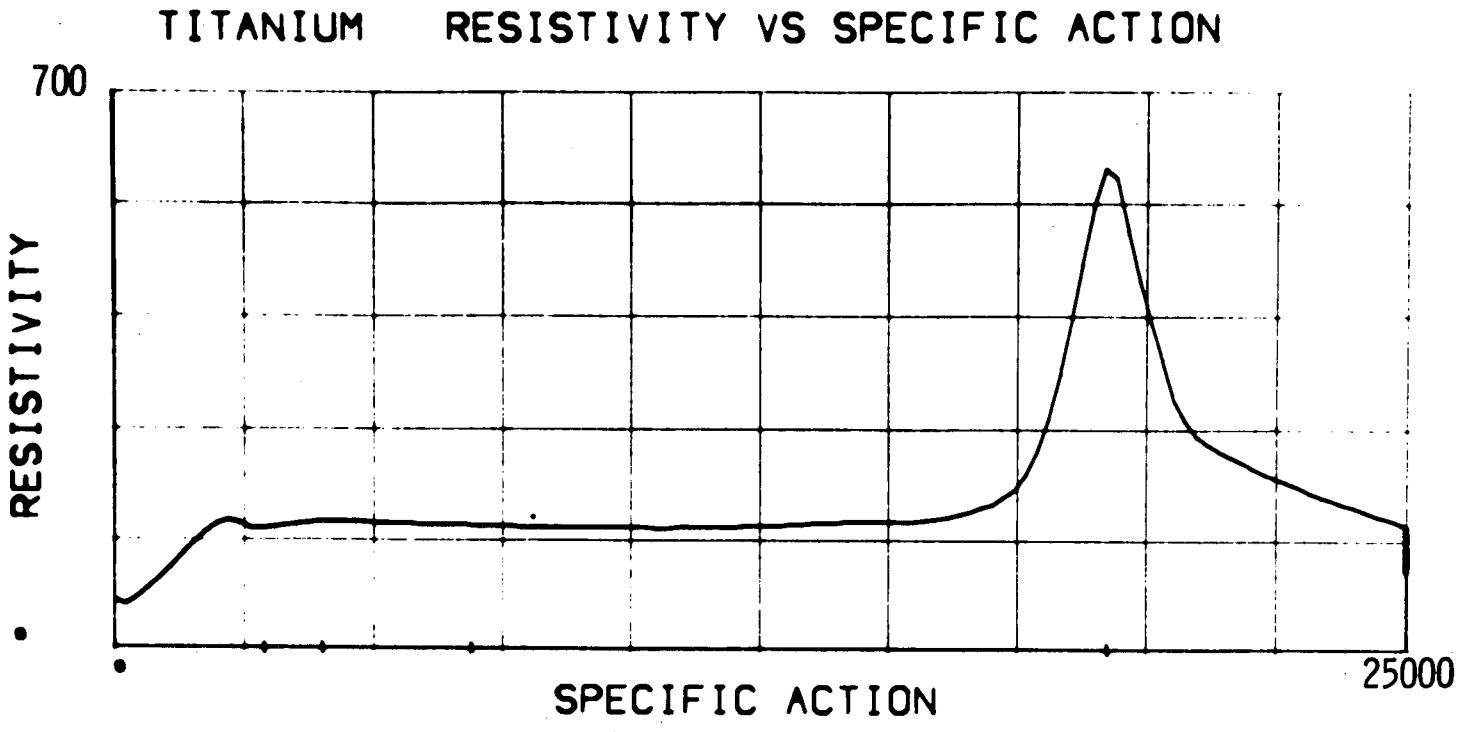

TIN RESISTIVITY VS ENERGY DENSITY
1100
RESISTIVITY
5000
ENERGY DENSITY

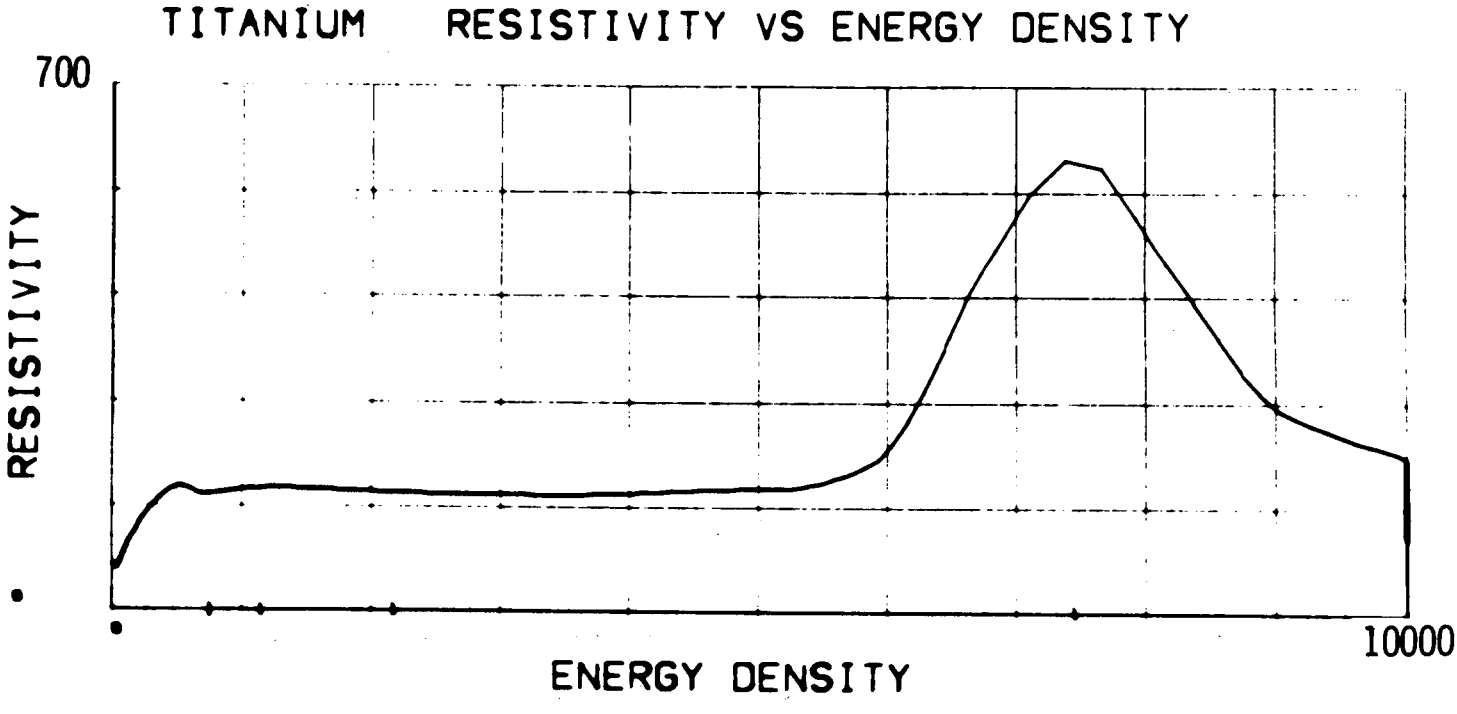

MOLYBDINUM RESISTIVITY VS SPECIFIC ACTION
200
RESISTIVITY
100000
SPECIFIC ACTION

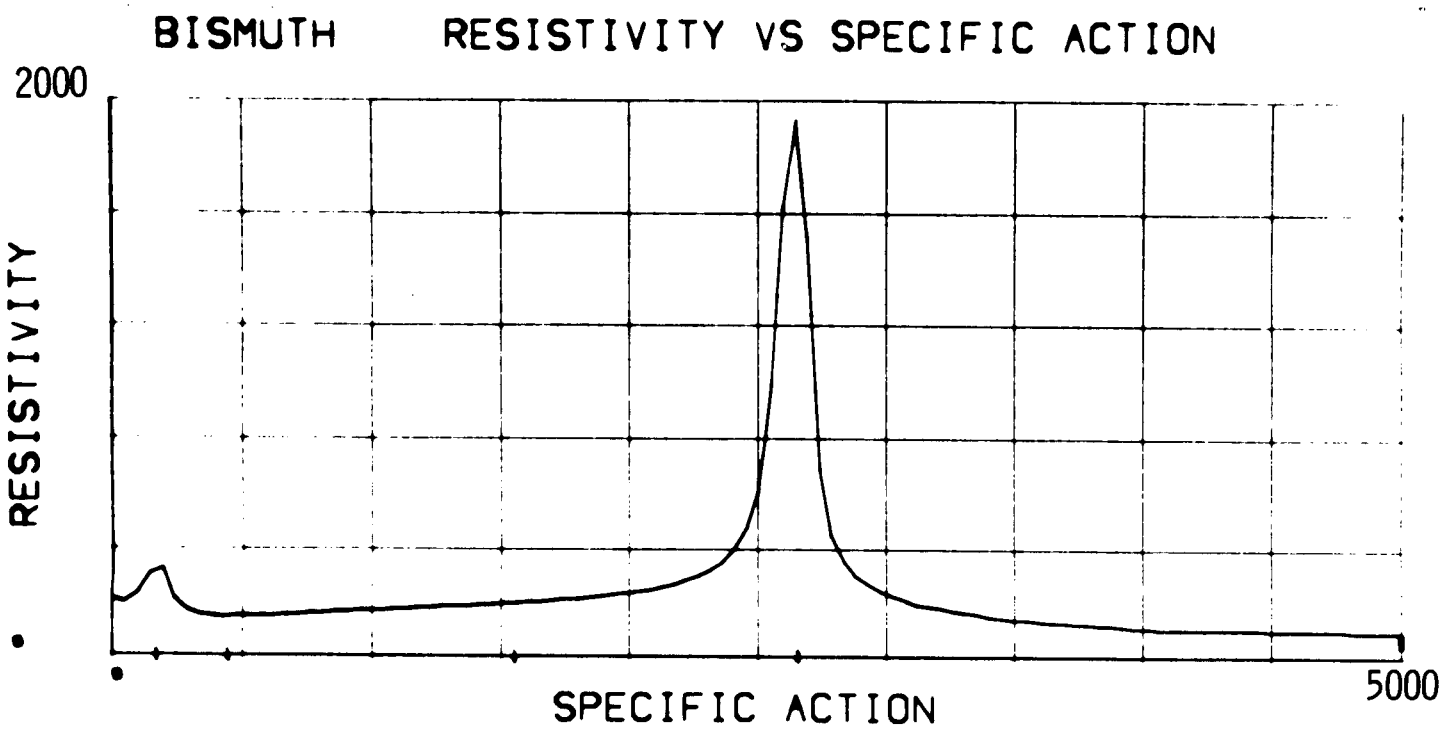

MOLYBDINUM RESISTIVITY VS ENERGY DENSITY
200
RESISTIVITY
10000
ENERGY DENSITY

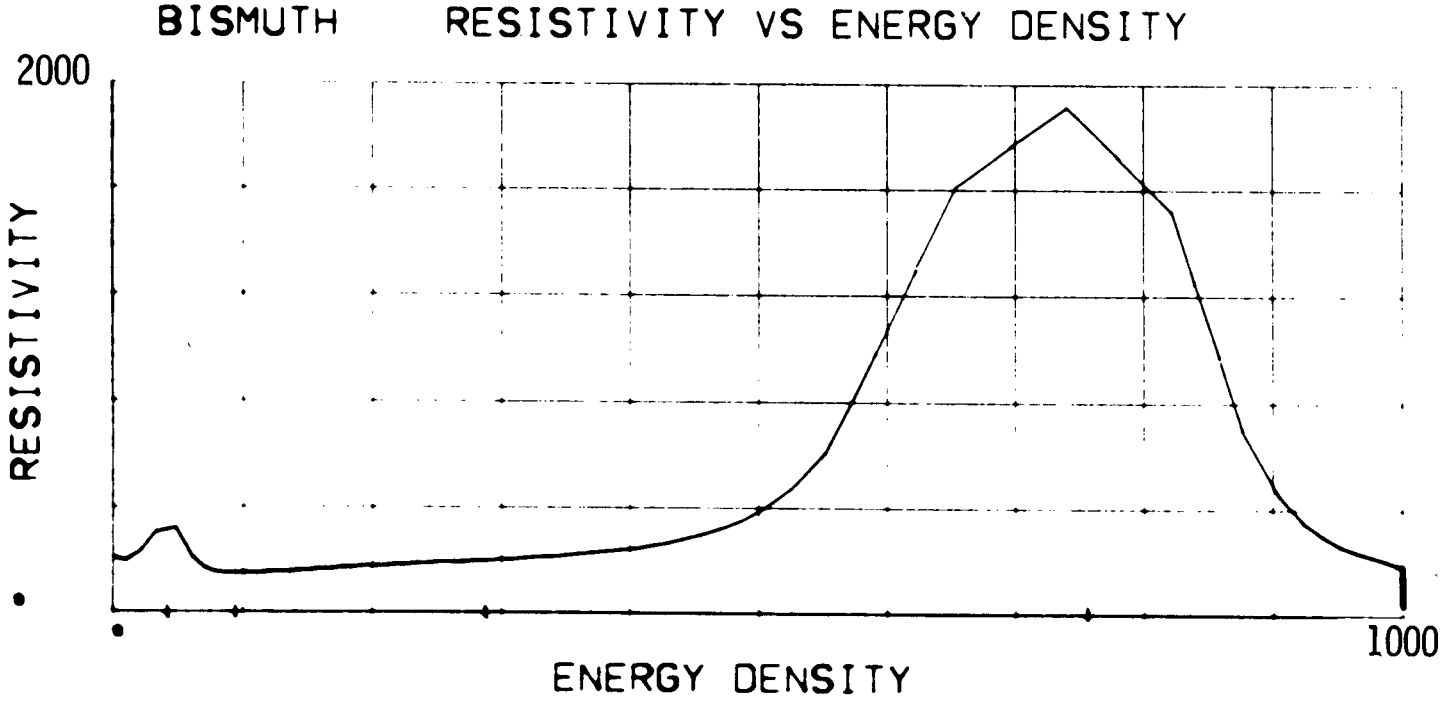

ZIRCONIUM RESISTIVITY VS SPECIFIC ACTION
700
RESISTIVITY
25000
SPECIFIC ACTION

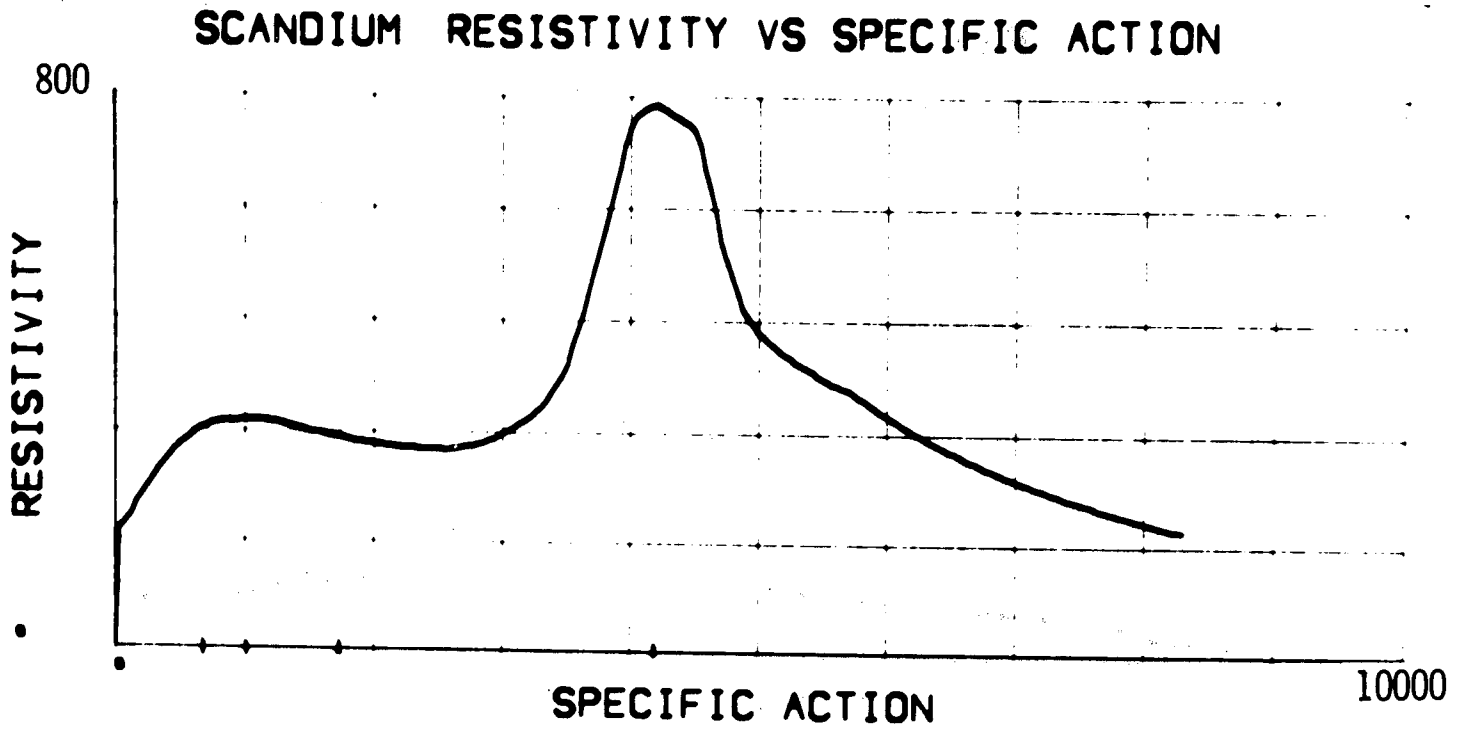

ZIRCONIUM RESISTIVITY VS ENERGY DENSITY
700
RESISTIVITY
10000
ENERGY DENSITY

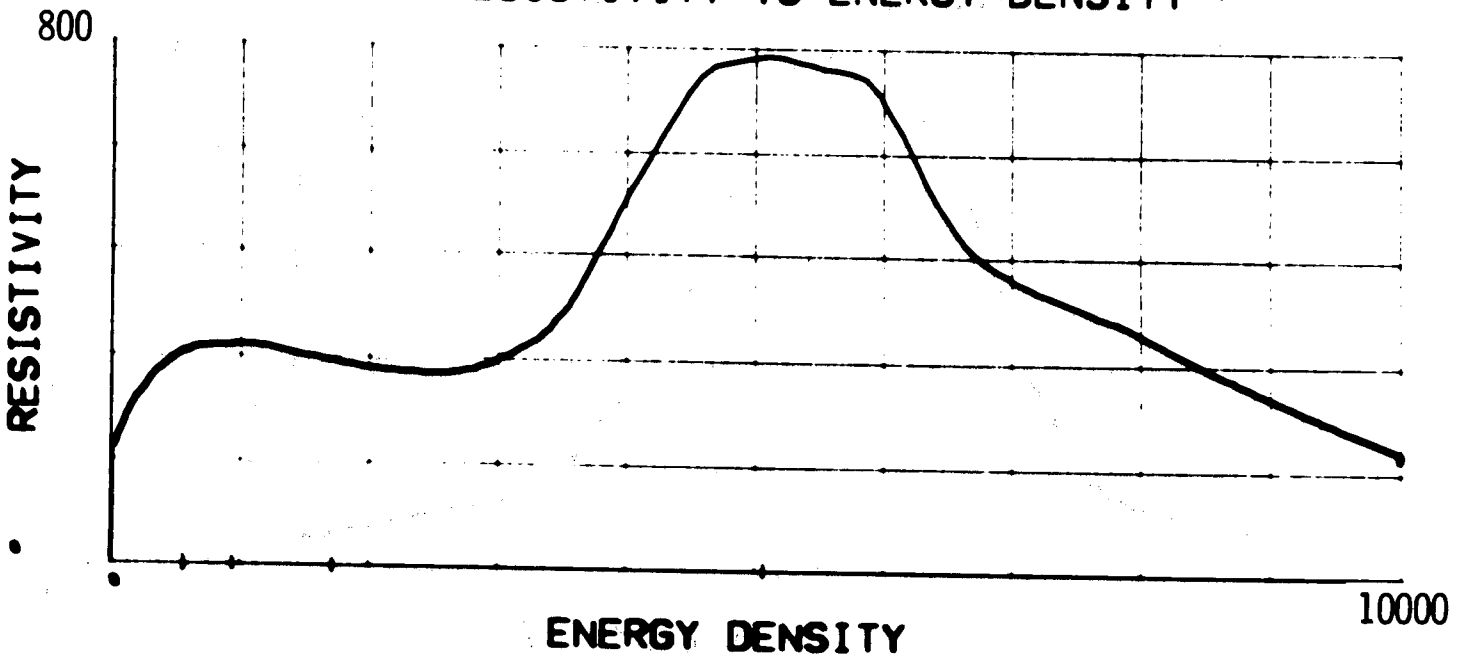

TITANIUM RESISTIVITY VS SPECIFIC ACTION
700
RESISTIVITY
0
0
25000
SPECIFIC ACTION

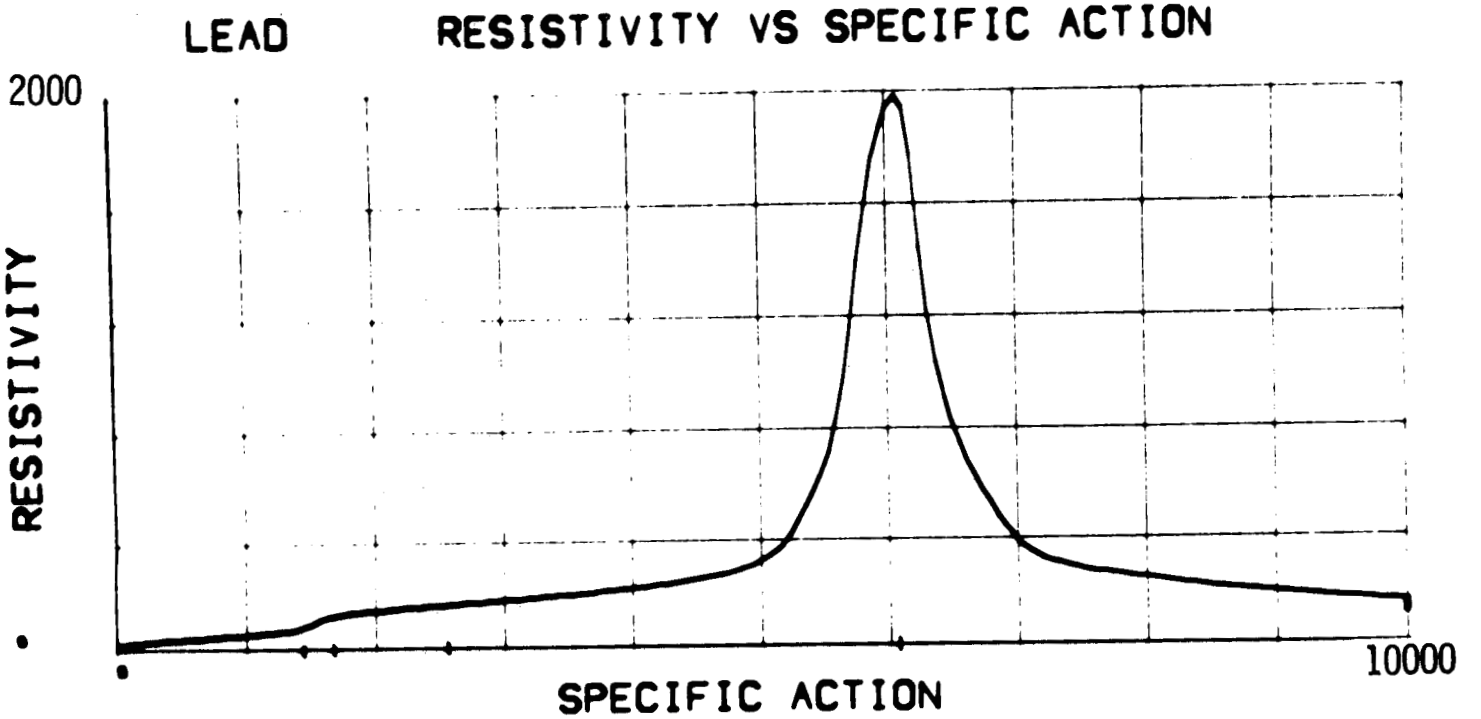

TITANIUM RESISTIVITY VS ENERGY DENSITY
700
RESISTIVITY
0
0
10000
ENERGY DENSITY

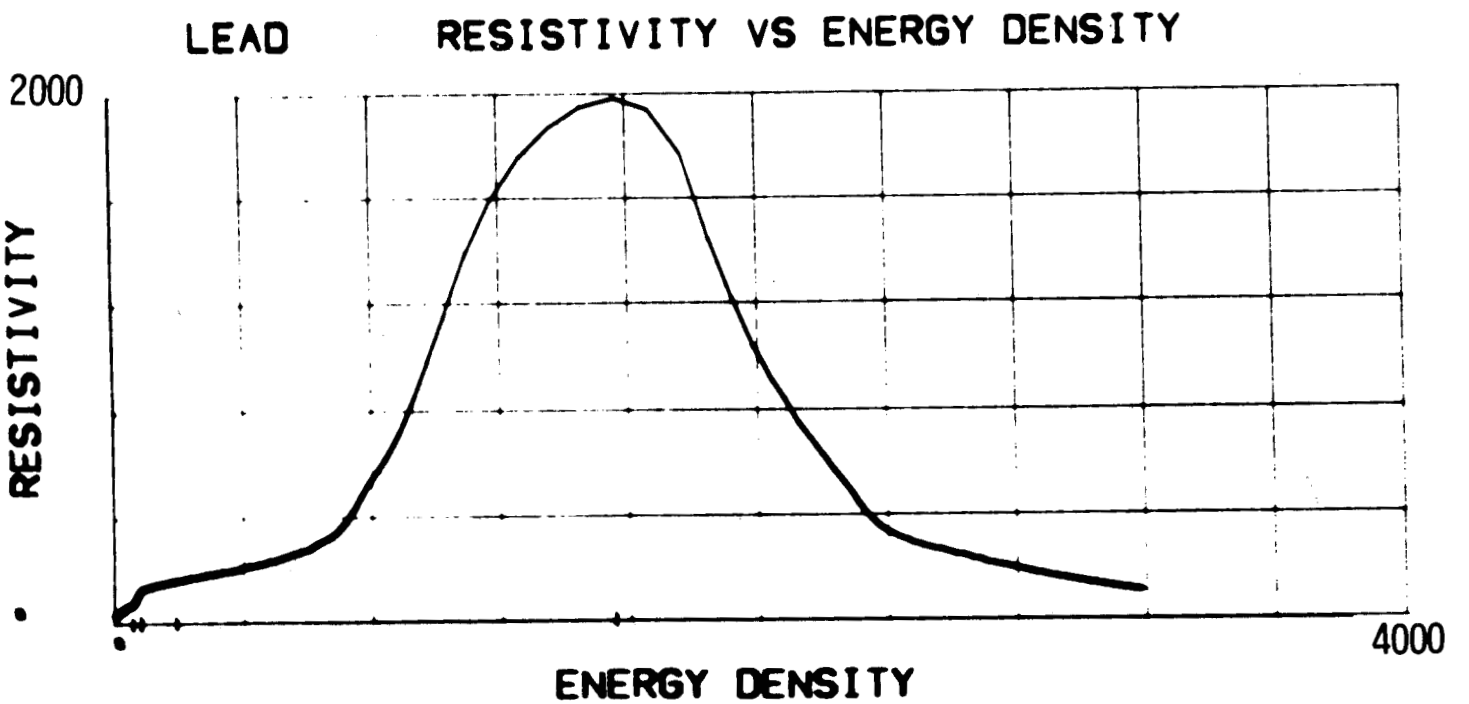

BISMUTH RESISTIVITY VS SPECIFIC ACTION
2000
RESISTIVITY
5000
SPECIFIC ACTION

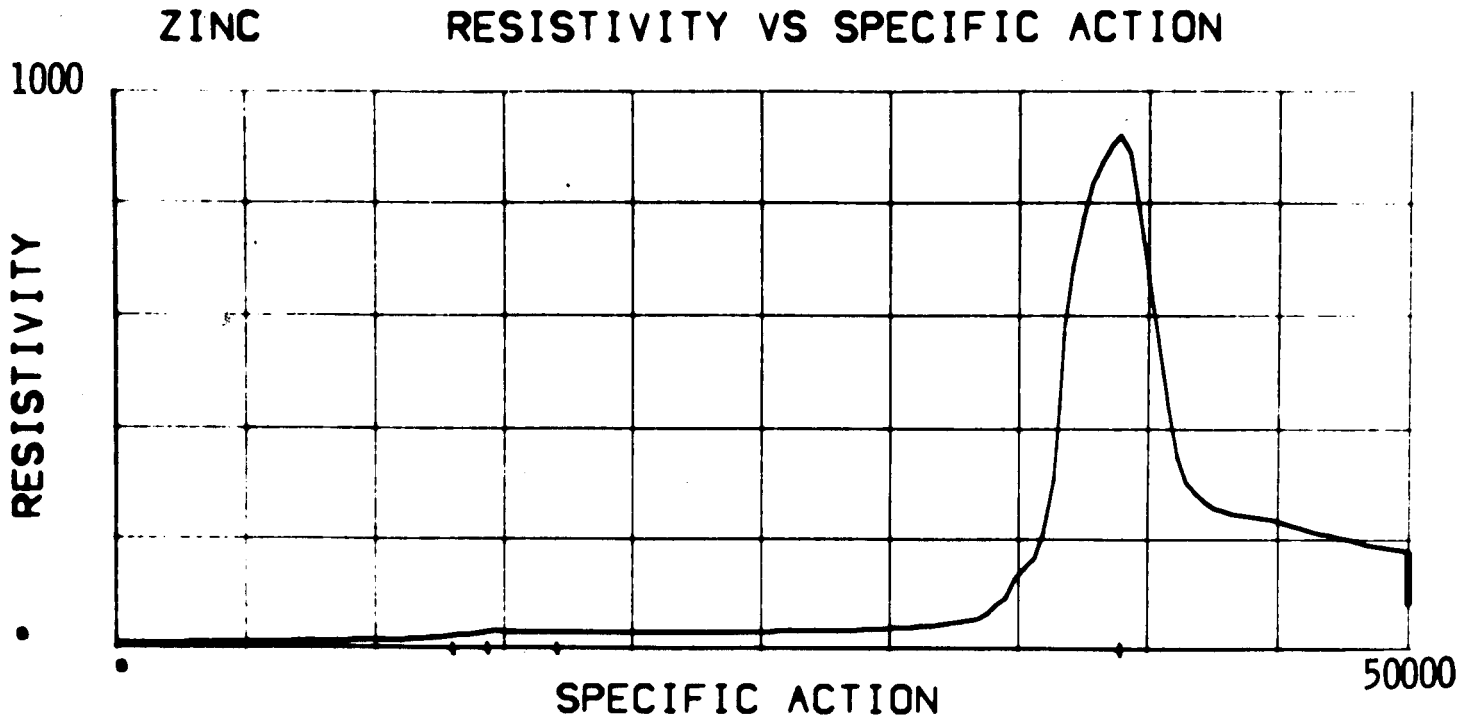

BISMUTH RESISTIVITY VS ENERGY DENSITY
2000
