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VENTING OF A HIGH-ENTHALPY GAS FROM AN UNDERGROUND CAVITY THROUGH A VERTICAL HOLE ONE-HALF MILE LONG

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VENTING OF A HIGH-ENTHALPY GAS FROM AN UNDERGROUND CAVITY THROUGH A VERTICAL HOLE ONE-HALF MILE LONG

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ABSTRACT

The flow characteristics of the hot, high-pressure products of a methane-oxygen combustion exhausting from a large, spherical, underground cavity through a 1/2-mile-long hole were calculated. The results are presented in tabular form.

Summary

A numerical solution of the flow characteristics of a particular high-enthalpy gas venting from a 110-foot-diameter subterranean cavity was obtained. The vent was assumed to be a steel-lined, vertical, 1/2-mile-long hole, initially 9 inches in diameter. The calculations assumed an ideal gas and included wall friction as well as heat transfer to and ablation of the vent walls. These calculations were made using the one dimensional quasi-static equations of the conservation of energy, mass, and momentum. The results indicate a mass flow rate which grows rapidly with time because of the sudden melting and subsequent erosion of the vent walls.

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LIST OF SYMBOLS

A	pipe cross-sectional area	ft^2
B	$C_{pw}\left(T_{\substack{fusion\\wall}} - T_g\right)$	BTU/lb_m
C_p	specific heat of the gas at constant pressure	$BTU/lb_m\text{-}^\circ R$
C_{pw}	specific heat of the wall material at constant pressure	$BTU/lb_m\text{-}^\circ R$
C_{pg}	specific heat of the ground	$BTU/lb_m\text{-}^\circ R$
D_H	hydraulic diameter of the pipe (= r)	ft
f	friction factor	
g	acceleration due to gravity	ft/sec^2
h_c	convective heat transfer coefficient	$BTU/ft^2\text{-sec-}^\circ R$
J	mechanical equivalent to heat	ft-lbs/BTU
K_g	thermal conductivity of the ground (salt)	$BTU/ft^2\text{-sec-}^\circ R$
M_i	Mach number at the pipe inlet	
$\dot{M}$	mass flow rate	lbs_m/sec
p	gas pressure in the pipe	lbs/ft^2
p_i	gas pressure at the pipe inlet	lbs/ft^2
Pr	Prandtl number of the gas	
Q	heat added to the gas	BTU/lb_m
r	pipe inner radius	ft
Δr	initial wall thickness of the iron tube	ft
R	gas constant for the given gas composition	$lbs\text{-}ft/lb_m\text{-}^\circ R$
$\mathcal{R}$	universal gas constant	$lbs\text{-}ft/lb_m\text{-}^\circ R\text{-mol wt}$

Re	Reynolds number based on pipe diameter	
T	gas temperature in the pipe	$^{\circ}R$
T_g	ambient temperature of the ground	$^{\circ}R$
T_i	gas temperature at the pipe inlet	$^{\circ}R$
T_w	pipe wall temperature	$^{\circ}R$
$T_{fusion\ wall}$	melting temperature of the wall material	$^{\circ}R$
$U_{Fusion\ wall}$	heat of fusion of the wall material	BTU/lb_m
v	gas velocity	ft/sec
V_s	volume of the sphere	ft^3
x	distance up the pipe	ft
α_g	thermal diffusivity of the ground	ft^2/sec
β	adiabatically expanding gas constant	$lbs\text{-}lbs_m^{-\gamma}/ft^{(3\gamma-2)}$
γ	ratio of specific heats	
μ	gas dynamic viscosity	$lb\text{-}sec/ft^2$
ρ	gas density in the pipe	lbs_m/ft^3
ρ_i	gas density at the pipe inlet	lbs_m/ft^3
ρ_w	density of wall material	lbs_m/ft^3

VENTING OF A HIGH-ENTHALPY GAS FROM AN UNDERGROUND CAVITY THROUGH A VERTICAL HOLE ONE-HALF MILE LONG

Introduction

In connection with a test-site safety question, the following problem was presented.

Consider a spherical cavity, 110 feet in diameter, to be located in a sodium chloride (salt) bed extending to the ground surface. The sphere is connected with the ground surface by a vertical circular hole 2660 feet long. Assume that the hole is lined with an iron tube of 9-inch inside and 11-inch outside diameter. The bottom 10 feet of the hole (pipe) is plugged. The spherical cavity is filled with a gas whose composition, temperature, pressure, and mass are given. The question to be answered is: "If the plug is assumed to disappear, what will be the mass flow rate, gas velocity, and gas temperature at the exhaust end of the pipe at the ground surface as a function of time?"

The geometry of the problem is shown in Figure 1.

Gas Conditions

Specifically, two cases were to be considered. These were:

	Case I	Case II
Pressure	175 atmospheres	490 atmospheres
Mass	5.715×10^5 pounds	1.519×10^6 pounds
Temperature	2500° Kelvin	2500° Kelvin

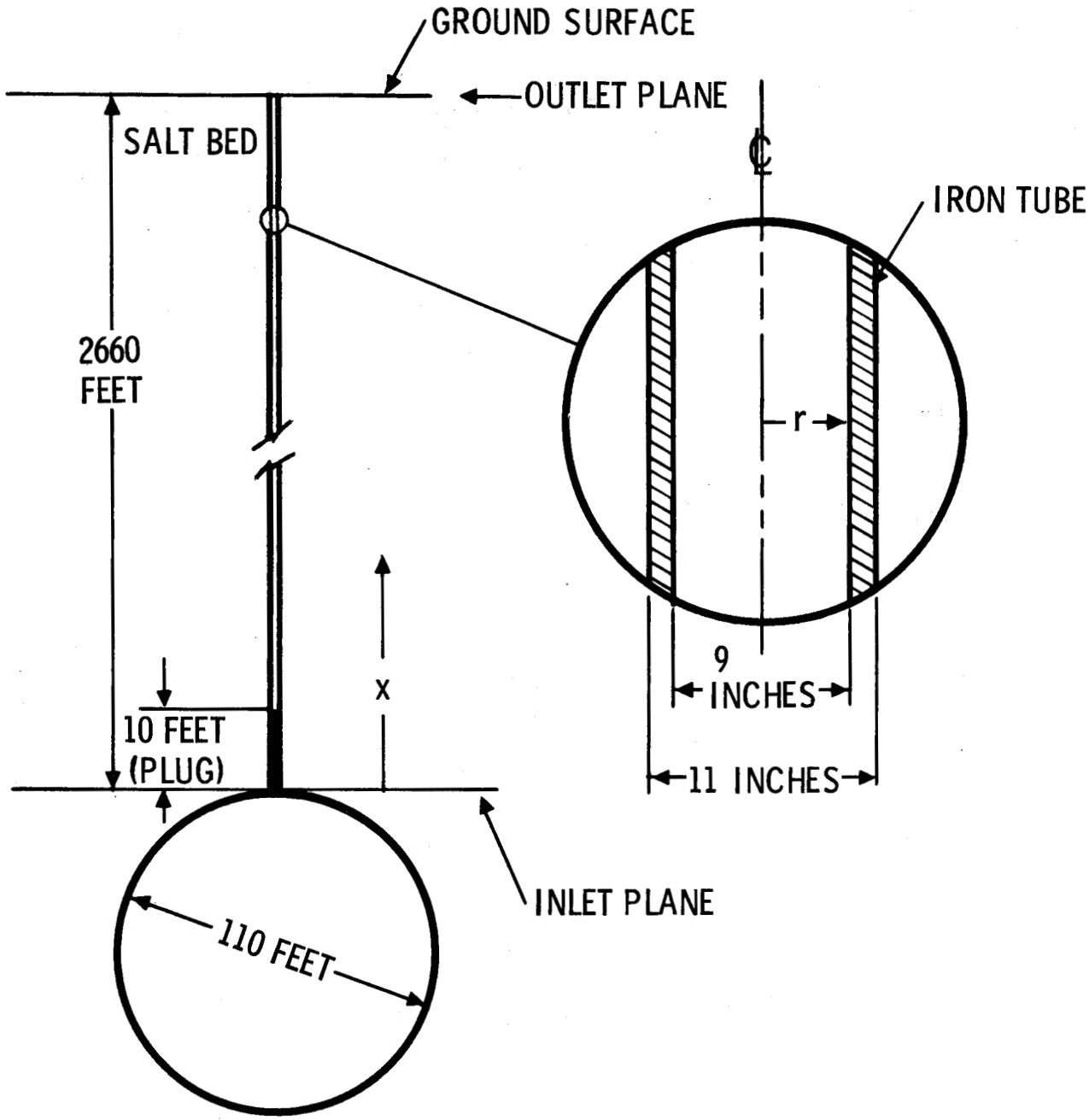

Figure 1. Vertical section through the spherical cavity and vent located in a salt bed.

The mass is considered the most reliable and the temperature the least reliable figure. In both cases, the gas composition was assumed to be:

Constituent	Weight %	Constituent	Weight %
H_2O	34	O_2	2
CO	29	H_2	1.5
CO_2	17	O	5.5
OH	6	NO	
N_2	5	H	

On examining the thermodynamic relations for the various constituents, it was noticed that there should be no marked dissociation or high-pressure deviation from the ideal gas relationships. Therefore, for the purposes of analysis, the gas composition was considered as fixed and to obey the equation of state,

$$p = \rho RT \ , \tag{1}$$

where

p = pressure,

ρ = density,

T = temperature, and

R = gas constant for the stated gas composition.

The mean value of R calculated from equation (1) and the given conditions in the cavity is 101.629 (lbs-ft/lb_m-°R). Associated with this is a mean value of C_p of 0.5369 (BTU/lb_m-°R) and a γ of 1.40. As is shown in the appendix, this value of R implies a rather large (0.27) mole fraction of atomic hydrogen. Therefore, a second gas composition was considered in which there

was no atomic hydrogen. The corresponding values of R, C_p, and γ are 75.873 (lbs-ft/lb_m-°R), 0.6111 (BTU/lb_m-°R) and 1.30, respectively. Since there was no available means of deciding which set of constants to use in the following calculations, both cases were treated.

Governing Equations

Spherical Cavity

If the gas in the cavity is assumed to expand adiabatically, and using the subscript "s" to denote conditions inside the spherical cavity,

$$p_s \rho_s^{-\gamma} = p_s \rho_s^{-\gamma}\Big]_{t-0} = \beta \text{ (a constant)} , \tag{2}$$

so that

$$\rho_s = \left(\frac{p_s}{\beta}\right)^{1/\gamma} \tag{3}$$

The mass flow rate, $\dot{M}$, out of the sphere is

$$\dot{M} = -V_s \frac{d\rho_s}{dt} = -\frac{V_s}{\gamma}\left[\frac{p_s^{\left(\frac{1}{\gamma}-1\right)}}{\beta^{(1/\gamma)}}\right]\frac{dp_s}{dt} , \tag{4}$$

where V_s is the volume of the cavity and t is time. This mass flow rate, which varies with time, is also the mass flow rate of the gas entering the bottom end of the pipe.

Vertical Pipe

The equations governing the flow in the vertical pipe are the equations of energy, momentum, and mass balance, and of the associated initial and boundary conditions. The equations of energy, momentum, and mass are:

$$-\frac{dQ}{dx} + C_p \frac{dT}{dx} + \frac{1}{2Jg}\frac{d(v^2)}{dx} + \frac{1}{J} = 0 \ , \qquad \text{(energy)} \qquad (5)$$

$$\frac{dp}{dx} + \frac{f}{D_H}\frac{p}{RT}\frac{v^2}{2g} + \frac{p}{RT} + \frac{pv}{RTg}\frac{dv}{dx} = 0 \ , \qquad \text{(momentum)} \qquad (6)$$

$$\frac{d}{dx}(\rho vA) = 0 \ , \qquad \text{(mass)} \qquad (7)$$

where

$\frac{dQ}{dx}$ = heat added to a pound of the gas while traveling the distance dx,

C_p = specific heat of the gas,

A = cross-sectional area of the pipe,

J = the mechanical equivalent of heat,

g = acceleration due to gravity,

v = velocity of the gas,

f = friction factor,

D_H = hydraulic diameter of the pipe, and

x = distance up the pipe.

