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Electric field investigations and a model of electrical spraying of liquids

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ELECTRIC FIELD INVESTIGATIONS AND A MODEL
OF ELECTRICAL SPRAYING OF LIQUIDS

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THESIS

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Al Carson (advisor) _Norman Dillman_

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ABSTRACT

The equation $E = \dfrac{2 V}{N \ln(4d/N)}$ has been used for determining the electric field at the liquid tip in electrical spraying of liquids. Data were taken at the instant of spraying in an attempt to experimentally verify this equation. the results indicate that the value given by the equation needs to be increased by about 20% in the normal range of operation. A model for the spraying mechanism of the liquid is also proposed.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

Electrical spraying of liquids results from liquids emerging from a small capillary under a high potential. This paper deals with a dc potential only, however Vonnegut and Neubauer[1] state that a 60-cycle ac potential gives results similar to that produced by direct current. The relationship for the electric field between a plate and the capillary comes from work done by Eyring, Mackeown, and Millikan.[2] In their work a dc potential was established between a metal point shaped in the form of a hyperboloid of revolution and a plate in order to extract electrons from metals under the influence of electric fields.

Their equation for the electric field was later simplified by Loeb,[3] et al., to the form:

$$E = \frac{2V}{N \ln(4d/N)} \qquad 1$$

where d is the spacing between the tip and ground plate in meters, N is the radius of curvature of the tip in meters, and V is the applied potential in volts. The stress produced by this electric field at the tip is:

$$\tfrac{1}{2}\epsilon E^2 = \frac{2\epsilon V^2}{N^2\left[\ln(4d/N)\right]^2} \qquad 2$$

Consider an electric field acting on a spherical liquid drop in free space. If the dielectric stress is neglected, i.e., the liquid is a perfect conductor, then the condition for instability of the liquid surface as given by Zeleny[4] is:

$$P_E = P_\gamma - P \qquad 3$$

where P_E is the electrostatic pressure, P_γ is the pressure due to surface tension, and P is the net pressure. When the liquid emerges from the tip of a capillary, the hydrostatic pressure P_h forcing the liquid out must be added to the electrostatic pressure or:

$$P_E + P_h = P_\gamma \div P \qquad\qquad 4$$

This paper deals with spraying of glycerine, a viscous liquid, through a small capillary when subjected to limited liquid heads. The hydrostatic pressure for this case was found to be negligible in comparison to the electrostatic and surface tension pressures. Although the following equations will have the term P_h omitted, the hydrostatic pressure does influence a change in the radius of curvature with respect to time. Equation 4 becomes:

$$P = \frac{2\gamma}{N} - \tfrac{1}{2}\epsilon_\circ E^2 \qquad\qquad 5$$

where N is the radius of curvature of the liquid tip and γ is surface tension in dynes/meter.

LIQUID MODEL

The model used for the liquid tip in calculating the radius of curvature is shown in Fig. 1. From time t=0 at surface A to some time later at surface B, the pressure due to the liquid head has forced more liquid out of the capillary. The radius of curvature continues to decrease as time increases until surface C is reached where the electrostatic pressure is equal to the surface tension pressure and spraying begins. If the applied potential is limited to prevent the brush effect described by Hendricks,[5] the spraying will consist of a large number of droplets directed axially from surface D to the plate. As spraying continues, the volume of the liquid tip decreases to surface A where spraying ceases and the process is then repeated.

By assuming that the liquid tip is in the form of a prolate spheroid, the equation used to approximate its surface would be:

$$\frac{x^2}{R^2} + \frac{y^2}{R^2} + \frac{z^2}{(FR)^2} = 1 \qquad\qquad 6$$

where F in the third term is a time varying quantity. The product FR represents the z directed semi-axis of the spheroid. The volume of the liquid tip is given by:

$$\tau = \int_0^{FR} \pi r^2 \, dz = \frac{2}{3} \pi R^3 F \qquad\qquad 7$$

Differentiating with respect to time gives:

$$\frac{d\tau}{dt} = \frac{2}{3} \pi R^3 \frac{dF}{dt} \qquad\qquad 8$$

Poiseuille's equation for the change in volume with respect

to time of an incompressible viscous liquid in a long narrow tube of circular cross section is:

$$\frac{d\tau}{dt} = \frac{\pi \, \Delta P \, R^4}{8 \eta L} = \frac{\pi \, \Delta P \, R^4}{8 \rho \nu L} \qquad 9$$

where ΔP = pressure difference to overcome viscosity, dynes/cm^2

   R = tube radius, cm

   L = tube length, cm

   ρ = density, gm/cm^3

   η = dynamic viscosity, gm/cm sec

   $\nu = \eta/\rho$ = kinematic viscosity, cm^2/sec

Substituting Eq. 9 into Eq. 8 gives:

$$\frac{dF}{dt} = \frac{3}{16} \frac{R \, \Delta P}{\eta L} = \frac{3}{16} \frac{R \rho \, gH}{\eta \, L} = \frac{3}{16} \frac{RgH}{\nu L} \qquad 10$$

F is then given by:

$$F = A + \left(\frac{3}{16} \frac{RgH}{\nu L} \right) t = A + Bt \qquad 11$$

The constant B has the dimension reciprocal of time. The dimensionless constant A is independent of time but is a function of pressure, applied voltage, etc. Observations indicate that if the value of A decreases linearly from approximately unity to zero as applied voltage is increased from the minimum spraying potential V_m to a critical value V_c for which the spraying pulses cease, then it can be assumed that:

$$A \cong \frac{V_c - V}{V_c - V_m} \qquad 12$$

The dependence of A on pressure, liquid constants, geometry, etc., is automatically accounted for in the measured values of V_m and V_c.

The radius of curvature in the r-z plane is:

$$N = \left| \frac{\left[1 + (dz/dr)^2\right]^{3/2}}{d^2z/dr^2} \right|$$

Using $z = F(R^2-r^2)^{\frac{1}{2}}$, the radius of curvature at the tip, where $r = 0$, is given by:

$$N = \frac{R}{F} = \frac{R}{A + BT_c} \tag{13}$$

where T_c is the time from the end of one pulse to the beginning of the next. When spraying commences the net pressure equals zero and Eq. 5 becomes:

$$E\Big|_{T_c} = \left[\frac{4\gamma}{\epsilon_0 N}\right]^{\frac{1}{2}} \Big|_{T_c} \tag{14}$$

Thus a value for the electric field can be obtained from Eq. 14 using experimental measurements to compare with the value of electric field as given by Eq. 1. Data were obtained by experimental methods to determine the various parameters.

EXPERIMENTAL METHODS

Most of the data were taken in a vacuum of about 10^{-5} Torr in the system shown in Fig. 2. The bellows was filled with glycerine and it could be compressed by an external knob to change the glycerine level in the vertical glass tube, thus varying the pressure head at the capillary. An external adjustment was also used to change the spacing between the plate and the capillary. Temperature was monitored by a thermometer attached to the vertical glass tube. Due to ripple in the high voltage power supply, a bank of four $7.5\,\mu F$ capacitors connected in parallel were charged by the HV power supply and then used as the source of dc potential. A screen cage was built around the system to reduce noise. The current produced by the movement of the charged droplets was passed through a one-megohm resistor and the resulting voltage was monitored by a differential input oscilloscope. Another one-megohm resistor was inserted between the oscilloscope input and ground to give some isolation. An oscilloscope plug-in unit of 1 millivolt sensitivity was used since the voltages ranged from 2 mv to 10 mv.

Data were taken at various liquid pressures, voltages, and spacings, the latter being varied while the other parameters were held constant. This method gave more sensitivity and greater flexibility than varying the voltage. The data consisted of the width of the output pulses, the period between pulses, and the spacing at which the pulsing mode

changed to a dc mode. The voltage was varied from 3.0 KV
to 5.0 KV in steps of 0.5 KV and the height of liquid pres-
sure was varied from 18 inches to 30 inches using 2 inch
steps. The spacing was changed in steps of one millimeter
from the point at which the dc level was established to a
maximum of 24 millimeters. The capillary was mounted in a
teflon holder and was 1 inch long and had an inside diameter
of 0.01 inches. It was made of stainless steel and the tip
was cone shaped by an electro-chemical etching process.

The temperature varied about $\pm$ 2 degrees Fahrenheit
from its normal value of 74 degrees. The viscosity is the
only major temperature dependent parameter but does not
cause a significant change over this small temperature
range.

The viscosity was measured by the Saybolt Furol method
giving a value of 6.8 cm^2/sec and the surface tension was
measured by the Du Nouy Ring method giving a value of 60
dynes/cm.

EXPERIMENTAL RESULTS

Computer programs were written to calculate the values of electric fields given by Eq. 1 and Eq. 14. Figure 3 and Fig. 4 show these two values of electric field versus parameters of applied voltage and spacing respectively.

The logarithmic plot of Fig. 5 shows the values for electric field from Eq. 14, connected by a straight line, and the values of electric field from Eq. 1 shown as a scattering of points, versus the radius of curvature.

In order to determine the radius of curvature as given in Eq. 13, the values of V_c and V_m had to be found before computing a value for A. The value for B was determined from physical constants. V_m was found by making graphs of the period T_c versus applied voltage for each height and each spacing as shown in Fig. 6.

The value of V at which the period approached infinity for each spacing was then used as the value for the minimum spraying potential V_m. Thus for each height and each spacing a different value for V_m was obtained. It should be noted that this value for V_m was higher than that given by Hendricks, Carson, Hogan, and Schneider.[6]

V_c was determined by plotting the applied voltage versus the spacing at which the dc level was established for each height as shown in Fig. 7. From this plot the value for V_c could be read directly for any height or any spacing.

A few peculiarities were noticed while conducting the experiment. The first was the action of the dc level which has previously been mentioned. As the spacing between the

plate and the capillary was decreased, while operating at a fixed voltage, the pulsing changed from the normal pulse as shown in Fig. 8a to a continuous jet emitting from the capillary. This established a dc level of a few millivolts on the oscilloscope. As the spacing was then increased the dc level remained at the same value until pulsing resumed. By visual observation of the jet, it was noticed that as the spacing increased, the radius of the liquid filament also increased. This indicates some sort of constant resistance or constant current mechanism in the filament.

Another point of interest occurred when the spacing between the capillary and the plate became so great that the period between pulses exceeded about 0.5 seconds. At this point the normal pulse shape shown in Fig. 8a began to exhibit a peak at a point slightly below its maximum amplitude, 8b. Figure 8 shows the sequence of events, a through f, as the spacing is increased. This indicates an entirely different spraying mechanism than the one considered in this paper, possibly one of a large drop followed by a series of smaller drops.

CONCLUSIONS

The variation of the electric field, at the onset of spraying, with respect to the voltage, Fig. 3 and spacing, Fig. 4, shows a deviation between the two methods of finding the electric field, however the general trends of the curves are similar. Curves showing these same trends can be obtained at various heights as long as the pressure due to the liquid head is negligible. Although Eq. 1 seems to indicate a direct relationship between electric field and voltage and an inverse logarithmic relationship between electric field and spacing, it must be remembered that the radius of curvature is a function of voltage and spacing.

Figure 5 shows a logarithmic plot of about 260 values of electric field evaluated at T_c versus radius of curvature. These points should all lie on the line marked as $\sqrt{\frac{4\gamma}{\epsilon_0 N}}$ if Eq. 14 is true. Those points which correspond to a radius of curvature less than .005 cm may be neglected since the spraying mechanism changes to that described in Fig. 8. This value for the radius of curvature is determined from the period T_c, which was usually around 450 to 500 ms when the peak began.

Of the approximately 230 points remaining, an average error of -20% exists. Assuming that all previous assumptions and approximations are valid, two possibilities exist for giving this error: (1) Experimental error; this is unlikely because the instruments involved had good accuracy and even this would have to have been all negative to give an

error of -20%. (2) Error in the equation for electric field;
This is a more likely candidate since the equation was de-
rived for metal points in the shape of a hyperboloid of rev-
olution. Thus to apply to spraying of liquids it appears
Eq. 1 should be increased by 20% in the normal range of
operation.

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VITA

The author was born on August 12, 1944, in St. Joseph, Missouri. He received his primary education in Helena, Missouri and his secondary education in Savannah, Missouri. He has received his college education from the University of Missouri at Rolla. He received a Bachelor of Science Degree and Master of Science Degree in Electrical Engineering from the University of Missouri at Rolla in January 1967 and June 1968 respectively.