RESISTIVITY
1000
ENERGY DENSITY

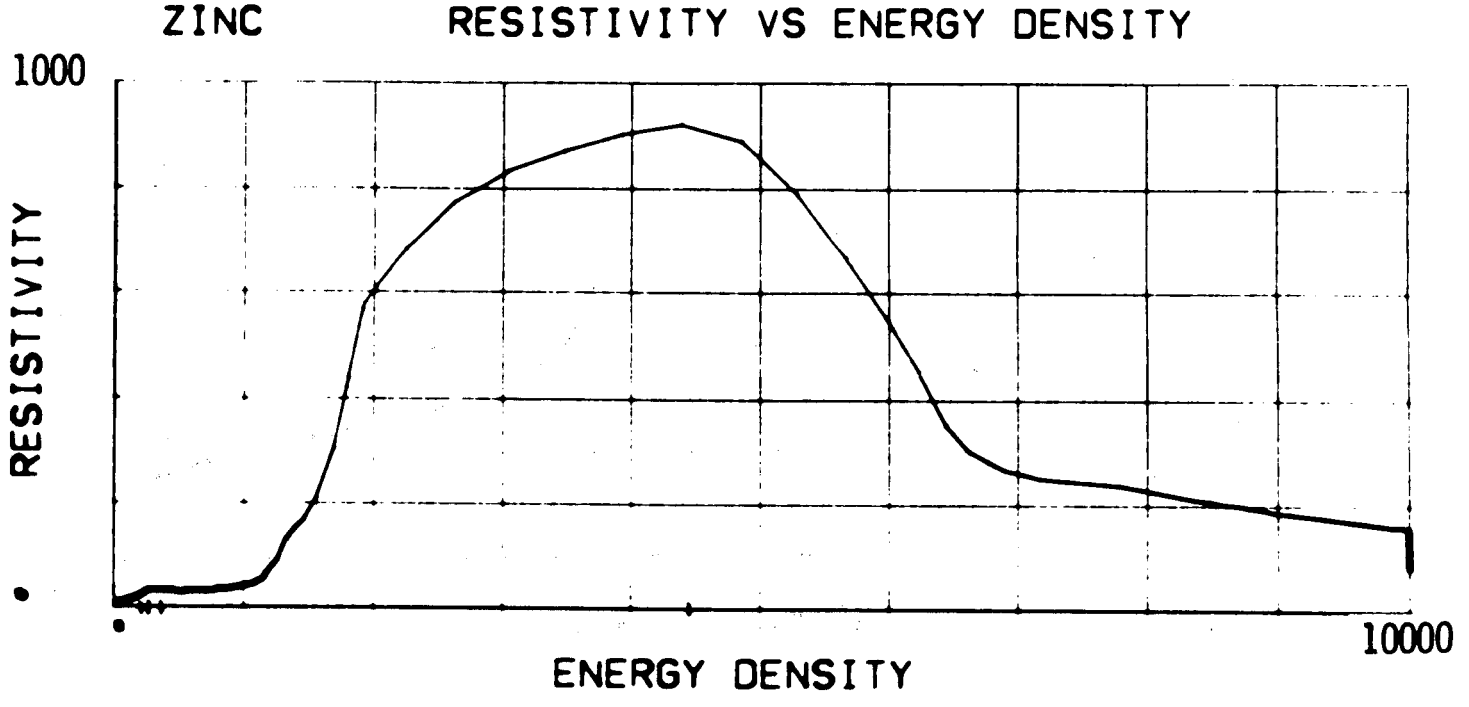

SCANDIUM RESISTIVITY VS SPECIFIC ACTION
800
RESISTIVITY
10000
SPECIFIC ACTION

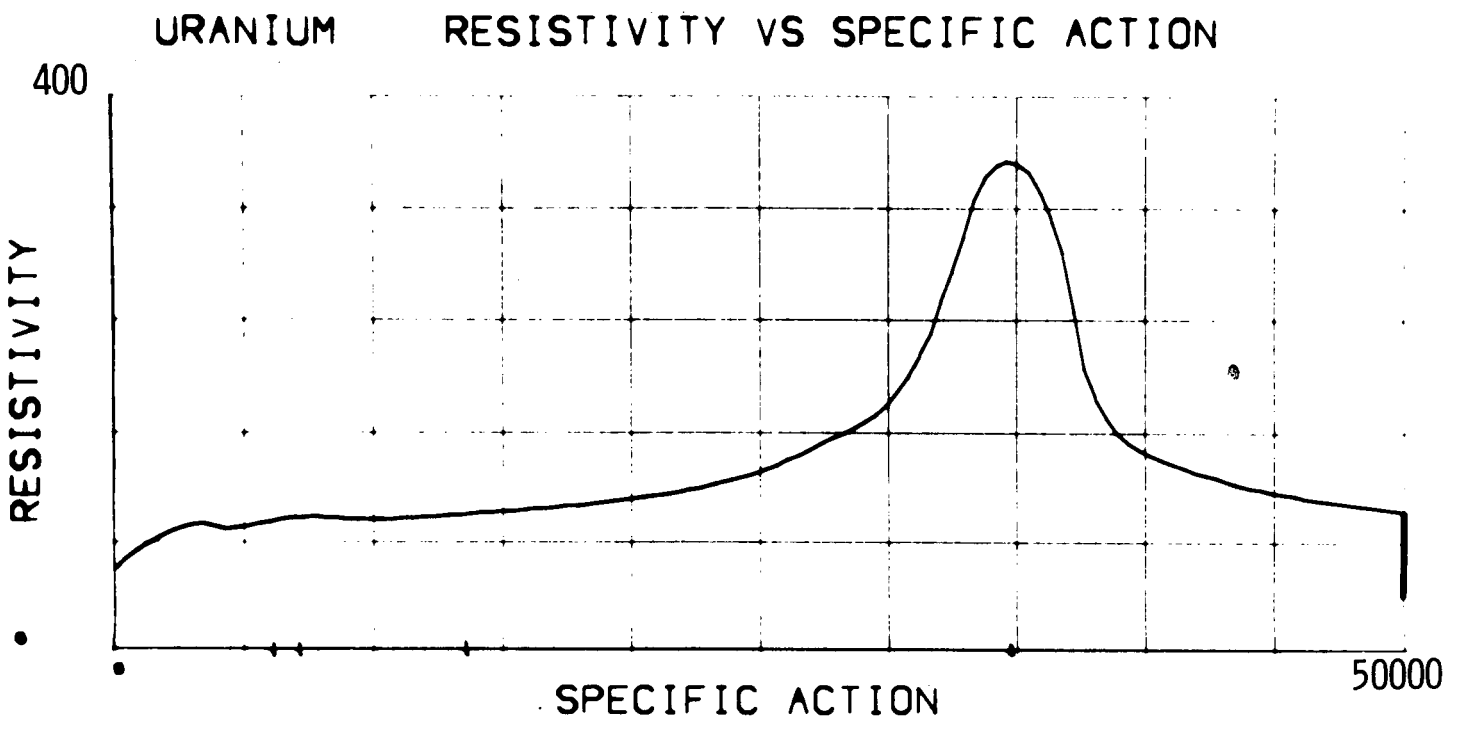

SCANDIUM RESISTIVITY VS ENERGY DENSITY
800
RESISTIVITY
10000
ENERGY DENSITY

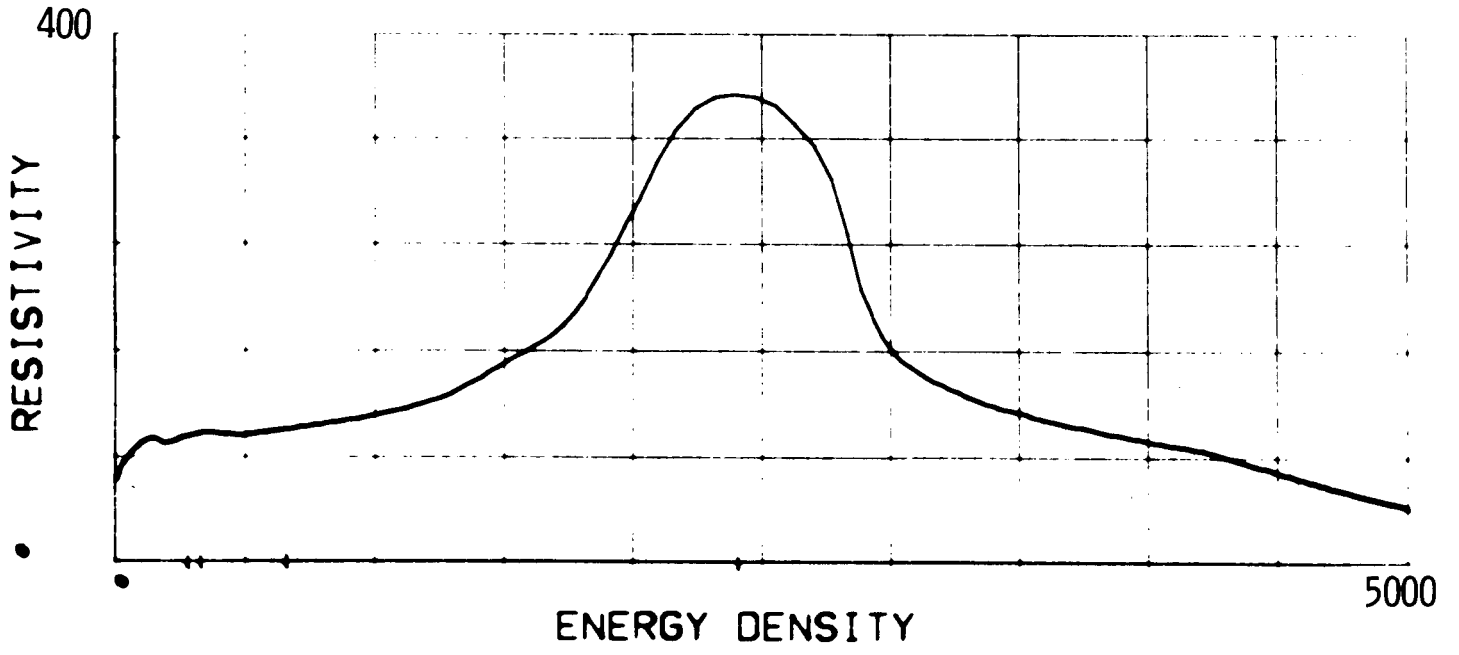

LEAD RESISTIVITY VS SPECIFIC ACTION
2000
RESISTIVITY
10000
SPECIFIC ACTION

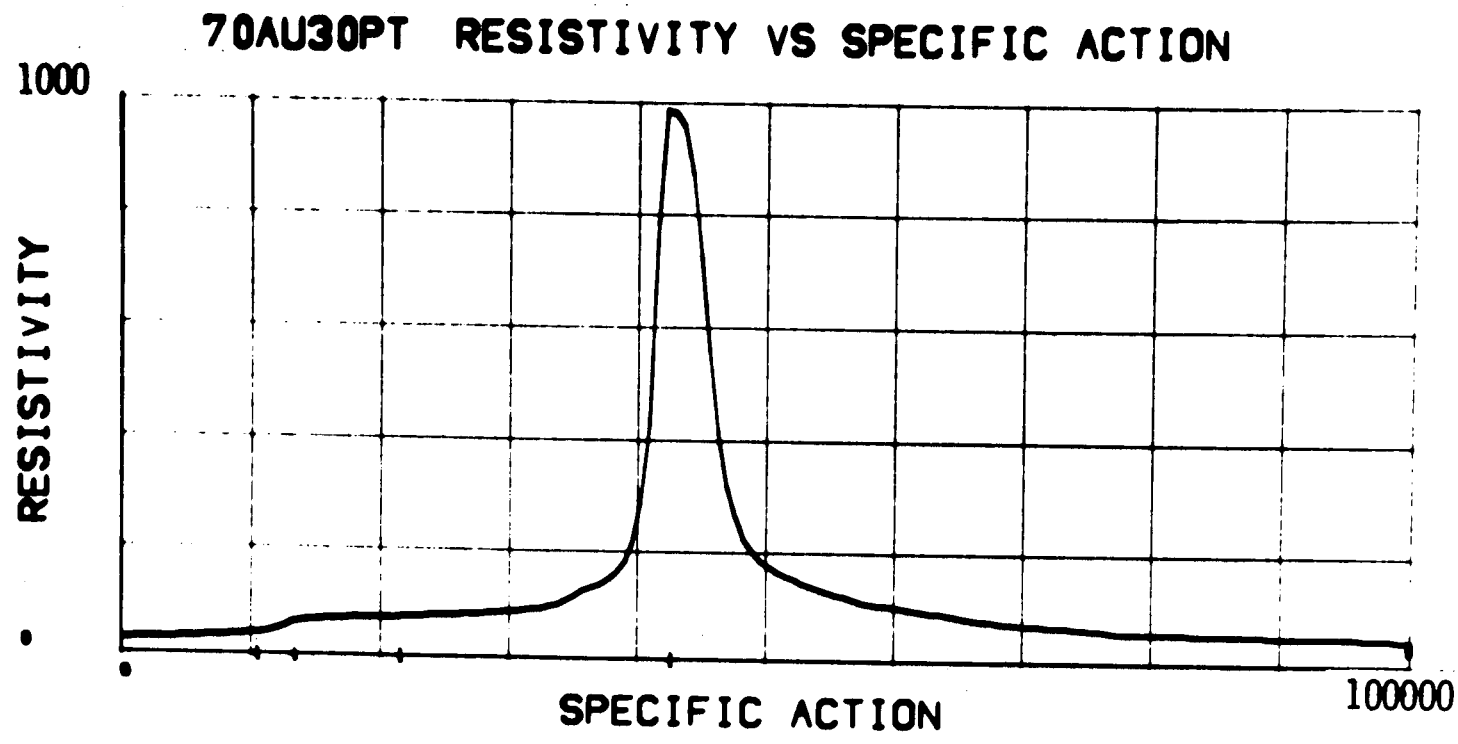

LEAD RESISTIVITY VS ENERGY DENSITY
2000
RESISTIVITY
4000
ENERGY DENSITY

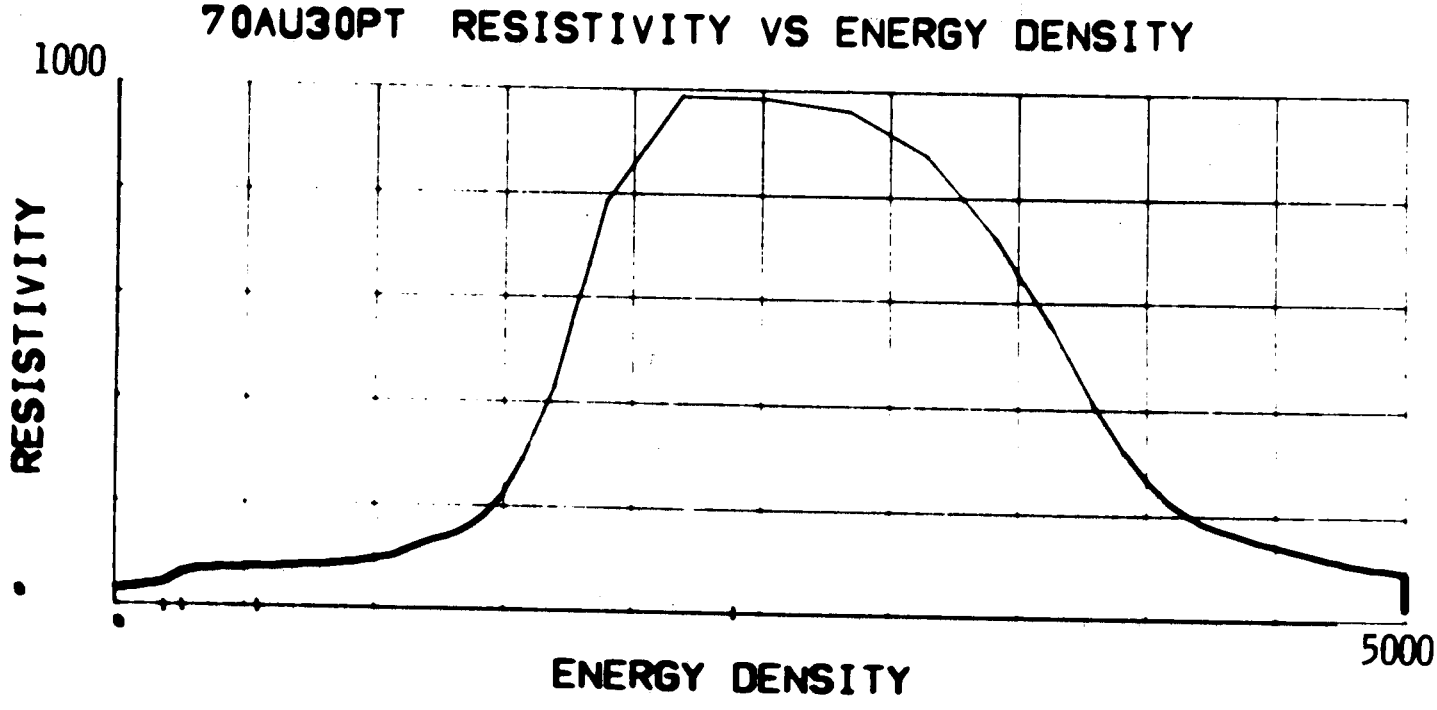

ZINC RESISTIVITY VS SPECIFIC ACTION
1000
RESISTIVITY
50000
SPECIFIC ACTION


ZINC RESISTIVITY VS ENERGY DENSITY
1000
RESISTIVITY
10000
ENERGY DENSITY


URANIUM RESISTIVITY VS SPECIFIC ACTION
400
RESISTIVITY
50000
SPECIFIC ACTION


URANIUM RESISTIVITY VS ENERGY DENSITY
400
RESISTIVITY
5000
ENERGY DENSITY


70AU30PT RESISTIVITY VS SPECIFIC ACTION
1000
RESISTIVITY
SPECIFIC ACTION
100000


70AU30PT RESISTIVITY VS ENERGY DENSITY
1000
RESISTIVITY
ENERGY DENSITY
5000

This page intentionally left blank.