Equation (7), as written here, implies a quasi-static situation by requiring that the mass flow rate at any instant of time be the same at all points

along the pipe. This mass flow rate out of the pipe is related to the mass flow rate out of the sphere by

$$\dot{M} = \rho v A \ . \tag{8}$$

It is possible to write the rate at which heat is lost by the gas to the pipe wall as

$$-\frac{dQ}{dx} = \left[\frac{2h_c(T - T_w)RT}{gvrp}\right], \tag{9}$$

where

T_w = the wall temperature,

r = the pipe radius, and

h_c = the connective heat-transfer coefficient.

The heat-transfer coefficient can be written as

$$h_c = \left[\frac{0.023C_p\rho v}{Re^{0.2}\ Pr^{0.333}}\right], \tag{10}$$

where

Re = the gas Reynolds number based on pipe diameter, and

Pr = the gas Prandtl number.

The friction factor, f, depends very strongly on the pipe wall roughness. Since it is not known how the surface will behave, calculations were made for both a rough (f = 0.75) and a smooth (f = 0.15) wall.

The wall temperature, T_w, when $T_w < T_{\substack{fusion \\ wall}}$, is obtained from the differential equation

$$\frac{dT_w}{dt} = \frac{1}{C_{pw}\rho_w \Delta r}\left[h_c(T - T_w) - \frac{K_g(T_w - T_g)}{\sqrt{\pi\alpha_g t}}\right], \tag{11}$$

where

Δr = the initial wall thickness of the iron tube,

C_{pw} = the specific heat of the wall material,

K_g = the thermal conductivity of the ground,

ρ_w = the density of the wall material,

T_g = the initial ground temperature,

α_g = the thermal diffusivity of the ground, and

$T_{\substack{fusion \\ wall}}$ = the melting temperature of the wall material.

If T_w calculates to greater than $T_{\substack{fusion \\ wall}}$, T_w is to be set equal to $T_{\substack{fusion \\ wall}}$.

The term $h_c(T - T_w)$ represents the rate at which heat is transferred from the gas to the iron tube, and assumes the tube is isothermal. The second term, $K_g(T_w - T_g)/\sqrt{\pi\alpha_g t}$, is a one-dimensional approximation to the rate at which heat is lost by the iron tube to the ground.

If it is assumed that the radius of the pipe is allowed to increase as a result of the absorbed heat's raising the wall temperature to the melting point of the wall material, an approximation to the recession rate of the wall can be obtained as follows.

Assume that at time zero the wall temperature is at some ambient temperature below the melting temperature of the wall. As the hot gases pass up the pipe, they raise the temperature of the wall to its melting temperature. The wall remains at this melting temperature while still absorbing heat, until sufficient heat has been absorbed to melt a layer of the wall surface. The melted wall material is assumed to blow away at the instant it is melted.

This process can be represented by

$$\frac{dr}{dt} = \begin{cases} 0 , & T < T_{\substack{fusion \\ wall}} \\ \left(\dfrac{h_c \left(T - T_{\substack{fusion \\ wall}} \right)}{\rho_w U_{\substack{fusion \\ wall}} + B} \right) , & T \geq T_{\substack{fusion \\ wall}} \end{cases} , \tag{12}$$

where $U_{\substack{fusion \\ wall}}$ is the heat of fusion of the wall material and r is the pipe radius. Initially, $U_{\substack{fusion \\ wall}}$ and $T_{\substack{fusion \\ wall}}$ are the values for iron and B = 0. After the iron has eroded away, $U_{\substack{fusion \\ wall}}$ and $T_{\substack{fusion \\ wall}}$ are changed to those values for the ground (salt), and $B = C_{pg}(T_{\substack{fusion \\ wall}} - T_g)$.

In addition to the conservation of mass, the other boundary conditions that relate the output of the sphere and the input to the pipe are contained in the equations for isentropic flow. These are

$$\frac{p_s}{p_i} = \left[1 + \left(\frac{\gamma - 1}{2}\right)M_i^2\right]^{\frac{\gamma}{\gamma - 1}} , \tag{13}$$

and

$$\frac{T_s}{T_i} = 1 + \left(\frac{\gamma - 1}{2}\right)M_i^2 , \tag{14}$$

where p_i, T_i, and M_i are the pressure, temperature, and Mach number, respectively, at the point where the sphere and pipe meet. The mass flow rate at this point is given by

$$\dot{M} = \rho v A = A \frac{\sqrt{g\gamma}\, p_s M_i}{\sqrt{RT_s}} \left[1 + \left(\frac{\gamma - 1}{2}\right)M_i^2\right]^{-\frac{1}{2}\left(\frac{\gamma+1}{\gamma-1}\right)} . \tag{15}$$

In order to keep the problem reasonably simple, it is assumed that the pipe inlet has been initially contoured or has developed a contour in a very short time, such that there exists no "vena contracta." Furthermore, in the model used here, all "start up" transients are ignored.

It is known that, for a straight pipe with no input losses, any choking that occurs will occur at the pipe exit. Although there is no guarantee that this situation will be true, as the pipe radius (and therefore the heat transfer) varies with distance up the pipe and with time, it is assumed to be true for the sake of the calculations, and is justified by the results of the calculations. Therefore, the boundary conditions at the exhaust end of the pipe are set by whether there is or is not choked flow. If the flow is choked, the velocity at the exit is Mach 1, i.e.,

$$v = \sqrt{\gamma RT} \ . \tag{16}$$

If the flow is not choked, the static pressure in the exhaust stream is set equal to the ambient pressure.

Method of Solution

Since the problem given here involved specific numbers, it appeared that an iterated solution was the most practical. The procedure was as follows.

The solution is started by assuming a value for the Mach number at the input to the pipe. Values of p_i and T_i are then computed from equations (13) and (14). ρ_i, the density at the pipe input, is computed from equation (1). The mass flow rate is computed from equation (15).

Using these values as starting values, equations (5), (6), and (7), in conjunction with equations (8), (9), (10), and (11), are integrated numerically along the pipe from the sphere up to the surface of the ground. The output conditions are then compared with the pertinent exit criteria (Mach 1, or exit pressure = ambient pressure) and the input Mach number varied until the appropriate exit condition is satisfied to within 5%. After a convergent (steady state) solution has been obtained, it is assumed to persist for a short period of time. The variations caused by the losses over this short time period are then computed and subtracted from the initial input conditions. This process is continued until some arbitrary cutoff criterion is reached. In the particular cases at hand, the cutoff was set at the point where the pressure in the sphere had dropped to 1% of its initial value.

Results

The results of the present analysis consist of the computer printout for the eight combinations of the input data given in Table I. The output is listed in Tables II through IX. This output is given in two groups of data. The first group, Set A of Tables II through IX, is a tabulation of various computed quantities versus time. The second group, Set B of Tables II through IX, is a tabulation of quantities calculated as a function of distance along the pipe at selected times; specifically, zero time and then at 2-minute intervals.

The primary purpose in presenting the x-distributed data is to justify the assumption that choking, if it occurs, occurs at the ground surface. If this assumption had been wrong, there would have been a point in the pipe, somewhere between the sphere and the ground surface, where flow would exceed Mach 1. None of the data listed show the flow to be supersonic at any point; therefore, it is concluded that the assumed boundary condition is valid.

A second reason for giving the x-distributed data is to show that the Reynolds number stays well above 10^6 over the range of time investigated. This justifies the use of a single number for the friction factor, f, although the exact value of f may be somewhat arbitrary.

Several exploratory computer runs were made, which are not listed here, using different values of time and distance increments in order to determine values which would keep the computation time within practical limits. For the tabulated results, values were selected such that the output numbers did not vary more than about 1% for a 2:1 variation in the time and/or distance increments.

TABLE I

Parameters and Initial Conditions Used in the Computations

Initial Sphere Pressure (Atmospheres)	Initial Sphere Mass (pounds)	Initial Sphere Temperature (°R)	γ	C_p (BTU/lb_m-°R)	R (lbs-ft/lb_m-°R)	f	Table Containing Results
175	571500	4500	1.4	0.537	101.63	0.015	II
175	571500	4500	1.4	0.537	101.63	0.075	III
175	571500	5954	1.3	0.611	75.87	0.015	IV
175	571500	5954	1.3	0.611	75.87	0.075	V
490	1519000	4500	1.4	0.542	101.63	0.015	VI
490	1519000	4500	1.4	0.542	101.63	0.075	VII
490	1519000	6271	1.3	0.637	75.87	0.015	VIII
490	1519000	6271	1.3	0.637	75.87	0.075	IX

TABLE IIA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of:

Temperature = 4500°R, Pressure = 175 Atm,
Mass = 571,500 lbs, Friction factor = 0.015