He has been enrolled in the Graduate School of the University of Missouri at Rolla since January, 1967, and has held a teaching assistantship for the period January, 1967, to June, 1967, and a research assistantship for the period June, 1967, to June, 1968.
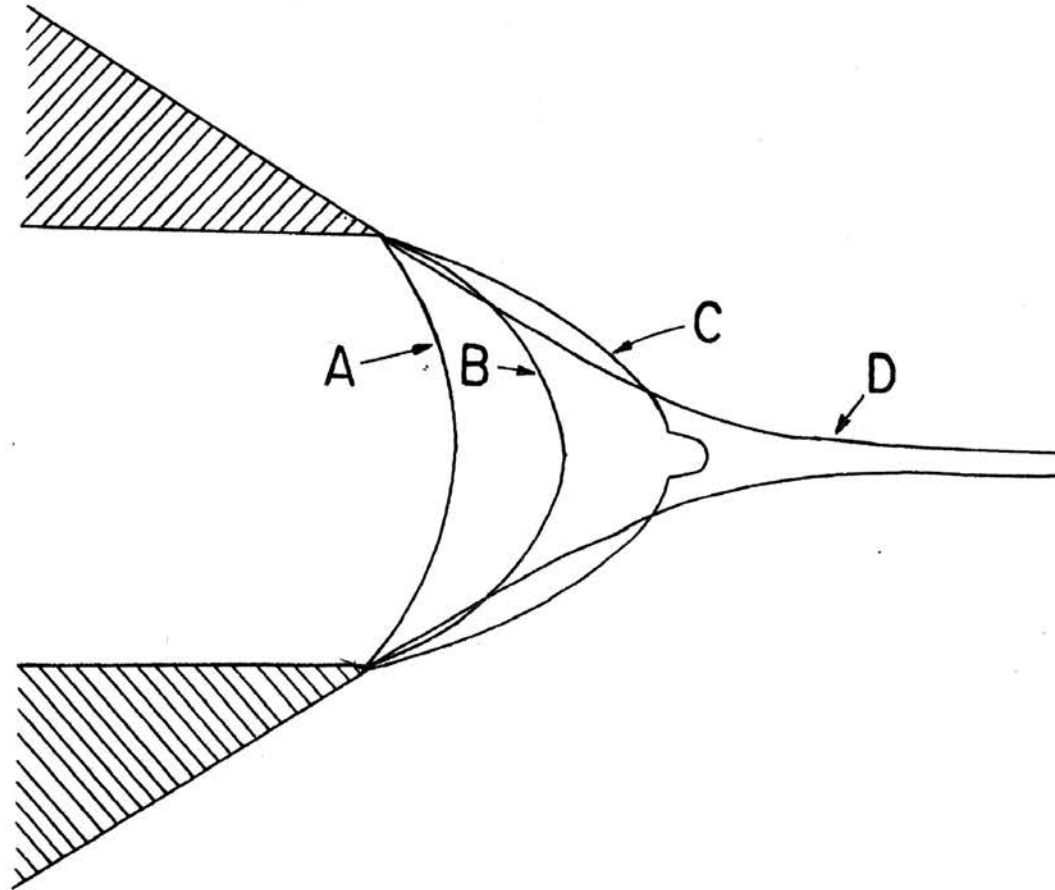
FIG. 1   Model of spraying mechanism: A and B - no spraying;   C - spraying begins;
D - spraying continues.