APPENDIX 3

Subroutine SR1 Listing

```
                SUBROUTINE SR1(C,T,DT,TTOT,DUM1,DUM2,DUM3)
000011          COMMON/SWITCH/IOUT,DUMMY(8)
000011          DIMENSION A(50,100),B(50,100)
000011          COMMON/TT/ JJ, TA(300),EA(300),GA(300),CA(300),VA(300),RA(300),
               1PA(300),SE(300),SG(300),NSHOT,DATE,WLC,WAC,METAL,HE,DENS,SP
000011          COMMON/TT/TR2,TR3,TR4,TR5,TRL
000011          DATA IFLAG/0/
000011          IF(IFLAG.NE.0.)GO TO 50
000012           A( 1,  1)= .00000E+00$A( 1,  2)= .29319E+03$A( 1,  3)= .27847E+04
000015           A( 1,  4)= .10539E+05$A( 1,  5)= .13617E+05$A( 1,  6)= .23364E+05
000022           A( 1,  7)= .26276E+05$A( 1,  8)= .33930E+05$A( 1,  9)= .39909E+05
000026           A( 1, 10)= .43986E+05$A( 1, 11)= .47407E+05$A( 1, 12)= .53296E+05
000033           A( 1, 13)= .61347E+05$A( 1, 14)= .65273E+05$A( 1, 15)= .73027E+05
000037           A( 1, 15)= .76744E+05$A( 1, 17)= .80401E+05$A( 1, 18)= .83011E+05
000044           A( 1, 19)= .84924E+05$A( 1, 20)= .87296E+05$A( 1, 21)= .89258E+05
000050           A( 1, 22)= .91157E+05$A( 1, 23)= .92363E+05$A( 1, 24)= .93282E+05
000055           A( 1, 25)= .94256E+05$A( 1, 26)= .95802E+05$A( 1, 27)= .98487E+05
000061           A( 1, 28)= .10236E+06$A( 1, 29)= .10441E+06$A( 1, 30)= .10787E+06
000066           A( 1, 31)= .11247E+06$A( 1, 32)= .11637E+06$A( 1, 33)= .11993E+06
000072           A( 1, 34)= .12421E+06$A( 1, 35)= .12799E+06$A( 1, 36)= .13176E+06
000077           A( 1, 37)= .13552E+06$A( 1, 38)= .13871E+06$A( 1, 39)= .14100E+06
000103           A( 1, 40)= .14345E+06$A( 1, 41)= .14556E+06$A( 1, 42)= .14750E+06
000110           A( 1, 43)= .14971E+06$A( 1, 44)= .15126E+06$A( 1, 45)= .15225E+06
000114           A( 1, 46)= .15291E+06$A( 1, 47)= .15357E+06$A( 1, 48)= .15493E+06
000121           A( 1, 49)= .15602E+06$A( 1, 50)= .15726E+06$A( 1, 51)= .15802E+06
000125           A( 1, 52)= .15867E+06$A( 1, 53)= .15920E+06$A( 1, 54)= .16043E+06
000132           A( 1, 55)= .16155E+06$A( 1, 56)= .16288E+06$A( 1, 57)= .16404E+06
000135           A( 1, 58)= .16531E+06$A( 1, 59)= .16625E+06$A( 1, 60)= .16682E+06
000143           A( 1, 61)= .16745E+06$A( 1, 62)= .16817E+06$A( 1, 63)= .16858E+06
000147           A( 1, 64)= .16894E+06$A( 1, 65)= .16893E+06$A( 1, 66)= .16954E+06
000154           A( 1, 67)= .17050E+06$A( 1, 68)= .17080E+06$A( 1, 69)= .17180E+06
000160           A( 1, 70)= .17260E+06$A( 1, 71)= .17300E+06$A( 1, 72)= .17420E+06
000165           A( 1, 73)= .17469E+06$A( 1, 74)= .17530E+06$A( 1, 75)= .17605E+06
000171           A( 1, 76)= .17695E+06$A( 1, 77)= .17762E+06$A( 1, 78)= .17814E+06
000176           A( 1, 79)= .17868E+06$A( 1, 80)= .17920E+06$A( 1, 81)= .17991E+06
000202           A( 1, 82)= .18096E+06$A( 1, 83)= .18202E+06$A( 1, 84)= .18368E+06
000207           A( 1, 85)= .18528E+06$A( 1, 86)= .18724E+06$A( 1, 87)= .18883E+06
000213           A( 1, 88)= .18997E+06$A( 1, 89)= .19102E+06$A( 1, 90)= .19253E+06
000220           A( 1, 91)= .19456E+06$A( 1, 92)= .19813E+06$A( 1, 93)= .20287E+06
000224           A( 1, 94)= .20927E+06$A( 1, 95)= .21582E+06$A( 1, 96)= .22355E+06
000231           B( 1,  1)= .18640E+01$B( 1,  2)= .22838E+01$B( 1,  3)= .23228E+01
000235           B( 1,  4)= .26946E+01$B( 1,  5)= .31062E+01$B( 1,  6)= .30372E+01
000242           B( 1,  7)= .35901E+01$B( 1,  8)= .42167E+01$B( 1,  9)= .46367E+01
000246           B( 1, 10)= .46405E+01$B( 1, 11)= .52676E+01$B( 1, 12)= .61051E+01
000253           B( 1, 13)= .66693E+01$B( 1, 14)= .73736E+01$B( 1, 15)= .87981E+01
000257           B( 1, 16)= .92178E+01$B( 1, 17)= .99203E+01$B( 1, 18)= .10622E+02
000264           B( 1, 19)= .11466E+02$B( 1, 20)= .12813E+02$B( 1, 21)= .13951E+02
000270           B( 1, 22)= .15440E+02$B( 1, 23)= .17136E+02$B( 1, 24)= .18129E+02
000275           B( 1, 25)= .18912E+02$B( 1, 26)= .19280E+02$B( 1, 27)= .20077E+02
000301           B( 1, 28)= .20597E+02$B( 1, 29)= .21104E+02$B( 1, 30)= .21967E+02
000306           B( 1, 31)= .23190E+02$B( 1, 32)= .24203E+02$B( 1, 33)= .25236E+02
000312           B( 1, 34)= .26370E+02$B( 1, 35)= .27859E+02$B( 1, 36)= .29337E+02
000317           B( 1, 37)= .30855E+02$B( 1, 38)= .32392E+02$B( 1, 39)= .33993E+02
000323           B( 1, 40)= .35529E+02$B( 1, 41)= .37205E+02$B( 1, 42)= .39105E+02
000330           B( 1, 43)= .41102E+02$B( 1, 44)= .42799E+02$B( 1, 45)= .44409E+02
000334           B( 1, 46)= .47962E+02$B( 1, 47)= .52483E+02$B( 1, 48)= .52196E+02
000341           B( 1, 49)= .53606E+02$B( 1, 50)= .57054E+02$B( 1, 51)= .60392E+02
000345           B( 1, 52)= .64163E+02$B( 1, 53)= .67662E+02$B( 1, 54)= .67511E+02
```

```
000352          B( 1, 55)= .70557E+02$B( 1, 56)= .74596E+02$B( 1, 57)= .79169E+02
000356          B( 1, 58)= .85415E+02$B( 1, 59)= .91733E+02$B( 1, 60)= .10100E+03
000363          B( 1, 61)= .11605E+03$B( 1, 62)= .13447E+03$B( 1, 63)= .16447E+03
000367          B( 1, 64)= .18744E+03$B( 1, 65)= .19500E+03$B( 1, 66)= .25554E+03
000374          B( 1, 67)= .34844E+03$B( 1, 68)= .42303E+03$B( 1, 69)= .50000E+03
000400          B( 1, 70)= .58000E+03$B( 1, 71)= .62000E+03$B( 1, 72)= .54000E+03
000405          B( 1, 73)= .49261E+03$B( 1, 74)= .44915E+03$B( 1, 75)= .38618E+03
000411          B( 1, 76)= .31555E+03$B( 1, 77)= .25540E+03$B( 1, 78)= .22065E+03
000416          B( 1, 79)= .19422E+03$B( 1, 80)= .17841E+03$B( 1, 81)= .16198E+03
000422          B( 1, 82)= .14684E+03$B( 1, 83)= .13470E+03$B( 1, 84)= .12416E+03
000427          B( 1, 85)= .11692E+03$B( 1, 86)= .11042E+03$B( 1, 87)= .10626E+03
000433          B( 1, 88)= .10354E+03$B( 1, 89)= .98870E+02$B( 1, 90)= .92848E+02
000440          B( 1, 91)= .86795E+02$B( 1, 92)= .79929E+02$B( 1, 93)= .72440E+02
000444          B( 1, 94)= .63839E+02$B( 1, 95)= .55961E+02$B( 1, 96)= .48954E+02
000451          A( 2,  1)= .00000E+00$A( 2,  2)= .41463E+03$A( 2,  3)= .15145E+04
000454          A( 2,  4)= .53956E+04$A( 2,  5)= .96385E+04$A( 2,  6)= .14754E+05
000461          A( 2,  7)= .19405E+05$A( 2,  8)= .21515E+05$A( 2,  9)= .24321E+05
000465          A( 2, 10)= .25936E+05$A( 2, 11)= .27307E+05$A( 2, 12)= .29510E+05
000472          A( 2, 13)= .31086E+05$A( 2, 14)= .31753E+05$A( 2, 15)= .32349E+05
000476          A( 2, 16)= .33158E+05$A( 2, 17)= .34561E+05$A( 2, 18)= .36269E+05
000503          A( 2, 19)= .39744E+05$A( 2, 20)= .42335E+05$A( 2, 21)= .45176E+05
000507          A( 2, 22)= .48895E+05$A( 2, 23)= .51291E+05$A( 2, 24)= .52936E+05
000514          A( 2, 25)= .53607E+05$A( 2, 26)= .54091E+05$A( 2, 27)= .54529E+05
000520          A( 2, 28)= .54875E+05$A( 2, 29)= .55196E+05$A( 2, 30)= .55403E+05
000525          A( 2, 31)= .55609E+05$A( 2, 32)= .56064E+05$A( 2, 33)= .56765E+05
000531          A( 2, 34)= .57261E+05$A( 2, 35)= .57889E+05$A( 2, 36)= .58515E+05
000536          A( 2, 37)= .59430E+05$A( 2, 38)= .59987E+05$A( 2, 39)= .60542E+05
000542          A( 2, 40)= .60986E+05$A( 2, 41)= .61361E+05$A( 2, 42)= .61692E+05
000547          A( 2, 43)= .61955E+05$A( 2, 44)= .62326E+05$A( 2, 45)= .62759E+05
000553          A( 2, 46)= .63247E+05$A( 2, 47)= .63736E+05$A( 2, 48)= .64230E+05
000560          A( 2, 49)= .64585E+05$A( 2, 50)= .65033E+05$A( 2, 51)= .65315E+05
000564          A( 2, 52)= .65389E+05$A( 2, 53)= .65776E+05$A( 2, 54)= .65904E+05
000571          A( 2, 55)= .66033E+05$A( 2, 56)= .66809E+05$A( 2, 57)= .67143E+05
000575          A( 2, 58)= .67704E+05$A( 2, 59)= .68197E+05$A( 2, 60)= .68659E+05
000602          A( 2, 61)= .69073E+05$A( 2, 62)= .69536E+05$A( 2, 63)= .69989E+05
000606          A( 2, 64)= .70426E+05$A( 2, 65)= .71055E+05$A( 2, 66)= .71940E+05
000613          A( 2, 67)= .73213E+05$A( 2, 68)= .74515E+05$A( 2, 69)= .75350E+05
000617          A( 2, 70)= .76014E+05$A( 2, 71)= .77497E+05$A( 2, 72)= .79166E+05
000624          A( 2, 73)= .80694E+05$A( 2, 74)= .82360E+05$A( 2, 75)= .84204E+05
000630          A( 2, 76)= .86338E+05$A( 2, 77)= .87747E+05$A( 2, 78)= .89112E+05
000635          A( 2, 79)= .90037E+05$A( 2, 80)= .92614E+05$A( 2, 81)= .00000E+00
000640          B( 2,  1)= .30123E+01$B( 2,  2)= .37592E+01$B( 2,  3)= .40186E+01
000645          B( 2,  4)= .46222E+01$B( 2,  5)= .50485E+01$B( 2,  6)= .71090E+01
000651          B( 2,  7)= .83139E+01$B( 2,  8)= .96218E+01$B( 2,  9)= .11156E+02
000656          B( 2, 10)= .11170E+02$B( 2, 11)= .13033E+02$B( 2, 12)= .16656E+02
000662          B( 2, 13)= .20703E+02$B( 2, 14)= .22564E+02$B( 2, 15)= .23663E+02
000667          B( 2, 16)= .24656E+02$B( 2, 17)= .26098E+02$B( 2, 18)= .27440E+02
000673          B( 2, 19)= .31445E+02$B( 2, 20)= .33909E+02$B( 2, 21)= .36931E+02
000700          B( 2, 22)= .41961E+02$B( 2, 23)= .45101E+02$B( 2, 24)= .48325E+02
000704          B( 2, 25)= .49597E+02$B( 2, 26)= .51188E+02$B( 2, 27)= .52999E+02
000711          B( 2, 28)= .55693E+02$B( 2, 29)= .59533E+02$B( 2, 30)= .66287E+02
000715          B( 2, 31)= .76067E+02$B( 2, 32)= .75405E+02$B( 2, 33)= .78208E+02
000722          B( 2, 34)= .82041E+02$B( 2, 35)= .85589E+02$B( 2, 36)= .88758E+02
000726          B( 2, 37)= .92588E+02$B( 2, 38)= .95323E+02$B( 2, 39)= .98409E+02
000733          B( 2, 40)= .10181E+03$B( 2, 41)= .10569E+03$B( 2, 42)= .11098E+03
000737          B( 2, 43)= .11991E+03$B( 2, 44)= .12767E+03$B( 2, 45)= .14540E+03
000744          B( 2, 46)= .17727E+03$B( 2, 47)= .22075E+03$B( 2, 48)= .26402E+03
000750          B( 2, 49)= .30195E+03$B( 2, 50)= .34861E+03$B( 2, 51)= .36840E+03
```

```
000755          B( 2, 52)= .38246E+03$B( 2, 53)= .39327E+03$B( 2, 54)= .37869E+03
000761          B( 2, 55)= .36605E+03$B( 2, 56)= .35946E+03$B( 2, 57)= .35335E+03
000766          B( 2, 58)= .33447E+03$B( 2, 59)= .30825E+03$B( 2, 60)= .27924E+03
000772          B( 2, 61)= .23599E+03$B( 2, 62)= .19964E+03$B( 2, 63)= .17785E+03
000777          B( 2, 64)= .16309E+03$B( 2, 65)= .15352E+03$B( 2, 66)= .14411E+03
001003          B( 2, 67)= .13399E+03$B( 2, 68)= .12605E+03$B( 2, 69)= .12175E+03
001010          B( 2, 70)= .11564E+03$B( 2, 71)= .10442E+03$B( 2, 72)= .95180E+02
001014          B( 2, 73)= .87909E+02$B( 2, 74)= .82345E+02$B( 2, 75)= .78775E+02
001021          B( 2, 76)= .74969E+02$B( 2, 77)= .73226E+02$B( 2, 78)= .71980E+02
001025          B( 2, 79)= .69986E+02$B( 2, 80)= .62494E+02$B( 2, 81)= .00000E+00
001031          A( 3,  1)= .00000E+00$A( 3,  2)= .21933E+03$A( 3,  3)= .18560E+04
001035          A( 3,  4)= .96613E+04$A( 3,  5)= .15023E+05$A( 3,  6)= .21214E+05
001041          A( 3,  7)= .22603E+05$A( 3,  8)= .25234E+05$A( 3,  9)= .28267E+05
001046          A( 3, 10)= .31076E+05$A( 3, 11)= .33523E+05$A( 3, 12)= .36736E+05
001052          A( 3, 13)= .39312E+05$A( 3, 14)= .41857E+05$A( 3, 15)= .43775E+05
001057          A( 3, 16)= .44709E+05$A( 3, 17)= .45784E+05$A( 3, 18)= .46739E+05
001063          A( 3, 19)= .47883E+05$A( 3, 20)= .48859E+05$A( 3, 21)= .49475E+05
001070          A( 3, 22)= .49900E+05$A( 3, 23)= .50536E+05$A( 3, 24)= .51242E+05
001074          A( 3, 25)= .52727E+05$A( 3, 26)= .54564E+05$A( 3, 27)= .56769E+05
001101          A( 3, 28)= .58404E+05$A( 3, 29)= .59940E+05$A( 3, 30)= .61654E+05
001105          A( 3, 31)= .63638E+05$A( 3, 32)= .65293E+05$A( 3, 33)= .66897E+05
001112          A( 3, 34)= .67993E+05$A( 3, 35)= .69177E+05$A( 3, 36)= .70198E+05
001116          A( 3, 37)= .71217E+05$A( 3, 38)= .72323E+05$A( 3, 39)= .73424E+05
001123          A( 3, 40)= .74296E+05$A( 3, 41)= .75096E+05$A( 3, 42)= .75737E+05
001127          A( 3, 43)= .76309E+05$A( 3, 44)= .76704E+05$A( 3, 45)= .77097E+05
001134          A( 3, 46)= .77336E+05$A( 3, 47)= .77684E+05$A( 3, 48)= .78094E+05
001140          A( 3, 49)= .78566E+05$A( 3, 50)= .79099E+05$A( 3, 51)= .79563E+05
001145          A( 3, 52)= .80081E+05$A( 3, 53)= .80428E+05$A( 3, 54)= .80788E+05
001151          A( 3, 55)= .81082E+05$A( 3, 56)= .81366E+05$A( 3, 57)= .81727E+05
001156          A( 3, 58)= .82070E+05$A( 3, 59)= .82340E+05$A( 3, 60)= .82559E+05
001162          A( 3, 61)= .82705E+05$A( 3, 62)= .82857E+05$A( 3, 63)= .82963E+05
001167          A( 3, 64)= .83157E+05$A( 3, 65)= .83359E+05$A( 3, 66)= .83510E+05
001173          A( 3, 67)= .83772E+05$A( 3, 68)= .84083E+05$A( 3, 69)= .84375E+05
001200          A( 3, 70)= .84741E+05$A( 3, 71)= .85170E+05$A( 3, 72)= .85432E+05
001204          A( 3, 73)= .85739E+05$A( 3, 74)= .86073E+05$A( 3, 75)= .86453E+05
001211          A( 3, 76)= .86900E+05$A( 3, 77)= .87496E+05$A( 3, 78)= .88245E+05
001215          A( 3, 79)= .89256E+05$A( 3, 80)= .90281E+05$A( 3, 81)= .91469E+05
001222          A( 3, 82)= .93014E+05$A( 3, 83)= .00000E+00$A( 3, 84)= .00000E+00
001225          B( 3,  1)= .24737E+01$B( 3,  2)= .22726E+01$B( 3,  3)= .23813E+01
001232          B( 3,  4)= .28962E+01$B( 3,  5)= .38643E+01$B( 3,  6)= .46355E+01
001236          B( 3,  7)= .56057E+01$B( 3,  8)= .56084E+01$B( 3,  9)= .62753E+01
001243          B( 3, 10)= .77818E+01$B( 3, 11)= .77884E+01$B( 3, 12)= .91000E+01
001247          B( 3, 13)= .10315E+02$B( 3, 14)= .11841E+02$B( 3, 15)= .12396E+02
001254          B( 3, 16)= .13165E+02$B( 3, 17)= .14491E+02$B( 3, 18)= .16016E+02
001260          B( 3, 19)= .18754E+02$B( 3, 20)= .21295E+02$B( 3, 21)= .23961E+02
001265          B( 3, 22)= .25321E+02$B( 3, 23)= .26983E+02$B( 3, 24)= .28409E+02
001271          B( 3, 25)= .30237E+02$B( 3, 26)= .32587E+02$B( 3, 27)= .35202E+02
001276          B( 3, 28)= .37257E+02$B( 3, 29)= .39757E+02$B( 3, 30)= .42941E+02
001302          B( 3, 31)= .46466E+02$B( 3, 32)= .50038E+02$B( 3, 33)= .53749E+02
001307          B( 3, 34)= .56947E+02$B( 3, 35)= .59827E+02$B( 3, 36)= .63374E+02
001313          B( 3, 37)= .67264E+02$B( 3, 38)= .71734E+02$B( 3, 39)= .76443E+02
001320          B( 3, 40)= .80721E+02$B( 3, 41)= .85571E+02$B( 3, 42)= .90199E+02
001324          B( 3, 43)= .94150E+02$B( 3, 44)= .99075E+02$B( 3, 45)= .10575E+03
001331          B( 3, 46)= .11081E+03$B( 3, 47)= .11311E+03$B( 3, 48)= .11765E+03
001335          B( 3, 49)= .12460E+03$B( 3, 50)= .13597E+03$B( 3, 51)= .14721E+03
001342          B( 3, 52)= .16490E+03$B( 3, 53)= .18966E+03$B( 3, 54)= .21934E+03
001346          B( 3, 55)= .25305E+03$B( 3, 56)= .30920E+03$B( 3, 57)= .39256E+03
001353          B( 3, 58)= .54051E+03$B( 3, 59)= .70293E+03$B( 3, 60)= .85794E+03
```

```
001761  B( 4, 73)= .78126E+02$B( 4, 74)= .69525E+02$B( 4, 75)= .60118E+02
001766  B( 4, 76)= .54388E+02$B( 4, 77)= .47471E+02$B( 4, 78)= .00000E+00
001771  A( 5,  1)= .00000E+00$A( 5,  2)= .34067E+03$A( 5,  3)= .14170E+04
001775  A( 5,  4)= .38709E+04$A( 5,  5)= .64681E+04$A( 5,  6)= .87878E+04
002002  A( 5,  7)= .11310E+05$A( 5,  8)= .13334E+05$A( 5,  9)= .14868E+05
002006  A( 5, 10)= .15226E+05$A( 5, 11)= .15940E+05$A( 5, 12)= .16839E+05
002013  A( 5, 13)= .17544E+05$A( 5, 14)= .17824E+05$A( 5, 15)= .18057E+05
002017  A( 5, 16)= .18406E+05$A( 5, 17)= .19080E+05$A( 5, 18)= .20171E+05
002024  A( 5, 19)= .22072E+05$A( 5, 20)= .24178E+05$A( 5, 21)= .26926E+05
002030  A( 5, 22)= .29894E+05$A( 5, 23)= .31663E+05$A( 5, 24)= .33406E+05
002035  A( 5, 25)= .34504E+05$A( 5, 26)= .35350E+05$A( 5, 27)= .36194E+05
002041  A( 5, 28)= .37127E+05$A( 5, 29)= .37740E+05$A( 5, 30)= .38261E+05
002046  A( 5, 31)= .38781E+05$A( 5, 32)= .39052E+05$A( 5, 33)= .39481E+05
002052  A( 5, 34)= .39954E+05$A( 5, 35)= .40628E+05$A( 5, 36)= .41345E+05
002057  A( 5, 37)= .41948E+05$A( 5, 38)= .42594E+05$A( 5, 39)= .43148E+05
002063  A( 5, 40)= .43722E+05$A( 5, 41)= .44119E+05$A( 5, 42)= .44623E+05
002070  A( 5, 43)= .45103E+05$A( 5, 44)= .45515E+05$A( 5, 45)= .45881E+05
002074  A( 5, 46)= .46350E+05$A( 5, 47)= .46687E+05$A( 5, 48)= .47103E+05
002101  A( 5, 49)= .47307E+05$A( 5, 50)= .47454E+05$A( 5, 51)= .47881E+05
002105  A( 5, 52)= .48232E+05$A( 5, 53)= .48427E+05$A( 5, 54)= .48616E+05
002112  A( 5, 55)= .48947E+05$A( 5, 56)= .49111E+05$A( 5, 57)= .49342E+05
002116  A( 5, 58)= .49635E+05$A( 5, 59)= .49926E+05$A( 5, 60)= .50155E+05
002123  A( 5, 61)= .50532E+05$A( 5, 62)= .50942E+05$A( 5, 63)= .51340E+05
002127  A( 5, 64)= .51830E+05$A( 5, 65)= .52328E+05$A( 5, 66)= .52875E+05
002134  A( 5, 67)= .53513E+05$A( 5, 68)= .54201E+05$A( 5, 69)= .55095E+05
002140  A( 5, 70)= .55928E+05$A( 5, 71)= .57084E+05$A( 5, 72)= .58889E+05
002145  A( 5, 73)= .61190E+05$A( 5, 74)= .63982E+05$A( 5, 75)= .66730E+05
002151  A( 5, 76)= .70125E+05$A( 5, 77)= .74141E+05$A( 5, 78)= .74764E+05
002156  A( 5, 79)= .77575E+05$A( 5, 80)= .79119E+05$A( 5, 81)= .85778E+05
002162  A( 5, 82)= .93000E+05$A( 5, 83)= .00000E+00$A( 5, 84)= .00000E+00
002165  B( 5,  1)= .10154E+02$B( 5,  2)= .11500E+02$B( 5,  3)= .14963E+02
002172  B( 5,  4)= .21392E+02$B( 5,  5)= .29782E+02$B( 5,  6)= .38185E+02
002176  B( 5,  7)= .47956E+02$B( 5,  8)= .55481E+02$B( 5,  9)= .61808E+02
002203  B( 5, 10)= .63502E+02$B( 5, 11)= .68035E+02$B( 5, 12)= .75973E+02
002207  B( 5, 13)= .84817E+02$B( 5, 14)= .88130E+02$B( 5, 15)= .90328E+02
002214  B( 5, 16)= .91624E+02$B( 5, 17)= .92865E+02$B( 5, 18)= .94012E+02
002220  B( 5, 19)= .95192E+02$B( 5, 20)= .96162E+02$B( 5, 21)= .96325E+02
002225  B( 5, 22)= .97472E+02$B( 5, 23)= .98182E+02$B( 5, 24)= .99839E+02
002231  B( 5, 25)= .10027E+03$B( 5, 26)= .10179E+03$B( 5, 27)= .10278E+03
002236  B( 5, 28)= .10482E+03$B( 5, 29)= .10660E+03$B( 5, 30)= .10937E+03
002242  B( 5, 31)= .11271E+03$B( 5, 32)= .11534E+03$B( 5, 33)= .11802E+03
002247  B( 5, 34)= .11970E+03$B( 5, 35)= .12255E+03$B( 5, 36)= .12689E+03
002253  B( 5, 37)= .12982E+03$B( 5, 38)= .13383E+03$B( 5, 39)= .13870E+03
002260  B( 5, 40)= .14323E+03$B( 5, 41)= .14796E+03$B( 5, 42)= .15464E+03
002264  B( 5, 43)= .16251E+03$B( 5, 44)= .17105E+03$B( 5, 45)= .18349E+03
002271  B( 5, 46)= .20316E+03$B( 5, 47)= .22853E+03$B( 5, 48)= .25977E+03
002275  B( 5, 49)= .29534E+03$B( 5, 50)= .32193E+03$B( 5, 51)= .40253E+03
002302  B( 5, 52)= .49734E+03$B( 5, 53)= .55196E+03$B( 5, 54)= .60228E+03
002306  B( 5, 55)= .64881E+03$B( 5, 56)= .62627E+03$B( 5, 57)= .57600E+03
002313  B( 5, 58)= .44761E+03$B( 5, 59)= .34964E+03$B( 5, 60)= .29559E+03
002317  B( 5, 61)= .24572E+03$B( 5, 62)= .20978E+03$B( 5, 63)= .18891E+03
002324  B( 5, 64)= .16904E+03$B( 5, 65)= .14998E+03$B( 5, 66)= .13666E+03
002330  B( 5, 67)= .12436E+03$B( 5, 68)= .11167E+03$B( 5, 69)= .10095E+03
002335  B( 5, 70)= .89469E+02$B( 5, 71)= .78977E+02$B( 5, 72)= .73308E+02
002341  B( 5, 73)= .64967E+02$B( 5, 74)= .57712E+02$B( 5, 75)= .54815E+02
002346  B( 5, 76)= .51924E+02$B( 5, 77)= .49565E+02$B( 5, 78)= .45722E+02
002352  B( 5, 79)= .43810E+02$B( 5, 80)= .46698E+02$B( 5, 81)= .45254E+02
002357  B( 5, 82)= .43398E+02$B( 5, 83)= .00000E+00$B( 5, 84)= .00000E+00
```

```
002765          B( 6, 85)= .77680E+02$B( 6, 86)= .71697E+02$B( 6, 87)= .65275E+02
002772          B( 6, 88)= .62352E+02$B( 6, 89)= .00000E+00$B( 6, 90)= .00000E+00
002775          A( 7,  1)= .00000E+00$A( 7,  2)= .20482E+03$A( 7,  3)= .48334E+03
003001          A( 7,  4)= .14997E+04$A( 7,  5)= .27984E+04$A( 7,  6)= .37312E+04
003005          A( 7,  7)= .46741E+04$A( 7,  8)= .52810E+04$A( 7,  9)= .57674E+04
003012          A( 7, 10)= .62880E+04$A( 7, 11)= .67244E+04$A( 7, 12)= .71828E+04
003016          A( 7, 13)= .75227E+04$A( 7, 14)= .79312E+04$A( 7, 15)= .83138E+04
003023          A( 7, 16)= .87624E+04$A( 7, 17)= .92194E+04$A( 7, 18)= .94471E+04
003027          A( 7, 19)= .96745E+04$A( 7, 20)= .98789E+04$A( 7, 21)= .10072E+05
003034          A( 7, 22)= .10298E+05$A( 7, 23)= .10491E+05$A( 7, 24)= .10773E+05
003040          A( 7, 25)= .11056E+05$A( 7, 26)= .11541E+05$A( 7, 27)= .12250E+05
003045          A( 7, 28)= .13014E+05$A( 7, 29)= .13674E+05$A( 7, 30)= .14681E+05
003051          A( 7, 31)= .16009E+05$A( 7, 32)= .18306E+05$A( 7, 33)= .18918E+05
003056          A( 7, 34)= .20676E+05$A( 7, 35)= .21633E+05$A( 7, 36)= .22887E+05
003062          A( 7, 37)= .23597E+05$A( 7, 38)= .24470E+05$A( 7, 39)= .24845E+05
003067          A( 7, 40)= .25463E+05$A( 7, 41)= .25982E+05$A( 7, 42)= .26346E+05
003073          A( 7, 43)= .26710E+05$A( 7, 44)= .27073E+05$A( 7, 45)= .27456E+05
003100          A( 7, 46)= .27839E+05$A( 7, 47)= .28187E+05$A( 7, 48)= .28523E+05
003104          A( 7, 49)= .29487E+05$A( 7, 50)= .29834E+05$A( 7, 51)= .30266E+05
003111          A( 7, 52)= .30773E+05$A( 7, 53)= .31333E+05$A( 7, 54)= .31804E+05
003115          A( 7, 55)= .32178E+05$A( 7, 56)= .32498E+05$A( 7, 57)= .32870E+05
003122          A( 7, 58)= .33145E+05$A( 7, 59)= .33388E+05$A( 7, 60)= .33630E+05
003126          A( 7, 61)= .33892E+05$A( 7, 62)= .34131E+05$A( 7, 63)= .34429E+05
003133          A( 7, 64)= .34722E+05$A( 7, 65)= .35046E+05$A( 7, 66)= .35399E+05
003137          A( 7, 67)= .35488E+05$A( 7, 68)= .35723E+05$A( 7, 69)= .35933E+05
003144          A( 7, 70)= .36105E+05$A( 7, 71)= .36302E+05$A( 7, 72)= .36569E+05
003150          A( 7, 73)= .36948E+05$A( 7, 74)= .37336E+05$A( 7, 75)= .37640E+05
003155          A( 7, 76)= .37932E+05$A( 7, 77)= .38151E+05$A( 7, 78)= .38473E+05
003161          A( 7, 79)= .38861E+05$A( 7, 80)= .39212E+05$A( 7, 81)= .39756E+05
003166          A( 7, 82)= .40421E+05$A( 7, 83)= .41252E+05$A( 7, 84)= .42328E+05
003172          A( 7, 85)= .43509E+05$A( 7, 86)= .44837E+05$A( 7, 87)= .00000E+00
003176          B( 7,  1)= .11261E+02$B( 7,  2)= .12642E+02$B( 7,  3)= .12553E+02