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	370440.0	366532.1	31420.3	4500.0	4486.4	2589.2	558.2	3593.0	500.0	500.0	4531.9	3442.9	198.25	.375	0.0
.1	369347.1	365667.1	35128.1	4496.2	4483.4	2928.0	542.2	3571.9	1795.6	1213.3	4530.4	3661.2	192.24	.375	.2
.2	368288.3	364755.9	36088.5	4492.5	4480.2	3148.8	531.8	3665.7	2619.0	1760.8	4528.8	3796.7	188.19	.375	.4
.3	367252.6	363826.1	36032.0	4488.9	4476.9	3298.7	524.2	3780.7	3163.7	2190.3	4527.1	3886.0	185.19	.375	.6
.4	366234.2	363499.4	38284.9	4485.3	4475.7	3416.0	468.7	3851.7	3258.0	2540.9	4526.6	3954.5	193.62	.375	.8
.5	365170.4	362577.8	43991.1	4481.6	4472.5	3504.9	456.7	3827.8	3258.0	2841.0	4524.9	4005.7	214.86	.375	1.0
.6	363990.8	361348.4	50094.4	4477.5	4468.2	3561.6	461.7	3876.7	3258.0	3066.2	4522.7	4037.9	244.03	.375	1.2
.7	362652.3	359819.5	52591.9	4472.8	4462.8	3590.7	478.7	3917.5	3258.0	3258.0	4520.0	4054.4	276.93	.388	1.5
.8	361135.0	358647.6	56446.8	4467.4	4458.6	3623.1	449.1	3897.7	1933.5	3258.0	4517.9	4072.6	311.91	.401	1.8
.9	359428.0	356998.3	58370.5	4461.4	4452.7	3560.5	444.6	3853.5	1933.5	3258.0	4514.9	4037.3	359.37	.419	2.1
1.0	357463.9	354851.3	60578.5	4454.4	4445.1	3431.3	462.0	3847.4	1933.5	3258.0	4511.0	3963.4	427.67	.433	2.5
1.1	355130.3	352308.0	68404.8	4446.1	4435.9	3433.3	481.4	3880.2	1933.5	3258.0	4506.4	3964.5	505.89	.453	3.0
1.2	352374.9	349347.3	77757.7	4436.2	4425.3	3504.6	500.0	3849.6	1933.5	3258.0	4501.0	4005.5	592.06	.466	3.5
1.3	349157.4	345914.1	81630.2	4424.6	4412.8	3538.5	519.3	3993.5	1933.5	3258.0	4494.6	4024.8	687.64	.480	4.1
1.4	345430.3	341829.3	77829.8	4411.0	4397.8	3550.6	549.4	3918.2	1933.5	1933.5	4487.0	4031.7	807.68	.545	4.9
1.5	341065.9	337116.7	73915.7	4395.0	4380.4	3560.8	578.1	3912.7	1933.5	1933.5	4478.1	4037.5	938.55	.604	5.7
1.6	336012.7	331781.3	72448.6	4376.3	4360.5	3571.5	601.7	3869.3	1933.5	1933.5	4467.9	4043.6	1072.74	.658	6.7
1.7	330261.7	325766.3	70798.7	4354.8	4337.8	3579.3	624.1	3858.0	1933.5	1933.5	4456.2	4047.9	1213.97	.710	7.9
1.8	323785.6	319067.4	69350.9	4330.2	4312.1	3580.0	644.1	3847.5	1933.5	1933.5	4443.0	4048.3	1357.66	.759	9.2
1.9	316583.8	311692.3	67740.4	4302.5	4283.4	3566.3	661.2	3841.6	1933.5	1933.5	4428.2	4040.6	1500.15	.807	10.6
2.0	308677.1	303644.7	65319.4	4271.5	4251.5	3542.8	676.8	3869.6	1933.5	1933.5	4411.7	4027.3	1641.29	.854	12.2
2.1	300088.8	294951.5	64609.0	4237.2	4216.3	3536.1	690.9	3823.5	1933.5	1933.5	4393.4	4023.4	1778.02	.897	14.0
2.2	290859.7	285681.6	62981.6	4199.5	4178.1	3504.5	701.5	3826.0	1933.5	1933.5	4373.4	4005.4	1902.68	.938	15.9
2.3	281071.3	275817.2	54778.8	4158.7	4136.3	3401.4	715.4	4076.8	1933.5	1933.5	4351.5	3946.1	2030.43	.980	17.9
2.4	270727.4	265479.1	55097.7	4114.4	4091.4	3401.9	724.8	3968.4	1933.5	1933.5	4327.9	3946.3	2138.08	1.020	20.1
2.5	259951.1	254755.7	57237.8	4066.9	4043.5	3422.7	731.7	3764.7	1933.5	1933.5	4302.4	3958.4	2228.78	1.061	22.4
2.6	248847.3	243707.5	51404.6	4016.5	3992.6	3334.6	739.3	3922.8	1933.5	1933.5	4275.3	3907.1	2309.73	1.095	24.7
2.7	237482.8	232442.8	49301.6	3963.2	3939.0	3294.7	744.5	3903.4	1933.5	1933.5	4246.5	3883.7	2370.71	1.131	27.2
2.8	225973.1	221054.1	48080.9	3907.3	3882.8	3268.5	748.8	3829.6	1933.5	1933.5	4216.1	3868.2	2415.30	1.163	29.7
2.9	214412.2	209636.3	43051.7	3849.1	3824.5	3174.2	751.8	3964.5	1933.5	1933.5	4184.3	3812.0	2442.47	1.193	32.3
3.0	202895.3	198286.5	44654.9	3788.9	3764.1	3193.7	753.3	3722.7	1933.5	1933.5	4151.1	3823.7	2451.22	1.220	34.9
3.1	191518.0	187082.6	39107.5	3726.9	3702.1	3085.3	754.5	3893.7	1933.5	1933.5	4116.8	3758.2	2445.96	1.246	37.6
3.2	180350.8	176104.5	36921.8	3663.5	3638.7	3034.4	754.3	3869.1	1933.5	1933.5	4081.4	3727.1	2424.47	1.271	40.2
3.3	169470.0	165425.2	38710.8	3599.0	3574.2	3057.7	752.7	3586.6	1933.5	1933.5	4045.1	3741.4	2388.06	1.293	42.8
3.4	158941.6	155095.2	36130.3	3533.6	3509.0	2999.3	751.1	3578.8	1933.5	1933.5	4008.0	3705.5	2341.86	1.313	45.4
3.5	148804.3	145161.8	34664.7	3467.7	3443.2	2959.8	748.4	3497.9	1933.5	1933.5	3970.3	3681.0	2284.33	1.332	47.9

TABLE IIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	139100.5	135659.1	32256.4	3401.5	3377.3	2900.9	745.2	3485.9	1933.5	1933.5	3932.0	3644.2	2218.95	1.349	50.3
3.7	129854.3	126613.8	30416.3	3335.3	3311.3	2851.5	741.1	3437.4	1933.5	1933.5	3893.5	3613.1	2145.96	1.365	52.7
3.8	121086.3	118050.0	28051.6	3269.4	3245.7	2785.4	735.5	3443.2	1933.5	1380.0	3854.7	3570.9	2065.15	1.378	55.0
3.9	112815.3	109964.8	26285.2	3203.9	3180.6	2734.5	730.9	3406.0	1933.5	1933.5	3815.8	3538.1	1984.79	1.390	57.2
4.0	105025.2	102353.1	24840.0	3139.1	3116.1	2689.0	726.0	3349.3	1933.5	1933.5	3776.9	3508.6	1902.25	1.400	59.4
4.1	97710.2	95213.3	23276.3	3075.0	3052.4	2639.5	720.2	3304.7	1933.5	1933.5	3738.1	3476.2	1816.94	1.410	61.4
4.2	90865.9	88533.3	21417.4	3011.9	2989.6	2579.0	714.4	3305.1	1933.5	1933.5	3699.5	3436.1	1732.41	1.419	63.4
4.3	84474.0	82298.0	20201.6	2949.8	2927.8	2535.4	708.2	3248.0	1933.5	1933.5	3661.1	3406.9	1648.28	1.427	65.2
4.4	78517.9	76488.3	18566.4	2888.8	2867.2	2478.5	702.1	3243.0	1933.5	1933.5	3623.0	3368.4	1566.13	1.433	67.0
4.5	72975.7	71084.7	17388.2	2829.0	2807.8	2433.1	695.6	3200.8	1933.5	1933.5	3585.3	3337.4	1485.59	1.439	68.7
4.6	67827.3	66066.2	16300.2	2770.5	2749.7	2389.5	689.1	3153.6	1933.5	1933.5	3548.0	3307.4	1407.51	1.445	70.3
4.7	63050.4	61410.4	14959.9	2713.2	2692.9	2335.6	682.6	3153.6	1933.5	1933.5	3511.1	3269.9	1332.35	1.449	71.8
4.8	58622.0	57095.0	14116.8	2657.4	2637.4	2297.1	676.0	3096.8	1933.5	1933.5	3474.8	3242.8	1260.20	1.453	73.2
4.9	54519.7	53098.8	13098.0	2602.9	2583.3	2250.0	669.2	3073.8	1933.5	1933.5	3438.9	3209.5	1190.77	1.457	74.6
5.0	50722.8	49400.2	12258.3	2549.7	2530.6	2209.2	662.5	3034.0	1933.5	1933.5	3403.6	3180.2	1124.85	1.460	75.8
5.1	47209.4	45978.0	11390.0	2498.0	2479.2	2165.6	655.9	3014.8	1933.5	1933.5	3368.9	3148.7	1062.16	1.462	77.0
5.2	43959.1	42812.5	10571.5	2447.6	2429.2	2122.7	649.2	2995.7	1933.5	1933.5	3334.8	3117.3	1002.67	1.464	78.2
5.3	40952.8	39884.6	9941.4	2398.5	2380.5	2087.5	642.7	2948.1	1933.5	1933.5	3301.2	3091.4	946.45	1.466	79.3
5.4	38171.9	37176.2	9180.8	2350.8	2333.1	2044.5	636.3	2943.9	1933.5	1933.5	3268.2	3059.3	893.40	1.467	80.3
5.5	35599.1	34670.5	8512.8	2304.4	2287.1	2004.4	629.9	2928.4	1933.5	1933.5	3235.8	3029.2	843.38	1.468	81.2
5.6	33218.2	32351.8	8035.8	2259.3	2242.3	1973.7	623.7	2879.1	1933.5	1933.5	3203.9	3005.9	796.27	1.469	82.1
5.7	31014.4	30205.4	7469.1	2215.4	2198.7	1936.4	617.7	2861.8	1933.5	1933.5	3172.7	2977.4	751.92	1.469	83.0
5.8	28973.8	28218.0	6866.9	2172.7	2156.4	1895.8	611.7	2866.0	1933.5	1933.5	3142.0	2946.0	710.21	1.470	83.8
5.9	27083.4	26377.0	6530.8	2131.3	2115.2	1870.7	605.8	2798.6	1933.5	1933.5	3111.8	2926.5	670.97	1.470	84.6
6.0	25331.6	24670.9	5915.2	2090.9	2075.2	1825.8	600.1	2834.8	1933.5	1886.0	3082.2	2891.1	634.09	1.470	85.3
6.1	23707.5	23089.1	5577.4	2051.7	2036.3	1798.1	594.4	2790.7	1933.5	1844.1	3053.2	2869.1	599.43	1.470	86.0
6.2	22200.9	21621.8	4896.2	2013.6	1998.4	1741.4	588.9	2885.6	1933.5	1844.1	3024.7	2823.5	566.86	1.470	86.6
6.3	20802.6	20261.4	4541.3	1976.5	1961.7	1706.7	582.6	2888.8	1933.5	1844.1	2996.7	2795.2	535.54	1.470	87.2
6.4	19505.9	18998.5	4255.9	1940.5	1925.9	1678.7	577.3	2856.4	1933.5	1663.9	2969.3	2772.2	506.85	1.470	87.8
6.5	18301.1	17825.7	4012.2	1905.5	1891.2	1652.4	571.6	2824.0	1925.9	1663.9	2942.4	2750.4	479.54	1.470	88.3
6.6	17181.7	16735.5	3785.6	1871.4	1857.4	1625.3	566.5	2790.8	1891.2	1599.2	2916.0	2727.7	454.29	1.470	88.8
6.7	16140.3	15721.0	3458.3	1838.3	1824.5	1585.4	561.4	2812.5	1857.4	1599.2	2890.1	2694.1	430.58	1.470	89.3
6.8	15170.7	14777.5	3436.4	1806.0	1792.5	1577.2	555.9	2700.6	1824.5	1599.2	2864.6	2687.1	407.86	1.470	89.8
6.9	14268.3	13898.5	3319.5	1774.7	1761.4	1561.2	551.0	2621.8	1792.5	1525.6	2839.6	2673.4	386.97	1.470	90.2
7.0	13427.0	13079.1	3122.7	1744.1	1731.1	1534.1	546.2	2595.0	1761.4	1579.1	2815.1	2650.1	367.33	1.470	90.6
7.1	12642.2	12314.6	2898.5	1714.4	1701.5	1475.3	541.6	2728.5	1731.1	1579.1	2791.0	2598.8	348.85	1.470	91.0
7.2	11909.6	11602.0	2811.3	1685.4	1672.8	1485.3	536.0	2543.8	1701.5	1579.1	2767.3	2607.6	330.90	1.470	91.4
7.3	11226.4	10936.5	2635.7	1657.2	1644.8	1459.0	531.5	2526.5	1672.8	1521.1	2744.1	2584.4	314.56	1.470	91.8
7.4	10587.8	10314.4	2559.6	1629.7	1617.5	1444.6	527.1	2450.7	1644.8	1472.9	2721.2	2571.6	299.16	1.470	92.1
7.5	9990.6	9732.6	2409.1	1602.8	1590.9	1420.0	522.8	2434.6	1617.5	1472.9	2698.7	2549.7	284.64	1.470	92.4