GLASS TUBE

TO OSCILLOSCOPE

+dc

1 MΩ   1 MΩ

BRASS PLATE

BELLOWS

TO
VACUUM PUMP   STAINLESS STEEL
CAPILLARY
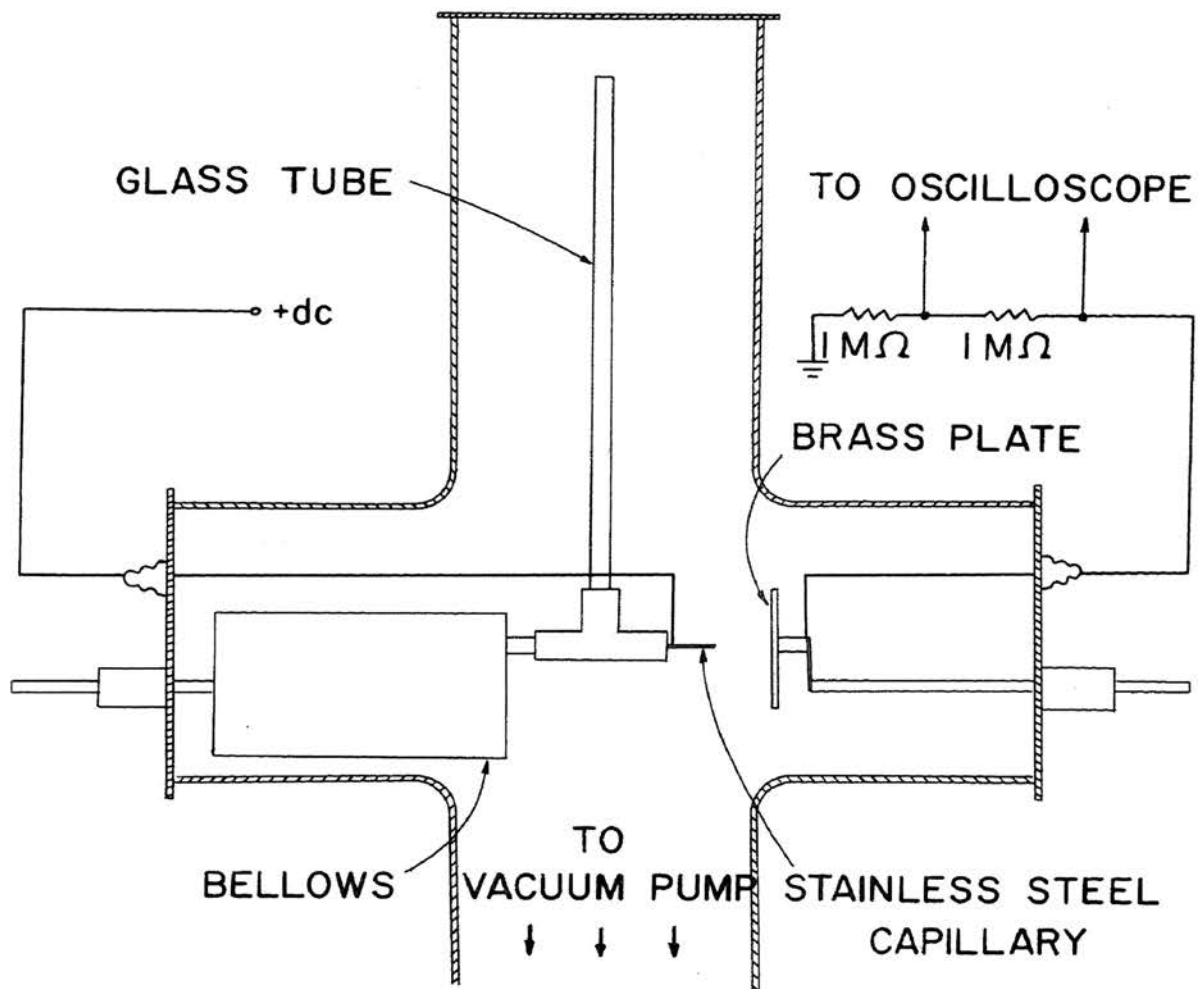
FIG. 2   Experimental apparatus
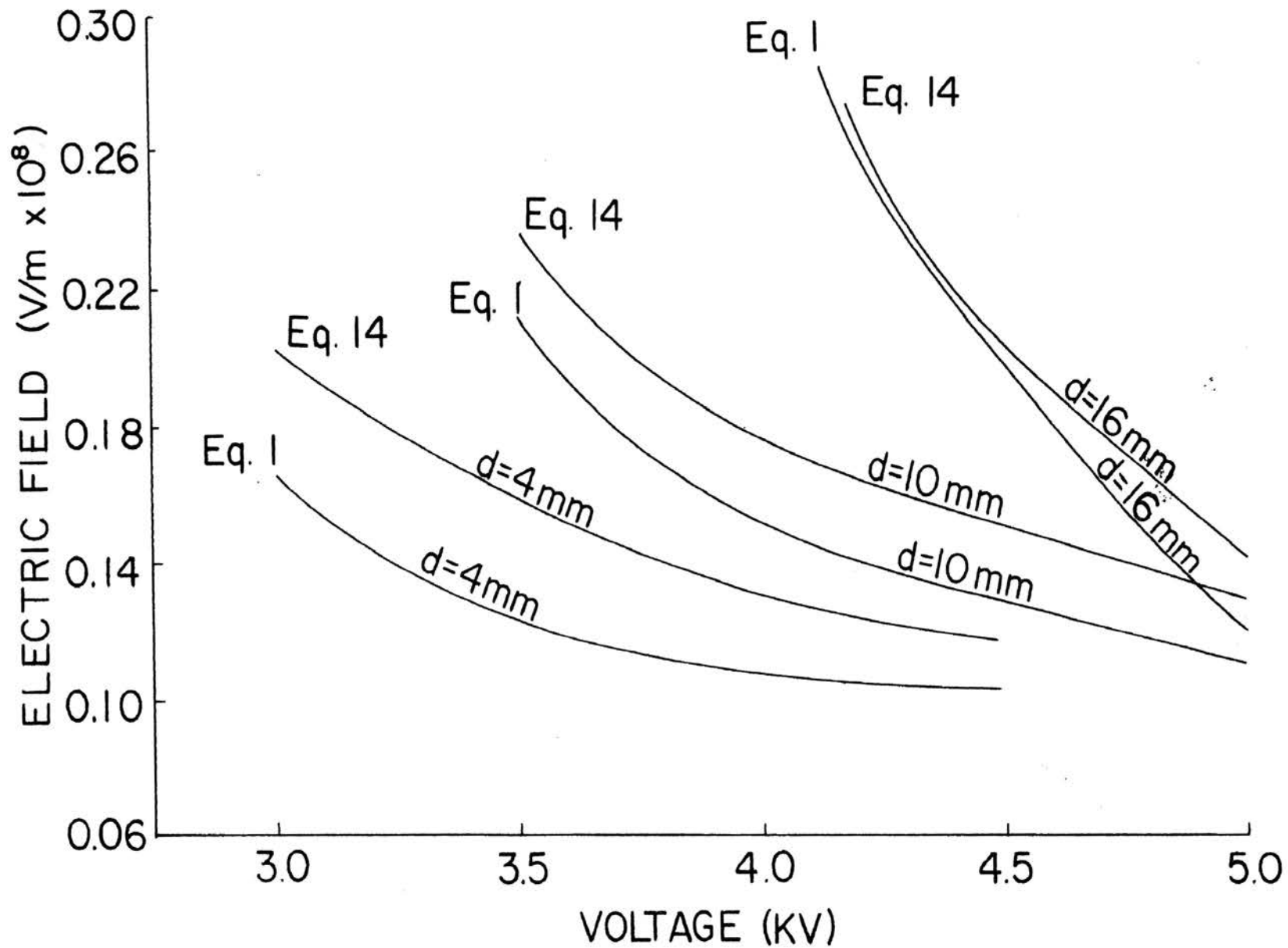
FIG. 3   Comparison of the electric field calculated by Eq. 1 and Eq. 14 versus applied voltage.
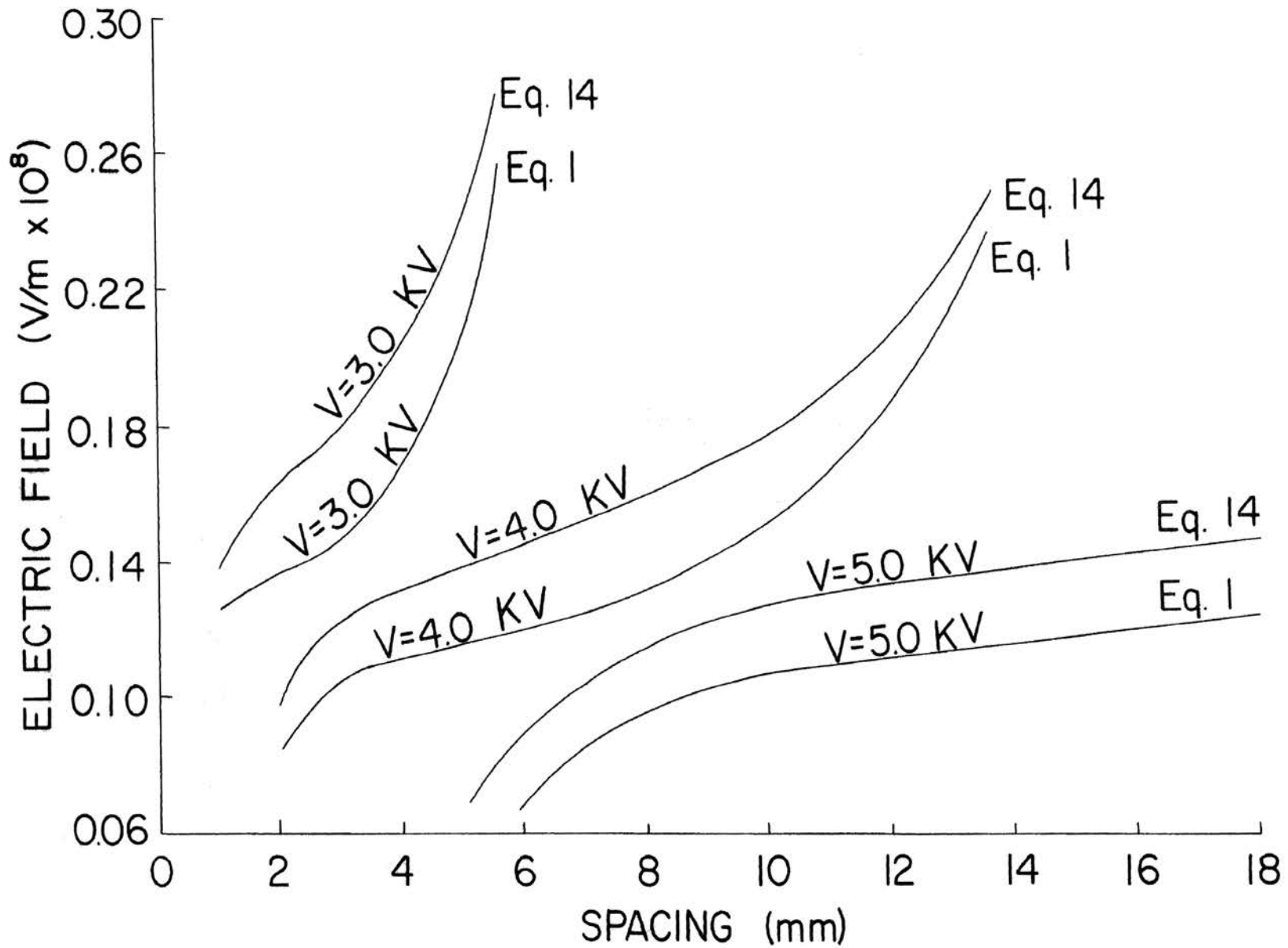
FIG. 4   Comparison of the electric field calculated by Eq. 1 and Eq. 14 versus spacing.
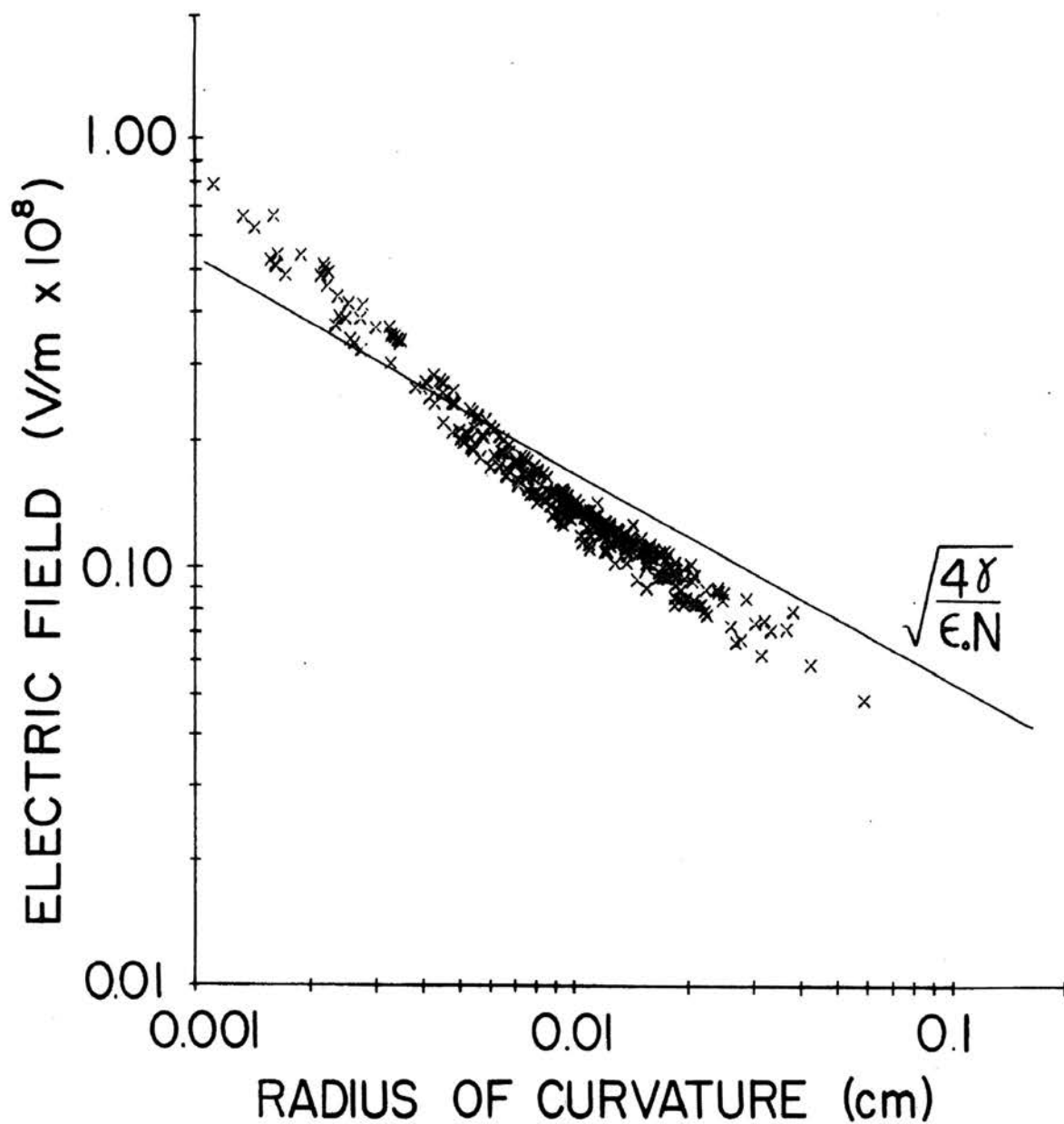
FIG. 5   Comparison of the electric field calculated by Eq. 1 (shown as individual points) and Eq. 14 (shown as a straight line) versus radius of curvature.
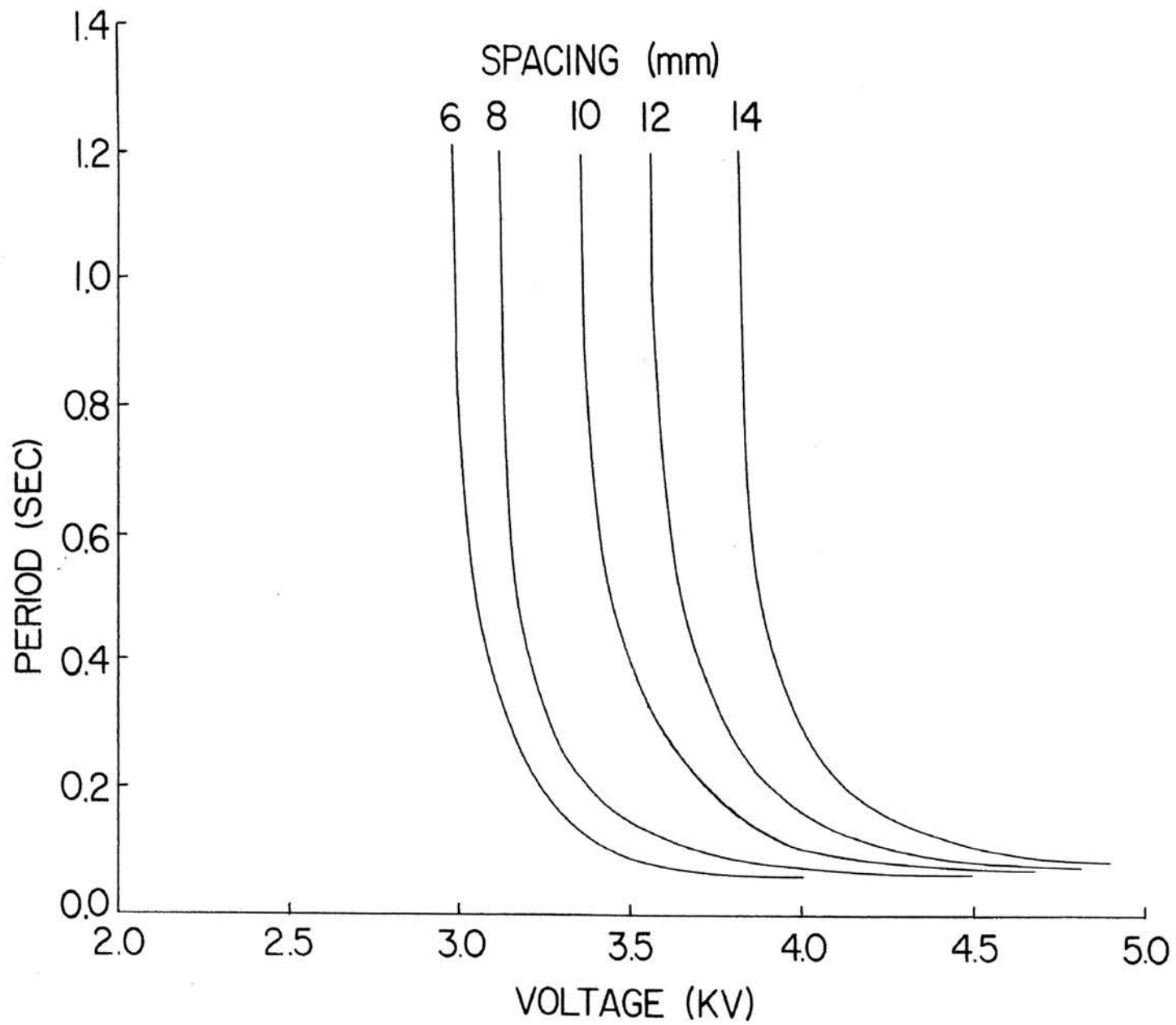
FIG. 6   Period versus applied voltage, with spacing as parameter.
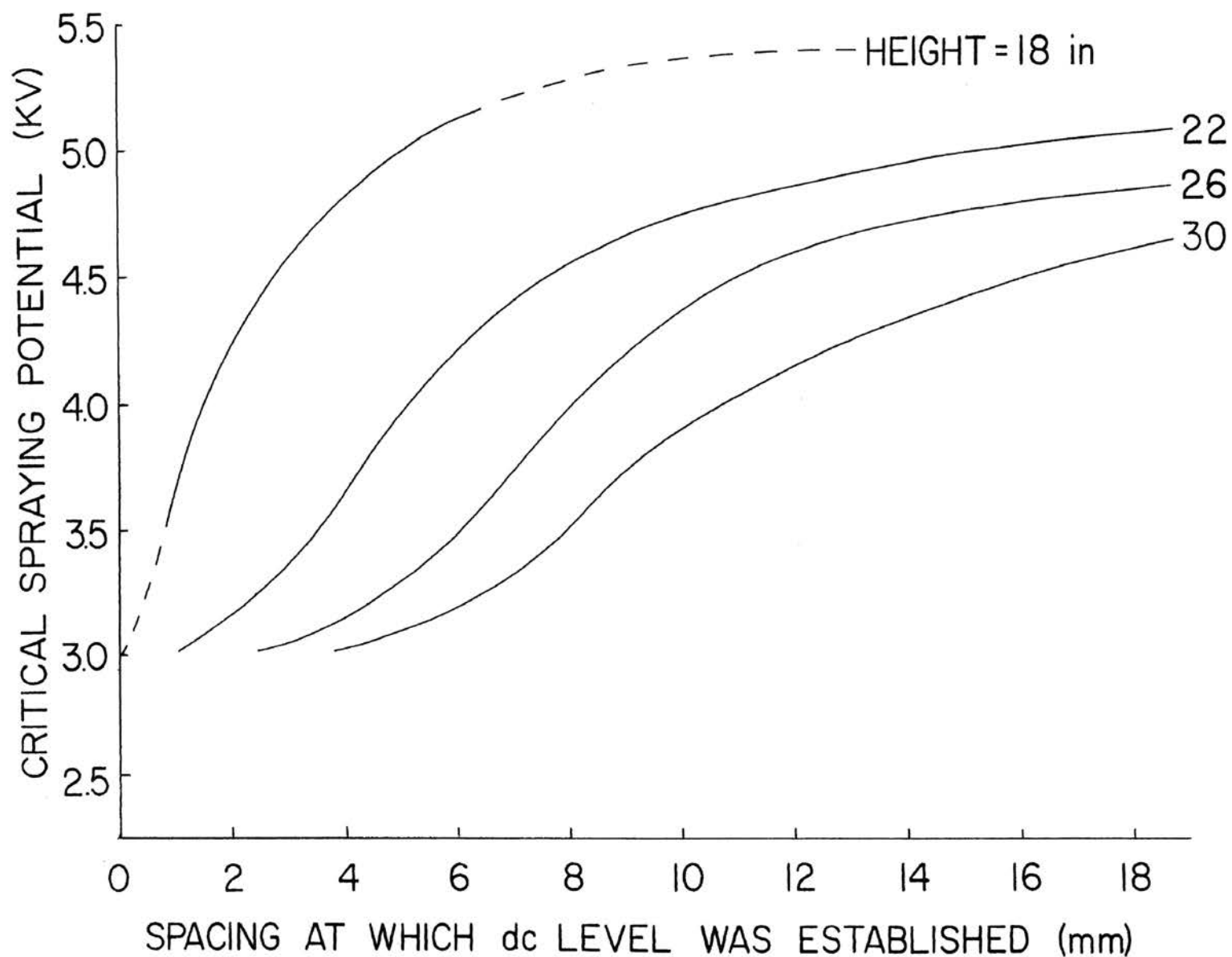
FIG. 7 Critical spraying potential versus spacing at which a dc level was established, with height as parameter.
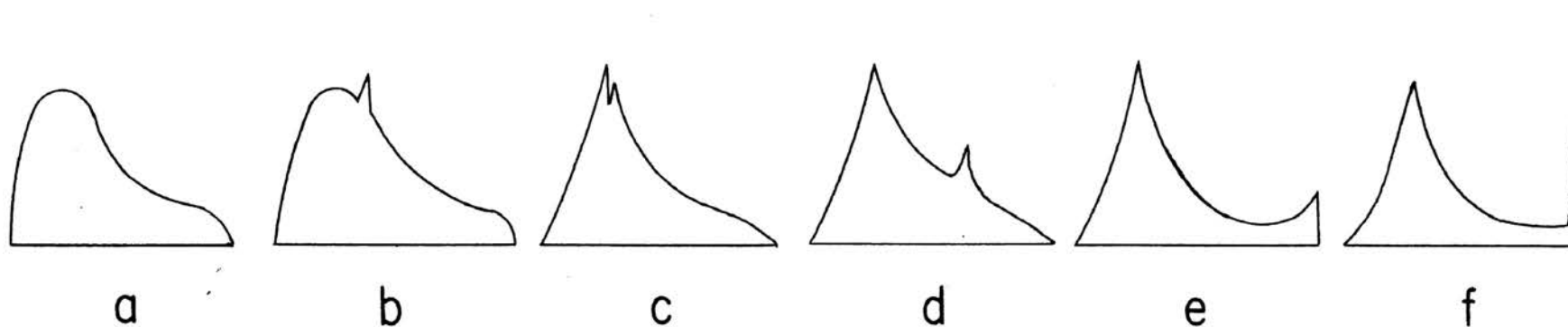
FIG. 8   Pulse shape as spacing is increased (a to f) beyond the "normal"
operating range.