003203          B( 7,  4)= .14523E+02$B( 7,  5)= .18769E+02$B( 7,  6)= .22165E+02
003207          B( 7,  7)= .26974E+02$B( 7,  8)= .31496E+02$B( 7,  9)= .35402E+02
003214          B( 7, 10)= .40253E+02$B( 7, 11)= .45283E+02$B( 7, 12)= .51576E+02
003220          B( 7, 13)= .55999E+02$B( 7, 14)= .63018E+02$B( 7, 15)= .70150E+02
003225          B( 7, 16)= .79070E+02$B( 7, 17)= .89719E+02$B( 7, 18)= .95296E+02
003231          B( 7, 19)= .10009E+03$B( 7, 20)= .10299E+03$B( 7, 21)= .10589E+03
003236          B( 7, 22)= .10832E+03$B( 7, 23)= .11028E+03$B( 7, 24)= .11176E+03
003242          B( 7, 25)= .11372E+03$B( 7, 26)= .11571E+03$B( 7, 27)= .11791E+03
003247          B( 7, 28)= .11966E+03$B( 7, 29)= .12076E+03$B( 7, 30)= .12356E+03
003253          B( 7, 31)= .12424E+03$B( 7, 32)= .12536E+03$B( 7, 33)= .12600E+03
003260          B( 7, 34)= .12539E+03$B( 7, 35)= .12579E+03$B( 7, 36)= .12669E+03
003264          B( 7, 37)= .12664E+03$B( 7, 38)= .12710E+03$B( 7, 39)= .12849E+03
003271          B( 7, 40)= .12894E+03$B( 7, 41)= .12956E+03$B( 7, 42)= .13082E+03
003275          B( 7, 43)= .13243E+03$B( 7, 44)= .13506E+03$B( 7, 45)= .13902E+03
003302          B( 7, 46)= .14413E+03$B( 7, 47)= .14907E+03$B( 7, 48)= .15272E+03
003306          B( 7, 49)= .15139E+03$B( 7, 50)= .15282E+03$B( 7, 51)= .15558E+03
003313          B( 7, 52)= .15968E+03$B( 7, 53)= .16404E+03$B( 7, 54)= .16871E+03
003317          B( 7, 55)= .17253E+03$B( 7, 56)= .17733E+03$B( 7, 57)= .18349E+03
003324          B( 7, 58)= .18917E+03$B( 7, 59)= .19466E+03$B( 7, 60)= .20310E+03
003330          B( 7, 61)= .21252E+03$B( 7, 62)= .22537E+03$B( 7, 63)= .24769E+03
003335          B( 7, 64)= .29186E+03$B( 7, 65)= .35915E+03$B( 7, 66)= .43544E+03
003341          B( 7, 67)= .44781E+03$B( 7, 68)= .50955E+03$B( 7, 69)= .53447E+03
003346          B( 7, 70)= .54661E+03$B( 7, 71)= .54370E+03$B( 7, 72)= .50766E+03
003352          B( 7, 73)= .44911E+03$B( 7, 74)= .38090E+03$B( 7, 75)= .32042E+03
003357          B( 7, 76)= .27760E+03$B( 7, 77)= .25585E+03$B( 7, 78)= .23083E+03
003363          B( 7, 79)= .20463E+03$B( 7, 80)= .18489E+03$B( 7, 81)= .16470E+03
```

```
003370          B( 7, 82)= .14545E+03$B( 7, 83)= .12636E+03$B( 7, 84)= .10899E+03
003374          B( 7, 85)= .95996E+02$B( 7, 86)= .85410E+02$B( 7, 87)= .00000E+00
003400          A( 8,  1)= .00000E+00$A( 8,  2)= .27 71E+03$A( 8,  3)= .13238E+04
003404          A( 8,  4)= .56688E+04$A( 8,  5)= .11254E+05$A( 8,  6)= .12485E+05
003410          A( 8,  7)= .15345E+05$A( 8,  8)= .16326E+05$A( 8,  9)= .16756E+05
003415          A( 8, 10)= .17398E+05$A( 8, 11)= .18272E+05$A( 8, 12)= .19071E+05
003421          A( 8, 13)= .19585E+05$A( 8, 14)= .19983E+05$A( 8, 15)= .21832E+05
003426          A( 8, 16)= .23305E+05$A( 8, 17)= .26826E+05$A( 8, 18)= .29592E+05
003432          A( 8, 19)= .32052E+05$A( 8, 20)= .34462E+05$A( 8, 21)= .36152E+05
003437          A( 8, 22)= .37309E+05$A( 8, 23)= .38374E+05$A( 8, 24)= .39160E+05
003443          A( 8, 25)= .39922E+05$A( 8, 26)= .40589E+05$A( 8, 27)= .41139E+05
003450          A( 8, 28)= .41597E+05$A( 8, 29)= .42074E+05$A( 8, 30)= .42526E+05
003454          A( 8, 31)= .43132E+05$A( 8, 32)= .43667E+05$A( 8, 33)= .44132E+05
003461          A( 8, 34)= .44839E+05$A( 8, 35)= .45369E+05$A( 8, 36)= .46074E+05
003465          A( 8, 37)= .46948E+05$A( 8, 38)= .47491E+05$A( 8, 39)= .47921E+05
003472          A( 8, 40)= .48410E+05$A( 8, 41)= .48891E+05$A( 8, 42)= .49299E+05
003476          A( 8, 43)= .49615E+05$A( 8, 44)= .49825E+05$A( 8, 45)= .50137E+05
003503          A( 8, 46)= .50397E+05$A( 8, 47)= .50647E+05$A( 8, 48)= .50869E+05
003507          A( 8, 49)= .51069E+05$A( 8, 50)= .51366E+05$A( 8, 51)= .51712E+05
003514          A( 8, 52)= .52100E+05$A( 8, 53)= .52561E+05$A( 8, 54)= .53069E+05
003520          A( 8, 55)= .53523E+05$A( 8, 56)= .53868E+05$A( 8, 57)= .54325E+05
003525          A( 8, 58)= .54874E+05$A( 8, 59)= .55431E+05$A( 8, 60)= .56339E+05
003531          A( 8, 61)= .57520E+05$A( 8, 62)= .59131E+05$A( 8, 63)= .61048E+05
003536          A( 8, 64)= .64467E+05$A( 8, 65)= .68978E+05$A( 8, 66)= .74585E+05
003542          A( 8, 67)= .82304E+05$A( 8, 68)= .92741E+05$A( 8, 69)= .00000E+00
003546          B( 8,  1)= .11590E+02$B( 8,  2)= .15029E+02$B( 8,  3)= .14483E+02
003553          B( 8,  4)= .23163E+02$B( 8,  5)= .36044E+02$B( 8,  6)= .39343E+02
003557          B( 8,  7)= .45010E+02$B( 8,  8)= .47344E+02$B( 8,  9)= .49163E+02
003564          B( 8, 10)= .52891E+02$B( 8, 11)= .58993E+02$B( 8, 12)= .66768E+02
003570          B( 8, 13)= .70864E+02$B( 8, 14)= .71729E+02$B( 8, 15)= .71721E+02
003575          B( 8, 16)= .70789E+02$B( 8, 17)= .69494E+02$B( 8, 18)= .69571E+02
003601          B( 8, 19)= .70392E+02$B( 8, 20)= .70881E+02$B( 8, 21)= .72341E+02
003606          B( 8, 22)= .73125E+02$B( 8, 23)= .74463E+02$B( 8, 24)= .75593E+02
003612          B( 8, 25)= .77164E+02$B( 8, 26)= .79057E+02$B( 8, 27)= .80712E+02
003617          B( 8, 28)= .82860E+02$B( 8, 29)= .86499E+02$B( 8, 30)= .94634E+02
003623          B( 8, 31)= .10593E+03$B( 8, 32)= .12059E+03$B( 8, 33)= .12667E+03
003630          B( 8, 34)= .12837E+03$B( 8, 35)= .13026E+03$B( 8, 36)= .13641E+03
003634          B( 8, 37)= .14474E+03$B( 8, 38)= .15080E+03$B( 8, 39)= .15789E+03
003641          B( 8, 40)= .16960E+03$B( 8, 41)= .19102E+03$B( 8, 42)= .21683E+03
003645          B( 8, 43)= .25651E+03$B( 8, 44)= .30653E+03$B( 8, 45)= .36955E+03
003652          B( 8, 46)= .45374E+03$B( 8, 47)= .52873E+03$B( 8, 48)= .57262E+03
003656          B( 8, 49)= .59547E+03$B( 8, 50)= .61412E+03$B( 8, 51)= .59288E+03
003663          B( 8, 52)= .51111E+03$B( 8, 53)= .39833E+03$B( 8, 54)= .31033E+03
003667          B( 8, 55)= .24181E+03$B( 8, 56)= .20914E+03$B( 8, 57)= .17717E+03
003674          B( 8, 58)= .15613E+03$B( 8, 59)= .14151E+03$B( 8, 60)= .12686E+03
003700          B( 8, 61)= .11387E+03$B( 8, 62)= .10257E+03$B( 8, 63)= .88861E+02
003705          B( 8, 64)= .71471E+02$B( 8, 65)= .60562E+02$B( 8, 66)= .49805E+02
003711          B( 8, 67)= .42069E+02$B( 8, 68)= .38200E+02$B( 8, 69)= .00000E+00
003715          A( 9,  1)= .00000E+00$A( 9,  2)= .54507E+03$A( 9,  3)= .16747E+04
003721          A( 9,  4)= .43062E+04$A( 9,  5)= .75437E+04$A( 9,  6)= .10885E+05
003725          A( 9,  7)= .13398E+05$A( 9,  8)= .16245E+05$A( 9,  9)= .18754E+05
003732          A( 9, 10)= .20834E+05$A( 9, 11)= .23052E+05$A( 9, 12)= .24487E+05
003736          A( 9, 13)= .26232E+05$A( 9, 14)= .27775E+05$A( 9, 15)= .28975E+05
003743          A( 9, 16)= .31266E+05$A( 9, 17)= .32855E+05$A( 9, 18)= .33682E+05
003747          A( 9, 19)= .34720E+05$A( 9, 20)= .35776E+05$A( 9, 21)= .36733E+05
003754          A( 9, 22)= .37292E+05$A( 9, 23)= .37733E+05$A( 9, 24)= .38266E+05
003760          A( 9, 25)= .39376E+05$A( 9, 26)= .42172E+05$A( 9, 27)= .45378E+05
003765          A( 9, 28)= .48117E+05$A( 9, 29)= .51240E+05$A( 9, 30)= .54357E+05
```

```
003771   A( 9, 31)= .57148E+05$A( 9, 32)= .58333E+05$A( 9, 33)= .59447E+05
003776   A( 9, 34)= .59945E+05$A( 9, 35)= .60962E+05$A( 9, 36)= .61953E+05
004002   A( 9, 37)= .62627E+05$A( 9, 38)= .63165E+05$A( 9, 39)= .64015E+05
004007   A( 9, 40)= .64997E+05$A( 9, 41)= .65953E+05$A( 9, 42)= .66819E+05
004013   A( 9, 43)= .67416E+05$A( 9, 44)= .67991E+05$A( 9, 45)= .68541E+05
004020   A( 9, 46)= .69068E+05$A( 9, 47)= .69571E+05$A( 9, 48)= .70070E+05
004024   A( 9, 49)= .70502E+05$A( 9, 50)= .71015E+05$A( 9, 51)= .71478E+05
004031   A( 9, 52)= .71931E+05$A( 9, 53)= .72212E+05$A( 9, 54)= .72486E+05
004035   A( 9, 55)= .72525E+05$A( 9, 56)= .72878E+05$A( 9, 57)= .73384E+05
004042   A( 9, 58)= .73600E+05$A( 9, 59)= .73983E+05$A( 9, 60)= .74273E+05
004046   A( 9, 61)= .74697E+05$A( 9, 62)= .75167E+05$A( 9, 63)= .75767E+05
004053   A( 9, 64)= .76553E+05$A( 9, 65)= .77353E+05$A( 9, 66)= .77865E+05
004057   A( 9, 67)= .78260E+05$A( 9, 68)= .78891E+05$A( 9, 69)= .79826E+05
004064   A( 9, 70)= .81843E+05$A( 9, 71)= .85326E+05$A( 9, 72)= .88895E+05
004070   A( 9, 73)= .93013E+05$A( 9, 74)= .00000E+00$A( 9, 75)= .00000E+00
004073   B( 9,  1)= .94559E+01$B( 9,  2)= .62532E+01$B( 9,  3)= .62540E+01
004100   B( 9,  4)= .74753E+01$B( 9,  5)= .93705E+01$B( 9,  6)= .11730E+02
004104   B( 9,  7)= .13986E+02$B( 9,  8)= .17461E+02$B( 9,  9)= .20527E+02
004111   B( 9, 10)= .24229E+02$B( 9, 11)= .28474E+02$B( 9, 12)= .31741E+02
004115   B( 9, 13)= .35498E+02$B( 9, 14)= .39284E+02$B( 9, 15)= .42847E+02
004122   B( 9, 16)= .49225E+02$B( 9, 17)= .53598E+02$B( 9, 18)= .56616E+02
004126   B( 9, 19)= .60990E+02$B( 9, 20)= .66319E+02$B( 9, 21)= .71770E+02
004133   B( 9, 22)= .74742E+02$B( 9, 23)= .76704E+02$B( 9, 24)= .77979E+02
004137   B( 9, 25)= .79447E+02$B( 9, 26)= .81739E+02$B( 9, 27)= .83921E+02
004144   B( 9, 28)= .85778E+02$B( 9, 29)= .87357E+02$B( 9, 30)= .89262E+02
004150   B( 9, 31)= .90421E+02$B( 9, 32)= .91589E+02$B( 9, 33)= .94875E+02
004155   B( 9, 34)= .97520E+02$B( 9, 35)= .99366E+02$B( 9, 36)= .10009E+03
004161   B( 9, 37)= .10313E+03$B( 9, 38)= .10491E+03$B( 9, 39)= .10697E+03
004165   B( 9, 40)= .10960E+03$B( 9, 41)= .11245E+03$B( 9, 42)= .11552E+03
004172   B( 9, 43)= .11915E+03$B( 9, 44)= .12271E+03$B( 9, 45)= .12639E+03
004177   B( 9, 46)= .13097E+03$B( 9, 47)= .13716E+03$B( 9, 48)= .14378E+03
004203   B( 9, 49)= .15215E+03$B( 9, 50)= .16610E+03$B( 9, 51)= .18800E+03
004210   B( 9, 52)= .22014E+03$B( 9, 53)= .25949E+03$B( 9, 54)= .30313E+03
004214   B( 9, 55)= .30883E+03$B( 9, 56)= .37818E+03$B( 9, 57)= .48321E+03
004221   B( 9, 58)= .51571E+03$B( 9, 59)= .53981E+03$B( 9, 60)= .53244E+03
004225   B( 9, 61)= .47944E+03$B( 9, 62)= .39853E+03$B( 9, 63)= .32262E+03
004232   B( 9, 64)= .25417E+03$B( 9, 65)= .20353E+03$B( 9, 66)= .17931E+03
004236   B( 9, 67)= .16484E+03$B( 9, 68)= .15432E+03$B( 9, 69)= .14298E+03
004243   B( 9, 70)= .13238E+03$B( 9, 71)= .11855E+03$B( 9, 72)= .10585E+03
004247   B( 9, 73)= .92671E+02$B( 9, 74)= .00000E+00$B( 9, 75)= .00000E+00
004252   A(10,  1)= .00000E+00$A(10,  2)= .58758E+03$A(10,  3)= .86371E+03
004256   A(10,  4)= .18332E+04$A(10,  5)= .40771E+04$A(10,  6)= .62389E+04
004262   A(10,  7)= .83988E+04$A(10,  8)= .95154E+04$A(10,  9)= .10303E+05
004267   A(10, 10)= .11019E+05$A(10, 11)= .11572E+05$A(10, 12)= .12192E+05
004273   A(10, 13)= .13087E+05$A(10, 14)= .14117E+05$A(10, 15)= .14804E+05
004300   A(10, 16)= .15674E+05$A(10, 17)= .18166E+05$A(10, 18)= .19557E+05
004304   A(10, 19)= .22306E+05$A(10, 20)= .24842E+05$A(10, 21)= .26513E+05
004311   A(10, 22)= .27617E+05$A(10, 23)= .28606E+05$A(10, 24)= .29774E+05
004315   A(10, 25)= .30715E+05$A(10, 26)= .31901E+05$A(10, 27)= .33038E+05
004322   A(10, 28)= .33706E+05$A(10, 29)= .34351E+05$A(10, 30)= .35060E+05
004326   A(10, 31)= .35678E+05$A(10, 32)= .36447E+05$A(10, 33)= .37038E+05
004333   A(10, 34)= .37476E+05$A(10, 35)= .37825E+05$A(10, 36)= .38260E+05
004337   A(10, 37)= .38846E+05$A(10, 38)= .39492E+05$A(10, 39)= .40088E+05
004344   A(10, 40)= .40716E+05$A(10, 41)= .41246E+05$A(10, 42)= .41505E+05
004350   A(10, 43)= .41797E+05$A(10, 44)= .42222E+05$A(10, 45)= .42469E+05
004355   A(10, 46)= .42786E+05$A(10, 47)= .43044E+05$A(10, 48)= .43565E+05
004361   A(10, 49)= .44087E+05$A(10, 50)= .44629E+05$A(10, 51)= .45210E+05
004366   A(10, 52)= .45719E+05$A(10, 53)= .46256E+05$A(10, 54)= .46887E+05
```

```
004372          A(10, 55)= .47700E+05$A(10, 56)= .49654E+05$A(10, 57)= .50355E+05
004377          A(10, 58)= .52730E+05$A(10, 59)= .56513E+05$A(10, 60)= .58503E+05
004403          A(10, 61)= .60266E+05$A(10, 62)= .65143E+05$A(10, 63)= .68647E+05
004410          A(10, 64)= .72973E+05$A(10, 65)= .76406E+05$A(10, 66)= .79542E+05
004414          A(10, 67)= .85611E+05$A(10, 68)= .92520E+05$A(10, 69)= .00000E+00
004420          B(10,  1)= .21000E+02$B(10,  2)= .29020E+02$B(10,  3)= .29028E+02
004425          B(10,  4)= .36538E+02$B(10,  5)= .53910E+02$B(10,  6)= .72458E+02
004431          B(10,  7)= .91691E+02$B(10,  8)= .10030E+03$B(10,  9)= .10601E+03
004436          B(10, 10)= .11082E+03$B(10, 11)= .11350E+03$B(10, 12)= .11604E+03
004442          B(10, 13)= .11886E+03$B(10, 14)= .12122E+03$B(10, 15)= .12156E+03
004447          B(10, 16)= .12080E+03$B(10, 17)= .12061E+03$B(10, 18)= .12155E+03
004453          B(10, 19)= .12293E+03$B(10, 20)= .12413E+03$B(10, 21)= .12506E+03
004460          B(10, 22)= .12640E+03$B(10, 23)= .12751E+03$B(10, 24)= .12965E+03
004464          B(10, 25)= .13180E+03$B(10, 26)= .13377E+03$B(10, 27)= .13529E+03
004471          B(10, 28)= .13720E+03$B(10, 29)= .13876E+03$B(10, 30)= .14155E+03
004475          B(10, 31)= .14423E+03$B(10, 32)= .14888E+03$B(10, 33)= .15303E+03
004502          B(10, 34)= .15770E+03$B(10, 35)= .16225E+03$B(10, 36)= .16584E+03
004506          B(10, 37)= .17188E+03$B(10, 38)= .18222E+03$B(10, 39)= .19497E+03
004513          B(10, 40)= .21481E+03$B(10, 41)= .24070E+03$B(10, 42)= .27286E+03
004517          B(10, 43)= .30418E+03$B(10, 44)= .36611E+03$B(10, 45)= .40656E+03
004524          B(10, 46)= .42772E+03$B(10, 47)= .41786E+03$B(10, 48)= .35455E+03
004530          B(10, 49)= .28931E+03$B(10, 50)= .23854E+03$B(10, 51)= .20101E+03
004535          B(10, 52)= .17505E+03$B(10, 53)= .15353E+03$B(10, 54)= .13787E+03
004541          B(10, 55)= .12487E+03$B(10, 56)= .11410E+03$B(10, 57)= .10229E+03
004546          B(10, 58)= .92120E+02$B(10, 59)= .75386E+02$B(10, 60)= .77767E+02
004552          B(10, 61)= .73895E+02$B(10, 62)= .62286E+02$B(10, 63)= .62299E+02
004557          B(10, 64)= .56034E+02$B(10, 65)= .47817E+02$B(10, 66)= .49741E+02
004563          B(10, 67)= .47318E+02$B(10, 68)= .44959E+02$B(10, 69)= .00000E+00
004567          A(11,  1)= .00000E+00$A(11,  2)= .60656E+03$A(11,  3)= .19606E+04
004573          A(11,  4)= .43822E+04$A(11,  5)= .70028E+04$A(11,  6)= .91028E+04
004577          A(11,  7)= .10899E+05$A(11,  8)= .12346E+05$A(11,  9)= .13641E+05
004604          A(11, 10)= .14859E+05$A(11, 11)= .16143E+05$A(11, 12)= .17395E+05
004610          A(11, 13)= .18641E+05$A(11, 14)= .20236E+05$A(11, 15)= .21300E+05
004615          A(11, 16)= .22662E+05$A(11, 17)= .24013E+05$A(11, 18)= .24914E+05
004621          A(11, 19)= .26178E+05$A(11, 20)= .27181E+05$A(11, 21)= .27929E+05
004626          A(11, 22)= .29013E+05$A(11, 23)= .30815E+05$A(11, 24)= .32639E+05
004632          A(11, 25)= .32954E+05$A(11, 26)= .35450E+05$A(11, 27)= .36608E+05
004637          A(11, 28)= .38458E+05$A(11, 29)= .40463E+05$A(11, 30)= .43431E+05
004643          A(11, 31)= .45662E+05$A(11, 32)= .48334E+05$A(11, 33)= .49892E+05
004650          A(11, 34)= .52430E+05$A(11, 35)= .54189E+05$A(11, 36)= .56502E+05
004654          A(11, 37)= .57812E+05$A(11, 38)= .59821E+05$A(11, 39)= .61423E+05
004661          A(11, 40)= .62518E+05$A(11, 41)= .64245E+05$A(11, 42)= .65985E+05
004665          A(11, 43)= .67326E+05$A(11, 44)= .68379E+05$A(11, 45)= .69426E+05
004672          A(11, 46)= .70971E+05$A(11, 47)= .72539E+05$A(11, 48)= .73572E+05
004676          A(11, 49)= .74472E+05$A(11, 50)= .75081E+05$A(11, 51)= .75609E+05
004703          A(11, 52)= .76545E+05$A(11, 53)= .77448E+05$A(11, 54)= .78676E+05
004707          A(11, 55)= .79734E+05$A(11, 56)= .80612E+05$A(11, 57)= .81806E+05
004714          A(11, 58)= .83209E+05$A(11, 59)= .84528E+05$A(11, 60)= .88548E+05
004720          A(11, 61)= .94910E+05$A(11, 62)= .00000E+00$A(11, 63)= .00000E+00
004723          B(11,  1)= .12000E+02$B(11,  2)= .12300E+02$B(11,  3)= .12325E+02
004730          B(11,  4)= .14349E+02$B(11,  5)= .17115E+02$B(11,  6)= .20466E+02
004734          B(11,  7)= .23951E+02$B(11,  8)= .27637E+02$B(11,  9)= .31456E+02
004741          B(11, 10)= .35520E+02$B(11, 11)= .40275E+02$B(11, 12)= .45819E+02
004745          B(11, 13)= .52259E+02$B(11, 14)= .60858E+02$B(11, 15)= .67733E+02
004752          B(11, 16)= .77030E+02$B(11, 17)= .88078E+02$B(11, 18)= .95758E+02
004756          B(11, 19)= .10503E+03$B(11, 20)= .11216E+03$B(11, 21)= .11670E+03
004763          B(11, 22)= .12077E+03$B(11, 23)= .12424E+03$B(11, 24)= .12682E+03
004767          B(11, 25)= .12777E+03$B(11, 26)= .13218E+03$B(11, 27)= .12924E+03
```

```
005375          B(12,  67)= .11198E+03$B(12,  68)= .10007E+03$B(12,  69)= .94296E+02
005402          B(12,  70)= .80105E+02$B(12,  71)= .69659E+02$B(12,  72)= .00000E+00
005405          A(13,   1)= .00000E+00$A(13,   2)= .40691E+02$A(13,   3)= .39310E+03
005411          A(13,   4)= .10712E+04$A(13,   5)= .17243E+04$A(13,   6)= .19639E+04
005416          A(13,   7)= .22551E+04$A(13,   8)= .25065E+04$A(13,   9)= .26798E+04
005422          A(13,  10)= .28719E+04$A(13,  11)= .31533E+04$A(13,  12)= .38678E+04
005427          A(13,  13)= .49271E+04$A(13,  14)= .60479E+04$A(13,  15)= .70731E+04
005433          A(13,  16)= .76012E+04$A(13,  17)= .80593E+04$A(13,  18)= .85532E+04
005440          A(13,  19)= .88856E+04$A(13,  20)= .91251E+04$A(13,  21)= .93396E+04
005444          A(13,  22)= .95229E+04$A(13,  23)= .96872E+04$A(13,  24)= .97721E+04
005451          A(13,  25)= .99837E+04$A(13,  26)= .10267E+05$A(13,  27)= .10525E+05
005455          A(13,  28)= .10758E+05$A(13,  29)= .10977E+05$A(13,  30)= .11204E+05
005462          A(13,  31)= .11421E+05$A(13,  32)= .11638E+05$A(13,  33)= .11788E+05
005466          A(13,  34)= .11912E+05$A(13,  35)= .11963E+05$A(13,  36)= .12048E+05
005473          A(13,  37)= .12160E+05$A(13,  38)= .12221E+05$A(13,  39)= .12290E+05
005477          A(13,  40)= .12362E+05$A(13,  41)= .12447E+05$A(13,  42)= .12599E+05
005504          A(13,  43)= .12738E+05$A(13,  44)= .12859E+05$A(13,  45)= .12958E+05
005510          A(13,  46)= .13040E+05$A(13,  47)= .13166E+05$A(13,  48)= .13347E+05
005515          A(13,  49)= .13494E+05$A(13,  50)= .13605E+05$A(13,  51)= .13724E+05
005521          A(13,  52)= .13850E+05$A(13,  53)= .13984E+05$A(13,  54)= .14136E+05
005526          A(13,  55)= .14374E+05$A(13,  56)= .14654E+05$A(13,  57)= .14999E+05
005532          A(13,  58)= .15427E+05$A(13,  59)= .15677E+05$A(13,  60)= .16268E+05
005537          A(13,  61)= .17085E+05$A(13,  62)= .17662E+05$A(13,  63)= .18264E+05
005543          A(13,  64)= .18737E+05$A(13,  65)= .19156E+05$A(13,  66)= .19458E+05
005550          A(13,  67)= .19902E+05$A(13,  68)= .20795E+05$A(13,  69)= .22327E+05
005554          A(13,  70)= .24161E+05$A(13,  71)= .00000E+00$A(13,  72)= .00000E+00
005557          B(13,   1)= .13763E+02$B(13,   2)= .14090E+02$B(13,   3)= .16909E+02
005564          B(13,   4)= .21573E+02$B(13,   5)= .27601E+02$B(13,   6)= .30738E+02
005570          B(13,   7)= .36620E+02$B(13,   8)= .41359E+02$B(13,   9)= .46882E+02
005575          B(13,  10)= .50692E+02$B(13,  11)= .53675E+02$B(13,  12)= .59890E+02
005601          B(13,  13)= .68805E+02$B(13,  14)= .79022E+02$B(13,  15)= .89360E+02
005606          B(13,  16)= .94676E+02$B(13,  17)= .10123E+03$B(13,  18)= .10846E+03
005612          B(13,  19)= .11439E+03$B(13,  20)= .11968E+03$B(13,  21)= .12604E+03
005617          B(13,  22)= .13250E+03$B(13,  23)= .14125E+03$B(13,  24)= .14705E+03
005623          B(13,  25)= .15404E+03$B(13,  26)= .16440E+03$B(13,  27)= .17734E+03
005630          B(13,  28)= .19199E+03$B(13,  29)= .21152E+03$B(13,  30)= .24317E+03
005634          B(13,  31)= .28803E+03$B(13,  32)= .36234E+03$B(13,  33)= .44574E+03
005641          B(13,  34)= .53040E+03$B(13,  35)= .59527E+03$B(13,  36)= .68077E+03
005645          B(13,  37)= .85478E+03$B(13,  38)= .94880E+03$B(13,  39)= .10142E+04
005652          B(13,  40)= .10509E+04$B(13,  41)= .10761E+04$B(13,  42)= .10533E+04
005656          B(13,  43)= .10430E+04$B(13,  44)= .10217E+04$B(13,  45)= .99523E+03
005663          B(13,  46)= .94571E+03$B(13,  47)= .82455E+03$B(13,  48)= .65654E+03
005667          B(13,  49)= .52237E+03$B(13,  50)= .45003E+03$B(13,  51)= .39562E+03
005674          B(13,  52)= .35339E+03$B(13,  53)= .32034E+03$B(13,  54)= .29349E+03
005700          B(13,  55)= .26732E+03$B(13,  56)= .24434E+03$B(13,  57)= .22044E+03
005705          B(13,  58)= .21093E+03$B(13,  59)= .19618E+03$B(13,  60)= .17743E+03
005711          B(13,  61)= .16192E+03$B(13,  62)= .15798E+03$B(13,  63)= .15406E+03
005716          B(13,  64)= .14258E+03$B(13,  65)= .13966E+03$B(13,  66)= .13016E+03
005722          B(13,  67)= .12161E+03$B(13,  68)= .12161E+03$B(13,  69)= .11686E+03
005726          B(13,  70)= .11021E+03$B(13,  71)= .00000E+00$B(13,  72)= .00000E+00
005731          A(14,   1)= .00000E+00$A(14,   2)= .24535E+03$A(14,   3)= .21422E+04
005735          A(14,   4)= .40870E+04$A(14,   5)= .64312E+04$A(14,   6)= .83178E+04
005741          A(14,   7)= .10472E+05$A(14,   8)= .12427E+05$A(14,   9)= .14293E+05
005746          A(14,  10)= .16373E+05$A(14,  11)= .18174E+05$A(14,  12)= .19773E+05
005752          A(14,  13)= .21797E+05$A(14,  14)= .23945E+05$A(14,  15)= .25460E+05
005757          A(14,  16)= .26857E+05$A(14,  17)= .27962E+05$A(14,  18)= .28636E+05
005763          A(14,  19)= .29238E+05$A(14,  20)= .30050E+05$A(14,  21)= .30649E+05
005770          A(14,  22)= .31632E+05$A(14,  23)= .32367E+05$A(14,  24)= .32821E+05
```

```
005774  A(14, 25)= .33451E+05$A(14, 26)= .34291E+05$A(14, 27)= .36392E+05
006001  A(14, 28)= .39638E+05$A(14, 29)= .41726E+05$A(14, 30)= .43602E+05