TABLE IIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
7.6	9431.7	9188.1	2224.9	1576.7	1565.0	1389.8	518.5	2449.7	1590.9	1472.9	2676.6	2522.4	270.93	1.470	92.7
7.7	8908.4	8678.3	2046.3	1551.2	1539.6	1358.8	514.3	2475.9	1565.0	1472.9	2654.9	2494.1	258.00	1.470	93.0
7.8	8418.2	8200.7	1909.0	1526.3	1514.9	1332.8	510.1	2476.5	1539.6	1472.9	2633.5	2470.2	245.78	1.470	93.3
7.9	7958.6	7754.1	2204.0	1502.0	1490.9	1369.1	504.7	2109.4	1514.9	1472.9	2612.5	2503.5	233.65	1.470	93.6
8.0	7528.7	7335.2	2155.7	1478.4	1467.4	1356.0	500.7	2021.2	1490.9	1378.2	2591.9	2491.5	222.79	1.470	93.8
8.1	7125.2	6943.5	2086.0	1455.3	1444.6	1337.5	494.9	1997.0	1467.4	1378.2	2571.6	2474.5	211.72	1.470	94.1
8.2	6747.8	6577.7	2211.9	1432.8	1422.4	1340.0	488.2	1789.8	1444.6	1322.8	2551.8	2476.8	200.93	1.470	94.3
8.3	6395.1	6233.9	2110.3	1411.0	1400.8	1320.6	484.4	1767.0	1422.4	1350.0	2532.3	2458.8	191.89	1.470	94.5
8.4	6063.4	5913.3	2212.0	1389.7	1379.8	1316.7	476.5	1584.9	1400.8	1350.0	2513.3	2455.1	181.77	1.470	94.7
8.5	5754.0	5611.5	2166.2	1369.1	1359.3	1301.8	473.0	1493.8	1379.8	1298.7	2494.6	2441.2	173.78	1.470	94.9
8.6	5462.5	5330.8	2204.0	1348.9	1339.5	1291.0	463.2	1416.2	1359.3	1298.7	2476.3	2431.1	164.06	1.470	95.1
8.7	5191.4	5066.2	2113.7	1329.4	1320.2	1273.5	459.8	1382.5	1339.5	1278.3	2458.4	2414.5	157.06	1.470	95.3
8.8	4935.6	4821.4	2222.6	1310.4	1301.6	1265.6	447.2	1238.9	1320.2	1278.3	2441.1	2407.0	147.45	1.470	95.4
8.9	4698.9	4590.2	2120.4	1292.1	1283.5	1248.1	444.1	1227.9	1301.6	1254.0	2424.0	2390.3	141.36	1.470	95.6
9.0	4475.2	4374.8	2146.8	1274.2	1266.0	1236.2	434.1	1135.6	1283.5	1254.0	2407.4	2378.9	133.53	1.470	95.7
9.1	4266.8	4171.0	2049.0	1257.0	1248.8	1219.5	431.2	1126.7	1266.0	1240.5	2391.1	2362.8	128.18	1.470	95.9
9.2	4069.4	3982.3	2115.2	1240.1	1232.4	1209.0	418.1	1015.3	1248.8	1240.5	2375.3	2352.6	120.25	1.470	96.0
9.3	3886.7	3803.6	2022.3	1223.9	1216.4	1193.3	415.4	1007.7	1232.4	1203.0	2359.8	2337.3	115.61	1.470	96.1
9.4	3713.4	3639.6	2114.4	1208.0	1201.1	1183.4	397.6	886.6	1216.4	1203.0	2344.9	2327.6	107.23	1.470	96.3

TABLE IIB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:
Temperature = 4500°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.015, Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	4486.0	558.2	4531.8	366492.8	12907613.8	.123	.375
52.4	500.0	4454.3	560.0	4515.7	362731.1	12943012.2	.124	.375
100.1	500.0	4419.9	561.9	4498.3	358600.9	12989659.6	.125	.375
153.0	500.0	4388.0	564.2	4482.0	354714.4	13030506.4	.126	.375
200.5	500.0	4354.2	566.3	4464.7	350554.0	13077225.5	.127	.375
253.4	500.0	4322.9	568.8	4448.6	346637.7	13118134.3	.128	.375
300.3	500.0	4292.9	571.1	4433.2	342846.2	13164477.3	.129	.375
353.8	500.0	4259.0	573.8	4415.6	338494.4	13205889.1	.130	.375
400.6	500.0	4229.6	576.4	4400.3	334669.4	13251501.3	.131	.375
454.0	500.0	4196.3	579.4	4383.0	330277.4	13293760.9	.132	.375
500.8	500.0	4167.4	582.3	4367.9	326415.4	13339397.3	.133	.375
554.2	500.0	4134.7	585.6	4350.7	321978.9	13381742.1	.135	.375
600.9	500.0	4106.4	588.8	4335.8	318075.9	13427396.5	.136	.375
654.3	500.0	4074.3	592.5	4318.8	313590.1	13469825.6	.137	.375
700.9	500.0	4046.4	596.0	4304.0	309641.8	13515491.8	.138	.375
754.2	500.0	4014.9	600.1	4287.2	305101.4	13558004.8	.140	.375
800.8	500.0	3987.6	604.0	4272.6	301102.7	13603676.6	.141	.375
854.0	500.0	3956.7	608.6	4256.0	296501.7	13646274.1	.143	.375
900.5	500.0	3929.9	612.8	4241.5	292447.0	13691945.8	.144	.375
953.7	500.0	3899.5	618.0	4225.1	287778.5	13734629.4	.146	.375
1000.1	500.0	3873.1	622.7	4210.8	283661.5	13781324.8	.148	.375
1053.2	500.0	3843.3	628.4	4194.6	278917.7	13823066.9	.150	.375
1100.2	500.0	3814.7	633.7	4178.9	274284.9	13870267.3	.152	.375
1152.5	500.0	3788.2	640.1	4164.4	269903.0	13911586.4	.154	.375
1200.5	500.0	3759.4	646.8	4148.6	265072.2	13958834.0	.156	.375
1251.7	500.0	3734.0	653.1	4134.5	260715.4	14000196.8	.158	.375
1304.5	500.0	3705.5	660.8	4118.7	255737.1	14047492.1	.160	.375
1350.6	500.0	3680.8	667.8	4104.9	251335.9	14093072.5	.163	.375
1402.1	500.0	3653.2	676.3	4089.5	246329.3	14135427.9	.165	.375
1452.5	500.0	3626.6	685.2	4074.6	241372.6	14180967.2	.168	.375
1501.7	500.0	3600.7	694.4	4060.0	236459.2	14225548.7	.171	.375
1550.4	500.0	3573.5	704.2	4044.7	231189.0	14273336.1	.174	.375
1603.6	500.0	3548.4	715.4	4030.4	226180.4	14318213.6	.177	.375
1650.4	500.0	3522.1	726.2	4015.5	220841.4	14364938.8	.181	.375
1700.0	500.0	3498.2	739.1	4001.8	215838.7	14406265.2	.185	.375
1750.8	500.0	3473.4	752.3	3987.6	210534.4	14455442.2	.189	.375
1800.1	500.0	3446.3	768.1	3972.1	204593.2	14500535.7	.193	.375
1851.5	500.0	3421.6	784.0	3957.8	198995.0	14545749.7	.198	.375
1900.5	500.0	3396.2	801.9	3943.0	193090.1	14593765.6	.203	.375
1950.4	500.0	3371.4	819.6	3928.6	187169.5	14640616.1	.209	.375
2000.4	500.0	3346.6	842.9	3914.2	181023.8	14686416.5	.215	.375
2050.0	500.0	3322.1	866.3	3899.8	174767.5	14731363.2	.222	.375
2100.1	500.0	3297.2	893.7	3885.2	168221.2	14779193.0	.230	.375
2150.5	500.0	3272.4	924.1	3870.5	161457.8	14828379.1	.239	.375
2200.4	500.0	3247.2	958.9	3855.6	154347.1	14876628.0	.249	.375
2251.0	500.0	3222.3	999.0	3840.7	147039.0	14926861.1	.260	.375
2300.1	500.0	3196.8	1046.0	3825.5	139317.8	14979004.1	.273	.375
2352.6	500.0	3170.7	1102.0	3809.9	131144.7	15028902.4	.289	.375
2401.6	500.0	3142.9	1172.2	3793.2	122198.2	15086060.0	.309	.375
2450.3	500.0	3112.6	1264.0	3774.8	112215.5	15145910.7	.335	.375
2500.5	500.0	3079.5	1382.2	3754.7	101340.5	15209872.3	.368	.375
2550.2	500.0	3039.6	1560.1	3730.3	88717.3	15288088.8	.418	.375
2601.0	500.0	2981.6	1858.6	3694.5	72994.5	15396881.7	.503	.375
2650.4	500.0	2774.9	2897.0	3564.2	43041.2	15653371.5	.813	.375

TABLE IIB (Cont.)

Initial temperature = 4500°R, presssure = 175 Atm, mass = 571,500 lbs, friction factor = 0.015.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	4251.4	676.8	4411.7	303626.4	34331179.6	.153	1.048
51.8	1933.5	4245.8	681.8	4408.8	301834.9	34380207.8	.155	1.047
100.0	1933.5	4239.5	687.2	4405.5	299799.5	34438408.8	.156	1.045
153.3	1933.5	4233.6	699.5	4402.4	297772.5	34668330.5	.159	1.039
203.8	1933.5	4227.5	705.1	4399.3	295722.0	34739101.4	.160	1.038
250.4	1933.5	4221.4	711.2	4396.1	293620.5	34798608.7	.162	1.036
301.0	1933.5	4215.7	717.1	4393.1	291623.7	34867171.3	.163	1.035
350.2	1933.5	4209.5	723.0	4389.9	289470.8	34932645.4	.165	1.033
400.5	1933.5	4203.4	729.6	4386.7	287293.6	34986980.6	.166	1.032
454.6	1933.5	4197.4	736.3	4383.5	285121.6	35046455.5	.168	1.030
503.0	1933.5	4191.5	742.9	4380.5	282991.5	35129748.0	.170	1.029
553.5	1933.5	4185.5	750.0	4377.3	280738.0	35187023.4	.171	1.027
600.6	1933.5	4179.4	757.0	4374.2	278470.7	35263564.7	.173	1.026
650.4	1933.5	4173.2	764.5	4370.9	276120.7	35327000.6	.175	1.025
700.4	1933.5	4167.4	771.7	4367.8	273855.2	35399589.6	.177	1.023
751.7	1933.5	4161.3	779.5	4364.7	271479.0	35466917.5	.179	1.022
800.4	1933.5	4155.3	787.7	4361.5	269091.6	35525570.8	.181	1.020
853.9	1933.5	4149.2	795.8	4358.3	266636.4	35601008.1	.183	1.019
900.9	1933.5	4143.1	804.4	4355.1	264159.1	35663918.7	.185	1.017
950.3	1933.5	4137.0	813.1	4351.9	261621.8	35737116.5	.187	1.016
1000.5	1933.5	4130.9	838.5	4348.7	258846.0	36212060.9	.193	1.005
1050.2	1933.5	4124.8	848.8	4345.5	256145.0	36208971.8	.195	1.004
1100.1	1933.5	4118.9	858.7	4342.4	253507.5	36289101.4	.198	1.002
1151.2	1933.5	4112.3	870.1	4338.9	250539.3	36346945.8	.201	1.001
1200.4	1933.5	4106.1	881.2	4335.6	247673.7	36428872.5	.203	.999
1250.6	1933.5	4099.8	892.6	4332.3	244718.4	36473353.2	.206	.998
1300.3	1933.5	4093.5	905.1	4329.0	241726.9	36559550.8	.209	.997
1350.1	1933.5	4087.2	918.0	4325.6	238689.2	36632077.1	.212	.995
1401.3	1933.5	4081.2	930.8	4322.5	235778.9	36698256.9	.215	.994
1450.2	1933.5	4074.7	945.1	4319.0	232536.6	36771447.3	.219	.992
1501.6	1933.5	4068.4	959.5	4315.6	229342.8	36847723.7	.222	.991
1550.8	1933.5	4061.4	975.6	4312.0	225817.1	36923589.9	.226	.989
1600.1	1933.5	4054.9	991.6	4308.5	222441.0	36992869.3	.230	.988
1650.3	1933.5	4048.3	1008.8	4305.0	218954.8	37075482.4	.234	.986
1700.6	1933.5	4041.7	1026.6	4301.5	215449.9	37141450.7	.239	.985
1750.2	1933.5	4034.8	1045.7	4297.8	211745.3	37225978.3	.243	.984
1800.8	1933.5	4028.4	1065.0	4294.4	208254.9	37299052.0	.248	.982
1851.0	1933.5	4021.2	1087.3	4290.6	204272.6	37380270.9	.253	.980
1902.1	1933.5	4014.1	1109.9	4286.8	200332.3	37467400.3	.259	.979
1950.2	1933.5	4006.5	1135.8	4282.7	196058.0	37512681.6	.265	.977
2000.8	1933.5	3999.2	1161.8	4278.8	191879.4	37635749.5	.272	.976
2050.9	1933.5	3991.5	1190.6	4274.7	187495.9	37713297.8	.279	.974
2100.2	1933.5	3983.5	1221.8	4270.4	182919.0	37789971.4	.286	.973
2150.2	1933.5	3975.4	1255.4	4266.0	178213.2	37837500.0	.294	.971
2200.1	1933.5	3966.9	1326.0	4261.5	172837.7	38400304.7	.311	.959
2251.2	1933.5	3957.0	1373.3	4256.2	167118.5	38499402.7	.323	.957
2300.4	1933.5	3946.7	1425.2	4250.6	161235.4	38617545.4	.335	.955
2351.4	1933.5	3935.6	1483.6	4244.7	155105.1	38743660.9	.350	.953
2400.4	1933.5	3923.8	1549.7	4238.3	148729.6	38861807.5	.366	.951
2450.5	1933.5	3909.3	1633.1	4230.5	141362.0	38996174.7	.386	.948
2500.3	1933.5	3893.0	1731.4	4221.6	133571.1	39118371.0	.410	.945
2550.4	1933.5	3872.5	1856.7	4210.5	124703.2	39379338.3	.441	.942
2600.2	1933.5	3841.5	2098.8	4193.6	112928.1	40007893.6	.500	.927
2650.7	1933.5	3765.8	2682.4	4152.0	92376.7	41727541.3	.646	.897