APPENDIX

This appendix contains the data and the computer program used in the calculation of the electric fields. The program was written in Fortran language and was executed on the IBM system 360 using WAT4 control.

In the following list of data it will be noticed that the period T_c varies from 0 to 20,000 msec. The value of zero indicates operation in the dc state and 20,000 msec is the upper bound indicating the period was so long no data was taken. This data is excluded from actual use in the computation by the "IF" statement in line 24 of the program along with any other periods of 500 msec or more.

Literals used in the computer program are defined as follows;

A - constant used in determining radius of curvature.

B - constant used in determining radius of curvature, $sec.^{-1}$

D - spacing between the capillary and plate, mm.

E - electric field calculated from Eq. 14, volts/m.

ECAL - electric field calculated from Eq. 1, volts/m.

EL - length of the capillary, in.

EPZRO - permittivity of free space, farad/m.

G - gravitational acceleration, cm/sec^2.

GAM - surface tension, dynes/cm.

GNU - kinematic viscosity, cm^2/sec.

H - height of the liquid head, in.

R - radius of the capillary, cm.

RATIO - ratio of ECAL to E.

RC - radius of curvature, cm.

TC= TC(L,K,I)= TCLKI - spraying period, msec.

V = V(L) - applied potential, KV.

VC = VC(K,I) =VCKI - critical spraying potential, KV.

VM - minimum spraying potential, KV.

W - intercept of VM equation, KV.

Z - slope of VM equation, KV/mm.

The literals W and Z refer to an equation for the minimum spraying potential. This equation was determined by plotting a graph of the potential at which the period approached infinity, versus spacing at fixed height. This plot was approximated by a straight line giving values for W and Z. The individual values of V_m determined from the period versus applied potential could have been used with equal ease.

COMPUTER PROGRAM USED IN NUMERICAL CALCULATIONS

```
 1          DIMENSION   VC(20,8),TC(5,20,8),V(5)
 2          R=0.0127
 3          G=978.05
 4          GNU=6.8
 5          GAM=60.0
 6          EL=1.0
 7          EPZRO= 8.85E-12
 8          READ(1,60)((VC(K,I),I=1,8),K=1,20)
 9          READ(1,40)(V(L),L=1,5)
10          READ(1,10)(((TC(L,K,I),I=1,8),K=1,20),L=1,5)
11          WRITE (3,50)
12          DO 4 I=1,8
13          READ (1,20) H,W,Z
14          B=(3.*R*G*H)/(16.*GNU*EL)
15          DO 4 K=1,20
16          D=K
17          VM=W+Z*D
18          VCKI=VC(K,I)
19          DO 4 L=1,5
20          IF(VCKI-V(L))4,8,8
21        8 IF(VCKI-VM)4,4,7
22        7 A=(VCKI-V(L))/(VCKI-VM)
23          TCLKI=TC(L,K,I)
24          IF(TCLKI-500)9,9,4
25        9 E=SQRT((0.4*GAM*(A+B*TCLKI*.001))/(EPZRO*R))
26          RC=R/(A+B*TCLKI*.001)
27          ECAL=2.*V(L)*1000./(RC*ALOG(0.4*D/RC)*0.01)
28          RATIO=ECAL/E
29          WRITE(3,80)VM,VCKI,A,B,TCLKI,V(L),E,D,RC,ECAL,RATIO
30        4 CONTINUE
31          STOP
32       10 FORMAT (8F6.0)
33       20 FORMAT (3F10.2)
34       40 FORMAT (F4.0)
35       50 FORMAT(8X,2HVM,8X,2HVC,8X,2H A,8X ,2H B,8X,2HTC,8X,2H V,
            18X,2H E,8X,3H  D,10X,3H RC,8X,4HECAL,8X,5HRATIO)
36       60 FORMAT (8F5.3)
37       80 FORMAT(6F10.4,E16.6,F6.2,2E14.6,F10.4)
38          END
```

24

H LIQUID HEAD INCHES	V APPLIED POTENTIAL KV	D SPACING MM	TC PERIOD MSEC	VC CRITICAL POTENTIAL KV	W INTERCEPT OF VM LINE KV	Z SLOPE OF VM LINE KV/MM
18.00	3.000	1.00	66.	3.580	2.270	0.1020
18.00	3.500	1.00	44.	3.580	2.270	0.1020
18.00	4.000	1.00	0.	3.580	2.270	0.1020
18.00	4.500	1.00	0.	3.580	2.270	0.1020
18.00	5.000	1.00	0.	3.580	2.270	0.1020
18.00	3.000	2.00	90.	4.220	2.270	0.1020
18.00	3.500	2.00	70.	4.220	2.270	0.1020
18.00	4.000	2.00	52.	4.220	2.270	0.1020
18.00	4.500	2.00	0.	4.220	2.270	0.1020
18.00	5.000	2.00	0.	4.220	2.270	0.1020
18.00	3.000	3.00	118.	4.560	2.270	0.1020
18.00	3.500	3.00	65.	4.560	2.270	0.1020
18.00	4.000	3.00	73.	4.560	2.270	0.1020
18.00	4.500	3.00	0.	4.560	2.270	0.1020
18.00	5.000	3.00	0.	4.560	2.270	0.1020
18.00	3.000	4.00	172.	4.820	2.270	0.1020
18.00	3.500	4.00	72.	4.820	2.270	0.1020
18.00	4.000	4.00	70.	4.820	2.270	0.1020
18.00	4.500	4.00	77.	4.820	2.270	0.1020
18.00	5.000	4.00	0.	4.820	2.270	0.1020

H	V	D	TC	VC	W	Z
18.00	3.000	5.00	285.	5.020	2.270	0.1020
18.00	3.500	5.00	80.	5.020	2.270	0.1020
18.00	4.000	5.00	70.	5.020	2.270	0.1020
18.00	4.500	5.00	78.	5.020	2.270	0.1020
18.00	5.000	5.00	34.	5.020	2.270	0.1020
18.00	3.000	6.00	720.	5.130	2.270	0.1020
18.00	3.500	6.00	92.	5.130	2.270	0.1020
18.00	4.000	6.00	76.	5.130	2.270	0.1020
18.00	4.500	6.00	84.	5.130	2.270	0.1020
18.00	5.000	6.00	53.	5.130	2.270	0.1020
18.00	3.000	7.00	8700.	5.250	2.270	0.1020
18.00	3.500	7.00	112.	5.250	2.270	0.1020
18.00	4.000	7.00	84.	5.250	2.270	0.1020
18.00	4.500	7.00	125.	5.250	2.270	0.1020
18.00	5.000	7.00	68.	5.250	2.270	0.1020
18.00	3.000	8.00	20000.	5.320	2.270	0.1020
18.00	3.500	8.00	139.	5.320	2.270	0.1020
18.00	4.000	8.00	96.	5.320	2.270	0.1020
18.00	4.500	8.00	86.	5.320	2.270	0.1020
18.00	5.000	8.00	76.	5.320	2.270	0.1020
18.00	3.000	9.00	20000.	5.400	2.270	0.1020
18.00	3.500	9.00	184.	5.400	2.270	0.1020
18.00	4.000	9.00	112.	5.400	2.270	0.1020

H	V	D	TC	VC	W	7
18.00	4.500	9.00	92.	5.400	2.270	0.1020
18.00	5.000	9.00	82.	5.400	2.270	0.1020
18.00	3.000	10.00	20000.	5.450	2.270	0.1020
18.00	3.500	10.00	267.	5.450	2.270	0.1020
18.00	4.000	10.00	128.	5.450	2.270	0.1020
18.00	4.500	10.00	98.	5.450	2.270	0.1020
18.00	5.000	10.00	88.	5.450	2.270	0.1020
18.00	3.000	11.00	20000.	5.480	2.270	0.1020
18.00	3.500	11.00	700.	5.480	2.270	0.1020
18.00	4.000	11.00	155.	5.480	2.270	0.1020
18.00	4.500	11.00	110.	5.480	2.270	0.1020
18.00	5.000	11.00	89.	5.480	2.270	0.1020
18.00	3.000	12.00	20000.	5.510	2.270	0.1020
18.00	3.500	12.00	5600.	5.510	2.270	0.1020
18.00	4.000	12.00	197.	5.510	2.270	0.1020
18.00	4.500	12.00	122.	5.510	2.270	0.1020
18.00	5.000	12.00	89.	5.510	2.270	0.1020
18.00	3.000	13.00	20000.	5.520	2.270	0.1020
18.00	3.500	13.00	20000.	5.520	2.270	0.1020
18.00	4.000	13.00	248.	5.520	2.270	0.1020
18.00	4.500	13.00	134.	5.520	2.270	0.1020
18.00	5.000	13.00	88.	5.520	2.270	0.1020
18.00	3.000	14.00	20000.	5.530	2.270	0.1020

H	V	D	TC	VC	W	Z
18.00	3.500	14.00	20000.	5.530	2.270	0.1020
18.00	4.000	14.00	366.	5.530	2.270	0.1020
18.00	4.500	14.00	151.	5.530	2.270	0.1020
18.00	5.000	14.00	90.	5.530	2.270	0.1020
18.00	3.000	15.00	20000.	5.530	2.270	0.1020
18.00	3.500	15.00	20000.	5.530	2.270	0.1020
18.00	4.000	15.00	720.	5.530	2.270	0.1020
18.00	4.500	15.00	180.	5.530	2.270	0.1020
18.00	5.000	15.00	94.	5.530	2.270	0.1020
18.00	3.000	16.00	20000.	5.540	2.270	0.1020
18.00	3.500	16.00	20000.	5.540	2.270	0.1020
18.00	4.000	16.00	7300.	5.540	2.270	0.1020
18.00	4.500	16.00	212.	5.540	2.270	0.1020
18.00	5.000	16.00	97.	5.540	2.270	0.1020
18.00	3.000	17.00	20000.	5.540	2.270	0.1020
18.00	3.500	17.00	20000.	5.540	2.270	0.1020
18.00	4.000	17.00	20000.	5.540	2.270	0.1020
18.00	4.500	17.00	259.	5.540	2.270	0.1020
18.00	5.000	17.00	99.	5.540	2.270	0.1020
18.00	3.000	18.00	20000.	5.550	2.270	0.1020
18.00	3.500	18.00	20000.	5.550	2.270	0.1020
18.00	4.000	18.00	20000.	5.550	2.270	0.1020
18.00	4.500	18.00	346.	5.550	2.270	0.1020