006005  A(14, 31)= .45753E+05$A(14, 32)= .47690E+05$A(14, 33)= .49485E+05
006012  A(14, 34)= .50587E+05$A(14, 35)= .51617E+05$A(14, 36)= .52542E+05
006016  A(14, 37)= .53259E+05$A(14, 38)= .54077E+05$A(14, 39)= .55643E+05
006023  A(14, 40)= .57246E+05$A(14, 41)= .58814E+05$A(14, 42)= .60277E+05
006027  A(14, 43)= .61669E+05$A(14, 44)= .62719E+05$A(14, 45)= .63833E+05
006034  A(14, 46)= .65142E+05$A(14, 47)= .65911E+05$A(14, 48)= .66678E+05
006040  A(14, 49)= .67242E+05$A(14, 50)= .67937E+05$A(14, 51)= .68596E+05
006045  A(14, 52)= .69285E+05$A(14, 53)= .70099E+05$A(14, 54)= .70903E+05
006051  A(14, 55)= .71665E+05$A(14, 56)= .72356E+05$A(14, 57)= .73042E+05
006056  A(14, 58)= .73952E+05$A(14, 59)= .74430E+05$A(14, 60)= .75012E+05
006062  A(14, 61)= .75703E+05$A(14, 62)= .76469E+05$A(14, 63)= .77211E+05
006067  A(14, 64)= .77925E+05$A(14, 65)= .78746E+05$A(14, 66)= .79434E+05
006073  A(14, 67)= .80021E+05$A(14, 68)= .80748E+05$A(14, 69)= .81511E+05
006100  A(14, 70)= .82589E+05$A(14, 71)= .83878E+05$A(14, 72)= .85553E+05
006104  A(14, 73)= .87020E+05$A(14, 74)= .88070E+05$A(14, 75)= .88561E+05
006111  A(14, 76)= .89194E+05$A(14, 77)= .90075E+05$A(14, 78)= .91277E+05
006115  A(14, 79)= .92765E+05$A(14, 80)= .94006E+05$A(14, 81)= .95675E+05
006122  A(14, 82)= .97669E+05$A(14, 83)= .10017E+06$A(14, 84)= .10339E+06
006126  A(14, 85)= .10699E+06$A(14, 86)= .11144E+06$A(14, 87)= .11564E+06
006133  A(14, 88)= .11988E+06$A(14, 89)= .12516E+06$A(14, 90)= .13088E+06
006137  A(14, 91)= .13682E+06$A(14, 92)= .14320E+06$A(14, 93)= .00000E+00
006143  B(14,  1)= .92819E+01$B(14,  2)= .96156E+01$B(14,  3)= .94188E+01
006150  B(14,  4)= .10394E+02$B(14,  5)= .12347E+02$B(14,  6)= .14833E+02
006154  B(14,  7)= .17763E+02$B(14,  8)= .21517E+02$B(14,  9)= .25214E+02
006161  B(14, 10)= .30421E+02$B(14, 11)= .36388E+02$B(14, 12)= .42414E+02
006165  B(14, 13)= .50906E+02$B(14, 14)= .59866E+02$B(14, 15)= .67445E+02
006172  B(14, 16)= .73367E+02$B(14, 17)= .77997E+02$B(14, 18)= .80689E+02
006176  B(14, 19)= .82392E+02$B(14, 20)= .83775E+02$B(14, 21)= .86025E+02
006203  B(14, 22)= .88885E+02$B(14, 23)= .91172E+02$B(14, 24)= .92234E+02
006207  B(14, 25)= .93094E+02$B(14, 26)= .92681E+02$B(14, 27)= .92361E+02
006214  B(14, 28)= .92581E+02$B(14, 29)= .93024E+02$B(14, 30)= .93641E+02
006220  B(14, 31)= .94541E+02$B(14, 32)= .95749E+02$B(14, 33)= .97058E+02
006225  B(14, 34)= .98333E+02$B(14, 35)= .10039E+03$B(14, 36)= .10281E+03
006231  B(14, 37)= .10411E+03$B(14, 38)= .10469E+03$B(14, 39)= .10482E+03
006236  B(14, 40)= .10548E+03$B(14, 41)= .10611E+03$B(14, 42)= .10730E+03
006242  B(14, 43)= .10888E+03$B(14, 44)= .11070E+03$B(14, 45)= .11334E+03
006247  B(14, 46)= .11722E+03$B(14, 47)= .11924E+03$B(14, 48)= .12090E+03
006253  B(14, 49)= .12278E+03$B(14, 50)= .12545E+03$B(14, 51)= .12888E+03
006260  B(14, 52)= .13330E+03$B(14, 53)= .14006E+03$B(14, 54)= .14776E+03
006264  B(14, 55)= .15710E+03$B(14, 56)= .16787E+03$B(14, 57)= .17930E+03
006271  B(14, 58)= .18481E+03$B(14, 59)= .18092E+03$B(14, 60)= .17208E+03
006275  B(14, 61)= .15641E+03$B(14, 62)= .13896E+03$B(14, 63)= .12605E+03
006302  B(14, 64)= .11404E+03$B(14, 65)= .10543E+03$B(14, 66)= .99975E+02
006306  B(14, 67)= .95654E+02$B(14, 68)= .91874E+02$B(14, 69)= .88563E+02
006313  B(14, 70)= .85865E+02$B(14, 71)= .83067E+02$B(14, 72)= .80392E+02
006317  B(14, 73)= .78191E+02$B(14, 74)= .76684E+02$B(14, 75)= .75259E+02
006324  B(14, 76)= .72380E+02$B(14, 77)= .69832E+02$B(14, 78)= .66975E+02
006330  B(14, 79)= .64695E+02$B(14, 80)= .62067E+02$B(14, 81)= .59074E+02
006335  B(14, 82)= .56595E+02$B(14, 83)= .53372E+02$B(14, 84)= .50153E+02
006341  B(14, 85)= .46945E+02$B(14, 86)= .43323E+02$B(14, 87)= .40671E+02
006346  B(14, 88)= .38283E+02$B(14, 89)= .35896E+02$B(14, 90)= .34039E+02
006352  B(14, 91)= .32360E+02$B(14, 92)= .31033E+02$B(14, 93)= .00000E+00
006356  A(15,  1)= .00000E+00$A(15,  2)= .56476E+02$A(15,  3)= .28882E+03
006362  A(15,  4)= .67945E+03$A(15,  5)= .99904E+03$A(15,  6)= .12137E+04
006366  A(15,  7)= .13721E+04$A(15,  8)= .16341E+04$A(15,  9)= .17860E+04
006373  A(15, 10)= .19064E+04$A(15, 11)= .20028E+04$A(15, 12)= .21636E+04
```

```
006377          A(15, 13)= .26622E+04$A(15, 14)= .33499E+04$A(15, 15)= .35640E+04
006404          A(15, 16)= .37618E+04$A(15, 17)= .33990E+04$A(15, 18)= .42518E+04
006410          A(15, 19)= .53638E+04$A(15, 20)= .60321E+04$A(15, 21)= .65573E+04
006415          A(15, 22)= .70503E+04$A(15, 23)= .78715E+04$A(15, 24)= .85894E+04
006421          A(15, 25)= .90170E+04$A(15, 26)= .95208E+04$A(15, 27)= .10062E+05
006426          A(15, 28)= .10455E+05$A(15, 29)= .10694E+05$A(15, 30)= .10840E+05
006432          A(15, 31)= .11034E+05$A(15, 32)= .11385E+05$A(15, 33)= .11738E+05
006437          A(15, 34)= .12136E+05$A(15, 35)= .12548E+05$A(15, 36)= .12852E+05
006443          A(15, 37)= .13118E+05$A(15, 38)= .13376E+05$A(15, 39)= .13641E+05
006450          A(15, 40)= .13845E+05$A(15, 41)= .14032E+05$A(15, 42)= .14211E+05
006454          A(15, 43)= .14397E+05$A(15, 44)= .14558E+05$A(15, 45)= .14718E+05
006461          A(15, 46)= .14890E+05$A(15, 47)= .15086E+05$A(15, 48)= .15264E+05
006465          A(15, 49)= .15437E+05$A(15, 50)= .15630E+05$A(15, 51)= .15785E+05
006472          A(15, 52)= .16052E+05$A(15, 53)= .16099E+05$A(15, 54)= .16209E+05
006476          A(15, 55)= .16324E+05$A(15, 56)= .16448E+05$A(15, 57)= .16655E+05
006503          A(15, 58)= .16812E+05$A(15, 59)= .17151E+05$A(15, 60)= .17553E+05
006507          A(15, 61)= .17971E+05$A(15, 62)= .18187E+05$A(15, 63)= .18402E+05
006514          A(15, 64)= .18621E+05$A(15, 65)= .18878E+05$A(15, 66)= .19232E+05
006520          A(15, 67)= .19820E+05$A(15, 68)= .20636E+05$A(15, 69)= .21625E+05
006525          A(15, 70)= .23110E+05$A(15, 71)= .24968E+05$A(15, 72)= .27751E+05
006531          A(15, 73)= .30542E+05$A(15, 74)= .00000E+00$A(15, 75)= .00000E+00
006534          B(15,  4)= .90623E+02$B(15,  5)= .11522E+03$B(15,  6)= .13510E+03
006541          B(15,  1)= .050000+03$B(15,  2)= .053000+03$B(15,  3)= .66337E+02
006547          B(15,  7)= .14476E+03$B(15,  8)= .15273E+03$B(15,  9)= .14902E+03
006554          B(15, 10)= .13914E+03$B(15, 11)= .13481E+03$B(15, 12)= .13610E+03
006560          B(15, 13)= .14186E+03$B(15, 14)= .15141E+03$B(15, 15)= .15438E+03
006565          B(15, 16)= .15632E+03$B(15, 17)= .15808E+03$B(15, 18)= .15832E+03
006571          B(15, 19)= .15856E+03$B(15, 20)= .15881E+03$B(15, 21)= .15939E+03
006576          B(15, 22)= .16025E+03$B(15, 23)= .16063E+03$B(15, 24)= .16157E+03
006602          B(15, 25)= .16332E+03$B(15, 26)= .16396E+03$B(15, 27)= .16589E+03
006607          B(15, 28)= .16777E+03$B(15, 29)= .17017E+03$B(15, 30)= .17196E+03
006613          B(15, 31)= .17379E+03$B(15, 32)= .17429E+03$B(15, 33)= .17561E+03
006620          B(15, 34)= .17813E+03$B(15, 35)= .18085E+03$B(15, 36)= .18314E+03
006624          B(15, 37)= .18600E+03$B(15, 38)= .18897E+03$B(15, 39)= .19326E+03
006631          B(15, 40)= .19674E+03$B(15, 41)= .20091E+03$B(15, 42)= .20702E+03
006635          B(15, 43)= .21360E+03$B(15, 44)= .22152E+03$B(15, 45)= .23290E+03
006642          B(15, 46)= .24920E+03$B(15, 47)= .27342E+03$B(15, 48)= .30148E+03
006646          B(15, 49)= .34234E+03$B(15, 50)= .39686E+03$B(15, 51)= .44405E+03
006653          B(15, 52)= .55446E+03$B(15, 53)= .57554E+03$B(15, 54)= .61501E+03
006657          B(15, 55)= .64893E+03$B(15, 56)= .66789E+03$B(15, 57)= .68140E+03
006664          B(15, 58)= .67130E+03$B(15, 59)= .61306E+03$B(15, 60)= .52392E+03
006670          B(15, 61)= .42927E+03$B(15, 62)= .38334E+03$B(15, 63)= .35224E+03
006675          B(15, 64)= .32081E+03$B(15, 65)= .29605E+03$B(15, 66)= .27434E+03
006701          B(15, 67)= .24702E+03$B(15, 68)= .21737E+03$B(15, 69)= .19734E+03
006706          B(15, 70)= .17979E+03$B(15, 71)= .15844E+03$B(15, 72)= .12855E+03
006712          B(15, 73)= .10691E+03$B(15, 74)= .00000E+00$B(15, 75)= .00000E+00
006715          A(16,  1)= .00000E+00$A(16,  2)= .34551E+02$A(16,  3)= .20231E+03
006721          A(16,  4)= .45475E+03$A(16,  5)= .81922E+03$A(16,  6)= .11582E+04
006725          A(16,  7)= .14941E+04$A(16,  8)= .17552E+04$A(16,  9)= .19202E+04
006732          A(16, 10)= .20536E+04$A(16, 11)= .22267E+04$A(16, 12)= .23844E+04
006736          A(16, 13)= .24872E+04$A(16, 14)= .26773E+04$A(16, 15)= .29390E+04
006743          A(16, 16)= .33664E+04$A(16, 17)= .37374E+04$A(16, 18)= .41629E+04
006747          A(16, 19)= .46508E+04$A(16, 20)= .53897E+04$A(16, 21)= .65059E+04
006754          A(16, 22)= .80701E+04$A(16, 23)= .89719E+04$A(16, 24)= .10479E+05
006760          A(16, 25)= .11227E+05$A(16, 26)= .12115E+05$A(16, 27)= .12754E+05
006765          A(16, 28)= .13251E+05$A(16, 29)= .13926E+05$A(16, 30)= .14537E+05
006771          A(16, 31)= .15139E+05$A(16, 32)= .15471E+05$A(16, 33)= .15795E+05
006776          A(16, 34)= .16080E+05$A(16, 35)= .16372E+05$A(16, 36)= .16761E+05
```

```
007002          A(16, 37)= .17043E+05$A(16, 38)= .17277E+05$A(16, 39)= .17479E+05
007007          A(16, 40)= .17642E+05$A(16, 41)= .17853E+05$A(16, 42)= .18094E+05
007013          A(16, 43)= .18360E+05$A(16, 44)= .18557E+05$A(16, 45)= .18709E+05
007020          A(16, 46)= .18924E+05$A(16, 47)= .18966E+05$A(16, 48)= .19121E+05
007024          A(16, 49)= .19261E+05$A(16, 50)= .19377E+05$A(16, 51)= .19561E+05
007031          A(16, 52)= .19907E+05$A(16, 53)= .20261E+05$A(16, 54)= .20533E+05
007035          A(16, 55)= .20708E+05$A(16, 56)= .20940E+05$A(16, 57)= .21391E+05
007042          A(16, 58)= .22228E+05$A(16, 59)= .23407E+05$A(16, 60)= .25130E+05
007046          A(16, 61)= .26980E+05$A(16, 62)= .28988E+05$A(16, 63)= .30990E+05
007053          B(16,  1)= .61044E+02$B(16,  2)= .57703E+02$B(16,  3)= .55127E+02
007057          B(16,  4)= .65642E+02$B(16,  5)= .86587E+02$B(16,  6)= .10961E+03
007064          B(16,  7)= .13399E+03$B(16,  8)= .14987E+03$B(16,  9)= .15872E+03
007070          B(16, 10)= .16274E+03$B(16, 11)= .16612E+03$B(16, 12)= .16175E+03
007075          B(16, 13)= .15670E+03$B(16, 14)= .15363E+03$B(16, 15)= .15519E+03
007101          B(16, 16)= .15903E+03$B(16, 17)= .16206E+03$B(16, 18)= .16349E+03
007106          B(16, 19)= .16304E+03$B(16, 20)= .16117E+03$B(16, 21)= .15908E+03
007112          B(16, 22)= .15624E+03$B(16, 23)= .15621E+03$B(16, 24)= .15480E+03
007117          B(16, 25)= .15518E+03$B(16, 26)= .15660E+03$B(16, 27)= .15801E+03
007123          B(16, 28)= .16016E+03$B(16, 29)= .16195E+03$B(16, 30)= .16287E+03
007130          B(16, 31)= .16287E+03$B(16, 32)= .16383E+03$B(16, 33)= .16478E+03
007133          B(16, 34)= .16790E+03$B(16, 35)= .17211E+03$B(16, 36)= .17991E+03
007140          B(16, 37)= .18661E+03$B(16, 38)= .19579E+03$B(16, 39)= .20513E+03
007144          B(16, 40)= .21981E+03$B(16, 41)= .24929E+03$B(16, 42)= .29485E+03
007151          B(16, 43)= .36318E+03$B(16, 44)= .42604E+03$B(16, 45)= .47047E+03
007155          B(16, 46)= .54199E+03$B(16, 47)= .55511E+03$B(16, 48)= .59348E+03
007162          B(16, 49)= .61339E+03$B(16, 50)= .60219E+03$B(16, 51)= .54714E+03
007166          B(16, 52)= .44817E+03$B(16, 53)= .36861E+03$B(16, 54)= .31389E+03
007173          B(16, 55)= .29338E+03$B(16, 56)= .27216E+03$B(16, 57)= .25086E+03
007177          B(16, 58)= .22346E+03$B(16, 59)= .19296E+03$B(16, 60)= .15635E+03
007204          B(16, 61)= .13336E+03$B(16, 62)= .11235E+03$B(16, 63)= .10124E+03
007210          A(17,  1)= .00000E+00$A(17,  2)= .23086E+02$A(17,  3)= .25985E+02
007214          A(17,  4)= .83673E+02$A(17,  5)= .13292E+03$A(17,  6)= .17302E+03
007220          A(17,  7)= .19533E+03$A(17,  8)= .22144E+03$A(17,  9)= .26228E+03
007225          A(17, 10)= .30426E+03$A(17, 11)= .34306E+03$A(17, 12)= .43547E+03
007231          A(17, 13)= .66036E+03$A(17, 14)= .91566E+03$A(17, 15)= .13309E+04
007236          A(17, 16)= .16454E+04$A(17, 17)= .17462E+04$A(17, 18)= .18602E+04
007242          A(17, 19)= .19668E+04$A(17, 20)= .20609E+04$A(17, 21)= .21177E+04
007247          A(17, 22)= .21676E+04$A(17, 23)= .22122E+04$A(17, 24)= .22598E+04
007253          A(17, 25)= .23037E+04$A(17, 26)= .23455E+04$A(17, 27)= .23789E+04
007260          A(17, 28)= .24196E+04$A(17, 29)= .24576E+04$A(17, 30)= .25010E+04
007264          A(17, 31)= .25271E+04$A(17, 32)= .25491E+04$A(17, 33)= .25703E+04
007271          A(17, 34)= .25711E+04$A(17, 35)= .25977E+04$A(17, 36)= .26106E+04
007275          A(17, 37)= .26354E+04$A(17, 38)= .26535E+04$A(17, 39)= .26758E+04
007302          A(17, 40)= .26920E+04$A(17, 41)= .27156E+04$A(17, 42)= .27354E+04
007306          A(17, 43)= .27551E+04$A(17, 44)= .27878E+04$A(17, 45)= .28216E+04
007313          A(17, 46)= .28661E+04$A(17, 47)= .29441E+04$A(17, 48)= .31042E+04
007317          A(17, 49)= .34575E+04$A(17, 50)= .41063E+04$A(17, 51)= .43851E+04
007324          A(17, 52)= .49851E+04$A(17, 53)= .59417E+04$A(17, 54)= .68717E+04
007330          B(17,  1)= .20453E+03$B(17,  2)= .18779E+03$B(17,  3)= .18783E+03
007335          B(17,  4)= .21169E+03$B(17,  5)= .28373E+03$B(17,  6)= .36784E+03
007341          B(17,  7)= .29865E+03$B(17,  8)= .22643E+03$B(17,  9)= .17990E+03
007346          B(17, 10)= .16007E+03$B(17, 11)= .15083E+03$B(17, 12)= .14491E+03
007352          B(17, 13)= .15217E+03$B(17, 14)= .16593E+03$B(17, 15)= .18541E+03
007357          B(17, 16)= .20096E+03$B(17, 17)= .20899E+03$B(17, 18)= .21721E+03
007363          B(17, 19)= .22863E+03$B(17, 20)= .24086E+03$B(17, 21)= .25095E+03
007370          B(17, 22)= .26283E+03$B(17, 23)= .27595E+03$B(17, 24)= .29140E+03
007374          B(17, 25)= .31080E+03$B(17, 26)= .33445E+03$B(17, 27)= .36507E+03
007401          B(17, 28)= .41062E+03$B(17, 29)= .48007E+03$B(17, 30)= .60541E+03
```

```
007405          B(17,  31) = .77294E+03$B(17,  32) = .97784E+03$B(17,  33) = .12741E+04
007412          B(17,  34) = .12848E+04$B(17,  35) = .15219E+04$B(17,  36) = .17688E+04
007416          B(17,  37) = .19180E+04$B(17,  38) = .19195E+04$B(17,  39) = .17526E+04
007423          B(17,  40) = .15044E+04$B(17,  41) = .10400E+04$B(17,  42) = .71391E+03
007427          B(17,  43) = .56878E+03$B(17,  44) = .44182E+03$B(17,  45) = .36626E+03
007434          B(17,  46) = .30721E+03$B(17,  47) = .24840E+03$B(17,  48) = .19339E+03
007440          B(17,  49) = .14072E+03$B(17,  50) = .10033E+03$B(17,  51) = .10033E+03
007444          B(17,  52) = .90123E+02$B(17,  53) = .78220E+02$B(17,  54) = .74819E+02
007451          A(19,   1) = .00000E+00$A(19,   2) = .40222E+02$A(19,   3) = .11157E+03
007454          A(19,   4) = .18363E+03$A(19,   5) = .26773E+03$A(19,   6) = .33718E+03
007461          A(19,   7) = .39335E+03$A(19,   8) = .44208E+03$A(19,   9) = .49658E+03
007465          A(19,  10) = .54946E+03$A(19,  11) = .60221E+03$A(19,  12) = .66659E+03
007472          A(19,  13) = .72070E+03$A(19,  14) = .77770E+03$A(19,  15) = .83613E+03
007476          A(19,  16) = .94259E+03$A(19,  17) = .10588E+04$A(19,  18) = .11661E+04
007503          A(19,  19) = .12516E+04$A(19,  20) = .13532E+04$A(19,  21) = .15115E+04
007507          A(19,  22) = .16897E+04$A(19,  23) = .18372E+04$A(19,  24) = .20299E+04
007514          A(19,  25) = .22082E+04$A(19,  26) = .23880E+04$A(19,  27) = .25678E+04
007520          A(19,  28) = .26977E+04$A(19,  29) = .28143E+04$A(19,  30) = .29366E+04
007525          A(19,  31) = .30129E+04$A(19,  32) = .30717E+04$A(19,  33) = .31547E+04
007531          A(19,  34) = .32205E+04$A(19,  35) = .32847E+04$A(19,  36) = .33474E+04
007536          A(19,  37) = .34069E+04$A(19,  38) = .34592E+04$A(19,  39) = .35069E+04
007542          A(19,  40) = .35558E+04$A(19,  41) = .36155E+04$A(19,  42) = .36666E+04
007547          A(19,  43) = .37446E+04$A(19,  44) = .37975E+04$A(19,  45) = .38406E+04
007553          A(19,  46) = .38900E+04$A(19,  47) = .39404E+04$A(19,  48) = .39786E+04
007560          A(19,  49) = .40075E+04$A(19,  50) = .40428E+04$A(19,  51) = .40741E+04
007564          A(19,  52) = .41159E+04$A(19,  53) = .41943E+04$A(19,  54) = .42413E+04
007571          A(19,  55) = .43027E+04$A(19,  56) = .43797E+04$A(19,  57) = .44359E+04

007575          A(19,  58) = .44751E+04$A(19,  59) = .45104E+04$A(19,  60) = .45353E+04
007602          A(19,  61) = .45720E+04$A(19,  62) = .46089E+04$A(19,  63) = .46580E+04
007606          A(19,  64) = .47020E+04$A(19,  65) = .47544E+04$A(19,  66) = .47909E+04
007613          A(19,  67) = .48316E+04$A(19,  68) = .48670E+04$A(19,  69) = .49120E+04
007617          A(19,  70) = .49791E+04$A(19,  71) = .50737E+04$A(19,  72) = .51712E+04
007624          A(19,  73) = .53834E+04$A(19,  74) = .55489E+04$A(19,  75) = .57063E+04
007630          B(1 ,   1) = .16000E+03$B(19,   2) = .17532E+03$B(19,   3) = .19288E+03
007635          B(19,   4) = .21959E+03$B(19,   5) = .24566E+03$B(19,   6) = .26305E+03
007641          B(19,   7) = .27661E+03$B(19,   8) = .28874E+03$B(19,   9) = .29881E+03
007646          B(19,  10) = .30802E+03$B(19,  11) = .31581E+03$B(19,  12) = .32383E+03
007652          B(19,  13) = .32832E+03$B(19,  14) = .33238E+03$B(19,  15) = .33379E+03
007657          B(19,  16) = .33425E+03$B(19,  17) = .33761E+03$B(19,  18) = .33607E+03
007663          B(19,  19) = .33403E+03$B(19,  20) = .32850E+03$B(19,  21) = .32099E+03
007670          B(19,  22) = .31437E+03$B(19,  23) = .30871E+03$B(19,  24) = .30318E+03
007674          B(19,  25) = .29921E+03$B(19,  26) = .29700E+03$B(19,  27) = .29567E+03
007701          B(19,  28) = .29949E+03$B(19,  29) = .30341E+03$B(19,  30) = .31265E+03
007705          B(19,  31) = .32105E+03$B(19,  32) = .32626E+03$B(19,  33) = .33590E+03
007712          B(19,  34) = .34503E+03$B(19,  35) = .35432E+03$B(19,  36) = .36866E+03
007716          B(19,  37) = .38520E+03$B(19,  38) = .40088E+03$B(19,  39) = .41990E+03
007723          B(19,  40) = .44942E+03$B(19,  41) = .48173E+03$B(19,  42) = .51309E+03
007727          B(19,  43) = .57367E+03$B(19,  44) = .60990E+03$B(19,  45) = .63632E+03
007734          B(19,  46) = .67519E+03$B(19,  47) = .71443E+03$B(19,  48) = .74204E+03
007740          B(19,  49) = .75854E+03$B(19,  50) = .77201E+03$B(19,  51) = .77574E+03
007745          B(19,  52) = .78086E+03$B(19,  53) = .79017E+03$B(19,  54) = .78645E+03
007751          B(19,  55) = .77900E+03$B(19,  56) = .76875E+03$B(19,  57) = .76549E+03
007756          B(19,  58) = .75944E+03$B(19,  59) = .75098E+03$B(19,  60) = .73666E+03
007762          B(19,  61) = .70427E+03$B(19,  62) = .68058E+03$B(19,  63) = .63985E+03
007767          B(19,  64) = .59923E+03$B(19,  65) = .56539E+03$B(19,  66) = .54188E+03
007773          B(19,  67) = .51789E+03$B(19,  68) = .49998E+03$B(19,  69) = .48629E+03
010000          B(19,  70) = .46923E+03$B(19,  71) = .45237E+03$B(19,  72) = .43557E+03
```

```
010011  A(21,  1)= .00000E+00$A(21,  2)= .83908E+02$A(21,  3)= .22053E+03
010014  A(21,  4)= .56658E+03$A(21,  5)= .11515E+04$A(21,  6)= .12857E+04
010021  A(21,  7)= .13894E+04$A(21,  8)= .14619E+04$A(21,  9)= .15595E+04
010025  A(21, 10)= .16170E+04$A(21, 11)= .16742E+04$A(21, 12)= .19270E+04
010032  A(21, 13)= .24702E+04$A(21, 14)= .29879E+04$A(21, 15)= .36318E+04
010036  A(21, 16)= .38130E+04$A(21, 17)= .40531E+04$A(21, 18)= .42759E+04
010043  A(21, 19)= .44873E+04$A(21, 20)= .46396E+04$A(21, 21)= .47533E+04
010047  A(21, 22)= .48551E+04$A(21, 23)= .49461E+04$A(21, 24)= .50305E+04
010054  A(21, 25)= .50978E+04$A(21, 26)= .51751E+04$A(21, 27)= .52499E+04
010060  A(21, 28)= .53300E+04$A(21, 29)= .54154E+04$A(21, 30)= .55094E+04
010065  A(21, 31)= .55821E+04$A(21, 32)= .56532E+04$A(21, 33)= .57096E+04
010071  A(21, 34)= .57775E+04$A(21, 35)= .58052E+04$A(21, 36)= .58600E+04
010076  A(21, 37)= .58988E+04$A(21, 38)= .59632E+04$A(21, 39)= .60164E+04
010102  A(21, 40)= .60640E+04$A(21, 41)= .61132E+04$A(21, 42)= .61610E+04
010107  A(21, 43)= .62024E+04$A(21, 44)= .62481E+04$A(21, 45)= .63040E+04
010113  A(21, 46)= .63632E+04$A(21, 47)= .64524E+04$A(21, 48)= .65632E+04
010120  A(21, 49)= .66815E+04$A(21, 50)= .68293E+04$A(21, 51)= .69625E+04
010124  A(21, 52)= .70702E+04$A(21, 53)= .72275E+04$A(21, 54)= .75316E+04
010131  A(21, 55)= .80560E+04$A(21, 56)= .85545E+04$A(21, 57)= .00000E+00
010134  B(21,  1)= .22024E+02$B(21,  2)= .23609E+02$B(21,  3)= .23011E+02
010141  B(21,  4)= .32274E+02$B(21,  5)= .44426E+02$B(21,  6)= .48748E+02
010145  B(21,  7)= .54846E+02$B(21,  8)= .62053E+02$B(21,  9)= .77240E+02
010152  B(21, 10)= .84896E+02$B(21, 11)= .90748E+02$B(21, 12)= .98702E+02
010156  B(21, 13)= .11158E+03$B(21, 14)= .12395E+03$B(21, 15)= .14061E+03
010163  B(21, 16)= .14764E+03$B(21, 17)= .15473E+03$B(21, 18)= .16401E+03
010167  B(21, 19)= .17493E+03$B(21, 20)= .18418E+03$B(21, 21)= .19349E+03
010174  B(21, 22)= .20428E+03$B(21, 23)= .21624E+03$B(21, 24)= .22981E+03
010200  B(21, 25)= .24429E+03$B(21, 26)= .26742E+03$B(21, 27)= .30309E+03
010205  B(21, 28)= .35225E+03$B(21, 29)= .40479E+03$B(21, 30)= .47247E+03
010211  B(21, 31)= .56145E+03$B(21, 32)= .69036E+03$B(21, 33)= .81452E+03
010216  B(21, 34)= .99181E+03$B(21, 35)= .10656E+04$B(21, 36)= .11777E+04
010222  B(21, 37)= .12398E+04$B(21, 38)= .13172E+04$B(21, 39)= .13628E+04
010227  B(21, 40)= .13845E+04$B(21, 41)= .13655E+04$B(21, 42)= .13237E+04