TABLE IIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.015.
Time - 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	3116.1	726.0	3776.9	102346.7	28730785.8	.192	1.606
54.8	1933.5	3113.7	731.3	3775.5	101674.0	28744537.2	.194	1.605
104.8	1933.5	3111.4	737.3	3774.1	100987.5	28769399.1	.195	1.603
152.5	1933.5	3109.2	745.3	3772.8	100314.7	28839897.6	.198	1.599
202.5	1933.5	3106.8	751.1	3771.3	99611.1	28884301.3	.199	1.598
252.5	1933.5	3104.5	757.5	3769.9	98895.6	28916803.3	.201	1.596
302.5	1933.5	3102.1	763.9	3768.5	98172.5	28953086.1	.203	1.595
352.5	1933.5	3099.8	770.6	3767.0	97440.3	28983932.0	.205	1.593
402.5	1933.5	3097.4	777.4	3765.6	96699.3	29019056.3	.206	1.592
452.5	1933.5	3095.0	784.3	3764.1	95949.0	29054625.6	.208	1.590
502.5	1933.5	3092.6	791.5	3762.7	95188.9	29092429.1	.210	1.589
552.5	1933.5	3090.2	799.0	3761.2	94417.8	29119530.4	.212	1.587
602.5	1933.5	3087.8	806.4	3759.7	93639.0	29164032.5	.214	1.586
652.5	1933.5	3085.3	814.3	3758.3	92847.7	29197118.6	.217	1.584
702.5	1933.5	3082.9	822.3	3756.8	92046.8	29233056.2	.219	1.583
752.5	1933.5	3080.4	830.6	3755.3	91233.9	29267814.2	.221	1.581
802.5	1933.5	3077.9	839.3	3753.8	90408.2	29302155.5	.224	1.579
852.5	1933.5	3075.4	847.9	3752.2	89572.6	29339681.0	.226	1.578
902.5	1933.5	3072.9	857.1	3750.7	88723.2	29376248.4	.229	1.576
952.5	1933.5	3070.4	866.4	3749.2	87861.7	29416130.7	.231	1.575
1001.9	1933.5	3068.0	878.4	3747.7	87047.2	29857832.5	.234	1.571
1053.4	1933.5	3065.3	890.9	3746.1	86103.9	29560912.6	.238	1.567
1103.4	1933.5	3062.7	901.4	3744.4	85188.6	29605247.9	.241	1.566
1153.4	1933.5	3060.0	912.7	3742.8	84254.7	29631635.8	.244	1.564
1203.4	1933.5	3057.3	924.0	3741.2	83307.4	29677984.4	.247	1.563
1253.4	1933.5	3054.6	936.1	3739.5	82340.4	29709426.1	.250	1.561
1303.4	1933.5	3051.9	948.6	3737.8	81357.0	29744196.4	.254	1.559
1353.4	1933.5	3049.1	961.5	3736.1	80355.3	29789953.2	.257	1.558
1403.4	1933.5	3046.2	975.0	3734.4	79333.4	29828963.2	.261	1.556
1453.4	1933.5	3043.3	989.3	3732.6	78290.0	29864706.2	.265	1.554
1503.4	1933.5	3040.4	1004.0	3730.8	77225.9	29905047.0	.269	1.552
1553.4	1933.5	3037.4	1019.6	3728.9	76138.7	29948977.5	.273	1.551
1603.4	1933.5	3034.3	1035.9	3727.0	75026.2	29987228.3	.278	1.549
1653.4	1933.5	3031.1	1053.1	3725.1	73888.1	30032357.0	.283	1.547
1703.4	1933.5	3027.9	1071.3	3723.1	72721.8	30072781.1	.288	1.545
1753.4	1933.5	3024.6	1090.4	3721.1	71527.0	30127192.0	.293	1.544
1803.4	1933.5	3021.1	1111.0	3718.9	70297.7	30169559.1	.299	1.542
1853.4	1933.5	3017.5	1132.9	3716.7	69033.3	30207648.1	.305	1.540
1903.4	1933.5	3013.8	1155.7	3714.5	67736.5	30264318.1	.311	1.538
1953.4	1933.5	3010.0	1180.9	3712.1	66392.5	30300044.3	.318	1.536
2003.4	1933.5	3005.9	1207.2	3709.6	65010.3	30366210.9	.325	1.534
2053.4	1933.5	3001.6	1236.2	3706.9	63574.2	30411096.8	.333	1.531
2103.4	1933.5	2997.1	1267.6	3704.1	62084.1	30458511.6	.342	1.529
2153.4	1933.5	2992.2	1301.8	3701.1	60533.2	30515634.2	.352	1.527
2200.1	1933.5	2987.5	1350.6	3698.2	58900.3	30728239.9	.365	1.520
2254.3	1933.5	2981.6	1393.4	3694.5	57147.2	30794135.8	.377	1.517
2301.1	1933.5	2975.2	1440.7	3690.6	55335.4	30874405.8	.390	1.514
2353.9	1933.5	2968.0	1492.4	3686.1	53410.2	30886435.5	.405	1.511
2403.9	1933.5	2959.7	1555.7	3681.0	51326.2	30967052.1	.423	1.507
2453.9	1933.5	2950.0	1630.6	3674.9	49061.6	31064973.1	.444	1.503
2503.9	1933.5	2938.1	1722.0	3667.5	46558.3	31182016.6	.470	1.498
2553.9	1933.5	2922.7	1838.2	3657.9	43716.4	31333352.8	.503	1.491
2600.1	1933.5	2898.2	2053.6	3642.5	39819.0	31619669.0	.564	1.476
2650.5	1933.5	2842.7	2482.6	3607.4	33557.2	33119494.3	.688	1.448

TABLE IIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.015.
Time = 6 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
1.7	1933.5	2075.2	600.1	3082.2	24669.4	10182270.8	.195	1.696
51.7	1933.5	2074.7	604.4	3081.8	24518.9	10185263.7	.196	1.694
101.7	1933.5	2074.1	609.5	3081.4	24355.0	10192075.7	.198	1.692
150.8	1933.5	2073.5	616.2	3081.0	24190.2	10210804.0	.200	1.689
200.8	1933.5	2073.0	621.2	3080.6	24022.3	10227188.4	.202	1.687
250.8	1933.5	2072.4	626.8	3080.1	23851.6	10236970.6	.203	1.686
300.8	1933.5	2071.8	632.3	3079.7	23679.1	10247889.5	.205	1.684
350.8	1933.5	2071.2	638.0	3079.2	23504.4	10256899.4	.207	1.683
400.8	1933.5	2070.6	643.9	3078.8	23327.6	10267496.1	.209	1.681
450.8	1933.5	2069.9	649.9	3078.3	23148.6	10278197.8	.211	1.679
500.8	1933.5	2069.3	656.1	3077.9	22967.2	10289855.3	.213	1.678
550.8	1933.5	2068.7	662.5	3077.4	22783.1	10297617.5	.215	1.676
600.8	1933.5	2068.0	668.9	3076.9	22597.2	10311404.2	.217	1.675
650.8	1933.5	2067.4	675.7	3076.4	22408.3	10321384.3	.220	1.673
700.8	1933.5	2066.7	682.5	3075.9	22217.0	10332086.2	.222	1.671
750.8	1933.5	2066.0	689.6	3075.4	22022.9	10342560.3	.224	1.670
800.8	1933.5	2065.4	697.1	3074.9	21825.7	10353027.3	.227	1.668
850.8	1933.5	2064.7	704.6	3074.4	21626.1	10364372.2	.229	1.666
900.8	1933.5	2063.9	712.4	3073.9	21423.1	10375564.7	.232	1.665
950.8	1933.5	2063.2	720.4	3073.3	21217.2	10387869.3	.234	1.663
1001.0	1933.5	2062.5	730.2	3072.8	21009.3	10555618.5	.238	1.661
1052.5	1933.5	2061.7	740.9	3072.2	20793.6	10431359.1	.241	1.656
1102.5	1933.5	2061.0	749.8	3071.6	20575.2	10445218.1	.244	1.655
1152.5	1933.5	2060.1	759.5	3071.0	20352.2	10452773.0	.247	1.653
1202.5	1933.5	2059.3	769.1	3070.4	20126.1	10467313.8	.250	1.651
1252.5	1933.5	2058.4	779.5	3069.8	19895.1	10476717.2	.254	1.649
1302.5	1933.5	2057.6	790.1	3069.1	19660.2	10487145.6	.257	1.647
1352.5	1933.5	2056.6	801.1	3068.4	19420.9	10501652.6	.261	1.646
1402.5	1933.5	2055.7	812.6	3067.7	19176.7	10513665.3	.265	1.644
1452.5	1933.5	2054.7	824.8	3067.0	18927.3	10524530.6	.269	1.642
1502.5	1933.5	2053.7	837.4	3066.2	18672.8	10537030.4	.273	1.640
1552.5	1933.5	2052.6	850.6	3065.4	18412.8	10550807.1	.277	1.638
1602.5	1933.5	2051.5	864.6	3064.6	18146.5	10562699.0	.282	1.637
1652.5	1933.5	2050.3	879.3	3063.7	17874.1	10576897.4	.287	1.635
1702.5	1933.5	2049.1	894.8	3062.8	17594.8	10589562.4	.292	1.633
1752.5	1933.5	2047.8	911.0	3061.8	17308.6	10607122.1	.298	1.631
1802.5	1933.5	2046.4	928.5	3060.8	17013.9	10620542.1	.303	1.629
1852.5	1933.5	2044.9	947.2	3059.7	16710.7	10632371.7	.310	1.627
1902.5	1933.5	2043.3	966.6	3058.5	16399.5	10650743.0	.316	1.625
1952.5	1933.5	2041.6	988.0	3057.2	16076.7	10661955.0	.323	1.622
2002.5	1933.5	2039.8	1010.4	3055.9	15744.6	10683878.7	.331	1.620
2052.5	1933.5	2037.9	1035.2	3054.4	15399.1	10698399.7	.339	1.618
2102.5	1933.5	2035.7	1062.0	3052.8	15040.3	10713809.9	.348	1.615
2152.5	1933.5	2033.3	1091.2	3051.0	14666.4	10732805.5	.358	1.612
2202.1	1933.5	2031.2	1127.5	3049.4	14292.2	10780635.7	.370	1.606
2252.1	1933.5	2028.1	1163.8	3047.1	13875.7	10798904.1	.382	1.603
2302.1	1933.5	2024.7	1204.6	3044.5	13435.3	10826027.0	.396	1.599
2352.1	1933.5	2020.6	1251.1	3041.4	12966.0	10854590.0	.411	1.596
2402.1	1933.5	2015.8	1305.1	3037.8	12460.7	10882503.1	.430	1.591
2452.1	1933.5	2009.9	1369.4	3033.4	11909.7	10916827.0	.451	1.586
2502.1	1933.5	2002.5	1448.1	3027.8	11297.1	10958205.4	.478	1.580
2552.1	1933.5	1992.5	1549.3	3020.2	10595.9	11012144.3	.513	1.573
2602.4	1933.5	1974.7	1744.1	3006.7	9579.7	11103986.2	.580	1.556
2651.2	1933.5	1930.2	2148.6	2972.6	7907.7	11634015.9	.723	1.525