H	V	D	TC	VC	W	Z
18.00	5.000	18.00	103.	5.550	2.270	0.1020
18.00	3.000	19.00	20000.	5.550	2.270	0.1020
18.00	3.500	19.00	20000.	5.550	2.270	0.1020
18.00	4.000	19.00	20000.	5.550	2.270	0.1020
18.00	4.500	19.00	472.	5.550	2.270	0.1020
18.00	5.000	19.00	103.	5.550	2.270	0.1020
18.00	3.000	20.00	20000.	5.550	2.270	0.1020
18.00	3.500	20.00	20000.	5.550	2.270	0.1020
18.00	4.000	20.00	20000.	5.550	2.270	0.1020
18.00	4.500	20.00	776.	5.550	2.270	0.1020
18.00	5.000	20.00	106.	5.550	2.270	0.1020
20.00	3.000	1.00	48.	3.200	2.090	0.1160
20.00	3.500	1.00	0.	3.200	2.090	0.1160
20.00	4.000	1.00	0.	3.200	2.090	0.1160
20.00	4.500	1.00	0.	3.200	2.090	0.1160
20.00	5.000	1.00	0.	3.200	2.090	0.1160
20.00	3.000	2.00	77.	4.000	2.090	0.1160
20.00	3.500	2.00	62.	4.000	2.090	0.1160
20.00	4.000	2.00	51.	4.000	2.090	0.1160
20.00	4.500	2.00	0.	4.000	2.090	0.1160
20.00	5.000	2.00	0.	4.000	2.090	0.1160
20.00	3.000	3.00	100.	4.330	2.090	0.1160
20.00	3.500	3.00	61.	4.330	2.090	0.1160

H	V	D	TC	VC	W	Z
20.00	4.000	3.00	64.	4.330	2.090	0.1160
20.00	4.500	3.00	0.	4.330	2.090	0.1160
20.00	5.000	3.00	0.	4.330	2.090	0.1160
20.00	3.000	4.00	146.	4.590	2.090	0.1160
20.00	3.500	4.00	69.	4.590	2.090	0.1160
20.00	4.000	4.00	62.	4.590	2.090	0.1160
20.00	4.500	4.00	68.	4.590	2.090	0.1160
20.00	5.000	4.00	0.	4.590	2.090	0.1160
20.00	3.000	5.00	245.	4.820	2.090	0.1160
20.00	3.500	5.00	81.	4.820	2.090	0.1160
20.00	4.000	5.00	63.	4.820	2.090	0.1160
20.00	4.500	5.00	73.	4.820	2.090	0.1160
20.00	5.000	5.00	0.	4.820	2.090	0.1160
20.00	3.000	6.00	570.	5.000	2.090	0.1160
20.00	3.500	6.00	97.	5.000	2.090	0.1160
20.00	4.000	6.00	70.	5.000	2.090	0.1160
20.00	4.500	6.00	76.	5.000	2.090	0.1160
20.00	5.000	6.00	44.	5.000	2.090	0.1160
20.00	3.000	7.00	7000.	5.070	2.090	0.1160
20.00	3.500	7.00	127.	5.070	2.090	0.1160
20.00	4.000	7.00	69.	5.070	2.090	0.1160
20.00	4.500	7.00	60.	5.070	2.090	0.1160
20.00	5.000	7.00	57.	5.070	2.090	0.1160

H	V	D	TC	VC	W	Z
20.00	3.000	8.00	20000.	5.150	2.090	0.1160
20.00	3.500	8.00	160.	5.150	2.090	0.1160
20.00	4.000	8.00	108.	5.150	2.090	0.1160
20.00	4.500	8.00	72.	5.150	2.090	0.1160
20.00	5.000	8.00	65.	5.150	2.090	0.1160
20.00	3.000	9.00	20000.	5.200	2.090	0.1160
20.00	3.500	9.00	226.	5.200	2.090	0.1160
20.00	4.000	9.00	103.	5.200	2.090	0.1160
20.00	4.500	9.00	78.	5.200	2.090	0.1160
20.00	5.000	9.00	69.	5.200	2.090	0.1160
20.00	3.000	10.00	20000.	5.250	2.090	0.1160
20.00	3.500	10.00	356.	5.250	2.090	0.1160
20.00	4.000	10.00	120.	5.250	2.090	0.1160
20.00	4.500	10.00	84.	5.250	2.090	0.1160
20.00	5.000	10.00	72.	5.250	2.090	0.1160
20.00	3.000	11.00	20000.	5.270	2.090	0.1160
20.00	3.500	11.00	980.	5.270	2.090	0.1160
20.00	4.000	11.00	146.	5.270	2.090	0.1160
20.00	4.500	11.00	92.	5.270	2.090	0.1160
20.00	5.000	11.00	74.	5.270	2.090	0.1160
20.00	3.000	12.00	20000.	5.280	2.090	0.1160
20.00	3.500	12.00	20000.	5.280	2.090	0.1160
20.00	4.000	12.00	179.	5.280	2.090	0.1160

H	V	D	TC	VC	W	Z
20.00	4.500	12.00	100.	5.280	2.090	0.1160
20.00	5.000	12.00	78.	5.280	2.090	0.1160
20.00	3.000	13.00	20000.	5.300	2.090	0.1160
20.00	3.500	13.00	20000.	5.300	2.090	0.1160
20.00	4.000	13.00	141.	5.300	2.090	0.1160
20.00	4.500	13.00	111.	5.300	2.090	0.1160
20.00	5.000	13.00	75.	5.300	2.090	0.1160
20.00	3.000	14.00	20000.	5.310	2.090	0.1160
20.00	3.500	14.00	20000.	5.310	2.090	0.1160
20.00	4.000	14.00	335.	5.310	2.090	0.1160
20.00	4.500	14.00	122.	5.310	2.090	0.1160
20.00	5.000	14.00	71.	5.310	2.090	0.1160
20.00	3.000	15.00	20000.	5.320	2.090	0.1160
20.00	3.500	15.00	20000.	5.320	2.090	0.1160
20.00	4.000	15.00	700.	5.320	2.090	0.1160
20.00	4.500	15.00	120.	5.320	2.090	0.1160
20.00	5.000	15.00	77.	5.320	2.090	0.1160
20.00	3.000	16.00	20000.	5.330	2.090	0.1160
20.00	3.500	16.00	20000.	5.330	2.090	0.1160
20.00	4.000	16.00	6000.	5.330	2.090	0.1160
20.00	4.500	16.00	158.	5.330	2.090	0.1160
20.00	5.000	16.00	81.	5.330	2.090	0.1160

H	V	D	TC	VC	W	Z
20.00	3.000	17.00	20000.	5.340	2.090	0.1160
20.00	3.500	17.00	20000.	5.340	2.090	0.1160
20.00	4.000	17.00	8800.	5.340	2.090	0.1160
20.00	4.500	17.00	195.	5.340	2.090	0.1160
20.00	5.000	17.00	83.	5.340	2.090	0.1160
20.00	3.000	18.00	20000.	5.340	2.090	0.1160
20.00	3.500	18.00	20000.	5.340	2.090	0.1160
20.00	4.000	18.00	8800.	5.340	2.090	0.1160
20.00	4.500	18.00	237.	5.340	2.090	0.1160
20.00	5.000	18.00	87.	5.340	2.090	0.1160
20.00	3.000	19.00	20000.	5.350	2.090	0.1160
20.00	3.500	19.00	20000.	5.350	2.090	0.1160
20.00	4.000	19.00	8800.	5.350	2.090	0.1160
20.00	4.500	19.00	315.	5.350	2.090	0.1160
20.00	5.000	19.00	90.	5.350	2.090	0.1160
20.00	3.000	20.00	20000.	5.350	2.090	0.1160
20.00	3.500	20.00	20000.	5.350	2.090	0.1160
20.00	4.000	20.00	8800.	5.350	2.090	0.1160
20.00	4.500	20.00	428.	5.350	2.090	0.1160
20.00	5.000	20.00	94.	5.350	2.090	0.1160
22.00	3.000	1.00	53.	3.000	2.100	0.1160
22.00	3.500	1.00	0.	3.000	2.100	0.1160
22.00	4.000	1.00	0.	3.000	2.100	0.1160

H	V	D	TC	VC	W	Z
22.00	4.500	1.00	0.	3.000	2.100	0.1160
22.00	5.000	1.00	0.	3.000	2.100	0.1160
22.00	3.000	2.00	68.	3.120	2.100	0.1160
22.00	3.500	2.00	0.	3.120	2.100	0.1160
22.00	4.000	2.00	0.	3.120	2.100	0.1160
22.00	4.500	2.00	0.	3.120	2.100	0.1160
22.00	5.000	2.00	0.	3.120	2.100	0.1160
22.00	3.000	3.00	90.	3.330	2.100	0.1160
22.00	3.500	3.00	0.	3.330	2.100	0.1160
22.00	4.000	3.00	0.	3.330	2.100	0.1160
22.00	4.500	3.00	0.	3.330	2.100	0.1160
22.00	5.000	3.00	0.	3.330	2.100	0.1160
22.00	3.000	4.00	130.	3.660	2.100	0.1160
22.00	3.500	4.00	67.	3.660	2.100	0.1160
22.00	4.000	4.00	0.	3.660	2.100	0.1160
22.00	4.500	4.00	0.	3.660	7.100	0.1160
22.00	5.000	4.00	0.	3.660	2.100	0.1160
22.00	3.000	5.00	228.	4.000	2.100	0.1160
22.00	3.500	5.00	72.	4.000	2.100	0.1160
22.00	4.000	5.00	54.	4.000	2.100	0.1160
22.00	4.500	5.00	0.	4.000	2.100	0.1160
22.00	5.000	5.00	0.	4.000	2.100	0.1160
22.00	3.000	6.00	540.	4.200	2.100	0.1160

H	V	D	TC	VC	W	Z
22.00	3.500	6.00	86.	4.200	2.100	0.1160
22.00	4.000	6.00	62.	4.200	2.100	0.1160
22.00	4.500	6.00	0.	4.200	2.100	0.1160
22.00	5.000	6.00	0.	4.200	2.100	0.1160
22.00	3.000	7.00	6300.	4.360	2.100	0.1160
22.00	3.500	7.00	104.	4.360	2.100	0.1160
22.00	4.000	7.00	68.	4.360	2.100	0.1160
22.00	4.500	7.00	0.	4.360	2.100	0.1160
22.00	5.000	7.00	0.	4.360	2.100	0.1160
22.00	3.000	8.00	20000.	4.510	2.100	0.1160
22.00	3.500	8.00	145.	4.510	2.100	0.1160
22.00	4.000	8.00	76.	4.510	2.100	0.1160
22.00	4.500	8.00	64.	4.510	2.100	0.1160
22.00	5.000	8.00	0.	4.510	2.100	0.1160
22.00	3.000	9.00	20000.	4.620	2.100	0.1160
22.00	3.500	9.00	224.	4.620	2.100	0.1160
22.00	4.000	9.00	87.	4.620	2.100	0.1160
22.00	4.500	9.00	67.	4.620	2.100	0.1160
22.00	5.000	9.00	0.	4.620	2.100	0.1160
22.00	3.000	10.00	20000.	4.720	2.100	0.1160
22.00	3.500	10.00	400.	4.720	2.100	0.1160
22.00	4.000	10.00	104.	4.720	2.100	0.1160
22.00	4.500	10.00	71.	4.720	2.100	0.1160

H	V	D	TC	VC	W	Z
22.00	5.000	10.00	0.	4.720	2.100	0.1160
22.00	3.000	11.00	20000.	4.810	2.100	0.1160
22.00	3.500	11.00	1840.	4.810	2.100	0.1160
22.00	4.000	11.00	124.	4.810	2.100	0.1160
22.00	4.500	11.00	78.	4.810	2.100	0.1160
22.00	5.000	11.00	0.	4.810	2.100	0.1160
22.00	3.000	12.00	20000.	4.870	2.100	0.1160
22.00	3.500	12.00	20000.	4.870	2.100	0.1160
22.00	4.000	12.00	157.	4.870	2.100	0.1160
22.00	4.500	12.00	85.	4.870	2.100	0.1160
22.00	5.000	12.00	0.	4.870	2.100	0.1160
22.00	3.000	13.00	20000.	4.940	2.100	0.1160
22.00	3.500	13.00	20000.	4.940	2.100	0.1160
22.00	4.000	13.00	199.	4.940	2.100	0.1160
22.00	4.500	13.00	94.	4.940	2.100	0.1160
22.00	5.000	13.00	0.	4.940	2.100	0.1160
22.00	3.000	14.00	20000.	4.980	2.100	0.1160
22.00	3.500	14.00	20000.	4.980	2.100	0.1160
22.00	4.000	14.00	188.	4.980	2.100	0.1160
22.00	4.500	14.00	108.	4.980	2.100	0.1160
22.00	5.000	14.00	0.	4.980	2.100	0.1160
22.00	3.000	15.00	20000.	5.020	2.100	0.1160
22.00	3.500	15.00	20000.	5.020	2.100	0.1160