010233  B(21, 43)= .11987E+04$B(21, 44)= .10174E+04$B(21, 45)= .86500E+03
010240  B(21, 46)= .73361E+03$B(21, 47)= .61972E+03$B(21, 48)= .51148E+03
010244  B(21, 49)= .42951E+03$B(21, 50)= .34576E+03$B(21, 51)= .28612E+03
010251  B(21, 52)= .25159E+03$B(21, 53)= .22503E+03$B(21, 54)= .19720E+03
010255  B(21, 55)= .17119E+03$B(21, 56)= .14719E+03$B(21, 57)= .00000E+00
010261  A(22,  1)= .00000E+00$A(22,  2)= .59070E+03$A(22,  3)= .14883E+04
010265  A(22,  4)= .47054E+04$A(22,  5)= .63794E+04$A(22,  6)= .82646E+04
010271  A(22,  7)= .90731E+04$A(22,  8)= .10765E+05$A(22,  9)= .11596E+05
010276  A(22, 10)= .12268E+05$A(22, 11)= .13005E+05$A(22, 12)= .13766E+05
010302  A(22, 13)= .14434E+05$A(22, 14)= .15474E+05$A(22, 15)= .18003E+05
010307  A(22, 16)= .19696E+05$A(22, 17)= .20842E+05$A(22, 18)= .22195E+05
010313  A(22, 19)= .23873E+05$A(22, 20)= .25366E+05$A(22, 21)= .26312E+05
010320  A(22, 22)= .27645E+05$A(22, 23)= .28551E+05$A(22, 24)= .29417E+05
010324  A(22, 25)= .30373E+05$A(22, 26)= .31225E+05$A(22, 27)= .31934E+05
010331  A(22, 28)= .32473E+05$A(22, 29)= .32985E+05$A(22, 30)= .33394E+05
010335  A(22, 31)= .33697E+05$A(22, 32)= .33814E+05$A(22, 33)= .34004E+05
010342  A(22, 34)= .34257E+05$A(22, 35)= .34509E+05$A(22, 36)= .34722E+05
010346  A(22, 37)= .34884E+05$A(22, 38)= .35058E+05$A(22, 39)= .35329E+05
010353  A(22, 40)= .35636E+05$A(22, 41)= .35818E+05$A(22, 42)= .35927E+05
010357  A(22, 43)= .36141E+05$A(22, 44)= .36328E+05$A(22, 45)= .36431E+05
010364  A(22, 46)= .36541E+05$A(22, 47)= .36714E+05$A(22, 48)= .36823E+05
010370  A(22, 49)= .37058E+05$A(22, 50)= .37269E+05$A(22, 51)= .37520E+05
010375  A(22, 52)= .37748E+05$A(22, 53)= .38025E+05$A(22, 54)= .38532E+05
010401  A(22, 55)= .38945E+05$A(22, 56)= .39157E+05$A(22, 57)= .39400E+05
010406  A(22, 58)= .39733E+05$A(22, 59)= .40261E+05$A(22, 60)= .40446E+05
```

```
010412          A(22, 61)= .40634E+05$A(22, 62)= .40984E+05$A(22, 63)= .41191E+05
010417          A(22, 64)= .41435E+05$A(22, 65)= .41879E+05$A(22, 66)= .42278E+05
010423          A(22, 67)= .42796E+05$A(22, 68)= .43624E+05$A(22, 69)= .44834E+05
010430          A(22, 70)= .46263E+05$A(22, 71)= .48335E+05$A(22, 72)= .50897E+05
010434          B(22,  1)= .63837E+01$B(22,  2)= .68273E+01$B(22,  3)= .69438E+01
010441          B(22,  4)= .91996E+01$B(22,  5)= .10075E+02$B(22,  6)= .11836E+02
010445          B(22,  7)= .13603E+02$B(22,  8)= .14945E+02$B(22,  9)= .16713E+02
010452          B(22, 10)= .19507E+02$B(22, 11)= .22451E+02$B(22, 12)= .27072E+02
010456          B(22, 13)= .31550E+02$B(22, 14)= .30960E+02$B(22, 15)= .30077E+02
010463          B(22, 16)= .29349E+02$B(22, 17)= .29356E+02$B(22, 18)= .30396E+02
010467          B(22, 19)= .30564E+02$B(22, 20)= .31034E+02$B(22, 21)= .31938E+02
010474          B(22, 22)= .32556E+02$B(22, 23)= .33456E+02$B(22, 24)= .35232E+02
010500          B(22, 25)= .37452E+02$B(22, 26)= .39572E+02$B(22, 27)= .42600E+02
010505          B(22, 28)= .45629E+02$B(22, 29)= .49709E+02$B(22, 30)= .54246E+02
010511          B(22, 31)= .60446E+02$B(22, 32)= .68699E+02$B(22, 33)= .76688E+02
010516          B(22, 34)= .82658E+02$B(22, 35)= .93736E+02$B(22, 36)= .11236E+03
010522          B(22, 37)= .13056E+03$B(22, 38)= .13989E+03$B(22, 39)= .15242E+03
010527          B(22, 40)= .16913E+03$B(22, 41)= .18343E+03$B(22, 42)= .20906E+03
010533          B(22, 43)= .24498E+03$B(22, 44)= .31029E+03$B(22, 45)= .39777E+03
010540          B(22, 46)= .47004E+03$B(22, 47)= .60745E+03$B(22, 48)= .64055E+03
010544          B(22, 49)= .68725E+03$B(22, 50)= .74485E+03$B(22, 51)= .79282E+03
010551          B(22, 52)= .82934E+03$B(22, 53)= .86120E+03$B(22, 54)= .90265E+03
010555          B(22, 55)= .92473E+03$B(22, 56)= .90539E+03$B(22, 57)= .86108E+03
010562          B(22, 58)= .73333E+03$B(22, 59)= .57169E+03$B(22, 60)= .53228E+03
010566          B(22, 61)= .47585E+03$B(22, 62)= .36975E+03$B(22, 63)= .33133E+03
010573          B(22, 64)= .30343E+03$B(22, 65)= .27816E+03$B(22, 66)= .26287E+03
010577          B(22, 67)= .25223E+03$B(22, 68)= .24375E+03$B(22, 69)= .23523E+03
010604          B(22, 70)= .21459E+03$B(22, 71)= .19056E+03$B(22, 72)= .17018E+03
010610          A(23,  1)= .00000E+00$A(23,  2)= .30148E+03$A(23,  3)= .74571E+03
010614          A(23,  4)= .19055E+04$A(23,  5)= .25017E+04$A(23,  6)= .28791E+04
010620          A(23,  7)= .33991E+04$A(23,  8)= .37464E+04$A(23,  9)= .42366E+04
010625          A(23, 10)= .47745E+04$A(23, 11)= .59754E+04$A(23, 12)= .66851E+04
010631          A(23, 13)= .75822E+04$A(23, 14)= .85569E+04$A(23, 15)= .99244E+04
010636          A(23, 16)= .11211E+05$A(23, 17)= .13166E+05$A(23, 18)= .15923E+05
010642          A(23, 19)= .17165E+05$A(23, 20)= .18542E+05$A(23, 21)= .20175E+05
010647          A(23, 22)= .21830E+05$A(23, 23)= .23003E+05$A(23, 24)= .23943E+05
010653          A(23, 25)= .24728E+05$A(23, 26)= .25569E+05$A(23, 27)= .26524E+05
010660          A(23, 28)= .27326E+05$A(23, 29)= .28166E+05$A(23, 30)= .28768E+05
010664          A(23, 31)= .29249E+05$A(23, 32)= .29713E+05$A(23, 33)= .30045E+05
010671          A(23, 34)= .30545E+05$A(23, 35)= .31039E+05$A(23, 36)= .31622E+05
010675          A(23, 37)= .32140E+05$A(23, 38)= .32608E+05$A(23, 39)= .33003E+05
010702          A(23, 40)= .33264E+05$A(23, 41)= .33510E+05$A(23, 42)= .33768E+05
010706          A(23, 43)= .33973E+05$A(23, 44)= .34279E+05$A(23, 45)= .34701E+05
010713          A(23, 46)= .35021E+05$A(23, 47)= .35394E+05$A(23, 48)= .35808E+05
010717          A(23, 49)= .36384E+05$A(23, 50)= .36678E+05$A(23, 51)= .36991E+05
010724          A(23, 52)= .37226E+05$A(23, 53)= .37436E+05$A(23, 54)= .37691E+05
010730          A(23, 55)= .38036E+05$A(23, 56)= .38384E+05$A(23, 57)= .38720E+05
010735          A(23, 58)= .39145E+05$A(23, 59)= .39690E+05$A(23, 60)= .40488E+05
010741          A(23, 61)= .41514E+05$A(23, 62)= .42635E+05$A(23, 63)= .44135E+05
010746          A(23, 64)= .46079E+05$A(23, 65)= .49896E+05$A(23, 66)= .53815E+05
010752          A(23, 67)= .57158E+05$A(23, 68)= .60339E+05$A(23, 69)= .00000E+00
010756          B(23,  1)= 6.0000E+01$B(23,  2)= .65000E+02$B(23,  3)= .72729E+02
010763          B(23,  4)= .84808E+02$B(23,  5)= .89662E+02$B(23,  6)= .92269E+02
010767          B(23,  7)= .93229E+02$B(23,  8)= .91814E+02$B(23,  9)= .88939E+02
010774          B(23, 10)= .90298E+02$B(23, 11)= .94539E+02$B(23, 12)= .97037E+02
```

```
011000          B(23, 13)= .98355E+02$B(23, 14)= .96877E+02$B(23, 15)= .95960E+02
011005          B(23, 16)= .97051E+02$B(23, 17)= .99633E+02$B(23, 18)= .10377E+03
011011          B(23, 19)= .10569E+03$B(23, 20)= .10817E+03$B(23, 21)= .11109E+03
011016          B(23, 22)= .11666E+03$B(23, 23)= .12060E+03$B(23, 24)= .12503E+03
011022          B(23, 25)= .12917E+03$B(23, 26)= .13557E+03$B(23, 27)= .14356E+03
011027          B(23, 28)= .15144E+03$B(23, 29)= .15885E+03$B(23, 30)= .16367E+03
011033          B(23, 31)= .16881E+03$B(23, 32)= .17539E+03$B(23, 33)= .18163E+03
011040          B(23, 34)= .19346E+03$B(23, 35)= .20923E+03$B(23, 36)= .23066E+03
011044          B(23, 37)= .25809E+03$B(23, 38)= .28171E+03$B(23, 39)= .30647E+03
011051          B(23, 40)= .32175E+03$B(23, 41)= .33298E+03$B(23, 42)= .34223E+03
011055          B(23, 43)= .34807E+03$B(23, 44)= .35203E+03$B(23, 45)= .35366E+03
011062          B(23, 46)= .35203E+03$B(23, 47)= .34779E+03$B(23, 48)= .33471E+03
011065          B(23, 49)= .31146E+03$B(23, 50)= .29432E+03$B(23, 51)= .27189E+03
011072          B(23, 52)= .24233E+03$B(23, 53)= .21880E+03$B(23, 54)= .20078E+03
011076          B(23, 55)= .18567E+03$B(23, 56)= .17259E+03$B(23, 57)= .16360E+03
011103          B(23, 58)= .15516E+03$B(23, 59)= .14824E+03$B(23, 60)= .14081E+03
011107          B(23, 61)= .13350E+03$B(23, 62)= .12665E+03$B(23, 63)= .11906E+03
011114          B(23, 64)= .11259E+03$B(23, 65)= .10272E+03$B(23, 66)= .94791E+02
011120          B(23, 67)= .88790E+02$B(23, 68)= .84116E+02$B(23, 69)= .00000E+00
011124          A(25,  1)= .00000E+00$A(25,  2)= .62415E+03$A(25,  3)= .14898E+04
011130          A(25,  4)= .34900E+04$A(25,  5)= .65223E+04$A(25,  6)= .95839E+04
011134          A(25,  7)= .10405E+05$A(25,  8)= .10916E+05$A(25,  9)= .11349E+05
011141          A(25, 10)= .11932E+05$A(25, 11)= .12664E+05$A(25, 12)= .13217E+05
011145          A(25, 13)= .13594E+05$A(25, 14)= .14020E+05$A(25, 15)= .14771E+05
011152          A(25, 16)= .15522E+05$A(25, 17)= .16920E+05$A(25, 18)= .19161E+05
011156          A(25, 19)= .20823E+05$A(25, 20)= .22407E+05$A(25, 21)= .24360E+05
011163          A(25, 22)= .26110E+05$A(25, 23)= .27756E+05$A(25, 24)= .29006E+05
011167          A(25, 25)= .30033E+05$A(25, 26)= .31057E+05$A(25, 27)= .31884E+05
011174          A(25, 28)= .32901E+05$A(25, 29)= .33480E+05$A(25, 30)= .34152E+05
011200          A(25, 31)= .34604E+05$A(25, 32)= .34960E+05$A(25, 33)= .35433E+05
011205          A(25, 34)= .35810E+05$A(25, 35)= .36185E+05$A(25, 36)= .36723E+05
011211          A(25, 37)= .37232E+05$A(25, 38)= .37767E+05$A(25, 39)= .38430E+05
011216          A(25, 40)= .39012E+05$A(25, 41)= .39621E+05$A(25, 42)= .40042E+05
011222          A(25, 43)= .40347E+05$A(25, 44)= .40462E+05$A(25, 45)= .40914E+05
011227          A(25, 46)= .41263E+05$A(25, 47)= .41566E+05$A(25, 48)= .41768E+05
011233          A(25, 49)= .41872E+05$A(25, 50)= .42076E+05$A(25, 51)= .42277E+05
011240          A(25, 52)= .42689E+05$A(25, 53)= .43257E+05$A(25, 54)= .43543E+05
011244          A(25, 55)= .43817E+05$A(25, 56)= .44168E+05$A(25, 57)= .44640E+05
011251          A(25, 58)= .45210E+05$A(25, 59)= .45721E+05$A(25, 60)= .46191E+05
011255          A(25, 61)= .46585E+05$A(25, 62)= .47138E+05$A(25, 63)= .47666E+05
011262          A(25, 64)= .48186E+05$A(25, 65)= .48691E+05$A(25, 66)= .49627E+05
011266          A(25, 67)= .50237E+05$A(25, 68)= .51858E+05$A(25, 69)= .54468E+05
011273          A(25, 70)= .56637E+05$A(25, 71)= .58371E+05$A(25, 72)= .60632E+05
011277          A(25, 73)= .62217E+05$A(25, 74)= .65644E+05$A(25, 75)= .69115E+05
011304          A(25, 76)= .73602E+05$A(25, 77)= .75451E+05$A(25, 78)= .76988E+05
011310          A(25, 79)= .79533E+05$A(25, 80)= .81431E+05$A(25, 81)= .85754E+05
011315          A(25, 82)= .95316E+05$A(25, 83)= .00000E+00$A(25, 84)= .00000E+00
011320          B(25,  1)= .30801E+02$B(25,  2)= .31200E+02$B(25,  3)= .31730E+02
011325          B(25,  4)= .33091E+02$B(25,  5)= .36715E+02$B(25,  6)= .41131E+02
011331          B(25,  7)= .42918E+02$B(25,  8)= .44578E+02$B(25,  9)= .47502E+02
011336          B(25, 10)= .51312E+02$B(25, 11)= .57365E+02$B(25, 12)= .63388E+02
011342          B(25, 13)= .65465E+02$B(25, 14)= .67082E+02$B(25, 15)= .68606E+02
011347          B(25, 16)= .70345E+02$B(25, 17)= .72117E+02$B(25, 18)= .74214E+02
011353          B(25, 19)= .75163E+02$B(25, 20)= .76814E+02$B(25, 21)= .78718E+02
011360          B(25, 22)= .80665E+02$B(25, 23)= .82830E+02$B(25, 24)= .84768E+02
011364          B(25, 25)= .86800E+02$B(25, 26)= .89056E+02$B(25, 27)= .92009E+02
011371          B(25, 28)= .95716E+02$B(25, 29)= .99455E+02$B(25, 30)= .10459E+03
011375          B(25, 31)= .11057E+03$B(25, 32)= .11627E+03$B(25, 33)= .12141E+03
```

```
011402          B(25, 34)= .12817E+03$B(25, 35)= .13100E+03$B(25, 36)= .13425E+03
011406          B(25, 37)= .14067E+03$B(25, 38)= .14859E+03$B(25, 39)= .16242E+03
011413          B(25, 40)= .18230E+03$B(25, 41)= .21445E+03$B(25, 42)= .25638E+03
011417          B(25, 43)= .30012E+03$B(25, 44)= .31297E+03$B(25, 45)= .41475E+03
011424          B(25, 46)= .58387E+03$B(25, 47)= .76577E+03$B(25, 48)= .88448E+03
011430          B(25, 49)= .93944E+03$B(25, 50)= .97118E+03$B(25, 51)= .98738E+03
011435          B(25, 52)= .98749E+03$B(25, 53)= .97813E+03$B(25, 54)= .96367E+03
011441          B(25, 55)= .94162E+03$B(25, 56)= .89267E+03$B(25, 57)= .79372E+03
011446          B(25, 58)= .65435E+03$B(25, 59)= .51537E+03$B(25, 60)= .41903E+03
011452          B(25, 61)= .35634E+03$B(25, 62)= .29047E+03$B(25, 63)= .25657E+03
011457          B(25, 64)= .22450E+03$B(25, 65)= .20641E+03$B(25, 66)= .18133E+03
011463          B(25, 67)= .17122E+03$B(25, 68)= .15142E+03$B(25, 69)= .12847E+03
011470          B(25, 70)= .11372E+03$B(25, 71)= .10394E+03$B(25, 72)= .98915E+02
011474          B(25, 73)= .92563E+02$B(25, 74)= .80834E+02$B(25, 75)= .71252E+02
011501          B(25, 76)= .65086E+02$B(25, 77)= .61772E+02$B(25, 78)= .56112E+02
011505          B(25, 79)= .55169E+02$B(25, 80)= .55641E+02$B(25, 81)= .52812E+02
011512          B(25, 82)= .50433E+02$B(25, 83)= .00000E+00$B(25, 84)= .00000E+00
011516          READ 10,SHOT,DATE,WLC,WAC,METAL,HE,DENS,SP
011541          WL=WLC/25.4*1000.
011543          WD=SQRT(4.*WAC/3.14/25.4**2*1.E+6)
011552       10 FORMAT(F10.0,A10,2F10.3,2A10,2F10.3)
011555          NSHOT=SHOT
011556          TTH=TTL=0.
011561          IF(SP.LE.0.)GO TO 113
011564          TTH=WD/WL**.5*(850.+35.5*(WL*WD*SP*.001-120.)**2
                1/(WL*WD*SP*.001)**1.5)/(1.88-DENS)**3
011606          TTL=WD/WL**.5*850./(1.88-DENS)**3
011615      113 CONTINUE
011615          M=JJ=0
011617          IF(METAL.NE.10HCOPPER    )GO TO 1002
011621          M=1           $NA=96     $WDEN= 8.96  $FACT= 2.2965E+12
011626          TR2= 80492. $TR3= 94228. $TR4=124008. $TR5=173000. $TR6=223550.
011636     1002 IF(METAL.NE.10HALUMINUM  )GO TO 1003
011640          M=2           $NA=80     $WDEN= 2.699 $FACT=  .5360E+12
011645          TR2= 25238. $TR3= 32035. $TR4= 48561. $TR5= 65776. $TR6= 92614.
011655     1003 IF(METAL.NE.10HGOLD      )GO TO 1004
011657          M=3           $NA=82     $WDEN=19.32  $FACT=  .7313E+12
011664          TR2= 42816. $TR3= 50180. $TR4= 64950. $TR5= 83157. $TR6= 93014.
011674     1004 IF(METAL.NE.10HSILVER    )GO TO 1005
011676          M=4           $NA=77     $WDEN=10.50  $FACT=  .9036E+12
011703          TR2= 61682. $TR3= 71771. $TR4= 90132. $TR5=112290. $TR6=137970.
011713     1005 IF(METAL.NE.10HPLATINUM  )GO TO 1006
011715          M=5           $NA=82     $WDEN=21.45  $FACT=  .3753E+12
011722          TR2= 14701. $TR3= 17979. $TR4= 24979. $TR5= 48947. $TR6= 93000.
011732     1006 IF(METAL.NE.10HNICKEL    )GO TO 1007
011734          M=6           $NA=88     $WDEN= 8.902 $FACT=  .5266E+12
011741          TR2= 17233. $TR3= 21156. $TR4= 30173. $TR5= 56007. $TR6= 91900.
011751     1007 IF(METAL.NE.10HIRON      )GO TO 1008
011753          M=7           $NA=86     $WDEN= 7.874 $FACT=  .1717E+12
011760          TR2= 12806. $TR3= 14581. $TR4= 21568. $TR5= 36105. $TR6= 44837.
011770     1008 IF(METAL.NE.10HPALLADIUM )GO TO 1009
011772          M=8           $NA=68     $WDEN=12.02  $FACT=  .3286E+12
011777          TR2= 16187. $TR3= 19583. $TR4= 25979. $TR5= 51366. $TR6= 92741.
012007     1009 IF(METAL.NE.10HRHODIUM   )GO TO 1010
012011          M=9           $NA=73     $WDEN=12.41  $FACT=  .8017E+12
012016          TR2= 33617. $TR3= 37597. $TR4= 46139. $TR5= 73983. $TR6= 93013.
012026     1010 IF(METAL.NE.10HVANADIUM  )GO TO 1011
012030          M=10          $NA=68     $WDEN= 6.11  $FACT=  .3848E+12
```

```
012035          TR2= 10444. $TR3= 12232. $TR4= 15479. $TR5= 42786. $TR6= 92520.
012045     1011 IF(METAL.NE.10HTUNGSTEN  )GO TO 1012
012047          M=11          $NA=61          $WDEN=19.3    $FACT= .7246E+12
012054          TR2= 32469. $TR3= 35450. $TR4= 42128. $TR5= 75081. $TR6= 94910.
012064     1012 IF(METAL.NE.10HCADMIUM   )GO TO 1013
012066          M=12          $NA=71          $WDEN= 8.65   $FACT= .1373E+12
012073          TR2=  4550. $TR3=  6348. $TR4=  9169. $TR5= 18049. $TR6= 44400.
012103     1013 IF(METAL.NE.10HTIN       )GO TO 1014
012105          M=13          $NA=70          $WDEN= 7.31   $FACT= .0643E+12
012112          TR2=  1727. $TR3=  2870. $TR4=  8023. $TR5= 12447. $TR6= 24161.
012122     1014 IF(METAL.NE.10HMOLYBDINUM)GO TO 1015
012124          M=14          $NA=92          $WDEN=10.22   $FACT= .6365E+12
012131          TR2= 30097. $TR3= 33005. $TR4= 42905. $TR5= 73952. $TR6=143200.
012141     1015 IF(METAL.NE.10HZIRCONIUM )GO TO 1016
012143          M=15          $NA=73          $WDEN= 6.53   $FACT= .1000E+12
012150          TR2=  2843. $TR3=  3812. $TR4=  6082. $TR5= 16665. $TR6= 30582.
012160     1016 IF(METAL.NE.10HTITANIUM  )GO TO 1017
012162          M=16          $NA=63          $WDEN= 4.54   $FACT= .09572+12
012170          TR2=  2864. $TR3=  4000. $TR4=  6906. $TR5= 19261. $TR6= 30990.
012200     1017 IF(METAL.NE.10HBISMUTH   )GO TO 1018
012202          M=17          $NA=54          $WDEN= 9.747 $FACT= .3533E+10
012207          TR2=   168.7$TR3=   440.6$TR4=  1553. $TR5=  2654. $TR6=  6872.
012217     1018 CONTINUE
012217     1019 IF(METAL.NE.10HSCANDIUM  )GO TO 1020
012221          M=19          $NA=75          $WDEN= 2.992 $FACT= .0125E+12
012226          TR2=   684.8$TR3=  1020. $TR4=  1730. $TR5=  4194. $TR6=  5706.
012236     1020 CONTINUE
012236     1021 IF(METAL.NE.10HLEAD      )GO TO 1022
012240          M=21          $NA=56          $WDEN=11.35   $FACT= .0155E+12
012245          TR2=  1424. $TR3=  1670. $TR4=  2553. $TR5=  6066. $TR6=  8556.
012255     1022 IF(METAL.NE.10HZINC      )GO TO 1023
012257          M=22          $NA=72          $WDEN= 7.133 $FACT= .4403E+12
012264          TR2= 12980. $TR3= 14348. $TR4= 17067. $TR5= 38945. $TR6= 50897.
012274     1023 IF(METAL.NE.10HURANIUM   )GO TO 1024
012276          M=23          $NA=68          $WDEN=18.95   $FACT= .3063E+12
012303          TR2=  6090. $TR3=  7130. $TR4= 13575. $TR5= 34701. $TR6= 60339.
012313     1024 CONTINUE
012313     1025 IF(METAL.NE.10H70AU30PT  )GO TO 9999
012315          M=25          $NA=82          $WDEN=19.9    $FACT= .4582E+12
012322          TR2= 10387. $TR3= 13391. $TR4= 21572. $TR5= 42689. $TR6= 95316.
012332     9999 CONTINUE
012332          IFLAG=1
012333          IF(M.NE.0) GO TO 30
012334          PRINT 20,METAL
012342       20 FORMAT(1H1,*THE REQUESTED METAL-*A10,2X*IS NOT ON FILE*)
012346          GO TO 200
012346       30 CONTINUE
012346      909 CONTINUE
012346      913 CONTINUE
012346          K=NA
012350       50 CONTINUE
012350          IF(M.EQ.0)GO TO 200
012351          KK=K-1
012353          IF(T.EQ.0.)GS=CLAST=TLAST=E=0.
012360          IF(T.EQ.0)JJ=0
012362          GS=GS+(T-TLAST)/2.*(C**2+CLAST**2)/WAC**2
012371          DO 60 I=2,K
012372          IF(A(M,I).LT.GS)GO TO 60
```

```
012377           GO TO 70
012400        60 CONTINUE
012403           SR1=FACT/GS**2*WLC/WAC *1.E-5
012407           GO TO 107
012410        70 CONTINUE
012410           SR1=(B(M,I-1)+(B(M,I)-B(M,I-1))*(GS-A(M,I-1))/
                1(A(M,I)-A(M,I-1)))*WLC/WAC*1.E-5
012431       107 CONTINUE
012431           E=E+(T-TLAST)/2.*(C**2*SR1+CLAST**2*RLAST)
012440           IF(T.EQ.0.)RLAST=SR1
012442           CLAST=C
012443           TLAST=T
012444           RLAST=SR1
012445           G=GS*WAC**2
012447           DUM3=SR1
012450           IF(IOUT.EQ.0) GO TO 200
012454           JJ=JJ+1
012455           TA(JJ)=T
012456           EA(JJ)=E
012460           GA(JJ)=G
012462           CA(JJ)=C
012464           VA(JJ)=C*SR1
012466           RA(JJ)=SR1
012470           RA(1)=B(M,1)*WLC/WAC*1.E-5
012475           PA(JJ)=C**2*SR1
012477           SE(JJ)=E/WAC/WLC/WDEN*1000.
012505           SG(JJ)=G/WAC**2
012511           IF(T.LT.TTOT    ) GO TO 200
         C       PRINTING
012517           IFLAG=0
012520           PRINT 100, NSHOT,DATE,TTH,TTL,METAL,WAC,WLC,HE,DENS,SP
012547       100 FORMAT(    12X*TEST NO.----*I4,20X*DATE----*A10,22X
                1*TTHS----*2F7.0,2X*AMPS*//12X*BRIDGEWIRE--*A10,14X
                2*WIRE AREA-*E9.3,2X*MM2*16X,*LENGTH--*F8.4,
                32X*MM  *//12X*EXPLOSIVE---*A10,14X*DENSITY--*+1PF6.3,2X,
                4*GM/CM3*17X,*AREA----*0PF7.0,2X*CM2/GM*//
                5             11X,*TIME*,8X,*CURRENT*,10X,*VOLTS*,11X,*OHMS*,
                610X,*POWER*,9X,*ENERGY*,9X,*ACTION*,10X,*GDENS*10X*EDENS*/
                71H ,6X*MICROSEC*11X*AMPS*36X*KILOWATTS*9X*MILLIJ*7X,
                8*AMP2 SEC*,3X,*AMP2 SEC/MM4*11X*J/GM*/)
012553           DO 240 K=1,JJ
012554           IF(          K.EQ.51.OR.K.      EQ.101.OR.K.EQ.151.OR.K.EQ.201.OR.
                1K.EQ.251)245,250
012576       245 PRINT 255
012602       255 FORMAT (1H1,10X,*TIME*,8X,*CURRENT*,10X,*VOLTS*,11X,*OHMS*,
                110X,*POWER*,9X,*ENERGY*,9X,*ACTION*,10X,*GDENS*10X*EDENS*/
                21H ,6X*MICROSEC*11X*AMPS*36X*KILOWATTS*9X*MILLIJ*7X,
                8*AMP2 SEC*,3X,*AMP2 SEC/MM4*11X*J/GM*/)
012606       250 IF(SG(K).LT.TR2)KEY=3HS
012613           IF(SG(K).GE.TR2)KEY=3HS+L
012621           IF(SG(K).GE.TR3)KEY=3HL
012627           IF(SG(K).GE.TR4)KEY=3HL+V
012635           IF(SG(K).GE.TR5)KEY=3HARC
012643           IF(SG(K).GE.TR6)KEY=3HEXT
012651           PRINT 260,KEY,TA(K),CA(K),VA(K),RA(K),PA(K),EA(K),GA(K),SG(K),
                1SE(K)
012701       260 FORMAT(X,A3,6PF11.3,0PF15.1,F15.1,F15.5,-3PF15.3,3PF15.2,0PF15.4,
                1E15.4,F15.3)
```

```
012705      240 CONTINUE
012707          PRINT 263
012713      263 FORMAT(1H1)
012717      200 CONTINUE
012717          RETURN
012721          END
```