TABLE IIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.015.
Time = 8 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
5.0	1490.9	1467.4	500.7	2591.9	7334.8	4161726.0	.193	1.697
50.0	1490.7	1467.3	504.3	2591.7	7291.6	4162859.7	.195	1.695
100.0	1490.5	1467.1	508.7	2591.6	7242.8	4165621.9	.196	1.694
151.8	1490.3	1466.9	514.4	2591.4	7190.9	4173240.1	.199	1.690
201.8	1490.1	1466.7	518.8	2591.2	7140.8	4179956.1	.200	1.689
251.8	1489.9	1466.5	523.5	2591.0	7090.0	4183948.6	.202	1.687
301.8	1489.7	1466.2	528.2	2590.8	7038.7	4188408.7	.204	1.685
351.8	1489.5	1466.0	533.1	2590.6	6986.8	4192092.3	.206	1.684
401.8	1489.3	1465.8	538.1	2590.4	6934.2	4196430.6	.208	1.682
451.8	1489.0	1465.6	543.2	2590.2	6881.0	4200816.4	.210	1.681
501.8	1488.8	1465.3	548.4	2590.0	6827.0	4205600.2	.212	1.679
551.8	1488.6	1465.1	553.9	2589.8	6772.3	4208794.9	.214	1.677
601.8	1488.3	1464.8	559.3	2589.6	6717.1	4214459.4	.216	1.676
651.8	1488.1	1464.6	565.0	2589.4	6660.9	4218574.8	.218	1.674
701.8	1487.8	1464.3	570.8	2589.1	6604.1	4222989.6	.220	1.672
751.8	1487.5	1464.0	576.9	2588.9	6546.4	4227320.1	.223	1.671
801.8	1487.2	1463.8	583.2	2588.6	6487.8	4231656.9	.225	1.669
851.8	1486.9	1463.5	589.5	2588.4	6428.6	4236358.5	.228	1.668
901.8	1486.6	1463.2	596.2	2588.1	6368.3	4241008.4	.230	1.666
951.8	1486.3	1462.8	603.0	2587.8	6307.2	4246122.1	.233	1.664
1001.9	1486.0	1462.6	611.2	2587.6	6245.6	4314584.7	.236	1.662
1053.8	1485.7	1462.2	620.3	2587.3	6180.5	4264040.6	.240	1.657
1103.8	1485.3	1461.8	627.9	2586.9	6115.7	4269827.1	.243	1.656
1153.8	1484.9	1461.5	636.0	2586.6	6049.5	4273046.4	.246	1.654
1203.8	1484.5	1461.1	644.2	2586.3	5982.4	4279138.8	.249	1.652
1253.8	1484.1	1460.7	653.0	2585.9	5913.9	4283144.3	.253	1.650
1303.8	1483.7	1460.2	661.9	2585.5	5844.2	4287584.1	.256	1.648
1353.8	1483.2	1459.8	671.2	2585.1	5773.3	4293713.9	.260	1.647
1403.8	1482.7	1459.3	681.0	2584.7	5700.9	4298840.6	.263	1.645
1453.8	1482.2	1458.8	691.3	2584.2	5626.9	4303518.8	.267	1.643
1503.8	1481.7	1458.2	701.9	2583.8	5551.5	4308889.8	.272	1.641
1553.8	1481.1	1457.7	713.1	2583.2	5474.4	4314809.9	.276	1.639
1603.8	1480.5	1457.1	724.8	2582.7	5395.5	4319987.5	.281	1.637
1653.8	1479.9	1456.4	737.2	2582.1	5314.8	4326140.8	.285	1.636
1703.8	1479.2	1455.7	750.3	2581.5	5232.1	4331702.1	.291	1.634
1753.8	1478.4	1455.0	763.9	2580.9	5147.3	4339309.5	.296	1.632
1803.8	1477.6	1454.2	778.7	2580.2	5060.1	4345266.0	.302	1.630
1853.8	1476.8	1453.3	794.4	2579.4	4970.3	4350619.8	.308	1.627
1903.8	1475.8	1452.4	810.7	2578.6	4878.2	4358713.5	.314	1.625
1953.8	1474.8	1451.4	828.7	2577.7	4782.7	4363939.6	.322	1.623
2003.8	1473.7	1450.3	847.5	2576.7	4684.5	4373638.1	.329	1.621
2053.8	1472.5	1449.1	868.3	2575.6	4582.3	4380389.0	.337	1.618
2103.8	1471.1	1447.7	890.8	2574.4	4476.2	4387603.6	.346	1.616
2153.8	1469.6	1446.2	915.3	2573.1	4365.8	4396408.1	.356	1.613
2202.5	1468.4	1445.0	944.9	2572.0	4258.7	4415527.1	.367	1.607
2252.5	1466.4	1443.0	975.3	2570.2	4135.8	4425659.9	.379	1.603
2302.5	1464.2	1440.7	1009.2	2568.2	4006.1	4438411.5	.393	1.600
2352.5	1461.5	1438.0	1047.9	2565.8	3867.9	4452072.7	.408	1.596
2402.5	1458.3	1434.9	1092.9	2563.0	3719.3	4465882.3	.426	1.592
2452.5	1454.5	1430.9	1146.1	2559.4	3557.4	4482924.1	.448	1.587
2502.5	1449.5	1425.9	1211.2	2555.0	3377.8	4503751.2	.474	1.581
2552.5	1443.0	1419.2	1294.5	2548.9	3172.7	4531134.2	.508	1.573
2600.1	1433.1	1408.8	1427.8	2539.6	2908.8	4576619.2	.562	1.556
2653.8	1403.6	1381.0	1757.9	2514.4	2429.6	4810290.0	.699	1.525

TABLE IIIA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of:

Temperature = 4500°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.075

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	370440.0	369593.8	15253.1	4500.0	4497.1	2502.1	259.4	3215.4	500.0	500.0	4537.3	3384.4	92.66	.375	0.0
.1	369929.2	369110.8	14507.2	4498.2	4495.4	2629.6	255.2	3444.3	1207.1	851.1	4536.5	3469.6	91.09	.375	.1
.2	369427.3	368631.1	13518.9	4496.5	4493.7	2718.0	251.8	3692.4	1761.9	1151.7	4535.6	3527.5	89.80	.375	.2
.3	368932.6	368155.4	14372.8	4494.8	4492.1	2870.7	248.9	3669.7	2210.3	1409.9	4534.8	3625.2	88.69	.375	.3
.4	368444.3	367681.9	15191.2	4493.1	4490.4	3008.3	246.7	3641.0	2574.5	1668.2	4534.0	3711.0	87.80	.375	.4
.5	367961.0	367213.3	14396.6	4491.4	4488.8	3059.6	244.4	3816.1	2871.5	1949.3	4533.1	3742.5	86.91	.375	.5
.6	367482.8	366744.5	14796.6	4489.7	4487.1	3155.1	243.0	3822.1	3114.1	2153.2	4532.3	3800.5	86.32	.375	.6
.7	367008.0	366388.5	14928.2	4488.0	4485.9	3223.9	222.7	3867.8	3258.0	2321.3	4531.7	3841.7	86.29	.375	.7
.8	366533.6	365980.6	15842.2	4486.4	4484.5	3303.6	210.5	3838.5	3258.0	2500.2	4531.0	3888.9	88.08	.375	.8
.9	366049.6	365532.8	15151.4	4484.7	4482.9	3283.7	203.5	4051.6	3258.0	2665.9	4530.2	3877.2	91.36	.375	.8
1.0	365547.7	365046.9	16654.4	4482.9	4481.2	3346.4	200.4	3987.5	3258.0	2791.9	4529.3	3914.0	96.03	.375	.9
1.1	365020.3	364516.6	18734.7	4481.1	4479.3	3406.6	201.2	3895.7	3258.0	2924.3	4528.4	3949.1	102.49	.375	1.0
1.2	364457.7	363940.8	20390.1	4479.1	4477.3	3436.0	203.9	3889.9	3258.0	3042.0	4527.4	3966.1	110.23	.375	1.2
1.3	363852.9	363313.4	21022.4	4477.0	4475.1	3429.2	208.4	3998.5	3258.0	3131.5	4526.2	3962.1	118.20	.375	1.3
1.4	363204.6	362690.5	23117.1	4474.7	4472.9	3468.8	203.6	3972.0	1933.5	3248.2	4525.1	3985.0	127.43	.375	1.4
1.5	362506.1	362002.3	22127.5	4472.2	4470.5	3376.4	201.7	4112.3	1933.5	3258.0	4523.9	3931.5	138.00	.384	1.5
1.6	361750.0	361256.6	24885.7	4469.6	4467.8	3429.5	199.7	3904.5	1933.5	3258.0	4522.6	3962.3	148.59	.393	1.7
1.7	360936.4	360439.2	26125.5	4466.7	4464.9	3396.9	200.7	3839.2	1933.5	3258.0	4521.1	3943.5	161.48	.403	1.8
1.8	360052.8	359536.8	25727.5	4463.6	4461.8	3327.5	204.6	3788.3	1933.5	3258.0	4519.5	3902.9	177.43	.411	2.0
1.9	359062.6	358547.2	27316.3	4460.1	4458.2	3303.8	208.6	3860.6	1933.5	3258.0	4517.7	3889.0	194.44	.421	2.2
2.0	358020.3	357459.4	26342.9	4456.4	4454.4	3238.5	213.7	4015.0	1933.5	3258.0	4515.7	3850.4	213.58	.426	2.4
2.1	356854.3	356255.5	30173.3	4452.2	4450.1	3254.1	221.1	4022.4	1933.5	3258.0	4513.6	3859.7	236.39	.428	2.6
2.2	355565.0	354926.0	35358.3	4447.6	4445.3	3368.8	228.7	3820.8	1933.5	3258.0	4511.2	3927.1	261.21	.435	2.9
2.3	354141.8	353466.6	35987.1	4442.5	4440.1	3339.1	235.4	3984.4	1933.5	3258.0	4508.5	3909.7	286.80	.443	3.2
2.4	352581.0	351867.9	39908.8	4436.9	4434.4	3402.1	242.3	3884.4	1933.5	3258.0	4505.6	3946.5	314.34	.453	3.5
2.5	350872.5	350119.6	40411.6	4430.8	4428.0	3412.7	249.4	3976.5	1933.5	3258.0	4502.4	3952.6	343.92	.465	3.8
2.6	349005.8	348195.9	37841.3	4424.0	4421.1	3510.1	259.2	3946.2	1933.5	3258.0	4498.8	4008.7	379.26	.475	4.2
2.7	346950.4	346117.8	39169.6	4416.6	4413.5	3433.4	264.2	4085.8	1933.5	1933.5	4495.0	3964.6	409.67	.508	4.6
2.8	344733.9	343851.1	37860.4	4408.5	4405.2	3456.3	271.8	4069.4	1933.5	1933.5	4490.8	3977.8	445.86	.543	5.0
2.9	342326.1	341396.1	34163.8	4399.7	4396.2	3458.7	279.7	4146.7	1933.5	1933.5	4486.2	3979.2	484.41	.577	5.5
3.0	339715.3	338755.2	37378.9	4390.0	4386.5	3482.8	285.0	3942.0	1933.5	1933.5	4481.2	3993.0	520.28	.609	6.0
3.1	336917.3	335907.3	30727.7	4379.7	4375.9	3435.8	293.2	4126.4	1933.5	1933.5	4475.8	3966.0	563.04	.641	6.6
3.2	333896.4	332855.1	33277.8	4368.4	4364.5	3491.9	298.7	4009.7	1933.5	1933.5	4470.0	3998.2	602.37	.668	7.2
3.3	330672.9	329600.1	32212.5	4356.3	4352.3	3467.3	304.2	4101.4	1933.5	1933.5	4463.7	3984.1	643.06	.697	7.8
3.4	327241.2	326136.7	34164.7	4343.4	4339.2	3522.3	309.8	3884.0	1933.5	1933.5	4457.0	4015.6	685.04	.726	8.5
3.5	323596.3	322471.2	33805.8	4329.5	4325.2	3476.4	314.0	3970.9	1933.5	1933.5	4449.8	3989.3	724.66	.754	9.2