H	V	D	TC	VC	W	Z
22.00	4.000	15.00	500.	5.020	2.100	0.1160
22.00	4.500	15.00	124.	5.020	2.100	0.1160
22.00	5.000	15.00	0.	5.020	2.100	0.1160
22.00	3.000	16.00	20000.	5.050	2.100	0.1160
22.00	3.500	16.00	20000.	5.050	2.100	0.1160
22.00	4.000	16.00	20000.	5.050	2.100	0.1160
22.00	4.500	16.00	143.	5.050	2.100	0.1160
22.00	5.000	16.00	72.	5.050	2.100	0.1160
22.00	3.000	17.00	20000.	5.070	2.100	0.1160
22.00	3.500	17.00	20000.	5.070	2.100	0.1160
22.00	4.000	17.00	20000.	5.070	2.100	0.1160
22.00	4.500	17.00	174.	5.070	2.100	0.1160
22.00	5.000	17.00	72.	5.070	2.100	0.1160
22.00	3.000	18.00	20000.	5.080	2.100	0.1160
22.00	3.500	18.00	20000.	5.080	2.100	0.1160
22.00	4.000	18.00	20000.	5.080	2.100	0.1160
22.00	4.500	18.00	215.	5.080	2.100	0.1160
22.00	5.000	18.00	76.	5.080	2.100	0.1160
22.00	3.000	19.00	20000.	5.100	2.100	0.1160
22.00	3.500	19.00	20000.	5.100	2.100	0.1160
22.00	4.000	19.00	20000.	5.100	2.100	0.1160
22.00	4.500	19.00	274.	5.100	2.100	0.1160
22.00	5.000	19.00	79.	5.100	2.100	0.1160

H	V	D	TC	VC	W	Z
22.00	3.000	20.00	20000.	5.100	2.100	0.1160
22.00	3.500	20.00	20000.	5.100	2.100	0.1160
22.00	4.000	20.00	20000.	5.100	2.100	0.1160
22.00	4.500	20.00	366.	5.100	2.100	0.1160
22.00	5.000	20.00	81.	5.100	2.100	0.1160
24.00	3.000	1.00	0.	2.980	1.570	0.2020
24.00	3.500	1.00	0.	2.980	1.570	0.2020
24.00	4.000	1.00	0.	2.980	1.570	0.2020
24.00	4.500	1.00	0.	2.980	1.570	0.2020
24.00	5.000	1.00	0.	2.980	1.570	0.2020
24.00	3.000	2.00	58.	3.000	1.570	0.2020
24.00	3.500	2.00	0.	3.000	1.570	0.2020
24.00	4.000	2.00	0.	3.000	1.570	0.2020
24.00	4.500	2.00	0.	3.000	1.570	0.2020
24.00	5.000	2.00	0.	3.000	1.570	0.2020
24.00	3.000	3.00	84.	3.120	1.570	0.2020
24.00	3.500	3.00	0.	3.120	1.570	0.2020
24.00	4.000	3.00	0.	3.120	1.570	0.2020
24.00	4.500	3.00	0.	3.120	1.570	0.2020
24.00	5.000	3.00	0.	3.120	1.570	0.2020
24.00	3.000	4.00	122.	3.340	1.570	0.2020
24.00	3.500	4.00	0.	3.340	1.570	0.2020
24.00	4.000	4.00	0.	3.340	1.570	0.2020

H	V	D	TC	VC	W	Z
24.00	4.500	4.00	0.	3.340	1.570	0.2020
24.00	5.000	4.00	0.	3.340	1.570	0.2020
24.00	3.000	5.00	197.	3.680	1.570	0.2020
24.00	3.500	5.00	64.	3.680	1.570	0.2020
24.00	4.000	5.00	0.	3.680	1.570	0.2020
24.00	4.500	5.00	0.	3.680	1.570	0.2020
24.00	5.000	5.00	0.	3.680	1.570	0.2020
24.00	3.000	6.00	460.	4.000	1.570	0.2020
24.00	3.500	6.00	76.	4.000	1.570	0.2020
24.00	4.000	6.00	69.	4.000	1.570	0.2020
24.00	4.500	6.00	0.	4.000	1.570	0.2020
24.00	5.000	6.00	0.	4.000	1.570	0.2020
24.00	3.000	7.00	5400.	4.180	1.570	0.2020
24.00	3.500	7.00	101.	4.180	1.570	0.2020
24.00	4.000	7.00	81.	4.180	1.570	0.2020
24.00	4.500	7.00	0.	4.180	1.570	0.2020
24.00	5.000	7.00	0.	4.180	1.570	0.2020
24.00	3.000	8.00	20000.	4.370	1.570	0.2020
24.00	3.500	8.00	142.	4.370	1.570	0.2020
24.00	4.000	8.00	98.	4.370	1.570	0.2020
24.00	4.500	8.00	0.	4.370	1.570	0.2020
24.00	5.000	8.00	0.	4.370	1.570	0.2020

H	V	D	TC	VC	W	Z
24.00	3.000	9.00	20000.	4.500	1.570	0.2020
24.00	3.500	9.00	262.	4.500	1.570	0.2020
24.00	4.000	9.00	119.	4.500	1.570	0.2020
24.00	4.500	9.00	56.	4.500	1.570	0.2020
24.00	5.000	9.00	0.	4.500	1.570	0.2020
24.00	3.000	10.00	20000.	4.580	1.570	0.2020
24.00	3.500	10.00	1020.	4.580	1.570	0.2020
24.00	4.000	10.00	157.	4.580	1.570	0.2020
24.00	4.500	10.00	60.	4.580	1.570	0.2020
24.00	5.000	10.00	0.	4.580	1.570	0.2020
24.00	3.000	11.00	20000.	4.670	1.570	0.2020
24.00	3.500	11.00	7400.	4.670	1.570	0.2020
24.00	4.000	11.00	224.	4.670	1.570	0.2020
24.00	4.500	11.00	66.	4.670	1.570	0.2020
24.00	5.000	11.00	0.	4.670	1.570	0.2020
24.00	3.000	12.00	20000.	4.750	1.570	0.2020
24.00	3.500	12.00	20000.	4.750	1.570	0.2020
24.00	4.000	12.00	394.	4.750	1.570	0.2020
24.00	4.500	12.00	72.	4.750	1.570	0.2020
24.00	5.000	12.00	0.	4.750	1.570	0.2020
24.00	3.000	13.00	20000.	4.820	1.570	0.2020
24.00	3.500	13.00	20000.	4.820	1.570	0.2020
24.00	4.000	13.00	1411.	4.820	1.570	0.2020

H	V	D	TC	VC	W	Z
24.00	4.500	13.00	81.	4.820	1.570	0.2020
24.00	5.000	13.00	0.	4.820	1.570	0.2020
24.00	3.000	14.00	20000.	4.860	1.570	0.2020
24.00	3.500	14.00	20000.	4.860	1.570	0.2020
24.00	4.000	14.00	8800.	4.860	1.570	0.2020
24.00	4.500	14.00	91.	4.860	1.570	0.2020
24.00	5.000	14.00	0.	4.860	1.570	0.2020
24.00	3.000	15.00	20000.	4.910	1.570	0.2020
24.00	3.500	15.00	20000.	4.910	1.570	0.2020
24.00	4.000	15.00	20000.	4.910	1.570	0.2020
24.00	4.500	15.00	103.	4.910	1.570	0.2020
24.00	5.000	15.00	0.	4.910	1.570	0.2020
24.00	3.000	16.00	20000.	4.960	1.570	0.2020
24.00	3.500	16.00	20000.	4.960	1.570	0.2020
24.00	4.000	16.00	20000.	4.960	1.570	0.2020
24.00	4.500	16.00	119.	4.960	1.570	0.2020
24.00	5.000	16.00	0.	4.960	1.570	0.2020
24.00	3.000	17.00	20000.	4.970	1.570	0.2020
24.00	3.500	17.00	20000.	4.970	1.570	0.2020
24.00	4.000	17.00	20000.	4.970	1.570	0.2020
24.00	4.500	17.00	131.	4.970	1.570	0.2020
24.00	5.000	17.00	0.	4.970	1.570	0.2020
24.00	3.000	18.00	20000.	4.980	1.570	0.2020

H	V	D	TC	VC	W	Z
24.00	3.500	18.00	20000.	4.980	1.570	0.2020
24.00	4.000	18.00	20000.	4.980	1.570	0.2020
24.00	4.500	18.00	154.	4.980	1.570	0.2020
24.00	5.000	18.00	0.	4.980	1.570	0.2020
24.00	3.000	19.00	20000.	5.000	1.570	0.2020
24.00	3.500	19.00	20000.	5.000	1.570	0.2020
24.00	4.000	19.00	20000.	5.000	1.570	0.2020
24.00	4.500	19.00	187.	5.000	1.570	0.2020
24.00	5.000	19.00	0.	5.000	1.570	0.2020
24.00	3.000	20.00	20000.	5.010	1.570	0.2020
24.00	3.500	20.00	20000.	5.010	1.570	0.2020
24.00	4.000	20.00	20000.	5.010	1.570	0.2020
24.00	4.500	20.00	227.	5.010	1.570	0.2020
24.00	5.000	20.00	64.	5.010	1.570	0.2020
26.00	3.000	1.00	0.	2.970	1.900	0.1400
26.00	3.500	1.00	0.	2.970	1.900	0.1400
26.00	4.000	1.00	0.	2.970	1.900	0.1400
26.00	4.500	1.00	0.	2.970	1.900	0.1400
26.00	5.000	1.00	0.	2.970	1.900	0.1400
26.00	3.000	2.00	0.	2.980	1.900	0.1400
26.00	3.500	2.00	0.	2.980	1.900	0.1400
26.00	4.000	2.00	0.	2.980	1.900	0.1400
26.00	4.500	2.00	0.	2.980	1.900	0.1400

H	V	D	TC	VC	W	Z
26.00	5.000	2.00	0.	2.980	1.900	0.1400
26.00	3.000	3.00	94.	3.020	1.900	0.1400
26.00	3.500	3.00	0.	3.020	1.900	0.1400
26.00	4.000	3.00	0.	3.020	1.900	0.1400
26.00	4.500	3.00	0.	3.020	1.900	0.1400
26.00	5.000	3.00	0.	3.020	1.900	0.1400
26.00	3.000	4.00	145.	3.100	1.900	0.1400
26.00	3.500	4.00	0.	3.100	1.900	0.1400
26.00	4.000	4.00	0.	3.100	1.900	0.1400
26.00	4.500	4.00	0.	3.100	1.900	0.1400
26.00	5.000	4.00	0.	3.100	1.900	0.1400
26.00	3.000	5.00	271.	3.260	1.900	0.1400
26.00	3.500	5.00	0.	3.260	1.900	0.1400
26.00	4.000	5.00	0.	3.260	1.900	0.1400
26.00	4.500	5.00	0.	3.260	1.900	0.1400
26.00	5.000	5.00	0.	3.260	1.900	0.1400
26.00	3.000	6.00	830.	3.460	1.900	0.1400
26.00	3.500	6.00	0.	3.460	1.900	0.1400
26.00	4.000	6.00	0.	3.460	1.900	0.1400
26.00	4.500	6.00	0.	3.460	1.900	0.1400
26.00	5.000	6.00	0.	3.460	1.900	0.1400
26.00	3.000	7.00	9800.	3.730	1.900	0.1400
26.00	3.500	7.00	81.	3.730	1.900	0.1400