SUBPROGRAM LENGTH
045367

FUNCTION ASSIGNMENTS

STATEMENT ASSIGNMENTS

10	-	021165	20	-	021510	30	-	012347	50	-	012351
60	-	012401	70	-	012411	100	-	021523	107	-	012432
113	-	011616	200	-	012720	245	-	012577	250	-	012607
255	-	021615	260	-	021662	263	-	021673	909	-	012347
913	-	012347	1002	-	011637	1003	-	011656	1004	-	011675
1005	-	011714	1006	-	011733	1007	-	011752	1008	-	011771
1009	-	012010	1010	-	012027	1011	-	012046	1012	-	012065
1013	-	012104	1014	-	012123	1015	-	012142	1016	-	012161
1017	-	012201	1018	-	012220	1019	-	012220	1020	-	012237
1021	-	012237	1022	-	012256	1023	-	012275	1024	-	012314
1025	-	012314	9999	-	012333						

BLOCK NAMES AND LENGTHS
SWITCH - 000011 TT - 005232

VARIABLE ASSIGNMENTS

A	-	021721	B	-	033531	CA	-	001605C02	CLAST	-	045357
DATE	-	005216C02	DENS	-	005223C02	DUMMY	-	000001C01	DUM3	-	000000
E	-	045361	EA	-	000455C02	FACT	-	045352	G	-	045365
GA	-	001131C02	GS	-	045356	HE	-	005222C02	I	-	045362
IFLAG	-	045341	IOUT	-	000000C01	JJ	-	000000C02	K	-	045354
KEY	-	045366	KK	-	045355	M	-	045347	METAL	-	005221C02
NA	-	045350	NSHOT	-	005215C02	PA	-	003411C02	RA	-	002735C02
RLAST	-	045364	SE	-	004065C02	SG	-	004541C02	SHOT	-	045342
SP	-	005224C02	SR1	-	045363	TA	-	000001C02	TLAST	-	045360
TR2	-	005225C02	TR3	-	005226C02	TR4	-	005227C02	TR5	-	005230C02
TR6	-	045353	TTH	-	045345	TTL	-	045346	VA	-	002261C02
WAC	-	005220C02	WD	-	045344	WDEN	-	045351	WL	-	045343
WLC	-	005217C02									