TABLE IIIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	319752.9	318596.4	34410.9	4314.7	4310.3	3519.6	319.7	3859.8	1933.5	1933.5	4442.1	4014.0	768.59	.783	10.0
3.7	315690.4	314514.1	34531.2	4299.0	4294.4	3503.4	323.9	3834.3	1933.5	1933.5	4433.9	4004.8	809.52	.811	10.8
3.8	311427.2	310225.9	31818.3	4282.3	4277.6	3458.8	328.9	3980.0	1933.5	1933.5	4425.2	3979.2	852.81	.839	11.7
3.9	306953.5	305733.7	32096.8	4264.7	4259.8	3463.6	333.1	3921.5	1933.5	1933.5	4416.0	3982.0	894.29	.866	12.6
4.0	302281.4	301044.1	32071.6	4246.0	4241.0	3473.1	337.4	3869.6	1933.5	1933.5	4406.3	3987.4	935.74	.893	13.5
4.1	297414.2	296160.1	29511.5	4226.4	4221.3	3417.1	341.7	4012.3	1933.5	1933.5	4396.0	3955.2	976.97	.918	14.5
4.2	292356.1	291086.1	28517.7	4205.7	4200.5	3404.1	345.9	3975.4	1933.5	1933.5	4385.2	3947.6	1017.80	.943	15.6
4.3	287112.3	285840.1	30157.5	4184.0	4178.7	3420.3	348.5	3910.5	1933.5	1933.5	4373.8	3957.0	1052.87	.965	16.6
4.4	281715.8	280429.9	27153.2	4161.4	4156.0	3367.9	352.7	4013.6	1933.5	1933.5	4361.9	3926.6	1092.08	.989	17.8
4.5	276148.6	274862.9	26992.5	4137.7	4132.2	3347.4	355.3	4046.2	1933.5	1933.5	4349.4	3914.6	1124.81	1.010	18.9
4.6	270447.2	269162.7	28285.5	4113.1	4107.6	3372.2	357.7	3942.9	1933.5	1933.5	4336.4	3929.1	1156.02	1.032	20.1
4.7	264622.4	263340.4	28972.0	4087.6	4082.0	3379.7	360.2	3820.2	1933.5	1933.5	4322.9	3933.4	1185.55	1.054	21.4
4.8	258685.8	257407.5	27363.3	4061.2	4055.5	3331.1	362.6	3901.2	1933.5	1933.5	4308.8	3905.1	1213.29	1.076	22.6
4.9	252649.6	251376.1	27002.0	4033.9	4028.1	3320.1	365.0	3869.2	1933.5	1933.5	4294.2	3898.6	1239.11	1.097	23.9
5.0	246526.4	245258.9	25703.9	4005.7	3999.8	3291.1	367.3	3889.6	1933.5	1933.5	4279.2	3881.6	1262.91	1.118	25.2
5.1	240329.2	239068.8	26125.0	3976.7	3970.7	3302.1	369.7	3712.0	1933.5	1933.5	4263.6	3888.0	1284.59	1.137	26.6
5.2	234071.2	232831.4	26445.4	3946.8	3940.9	3284.9	370.1	3727.2	1933.5	1933.5	4247.5	3877.9	1297.68	1.158	28.0
5.3	227797.0	226566.2	25063.3	3916.3	3910.3	3255.9	372.4	3752.4	1933.5	1933.5	4231.0	3860.7	1314.84	1.177	29.3
5.4	221489.0	220274.3	24022.6	3885.0	3878.9	3226.4	373.6	3784.0	1933.5	1933.5	4214.0	3843.2	1326.46	1.194	30.7
5.5	215176.1	213984.3	24792.8	3853.1	3846.9	3221.9	374.0	3669.9	1933.5	1933.5	4196.6	3840.5	1332.41	1.211	32.2
5.6	208887.0	207706.9	22088.8	3820.5	3814.4	3153.7	376.1	3767.7	1933.5	1933.5	4178.8	3799.7	1342.64	1.228	33.6
5.7	202603.1	201446.2	21297.0	3787.3	3781.2	3126.5	376.5	3830.7	1933.5	1933.5	4160.5	3783.3	1344.48	1.245	35.0
5.8	196365.3	195228.3	20908.3	3753.7	3747.4	3101.9	377.4	3742.8	1933.5	1933.5	4141.9	3768.4	1346.20	1.260	36.5
5.9	190175.1	189066.7	22140.6	3719.5	3713.3	3123.7	376.9	3604.7	1933.5	1933.5	4123.0	3781.5	1340.86	1.276	37.9
6.0	184065.6	182979.5	21126.4	3684.9	3678.7	3092.4	377.5	3609.7	1933.5	1933.5	4103.8	3762.5	1337.28	1.290	39.3
6.1	178029.0	176966.3	20159.2	3650.0	3643.7	3057.1	377.9	3601.1	1933.5	1933.5	4084.2	3741.0	1331.19	1.303	40.7
6.2	172076.9	171043.6	19765.9	3614.7	3608.5	3025.1	377.2	3618.9	1933.5	1933.5	4064.4	3721.4	1319.48	1.314	42.2
6.3	166234.1	165223.6	17710.8	3579.2	3573.0	2956.0	377.6	3737.1	1933.5	1933.5	4044.4	3678.7	1310.28	1.327	43.6
6.4	160489.1	159508.1	18008.5	3543.4	3537.2	2952.2	376.8	3651.2	1933.5	1933.5	4024.1	3676.3	1295.02	1.338	45.0
6.5	154867.8	153911.2	17497.7	3507.5	3501.3	2941.9	376.8	3611.0	1933.5	1933.5	4003.6	3669.9	1281.51	1.349	46.4
6.6	149361.5	148431.7	16620.8	3471.4	3465.2	2895.3	376.3	3611.5	1933.5	1933.5	3982.9	3640.7	1264.85	1.359	47.7
6.7	143982.7	143079.6	16369.3	3435.2	3429.0	2880.4	375.8	3536.4	1933.5	1933.5	3962.1	3631.3	1246.91	1.368	49.1
6.8	138735.5	137861.5	16024.3	3399.0	3392.8	2852.9	374.6	3543.3	1933.5	1933.5	3941.1	3613.9	1225.84	1.377	50.4
6.9	133631.3	132782.1	14364.1	3362.8	3356.6	2784.7	374.3	3634.3	1933.5	1933.5	3920.0	3570.5	1206.61	1.386	51.7
7.0	128660.8	127842.6	14907.1	3326.5	3320.5	2784.7	372.4	3526.1	1933.5	1933.5	3898.8	3570.5	1181.70	1.393	53.0
7.1	123845.3	123050.4	14730.1	3290.5	3284.4	2783.6	372.1	3425.8	1933.5	1933.5	3877.6	3569.7	1161.31	1.402	54.3
7.2	119164.1	118397.2	14577.9	3254.4	3248.5	2761.6	370.5	3381.8	1933.5	1933.5	3856.3	3555.6	1136.51	1.409	55.5
7.3	114633.2	113889.8	13350.4	3218.6	3212.6	2709.9	369.9	3456.2	1933.5	1933.5	3835.0	3522.2	1114.03	1.417	56.7
7.4	110240.7	109525.1	12922.2	3182.9	3177.0	2673.1	368.0	3447.4	1933.5	1933.5	3813.7	3498.2	1087.63	1.423	57.9
7.5	106000.0	105305.5	11679.3	3147.4	3141.5	2621.9	367.7	3518.1	1933.5	1933.5	3792.3	3464.5	1065.50	1.430	59.1

TABLE IIIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
7.6	101891.8	101224.3	12332.4	3112.1	3106.2	2638.0	365.6	3350.1	1933.5	1933.5	3771.0	3475.2	1038.26	1.435	60.2
7.7	97933.7	97288.8	12056.5	3077.0	3071.2	2622.0	364.4	3291.4	1933.5	1933.5	3749.7	3464.6	1013.67	1.441	61.3
7.8	94112.7	93491.7	11240.8	3042.2	3036.5	2572.2	362.8	3349.0	1933.5	1933.5	3728.4	3431.5	987.63	1.447	62.4
7.9	90432.0	89831.5	10422.6	3007.8	3002.0	2534.7	361.9	3383.0	1933.5	1933.5	3707.2	3406.4	963.86	1.452	63.5
8.0	86880.6	86303.7	10607.4	2973.5	2967.9	2527.6	359.8	3275.3	1933.5	1933.5	3686.0	3401.7	937.15	1.456	64.5
8.1	83466.9	82911.7	9996.5	2939.7	2934.1	2486.4	358.0	3302.7	1933.5	1933.5	3665.0	3373.8	911.59	1.461	65.5
8.2	80184.2	79648.5	9590.3	2906.2	2900.6	2464.5	356.8	3279.4	1933.5	1933.5	3644.0	3358.9	887.55	1.465	66.5
8.3	77024.4	76509.8	9153.4	2873.0	2867.5	2426.2	354.7	3289.0	1933.5	1933.5	3623.1	3332.8	861.91	1.469	67.4
8.4	73991.0	73494.5	8687.7	2840.2	2834.7	2398.7	353.5	3292.6	1933.5	1933.5	3602.4	3313.8	838.52	1.472	68.4
8.5	71073.6	70596.7	8796.8	2807.7	2802.3	2395.0	351.4	3176.4	1933.5	1933.5	3581.7	3311.2	813.77	1.476	69.2
8.6	68274.6	67815.3	8506.4	2775.7	2770.3	2376.3	349.9	3146.2	1933.5	1933.5	3561.2	3298.3	790.54	1.479	70.1
8.7	65586.6	65144.5	8031.4	2744.0	2738.7	2340.3	348.2	3165.6	1933.5	1933.5	3540.9	3273.2	767.55	1.482	71.0
8.8	63006.5	62581.6	7864.0	2712.7	2707.5	2321.0	346.3	3115.0	1933.5	1933.5	3520.6	3259.6	744.49	1.485	71.8
8.9	60532.5	60123.5	7280.0	2681.8	2676.6	2279.5	344.7	3173.7	1933.5	1933.5	3500.5	3230.4	722.57	1.487	72.6
9.0	58153.6	57763.3	7019.5	2651.4	2646.2	2265.1	343.7	3126.2	1933.5	1933.5	3480.5	3220.2	702.56	1.490	73.4
9.1	55876.7	55496.9	6826.1	2621.2	2616.1	2243.2	341.8	3108.8	1933.5	1933.5	3460.7	3204.6	680.90	1.492	74.1
9.2	53690.3	53325.3	6636.6	2591.5	2586.4	2227.6	339.8	3048.3	1933.5	1933.5	3441.0	3193.4	659.83	1.493	74.8
9.3	51595.6	51244.9	6163.3	2562.2	2557.2	2185.8	337.9	3108.9	1933.5	1933.5	3421.5	3163.3	639.35	1.495	75.5
9.4	49588.8	49251.7	6139.3	2533.3	2528.4	2176.5	336.0	3036.0	1933.5	1933.5	3402.2	3156.6	619.46	1.497	76.2
9.5	47666.4	47342.4	5842.5	2504.9	2500.0	2143.8	334.1	3055.6	1933.5	1933.5	3383.0	3132.8	600.15	1.498	76.9
9.6	45824.9	45513.3	5795.5	2476.8	2472.0	2135.8	332.3	2980.1	1933.5	1933.5	3364.0	3126.9	581.47	1.499	77.5
9.7	44060.6	43760.9	5340.7	2449.2	2444.4	2093.4	330.5	3047.9	1933.5	1933.5	3345.2	3095.7	563.44	1.501	78.1
9.8	42370.1	42081.8	5183.7	2422.0	2417.2	2076.9	328.7	3015.5	1933.5	1933.5	3326.6	3083.5	545.90	1.502	78.7
9.9	40750.5	40473.2	5021.1	2395.1	2390.5	2057.5	326.9	2988.3	1933.5	1933.5	3308.1	3069.1	528.82	1.503	79.3
10.0	39198.9	38932.1	4917.5	2368.7	2364.1	2044.7	325.1	2940.6	1933.5	1933.5	3289.8	3059.5	512.27	1.504	79.9
10.1	37712.4	37455.7	4691.1	2342.7	2338.1	2020.3	323.3	2942.3	1933.5	1933.5	3271.7	3041.2	496.33	1.505	80.4
10.2	36288.0	36041.0	4429.8	2317.1	2312.6	1990.6	321.6	2964.8	1933.5	1933.5	3253.7	3018.8	480.82	1.505	81.0
10.3	34923.2	34685.5	4350.0	2291.8	2287.4	1979.5	319.8	2913.9	1933.5	1933.5	3236.0	3010.3	465.80	1.506	81.5
10.4	33615.5	33386.7	4085.9	2267.0	2262.6	1948.6	318.1	2945.8	1933.5	1933.5	3218.4	2986.8	451.27	1.507	82.0
10.5	32362.3	32142.0	3936.1	2242.5	2238.1	1930.5	316.4	2931.1	1933.5	1933.5	3200.9	2972.8	437.22	1.507	82.5
10.6	31161.2	30949.1	3786.5	2218.4	2214.1	1911.9	314.6	2918.3	1933.5	1933.5	3183.7	2958.5	423.62	1.508	82.9
10.7	30010.0	29805.7	3795.1	2194.7	2190.4	1910.7	313.0	2831.0	1933.5	1933.5	3166.6	2957.5	410.48	1.508	83.4
10.8	28906.4	28709.6	3681.0	2171.3	2167.1	1895.0	311.3	2806.3	1933.5	1933.5	3149.7	2945.4	397.77	1.508	83.8
10.9	27848.4	27658.8	3544.7	2148.3	2144.1	1877.4	309.6	2791.7	1933.5	1933.5	3133.0	2931.7	385.49	1.508	84.3
11.0	26833.9	26651.2	3247.9	2125.6	2121.5	1839.3	308.0	2868.8	1933.5	1933.5	3116.4	2901.8	373.61	1.508	84.7
11.1	25861.0	25685.0	3256.3	2103.3	2099.2	1840.4	306.4	2774.1	1933.5	1933.5	3100.0	2902.6	362.13	1.508	85.1
11.2	24927.9	24758.2	3022.5	2081.4	2077.3	1808.2	304.8	2827.0	1933.5	1921.2	3083.8	2877.1	351.04	1.508	85.5
11.3	24032.9	23869.3	2950.8	2059.7	2055.7	1797.4	303.2	2782.3	1933.5	1899.0	3067.7	2868.5	340.32	1.508	85.8
11.4	23174.2	23016.4	2730.6	2038.4	2034.4	1764.8	301.6	2844.0	1933.5	1870.9	3051.8	2842.4	329.96	1.508	86.2
11.5	22350.2	22198.1	2568.9	2017.4	2013.5	1739.4	300.1	2860.7	1933.5	1846.2	3036.1	2821.9	319.95	1.508	86.5