H	V	D	TC	VC	W	Z
26.00	4.000	7.00	0.	3.730	1.900	0.1400
26.00	4.500	7.00	0.	3.730	1.900	0.1400
26.00	5.000	7.00	0.	3.730	1.900	0.1400
26.00	3.000	8.00	20000.	4.050	1.900	0.1400
26.00	3.500	8.00	121.	4.050	1.900	0.1400
26.00	4.000	8.00	72.	4.050	1.900	0.1400
26.00	4.500	8.00	0.	4.050	1.900	0.1400
26.00	5.000	8.00	0.	4.050	1.900	0.1400
26.00	3.000	9.00	20000.	4.240	1.900	0.1400
26.00	3.500	9.00	196.	4.240	1.900	0.1400
26.00	4.000	9.00	92.	4.240	1.900	0.1400
26.00	4.500	9.00	0.	4.240	1.900	0.1400
26.00	5.000	9.00	0.	4.240	1.900	0.1400
26.00	3.000	10.00	20000.	4.370	1.900	0.1400
26.00	3.500	10.00	480.	4.370	1.900	0.1400
26.00	4.000	10.00	114.	4.370	1.900	0.1400
26.00	4.500	10.00	0.	4.370	1.900	0.1400
26.00	5.000	10.00	0.	4.370	1.900	0.1400
26.00	3.000	11.00	20000.	4.500	1.900	0.1400
26.00	3.500	11.00	4600.	4.500	1.900	0.1400
26.00	4.000	11.00	149.	4.500	1.900	0.1400
26.00	4.500	11.00	72.	4.500	1.900	0.1400
26.00	5.000	11.00	0.	4.500	1.900	0.1400

H	V	D	TC	VC	W	Z
26.00	3.000	12.00	20000.	4.570	1.900	0.1400
26.00	3.500	12.00	20000.	4.570	1.900	0.1400
26.00	4.000	12.00	232.	4.570	1.900	0.1400
26.00	4.500	12.00	84.	4.570	1.900	0.1400
26.00	5.000	12.00	0.	4.570	1.900	0.1400
26.00	3.000	13.00	20000.	4.670	1.900	0.1400
26.00	3.500	13.00	20000.	4.670	1.900	0.1400
26.00	4.000	13.00	480.	4.670	1.900	0.1400
26.00	4.500	13.00	100.	4.670	1.900	0.1400
26.00	5.000	13.00	0.	4.670	1.900	0.1400
26.00	3.000	14.00	20000.	4.730	1.900	0.1400
26.00	3.500	14.00	20000.	4.730	1.900	0.1400
26.00	4.000	14.00	5400.	4.730	1.900	0.1400
26.00	4.500	14.00	118.	4.730	1.900	0.1400
26.00	5.000	14.00	0.	4.730	1.900	0.1400
26.00	3.000	15.00	20000.	4.770	1.900	0.1400
26.00	3.500	15.00	20000.	4.770	1.900	0.1400
26.00	4.000	15.00	20000.	4.770	1.900	0.1400
26.00	4.500	15.00	142.	4.770	1.900	0.1400
26.00	5.000	15.00	0.	4.770	1.900	0.1400
26.00	3.000	16.00	20000.	4.800	1.900	0.1400
26.00	3.500	16.00	20000.	4.800	1.900	0.1400
26.00	4.000	16.00	20000.	4.800	1.900	0.1400

H	V	D	TC	VC	W	Z
26.00	4.500	16.00	180.	4.800	1.900	0.1400
26.00	5.000	16.00	0.	4.800	1.900	0.1400
26.00	3.000	17.00	20000.	4.830	1.900	0.1400
26.00	3.500	17.00	20000.	4.830	1.900	0.1400
26.00	4.000	17.00	20000.	4.830	1.900	0.1400
26.00	4.500	17.00	229.	4.830	1.900	0.1400
26.00	5.000	17.00	0.	4.830	1.900	0.1400
26.00	3.000	18.00	20000.	4.860	1.900	0.1400
26.00	3.500	18.00	20000.	4.860	1.900	0.1400
26.00	4.000	18.00	20000.	4.860	1.900	0.1400
26.00	4.500	18.00	316.	4.860	1.900	0.1400
26.00	5.000	18.00	0.	4.860	1.900	0.1400
26.00	3.000	19.00	20000.	4.880	1.900	0.1400
26.00	3.500	19.00	20000.	4.880	1.900	0.1400
26.00	4.000	19.00	20000.	4.880	1.900	0.1400
26.00	4.500	19.00	520.	4.880	1.900	0.1400
26.00	5.000	19.00	0.	4.880	1.900	0.1400
26.00	3.000	20.00	20000.	4.910	1.900	0.1400
26.00	3.500	20.00	20000.	4.910	1.900	0.1400
26.00	4.000	20.00	20000.	4.910	1.900	0.1400
26.00	4.500	20.00	1210.	4.910	1.900	0.1400
26.00	5.000	20.00	0.	4.910	1.900	0.1400
28.00	3.000	1.00	0.	2.970	2.250	0.1080

H	V	D	TC	VC	W	7
28.00	3.500	1.00	0.	2.970	2.250	0.1080
28.00	4.000	1.00	0.	2.970	2.250	0.1080
28.00	4.500	1.00	0.	2.970	2.250	0.1080
28.00	5.000	1.00	0.	2.970	2.250	0.1080
28.00	3.000	2.00	0.	2.980	2.250	0.1080
28.00	3.500	2.00	0.	2.980	2.250	0.1080
28.00	4.000	2.00	0.	2.980	2.250	0.1080
28.00	4.500	2.00	0.	2.980	2.250	0.1080
28.00	5.000	2.00	0.	2.980	2.250	0.1080
28.00	3.000	3.00	85.	3.000	2.250	0.1080
28.00	3.500	3.00	0.	3.000	2.250	0.1080
28.00	4.000	3.00	0.	3.000	2.250	0.1080
28.00	4.500	3.00	0.	3.000	2.250	0.1080
28.00	5.000	3.00	0.	3.000	2.250	0.1080
28.00	3.000	4.00	132.	3.040	2.250	0.1080
28.00	3.500	4.00	0.	3.040	2.250	0.1080
28.00	4.000	4.00	0.	3.040	2.250	0.1080
28.00	4.500	4.00	0.	3.040	2.250	0.1080
28.00	5.000	4.00	0.	3.040	2.250	0.1080
28.00	3.000	5.00	184.	3.110	2.250	0.1080
28.00	3.500	5.00	0.	3.110	2.250	0.1080
28.00	4.000	5.00	0.	3.110	2.250	0.1080
28.00	4.500	5.00	0.	3.110	2.250	0.1080

47

H	V	D	TC	VC	W	7
28.00	5.000	5.00	0.	3.110	2.250	0.1080
28.00	3.000	6.00	740.	3.220	2.250	0.1080
28.00	3.500	6.00	0.	3.220	2.250	0.1080
28.00	4.000	6.00	0.	3.220	2.250	0.1080
28.00	4.500	6.00	0.	3.220	2.250	0.1080
28.00	5.000	6.00	0.	3.220	2.250	0.1080
28.00	3.000	7.00	8800.	3.380	2.250	0.1080
28.00	3.500	7.00	0.	3.380	2.250	0.1080
28.00	4.000	7.00	0.	3.380	2.250	0.1080
28.00	4.500	7.00	0.	3.380	2.250	0.1080
28.00	5.000	7.00	0.	3.380	2.250	0.1080
28.00	3.000	8.00	20000.	3.570	2.250	0.1080
28.00	3.500	8.00	111.	3.570	2.250	0.1080
28.00	4.000	8.00	0.	3.570	2.250	0.1080
28.00	4.500	8.00	0.	3.570	2.250	0.1080
28.00	5.000	8.00	0.	3.570	2.250	0.1080
28.00	3.000	9.00	20000.	3.810	2.250	0.1080
28.00	3.500	9.00	117.	3.810	2.250	0.1080
28.00	4.000	9.00	0.	3.810	2.250	0.1080
28.00	4.500	9.00	0.	3.810	2.250	0.1080
28.00	5.000	9.00	0.	3.810	2.250	0.1080
28.00	3.000	10.00	20000.	4.020	2.250	0.1080
28.00	3.500	10.00	840.	4.020	2.250	0.1080

H	V	D	TC	VC	W	Z
28.00	4.000	10.00	103.	4.020	2.250	0.1080
28.00	4.500	10.00	0.	4.020	2.250	0.1080
28.00	5.000	10.00	0.	4.020	2.250	0.1080
28.00	3.000	11.00	20000.	4.180	2.250	0.1080
28.00	3.500	11.00	6300.	4.180	2.250	0.1080
28.00	4.000	11.00	144.	4.180	2.250	0.1080
28.00	4.500	11.00	0.	4.180	2.250	0.1080
28.00	5.000	11.00	0.	4.180	2.250	0.1080
28.00	3.000	12.00	20000.	4.290	2.250	0.1080
28.00	3.500	12.00	20000.	4.290	2.250	0.1080
28.00	4.000	12.00	236.	4.290	2.250	0.1080
28.00	4.500	12.00	0.	4.290	2.250	0.1080
28.00	5.000	12.00	0.	4.290	2.250	0.1080
28.00	3.000	13.00	20000.	4.390	2.250	0.1080
28.00	3.500	13.00	20000.	4.390	2.250	0.1080
28.00	4.000	13.00	560.	4.390	2.250	0.1080
28.00	4.500	13.00	0.	4.390	2.250	0.1080
28.00	5.000	13.00	0.	4.390	2.250	0.1080
28.00	3.000	14.00	20000.	4.500	2.250	0.1080
28.00	3.500	14.00	20000.	4.500	2.250	0.1080
28.00	4.000	14.00	4900.	4.500	2.250	0.1080
28.00	4.500	14.00	97.	4.500	2.250	0.1080
28.00	5.000	14.00	0.	4.500	2.250	0.1080

H	V	D	TC	VC	W	Z
28.00	3.000	15.00	20000.	4.570	2.250	0.1080
28.00	3.500	15.00	20000.	4.570	2.250	0.1080
28.00	4.000	15.00	13200.	4.570	2.250	0.1080
28.00	4.500	15.00	115.	4.570	2.250	0.1080
28.00	5.000	15.00	0.	4.570	2.250	0.1080
28.00	3.000	16.00	20000.	4.650	2.250	0.1080
28.00	3.500	16.00	20000.	4.650	2.250	0.1080
28.00	4.000	16.00	20000.	4.650	2.250	0.1080
28.00	4.500	16.00	142.	4.650	2.250	0.1080
28.00	5.000	16.00	0.	4.650	2.250	0.1080
28.00	3.000	17.00	20000.	4.700	2.250	0.1080
28.00	3.500	17.00	20000.	4.700	2.250	0.1080
28.00	4.000	17.00	20000.	4.700	2.250	0.1080
28.00	4.500	17.00	186.	4.700	2.250	0.1080
28.00	5.000	17.00	0.	4.700	2.250	0.1080
28.00	3.000	18.00	20000.	4.730	2.250	0.1080
28.00	3.500	18.00	20000.	4.730	2.250	0.1080
28.00	4.000	18.00	20000.	4.730	2.250	0.1080
28.00	4.500	18.00	247.	4.730	2.250	0.1080
28.00	5.000	18.00	0.	4.730	2.250	0.1080
28.00	3.000	19.00	20000.	4.770	2.250	0.1080
28.00	3.500	19.00	20000.	4.770	2.250	0.1080
28.00	4.000	19.00	20000.	4.770	2.250	0.1080

H	V	D	TC	VC	W	Z
28.00	4.500	19.00	332.	4.770	2.250	0.1080
28.00	5.000	19.00	0.	4.770	2.250	0.1080
28.00	3.000	20.00	20000.	4.780	2.250	0.1080
28.00	3.500	20.00	20000.	4.780	2.250	0.1080
28.00	4.000	20.00	20000.	4.780	2.250	0.1080
28.00	4.500	20.00	520.	4.780	2.250	0.1080
28.00	5.000	20.00	0.	4.780	2.250	0.1080
30.00	3.000	1.00	0.	2.960	2.080	0.1280
30.00	3.500	1.00	0.	2.960	2.080	0.1280
30.00	4.000	1.00	0.	2.960	2.080	0.1280
30.00	4.500	1.00	0.	2.960	2.080	0.1280
30.00	5.000	1.00	0.	2.960	2.080	0.1280
30.00	3.000	2.00	0.	2.970	2.080	0.1280
30.00	3.500	2.00	0.	2.970	2.080	0.1280
30.00	4.000	2.00	0.	2.970	2.080	0.1280
30.00	4.500	2.00	0.	2.970	2.080	0.1280
30.00	5.000	2.00	0.	2.970	2.080	0.1280
30.00	3.000	3.00	0.	2.990	2.080	0.1280
30.00	3.500	3.00	0.	2.990	2.080	0.1280
30.00	4.000	3.00	0.	2.990	2.080	0.1280
30.00	4.500	3.00	0.	2.990	2.080	0.1280
30.00	5.000	3.00	0.	2.990	2.080	0.1280
30.00	3.000	4.00	115.	3.010	2.080	0.1280