START OF CONSTANTS
012724

START OF TEMPORARIES
021675

START OF INDIRECTS
021715

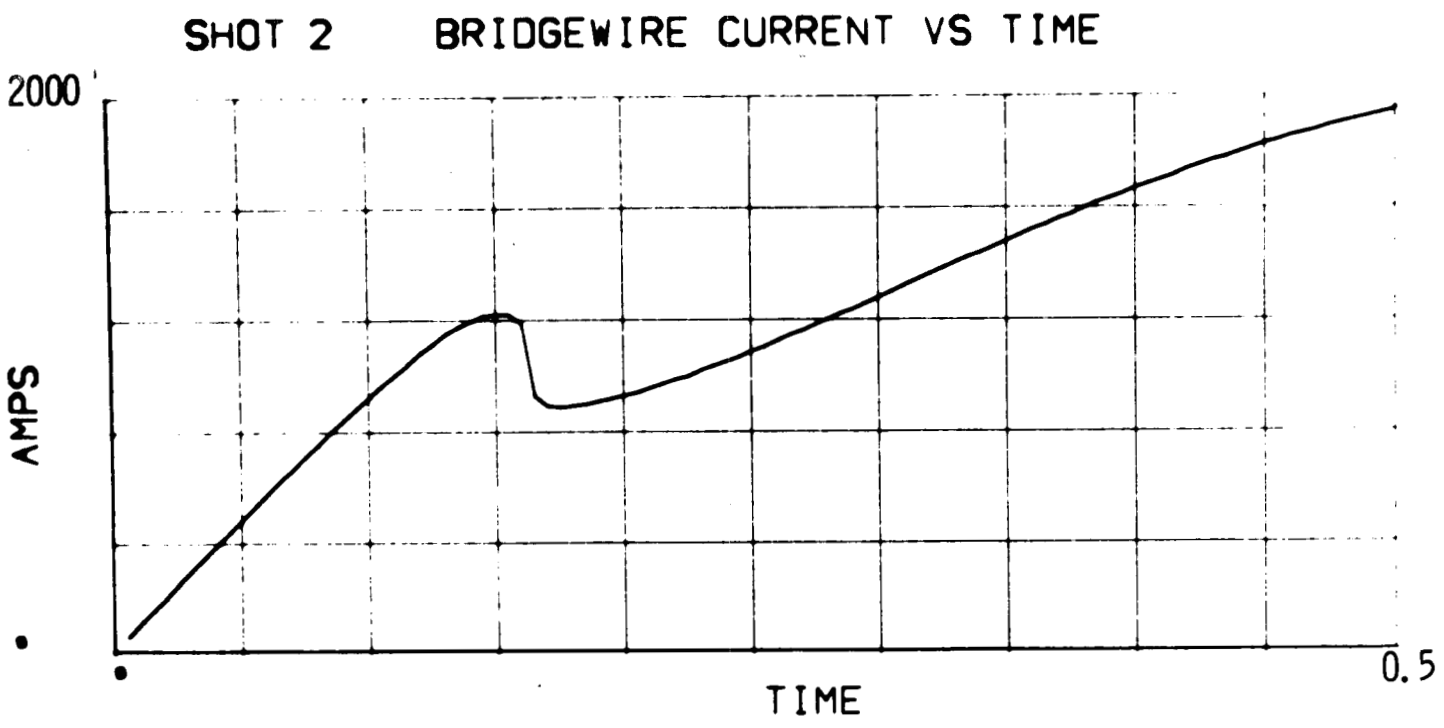
UNUSED COMPILER SPACE
017300

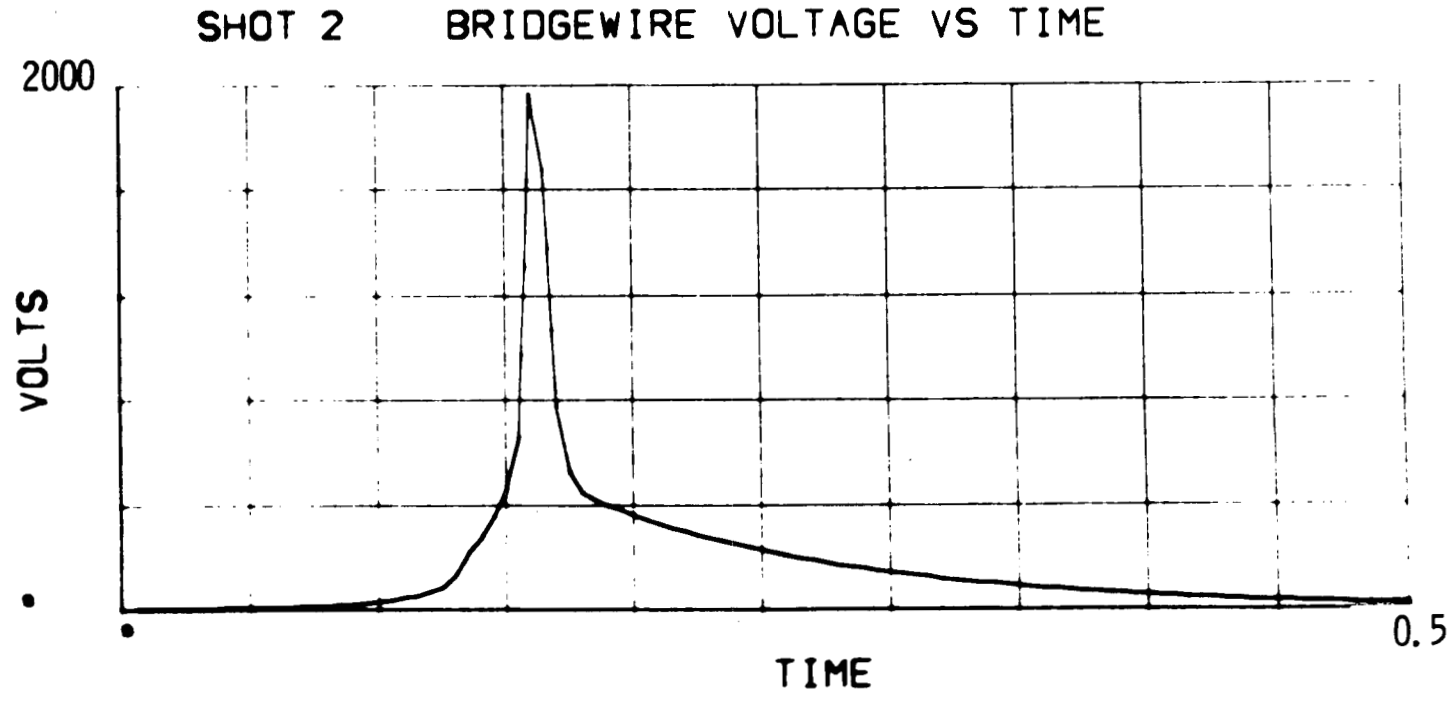
This page intentionally left blank.

APPENDIX 4

Computer Code EBW1 Listing and Typical Output Results

```
FBW1, T20 ,CM200000.                          T.J.TUCKER  BOX  102
ACCOUNT,S509260356,D5131,G8702,A0001020,RT,KUNC.
ATTACH,MIMICB,MIMIC.
PRFP,MIMICB,MIMIC.
ATTACH,USERA,TJ2.
ATTACH,USERB,TPT.
COLLECT,BINARY,PROGRAM=MIMIC,MIMIC,USERA,USERB,SCORS.
BINARY.
'
C-----------------------------------------------------------------------
C       PROGRAM REQUIRES TWO DATA CARDS-
C
C  ------------CIRCIUT PARAMETERS-----------------------
C
C   READ IN INDUCTANCE,SOURCE RESISTANCE,CAPACITANCE,VOLTAGE,PRINT OUT
C   TIME INCREMENT,AND TOTAL TIME OF RUN.
C   UNITS ARE HENRIES,OHMS,FARIDS,VOLTS,AND SECONDS.
C   USE STANDARD MIMIC 12 COLUMN FORMAT.
C
C--------SECOND DATA CARD-SR1 WIRE DEFINITION--------------
C
C   CARD INCLUDES SHOT NUMBER,DATE,WIRE LENGTH IN MILLIMETERS,WIRE
C   AREA IN SQUARE MILLIMETERS,AND WIRE METAL.
C
C   FORMAT AS 6 FIELDS OF 10 COLUMNS,WIRE METAL LEFT HAND JUSTIFIED.
C
C   IF DETONATOR PREDICTIONS REQUIRED INCLUDE 3 TEN COLUMN FIELDS OF HE
C   TYPE,DENSITY IN GRAMS/CM3,AND SPECIFIC SURFACE IN CM2/GRAM.
C-----------------------------------------------------------------------
                  PAR(L,R,C,V,DT,TTOT)
         QO       -V*C
 FLAG1            SR2(TTOT,RW)
         RW       SR1(I,T,DT,TTOT)
         2DQ      -1./L*(Q/C+1DQ*(RW+R))
         1DQ       INT(2DQ,0.)
         Q         INT(1DQ,QO)
         I         1DQ
         E         INT(I*I*RW,0.)
         G         INT(I*I,0.)
         FLAG1     FIN(T,TTOT)
                   END
     .100E-6   .1            1.00E-6   1000.        .0020E-6      .25E-6
     2.       1-2-75   1.       1.141E-3GOLD      PETN       1.       2000.
'
'
```


SHOT 2 BRIDGEWIRE CURRENT VS TIME
2000
AMPS
0.5
TIME


SHOT 2 BRIDGEWIRE VOLTAGE VS TIME
2000
VOLTS
0.5
TIME

L	R	C	V	DT	TTOT
1.00000E-07	1.00000E-01	1.00000E-06	1.00000E+03	2.00000E-09	2.50000E-07

TEST NO.---- 2 DATE---- 1-2-75 TTHS---- 374 298 AMPS

BRIDGEWIRE--GOLD WIRE AREA-1.141E-03 MM2 LENGTH-- 1.0000 MM

EXPLOSIVE---PETN DENSITY-- 1.000 GM/CM3 AREA---- 5000 CM2/GM

	TIME MICROSEC	CURRENT AMPS	VOLTS	OHMS	POWER KILOWATTS	ENERGY MILLIJ	ACTION AMP2 SEC	GOENS AMP2 SEC/MM4	EOENS J/GM
S	.002	20.0	.4	.02168	.009	.00	.0000	1.9173E-01	.000
S	.004	39.9	.9	.02167	.034	.00	.0000	1.6072E+00	.002
S	.006	59.8	1.3	.02164	.077	.00	.0000	5.4618E+00	.007
S	.008	79.6	1.7	.02158	.137	.00	.0000	1.2962E+01	.017
S	.010	99.4	2.1	.02148	.212	.00	.0000	2.5303E+01	.032
S	.012	119.1	2.5	.02133	.303	.00	.0001	4.3675E+01	.055
S	.014	138.8	2.9	.02112	.407	.00	.0001	6.9252E+01	.088
S	.016	158.4	3.3	.02085	.523	.00	.0001	1.0321E+02	.130
S	.018	178.0	3.6	.02050	.649	.00	.0002	1.4669E+02	.183
S	.020	197.5	4.0	.02007	.782	.01	.0003	2.0086E+02	.248
S	.022	216.9	4.3	.01995	.939	.01	.0003	2.6685E+02	.325
S	.024	236.3	4.7	.01999	1.117	.01	.0005	3.4579E+02	.419
S	.026	255.7	5.1	.02005	1.310	.01	.0006	4.3880E+02	.528
S	.028	275.0	5.5	.02011	1.520	.01	.0007	5.4699E+02	.657
S	.030	294.2	5.9	.02018	1.747	.02	.0009	6.7144E+02	.805
S	.032	313.4	6.4	.02026	1.990	.02	.0011	8.1326E+02	.974
S	.034	332.5	6.8	.02036	2.250	.03	.0013	9.7351E+02	1.166
S	.036	351.5	7.2	.02046	2.529	.03	.0015	1.1533E+03	1.383
S	.038	370.5	7.6	.02058	2.825	.04	.0018	1.3535E+03	1.626
S	.040	389.5	8.1	.02071	3.141	.04	.0021	1.5754E+03	1.896
S	.042	408.3	8.5	.02085	3.477	.05	.0024	1.8139E+03	2.196
S	.044	427.2	9.0	.02100	3.833	.06	.0027	2.0881E+03	2.528
S	.046	445.9	9.4	.02117	4.210	.06	.0031	2.3809E+03	2.892
S	.048	464.6	9.9	.02136	4.610	.07	.0035	2.6993E+03	3.292
S	.050	483.2	10.4	.02156	5.033	.08	.0040	3.9443E+03	3.729
S	.052	501.7	10.9	.02177	5.481	.09	.0044	3.4169E+03	4.206
S	.054	520.2	11.4	.02200	5.955	.10	.0050	3.8181E+03	4.725
S	.056	538.6	12.0	.02225	6.456	.12	.0055	4.2487E+03	5.287
S	.058	557.0	12.5	.02252	6.986	.13	.0061	4.7098E+03	5.897
S	.060	575.2	13.1	.02280	7.546	.14	.0068	5.2021E+03	6.556
S	.062	593.4	13.7	.02311	8.138	.16	.0075	5.7267E+03	7.267
S	.064	611.6	14.3	.02343	8.764	.18	.0082	6.2845E+03	8.034
S	.066	629.6	15.0	.02377	9.424	.20	.0090	6.8762E+03	8.858
S	.068	647.6	15.6	.02414	10.122	.21	.0098	7.5028E+03	9.745
S	.070	665.5	16.3	.02452	10.859	.24	.0106	8.1650E+03	10.696
S	.072	683.3	17.0	.02492	11.638	.26	.0115	8.8639E+03	11.716
S	.074	701.1	17.8	.02535	12.459	.28	.0125	9.6000E+03	12.809
S	.076	718.8	18.1	.02581	13.697	.31	.0135	1.0374E+04	13.994
S	.078	736.3	20.5	.02780	15.172	.34	.0146	1.1188E+04	15.298
S	.080	753.9	22.0	.02915	16.564	.37	.0157	1.2041E+04	16.732
S	.082	771.2	23.6	.03056	18.177	.40	.0168	1.2934E+04	18.307
S	.084	788.5	25.3	.03204	19.921	.44	.0181	1.3868E+04	20.034
S	.086	805.7	27.1	.03358	21.802	.48	.0193	1.4844E+04	21.926
S	.088	822.8	29.0	.03478	23.548	.53	.0207	1.5863E+04	23.983
S	.090	839.8	30.2	.03594	25.348	.58	.0220	1.6924E+04	26.201
S	.092	856.7	31.8	.03715	27.264	.63	.0235	1.8030E+04	28.586
S	.094	873.5	33.5	.03841	29.301	.69	.0250	1.9179E+04	31.151
S	.096	890.1	35.3	.03971	31.464	.75	.0265	2.0374E+04	33.907
S	.098	906.7	39.1	.04308	35.414	.81	.0281	2.1614E+04	36.872
S	.100	923.1	45.4	.04913	41.866	.89	.0298	2.2900E+04	40.505

	TIME MICROSEC	CURRENT AMPS	VOLTS	OHMS	POWER KILOWATTS	ENERGY MILLIJ	ACTION AMP2 SEC	GDENS AMP2 SEC/MM4	EDENS J/GM
S	.102	939.3	46.2	.04914	43.364	.98	.0315	2.4232E+04	44.372
S	.104	955.5	47.7	.04988	45.541	1.07	.0333	2.5611E+04	46.876
S	.106	971.8	51.1	.05263	49.677	1.16	.0352	2.7038E+04	52.693
S	.108	987.4	55.4	.05615	54.747	1.26	.0371	2.8512E+04	57.372
S	.110	1003.1	63.5	.06330	63.700	1.38	.0391	3.0033E+04	62.739
S	.112	1018.6	69.5	.06821	70.776	1.52	.0411	3.1603E+04	68.935
S	.114	1033.9	70.6	.06825	72.965	1.66	.0433	3.3221E+04	75.456
S	.116	1049.2	76.7	.07314	80.511	1.82	.0454	3.4888E+04	82.372
S	.118	1064.1	84.4	.07929	89.777	1.99	.0477	3.6603E+04	90.091
S	.120	1078.9	93.3	.08650	100.685	2.18	.0499	3.8367E+04	98.724
S	.122	1093.4	103.8	.09496	113.526	2.39	.0523	4.0180E+04	108.395
S	.124	1107.6	115.3	.10424	127.674	2.63	.0547	4.2040E+04	119.366
S+L	.126	1121.5	123.2	.10989	139.219	2.90	.0572	4.3949E+04	131.386
S+L	.128	1135.1	146.0	.12861	165.697	3.20	.0598	4.5904E+04	145.030
S+L	.130	1147.9	199.3	.16490	217.291	3.57	.0624	4.7907E+04	161.981
S+L	.132	1159.6	258.7	.22311	299.995	4.08	.0650	4.9952E+04	185.277
L	.134	1169.9	321.3	.27455	352.525	4.74	.0677	5.2036E+04	215.207
L	.136	1179.6	331.5	.28113	391.024	5.49	.0705	5.4157E+04	248.914
L	.138	1188.5	361.0	.30375	429.086	6.31	.0733	5.6311E+04	286.119
L	.140	1195.8	392.4	.32784	469.605	7.21	.0762	5.8496E+04	326.843
L	.142	1204.3	434.8	.36099	523.598	8.20	.0790	6.0711E+04	371.807
L	.144	1213.9	480.2	.39655	581.436	9.30	.0820	6.2951E+04	421.958
L+V	.146	1219.4	532.3	.43756	647.456	10.53	.0849	6.5214E+04	477.599
L+V	.148	1222.8	593.8	.48639	724.874	11.90	.0879	6.7496E+04	539.626
L+V	.150	1223.9	664.6	.54335	813.266	13.43	.0909	6.9792E+04	609.108
L+V	.152	1225.0	760.3	.62062	931.335	15.17	.0939	7.2095E+04	688.125
L+V	.154	1224.1	872.8	.71296	1068.404	17.16	.0969	7.4400E+04	778.495
L+V	.156	1220.4	1058.7	.86749	1292.098	19.47	.0998	7.6696E+04	883.150
L+V	.158	1211.2	1414.6	1.16744	1712.572	22.48	.1028	7.8969E+04	1019.988
L+V	.160	1188.8	2838.4	2.40447	3397.967	26.98	.1057	8.1190E+04	1224.054
ARC	.162	1069.1	10502.3	9.82322	11229.387	42.30	.1083	8.3204E+04	1919.093
ARC	.164	951.7	3564.2	3.74528	3392.382	55.76	.1103	8.4735E+04	2529.332
ARC	.166	916.6	1941.3	2.00874	1687.802	60.47	.1120	8.6067E+04	2742.990
ARC	.168	901.3	1346.0	1.49343	1213.080	63.29	.1137	8.7334E+04	2871.137
ARC	.170	892.7	1110.2	1.24363	991.018	65.47	.1153	8.8569E+04	2970.067
ARC	.172	887.9	943.4	1.06256	837.664	67.30	.1169	8.9786E+04	3052.847
ARC	.174	886.1	809.2	.91313	717.071	68.84	.1185	9.0994E+04	3122.913
ARC	.176	886.6	713.3	.80416	632.177	70.18	.1200	9.2201E+04	3183.738
EXT	.178	888.7	652.8	.73454	580.180	71.38	.1216	9.3411E+04	3237.954
EXT	.180	891.4	638.0	.71576	568.743	72.53	.1232	9.4628E+04	3290.068
EXT	.182	894.3	623.9	.69759	557.927	73.65	.1248	9.5853E+04	3341.173
EXT	.184	897.5	610.3	.67999	547.677	74.76	.1264	9.7086E+04	3391.323
EXT	.186	900.8	597.2	.66292	537.946	75.84	.1280	9.8328E+04	3440.567
EXT	.188	904.4	584.6	.64636	528.689	76.91	.1296	9.9579E+04	3488.950
EXT	.190	908.2	572.4	.63028	519.868	77.96	.1313	1.0084E+05	3536.513
EXT	.192	912.2	560.7	.61467	511.445	78.99	.1329	1.0211E+05	3583.294
EXT	.194	916.3	549.3	.59950	503.389	80.01	.1346	1.0340E+05	3629.328
EXT	.196	920.7	538.4	.58475	495.671	81.00	.1363	1.0469E+05	3674.646
EXT	.198	925.2	527.7	.57040	488.264	81.99	.1380	1.0600E+05	3719.279
EXT	.200	929.9	517.4	.55644	481.142	82.96	.1397	1.0732E+05	3763.252

	TIME	CURRENT	VOLTS	OHMS	POWER	ENERGY	ACTION	GOENS	EDENS
	MICROSEC	AMPS			KILOWATTS	MILLIJ	AMP2 SEC	AMP2 SEC/MM4	J/GM
EXT	.202	934.7	507.4	.54285	474.284	83.91	.1415	1.0866E+05	3806.592
EXT	.204	939.7	497.7	.52961	467.670	84.85	.1432	1.1001E+05	3849.321
EXT	.206	944.6	488.2	.51672	461.281	85.78	.1450	1.1137E+05	3891.460
EXT	.208	950.1	479.0	.50416	455.100	86.70	.1468	1.1275E+05	3933.029
EXT	.210	955.5	470.0	.49191	449.110	87.60	.1486	1.1415E+05	3974.045
EXT	.212	961.0	461.3	.47998	443.299	88.50	.1504	1.1556E+05	4014.527
EXT	.214	966.7	452.7	.46834	437.653	89.38	.1523	1.1698E+05	4054.489
EXT	.216	972.5	444.4	.45698	432.159	90.25	.1542	1.1843E+05	4093.946
EXT	.218	978.3	436.3	.44591	426.806	91.11	.1561	1.1989E+05	4132.910
EXT	.220	984.3	428.3	.43511	421.585	91.95	.1580	1.2137E+05	4171.395
EXT	.222	990.4	420.5	.42456	416.486	92.79	.1600	1.2287E+05	4209.412
EXT	.224	996.6	412.9	.41427	411.499	93.62	.1619	1.2438E+05	4246.972
EXT	.226	1002.9	405.4	.40423	406.618	94.44	.1639	1.2592E+05	4284.084
EXT	.228	1009.3	398.1	.39443	401.835	95.25	.1660	1.2747E+05	4320.758
EXT	.230	1015.8	391.0	.38486	397.143	96.05	.1680	1.2905E+05	4357.001
EXT	.232	1022.4	383.9	.37551	392.536	96.84	.1701	1.3064E+05	4392.824
EXT	.234	1029.1	377.0	.36639	388.008	97.62	.1722	1.3226E+05	4428.231
EXT	.236	1035.8	370.3	.35749	383.554	98.39	.1743	1.3390E+05	4463.232
EXT	.238	1042.6	363.7	.34879	379.168	99.15	.1765	1.3556E+05	4497.831
EXT	.240	1049.5	357.2	.34030	374.847	99.90	.1787	1.3724E+05	4532.035
EXT	.242	1056.5	350.8	.33201	370.587	100.65	.1809	1.3894E+05	4565.850
EXT	.244	1063.6	344.5	.32390	366.383	101.39	.1831	1.4067E+05	4599.282
EXT	.246	1070.7	338.3	.31600	362.233	102.12	.1854	1.4242E+05	4632.334
EXT	.248	1077.8	332.3	.30827	358.132	102.84	.1877	1.4419E+05	4665.012
EXT	.250	1085.1	326.3	.30073	354.079	103.55	.1901	1.4599E+05	4697.320
EXT	.252	1092.4	320.5	.29337	350.070	104.25	.1924	1.4781E+05	4729.262

Distribution:

Los Alamos Scientific Laboratory
P.O. Box 1663
Los Alamos, New Mexico 87544
Attn: R. L. Spaulding, GMX-7
W. A. Meyers, GMX-7

University of California
Lawrence Laboratory
P.O. Box 808
Livermore, California
Attn: J. R. Stroud
R. C. Weingart

1132 A. B. Church
1535 J. G. Harlan
1540 T. B. Lane
1641 W. J. Halpin
1652 S. D. Spray
2300 L. D. Smith
2310 C. B. McCampbell
2314 J. J. Marron
2315 J. E. Gover
2316 H. M. Barnett
2330 J. P. Shoup
2400 R. S. Claassen
2440 O. M. Stuetzer
2510 D. H. Anderson
2513 D. B. Hayes
2515 E. A. Kjeldgaard
2516 N. E. Brown
5000 A. Narath
5100 J. K. Galt
5110 F. L. Vook
5120 G. J. Simmons
5130 G. A. Samara
5131 L. W. Davison
5131 T. J. Tucker (20)
5131 R. P. Toth
5132 P. M. Richards
5150 J. E. Schirber
Attn: R. T. Johnson - 5155
5160 W. Herrmann
Attn: B. M. Butcher - 5167
5200 E. H. Beckner
Attn: F. Biggs - 5223
5600 A. Y. Pope
5700 J. H. Scott
5718 M. M. Newsom
5800 L. M. Berry
Attn: R. L. Schwoebel - 5820
R. W. Rohde - 5832
R. C. Heckman - 5842

8150 D. E. Gregson
5166 J. S. Anderson
8185 C. M. Potthoff
8330 G. W. Anderson
8340 J. L. Wirth
8416 J. A. Mogford
9320 M. Cowan
9350 F. W. Neilson
8266 Library (2)
3151 W. F. Carstens (3)
for AEC/TIC (Public Release)
3141 Central Tech. Files (5)