51

H	V	D	TC	VC	W	Z
30.00	3.500	4.00	0.	3.010	2.080	0.1280
30.00	4.000	4.00	0.	3.010	2.080	0.1280
30.00	4.500	4.00	0.	3.010	2.080	0.1280
30.00	5.000	4.00	0.	3.010	2.080	0.1280
30.00	3.000	5.00	213.	3.050	2.080	0.1280
30.00	3.500	5.00	0.	3.050	2.080	0.1280
30.00	4.000	5.00	0.	3.050	2.080	0.1280
30.00	4.500	5.00	0.	3.050	2.080	0.1280
30.00	5.000	5.00	0.	3.050	2.080	0.1280
30.00	3.000	6.00	660.	3.170	2.080	0.1280
30.00	3.500	6.00	0.	3.170	2.080	0.1280
30.00	4.000	6.00	0.	3.170	2.080	0.1280
30.00	4.500	6.00	0.	3.170	2.080	0.1280
30.00	5.000	6.00	0.	3.170	2.080	0.1280
30.00	3.000	7.00	8200.	3.330	2.080	0.1280
30.00	3.500	7.00	0.	3.330	2.080	0.1280
30.00	4.000	7.00	0.	3.330	2.080	0.1280
30.00	4.500	7.00	0.	3.330	2.080	0.1280
30.00	5.000	7.00	0.	3.330	2.080	0.1280
30.00	3.000	8.00	20000.	3.520	2.080	0.1280
30.00	3.500	8.00	108.	3.520	2.080	0.1280
30.00	4.000	8.00	0.	3.520	2.080	0.1280
30.00	4.500	8.00	0.	3.520	2.080	0.1280

H	V	D	TC	VC	W	Z
30.00	5.000	8.00	0.	3.520	2.080	0.1280
30.00	3.000	9.00	20000.	3.670	2.080	0.1280
30.00	3.500	9.00	249.	3.670	2.080	0.1280
30.00	4.000	9.00	0.	3.670	2.080	0.1280
30.00	4.500	9.00	0.	3.670	2.080	0.1280
30.00	5.000	9.00	0.	3.670	2.080	0.1280
30.00	3.000	10.00	20000.	3.860	2.080	0.1280
30.00	3.500	10.00	2000.	3.860	2.080	0.1280
30.00	4.000	10.00	0.	3.860	2.080	0.1280
30.00	4.500	10.00	0.	3.860	2.080	0.1280
30.00	5.000	10.00	0.	3.860	2.080	0.1280
30.00	3.000	11.00	20000.	4.050	2.080	0.1280
30.00	3.500	11.00	7500.	4.050	2.080	0.1280
30.00	4.000	11.00	129.	4.050	2.080	0.1280
30.00	4.500	11.00	0.	4.050	2.080	0.1280
30.00	5.000	11.00	0.	4.050	2.080	0.1280
30.00	3.000	12.00	20000.	4.170	2.080	0.1280
30.00	3.500	12.00	20000.	4.170	2.080	0.1280
30.00	4.000	12.00	227.	4.170	2.080	0.1280
30.00	4.500	12.00	0.	4.170	2.080	0.1280
30.00	5.000	12.00	0.	4.170	2.080	0.1280
30.00	3.000	13.00	20000.	4.260	2.080	0.1280
30.00	3.500	13.00	20000.	4.260	2.080	0.1280

H	V	D	TC	VC	W	Z
30.00	4.000	13.00	600.	4.260	2.080	0.1280
30.00	4.500	13.00	0.	4.260	2.080	0.1280
30.00	5.000	13.00	0.	4.260	2.080	0.1280
30.00	3.000	14.00	20000.	4.350	2.080	0.1280
30.00	3.500	14.00	20000.	4.350	2.080	0.1280
30.00	4.000	14.00	6100.	4.350	2.080	0.1280
30.00	4.500	14.00	0.	4.350	2.080	0.1280
30.00	5.000	14.00	0.	4.350	2.080	0.1280
30.00	3.000	15.00	20000.	4.430	2.080	0.1280
30.00	3.500	15.00	20000.	4.430	2.080	0.1280
30.00	4.000	15.00	20000.	4.430	2.080	0.1280
30.00	4.500	15.00	0.	4.430	2.080	0.1280
30.00	5.000	15.00	0.	4.430	2.080	0.1280
30.00	3.000	16.00	20000.	4.510	2.080	0.1280
30.00	3.500	16.00	20000.	4.510	2.080	0.1280
30.00	4.000	16.00	20000.	4.510	2.080	0.1280
30.00	4.500	16.00	116.	4.510	2.080	0.1280
30.00	5.000	16.00	0.	4.510	2.080	0.1280
30.00	3.000	17.00	20000.	4.580	2.080	0.1280
30.00	3.500	17.00	20000.	4.580	2.080	0.1280
30.00	4.000	17.00	20000.	4.580	2.080	0.1280
30.00	4.500	17.00	146.	4.580	2.080	0.1280
30.00	5.000	17.00	0.	4.580	2.080	0.1280

H	V	D	TC	VC	W	Z
30.00	3.000	18.00	20000.	4.620	2.080	0.1280
30.00	3.500	18.00	20000.	4.620	2.080	0.1280
30.00	4.000	18.00	20000.	4.620	2.080	0.1280
30.00	4.500	18.00	183.	4.620	2.080	0.1280
30.00	5.000	18.00	0.	4.620	2.080	0.1280
30.00	3.000	19.00	20000.	4.650	2.080	0.1280
30.00	3.500	19.00	20000.	4.650	2.080	0.1280
30.00	4.000	19.00	20000.	4.650	2.080	0.1280
30.00	4.500	19.00	339.	4.650	2.080	0.1280
30.00	5.000	19.00	0.	4.650	2.080	0.1280
30.00	3.000	20.00	20000.	4.680	2.080	0.1280
30.00	3.500	20.00	20000.	4.680	2.080	0.1280
30.00	4.000	20.00	20000.	4.680	2.080	0.1280
30.00	4.500	20.00	326.	4.680	2.080	0.1280
30.00	5.000	20.00	0.	4.680	2.080	0.1280
32.00	3.000	1.00	0.	2.960	2.100	0.1320
32.00	3.500	1.00	0.	2.960	2.100	0.1320
32.00	4.000	1.00	0.	2.960	2.100	0.1320
32.00	4.500	1.00	0.	2.960	2.100	0.1320
32.00	5.000	1.00	0.	2.960	2.100	0.1320
32.00	3.000	2.00	0.	2.970	2.100	0.1320
32.00	3.500	2.00	0.	2.970	2.100	0.1320
32.00	4.000	2.00	0.	2.970	2.100	0.1320

H	V	D	TC	VC	W	Z
32.00	4.500	2.00	0.	2.970	2.100	0.1320
32.00	5.000	2.00	0.	2.970	2.100	0.1320
32.00	3.000	3.00	0.	2.980	2.100	0.1320
32.00	3.500	3.00	0.	2.980	2.100	0.1320
32.00	4.000	3.00	0.	2.980	2.100	0.1320
32.00	4.500	3.00	0.	2.980	2.100	0.1320
32.00	5.000	3.00	0.	2.980	2.100	0.1320
32.00	3.000	4.00	105.	3.000	2.100	0.1320
32.00	3.500	4.00	0.	3.000	2.100	0.1320
32.00	4.000	4.00	0.	3.000	2.100	0.1320
32.00	4.500	4.00	0.	3.000	2.100	0.1320
32.00	5.000	4.00	0.	3.000	2.100	0.1320
32.00	3.000	5.00	207.	3.030	2.100	0.1320
32.00	3.500	5.00	0.	3.030	2.100	0.1320
32.00	4.000	5.00	0.	3.030	2.100	0.1320
32.00	4.500	5.00	0.	3.030	2.100	0.1320
32.00	5.000	5.00	0.	3.030	2.100	0.1320
32.00	3.000	6.00	654.	3.150	2.100	0.1320
32.00	3.500	6.00	0.	3.150	2.100	0.1320
32.00	4.000	6.00	0.	3.150	2.100	0.1320
32.00	4.500	6.00	0.	3.150	2.100	0.1320
32.00	5.000	6.00	0.	3.150	2.100	0.1320
32.00	3.000	7.00	8000.	3.290	2.100	0.1320

H	V	D	TC	VC	W	Z
32.00	3.500	7.00	0.	3.290	2.100	0.1320
32.00	4.000	7.00	0.	3.290	2.100	0.1320
32.00	4.500	7.00	0.	3.290	2.100	0.1320
32.00	5.000	7.00	0.	3.290	2.100	0.1320
32.00	3.000	8.00	20000.	3.500	2.100	0.1320
32.00	3.500	8.00	188.	3.500	2.100	0.1320
32.00	4.000	8.00	0.	3.500	2.100	0.1320
32.00	4.500	8.00	0.	3.500	2.100	0.1320
32.00	5.000	8.00	0.	3.500	2.100	0.1320
32.00	3.000	9.00	20000.	3.630	2.100	0.1320
32.00	3.500	9.00	1000.	3.630	2.100	0.1320
32.00	4.000	9.00	0.	3.630	2.100	0.1320
32.00	4.500	9.00	0.	3.630	2.100	0.1320
32.00	5.000	9.00	0.	3.630	2.100	0.1320
32.00	3.000	10.00	20000.	3.800	2.100	0.1320
32.00	3.500	10.00	7500.	3.800	2.100	0.1320
32.00	4.000	10.00	0.	3.800	2.100	0.1320
32.00	4.500	10.00	0.	3.800	2.100	0.1320
32.00	5.000	10.00	0.	3.800	2.100	0.1320
32.00	3.000	11.00	20000.	4.000	2.100	0.1320
32.00	3.500	11.00	20000.	4.000	2.100	0.1320
32.00	4.000	11.00	121.	4.000	2.100	0.1320
32.00	4.500	11.00	0.	4.000	2.100	0.1320

H	V	D	TC	VC	W	Z
32.00	5.000	11.00	0.	4.000	2.100	0.1320
32.00	3.000	12.00	20000.	4.080	2.100	0.1320
32.00	3.500	12.00	20000.	4.080	2.100	0.1320
32.00	4.000	12.00	239.	4.080	2.100	0.1320
32.00	4.500	12.00	0.	4.080	2.100	0.1320
32.00	5.000	12.00	0.	4.080	2.100	0.1320
32.00	3.000	13.00	20000.	4.170	2.100	0.1320
32.00	3.500	13.00	20000.	4.170	2.100	0.1320
32.00	4.000	13.00	600.	4.170	2.100	0.1320
32.00	4.500	13.00	0.	4.170	2.100	0.1320
32.00	5.000	13.00	0.	4.170	2.100	0.1320
32.00	3.000	14.00	20000.	4.250	2.100	0.1320
32.00	3.500	14.00	20000.	4.250	2.100	0.1320
32.00	4.000	14.00	5300.	4.250	2.100	0.1320
32.00	4.500	14.00	0.	4.250	2.100	0.1320
32.00	5.000	14.00	0.	4.250	2.100	0.1320
32.00	3.000	15.00	20000.	4.320	2.100	0.1320
32.00	3.500	15.00	20000.	4.320	2.100	0.1320
32.00	4.000	15.00	20000.	4.320	2.100	0.1320
32.00	4.500	15.00	0.	4.320	2.100	0.1320
32.00	5.000	15.00	0.	4.320	2.100	0.1320
32.00	3.000	16.00	20000.	4.370	2.100	0.1320
32.00	3.500	16.00	20000.	4.370	2.100	0.1320

H	V	D	TC	VC	W	Z
32.00	4.000	16.00	20000.	4.370	2.100	0.1320
32.00	4.500	16.00	0.	4.370	2.100	0.1320
32.00	5.000	16.00	0.	4.370	2.100	0.1320
32.00	3.000	17.00	20000.	4.410	2.100	0.1320
32.00	3.500	17.00	20000.	4.410	2.100	0.1320
32.00	4.000	17.00	20000.	4.410	2.100	0.1320
32.00	4.500	17.00	0.	4.410	2.100	0.1320
32.00	5.000	17.00	0.	4.410	2.100	0.1320
32.00	3.000	18.00	20000.	4.450	2.100	0.1320
32.00	3.500	18.00	20000.	4.450	2.100	0.1320
32.00	4.000	18.00	20000.	4.450	2.100	0.1320
32.00	4.500	18.00	0.	4.450	2.100	0.1320
32.00	5.000	18.00	0.	4.450	2.100	0.1320
32.00	3.000	19.00	20000.	4.480	2.100	0.1320
32.00	3.500	19.00	20000.	4.480	2.100	0.1320
32.00	4.000	19.00	20000.	4.480	2.100	0.1320
32.00	4.500	19.00	0.	4.480	2.100	0.1320
32.00	5.000	19.00	0.	4.480	2.100	0.1320
32.00	3.000	20.00	20000.	4.500	2.100	0.1320
32.00	3.500	20.00	20000.	4.500	2.100	0.1320
32.00	4.000	20.00	20000.	4.500	2.100	0.1320
32.00	4.500	20.00	113.	4.500	2.100	0.1320
32.00	5.000	20.00	0.	4.500	2.100	0.1320