TABLE IIIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
11.6	21559.5	21412.8	2448.9	1996.8	1992.9	1719.3	298.5	2852.0	1933.5	1805.8	3020.5	2805.5	310.27	1.508	86.9
11.7	20800.6	20659.0	2317.1	1976.5	1972.6	1696.0	297.0	2872.8	1933.5	1759.8	3005.1	2786.5	300.92	1.508	87.2
11.8	20072.0	19935.3	2294.0	1956.4	1952.6	1690.3	295.5	2801.8	1933.5	1738.6	2989.8	2781.7	291.89	1.508	87.5
11.9	19372.4	19240.6	2094.2	1936.7	1932.9	1657.9	294.0	2872.0	1933.5	1738.6	2974.7	2755.0	283.12	1.508	87.8
12.0	18700.7	18573.5	2132.5	1917.3	1913.5	1665.6	292.4	2762.1	1933.5	1595.8	2959.7	2761.3	274.63	1.508	88.2
12.1	18055.7	17933.0	1997.8	1898.1	1894.4	1636.0	290.8	2804.7	1913.5	1439.5	2944.9	2736.7	266.36	1.508	88.4
12.2	17436.3	17317.8	1997.3	1879.3	1875.6	1633.6	289.4	2727.5	1894.4	1548.4	2930.3	2734.7	258.51	1.508	88.7
12.3	16841.2	16726.8	1981.0	1860.7	1857.1	1626.7	287.9	2670.8	1875.6	1548.4	2915.8	2728.9	250.93	1.508	89.0
12.4	16269.2	16158.8	2074.3	1842.5	1838.9	1636.5	286.3	2528.2	1857.1	1548.4	2901.4	2737.1	243.42	1.508	89.3
12.5	15719.8	15613.1	1918.2	1824.5	1820.9	1602.4	284.9	2597.4	1838.9	1503.9	2887.2	2708.4	236.36	1.508	89.5
12.6	15191.6	15088.5	2121.0	1806.7	1803.2	1636.1	283.5	2324.9	1820.9	1503.9	2873.2	2736.8	229.53	1.508	89.8
12.7	14683.5	14584.1	2022.7	1789.3	1785.8	1610.5	281.9	2364.8	1803.2	1503.9	2859.2	2715.3	222.74	1.508	90.0
12.8	14195.3	14099.4	2109.7	1772.1	1768.6	1616.2	280.1	2241.9	1785.8	1503.9	2845.5	2720.1	216.09	1.508	90.3
12.9	13726.2	13633.5	2188.1	1755.1	1751.7	1620.9	278.8	2089.9	1768.6	1631.9	2831.8	2724.1	209.95	1.508	90.5
13.0	13274.8	13185.1	2056.8	1738.4	1735.1	1598.0	277.5	2128.5	1751.7	1631.9	2818.3	2704.7	204.02	1.508	90.7
13.1	12840.3	12753.6	2061.7	1722.0	1718.7	1591.6	276.2	2058.4	1735.1	1631.9	2805.0	2699.3	198.28	1.508	90.9
13.2	12422.1	12338.5	2208.7	1705.8	1702.5	1597.2	274.3	1879.5	1718.7	1631.9	2791.8	2704.1	192.35	1.508	91.2
13.3	12020.1	11939.2	2085.8	1689.8	1686.6	1577.6	273.0	1910.3	1702.5	1572.2	2778.7	2687.4	187.00	1.508	91.4
13.4	11633.0	11555.2	2211.2	1674.1	1670.9	1579.0	270.9	1805.3	1686.6	1572.2	2765.7	2688.6	181.28	1.508	91.6
13.5	11261.2	11185.9	2221.4	1658.6	1655.4	1571.4	269.7	1683.1	1670.9	1589.4	2752.9	2682.1	176.31	1.508	91.8
13.6	10903.0	10830.1	2156.3	1643.4	1640.2	1557.7	268.4	1678.5	1655.4	1589.4	2740.2	2670.4	171.49	1.508	91.9
13.7	10557.8	10487.2	2073.0	1628.3	1625.2	1541.9	267.2	1673.6	1640.2	1589.4	2727.7	2656.8	166.82	1.508	92.1
13.8	10225.0	10157.3	2223.4	1613.5	1610.4	1542.2	264.8	1574.3	1625.2	1589.4	2715.2	2657.1	161.57	1.508	92.3
13.9	9905.7	9840.0	2226.3	1598.9	1595.9	1533.3	263.6	1470.0	1610.4	1547.8	2703.0	2649.4	157.24	1.508	92.5
14.0	9597.7	9534.1	2179.9	1584.6	1581.6	1521.0	262.4	1447.4	1595.9	1547.8	2690.8	2638.7	153.04	1.508	92.6
14.1	9300.6	9239.0	2105.9	1570.4	1567.4	1506.9	261.2	1446.4	1581.6	1547.8	2678.7	2626.5	148.97	1.508	92.8
14.2	9014.0	8954.3	2033.0	1556.4	1553.5	1492.8	260.0	1445.4	1567.4	1547.8	2666.8	2614.2	145.02	1.508	93.0
14.3	8737.5	8680.4	2180.5	1542.6	1539.7	1490.1	257.1	1330.2	1553.5	1547.8	2655.0	2611.9	140.24	1.508	93.1
14.4	8472.5	8417.1	2182.4	1529.1	1526.3	1480.4	256.0	1259.3	1539.7	1493.0	2643.3	2603.3	136.59	1.508	93.3
14.5	8216.7	8162.9	2108.4	1515.8	1512.9	1467.2	254.8	1258.3	1526.3	1493.0	2631.8	2591.7	133.04	1.508	93.4
14.6	7969.6	7917.5	2030.7	1502.6	1499.8	1453.7	253.7	1261.0	1512.9	1493.0	2620.3	2579.8	129.61	1.508	93.6
14.7	7731.0	7681.5	2223.4	1489.6	1486.9	1450.7	250.0	1155.9	1499.8	1493.0	2609.0	2577.1	124.98	1.508	93.7
14.8	7503.0	7455.0	2212.7	1476.9	1474.2	1440.3	248.9	1073.8	1486.9	1452.8	2597.9	2567.8	121.81	1.508	93.8
14.9	7282.6	7236.0	2130.9	1464.4	1461.7	1427.7	247.9	1082.1	1474.2	1452.8	2586.8	2556.6	118.74	1.508	94.0
15.0	7069.6	7024.3	2087.6	1452.0	1449.4	1416.3	246.8	1062.2	1461.7	1452.8	2575.9	2546.4	115.75	1.508	94.1
16.0	5010.6	4982.0	2129.1	1316.0	1313.9	1315.9	221.9	685.2	1449.4	1452.8	2452.5	2454.4	81.42	1.508	95.4

TABLE IIIB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:
Temperature = 4500°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.075.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	4496.7	259.4	4537.1	369551.2	6026597.5	.057	.375
52.1	500.0	4460.1	260.1	4518.6	365525.8	6045713.7	.058	.375
100.2	500.0	4419.5	261.0	4498.0	361004.7	6070825.4	.058	.375
151.8	500.0	4383.7	261.8	4479.8	356956.4	6092817.0	.058	.375
204.9	500.0	4343.6	262.8	4459.2	352364.7	6117971.2	.059	.375
251.4	500.0	4308.9	263.7	4441.4	348333.7	6140262.2	.059	.375
304.5	500.0	4269.7	264.8	4421.1	343710.8	6165190.3	.060	.375
351.0	500.0	4235.7	265.8	4403.5	339650.9	6189844.0	.060	.375
404.0	500.0	4197.3	267.1	4383.5	334992.9	6212477.0	.061	.375
450.5	500.0	4164.1	268.2	4366.1	330900.3	6237483.1	.061	.375
503.5	500.0	4126.5	269.7	4346.4	326202.8	6259823.3	.062	.375
550.5	500.0	4090.5	271.0	4327.4	321628.2	6285095.8	.063	.375
602.8	500.0	4057.2	272.5	4309.7	317331.9	6307219.1	.063	.375
650.3	500.0	4021.5	274.2	4290.7	312654.7	6332515.6	.064	.375
702.1	500.0	3989.4	275.8	4273.6	308370.2	6354659.0	.065	.375
755.0	500.0	3953.8	277.6	4254.5	303549.8	6379975.0	.065	.375
801.2	500.0	3923.0	279.4	4237.9	299306.8	6400578.7	.066	.375
854.1	500.0	3888.2	281.5	4219.0	294427.2	6427462.2	.067	.375
900.3	500.0	3858.1	283.5	4202.6	290129.3	6452557.9	.067	.375
953.0	500.0	3824.0	285.8	4184.0	285183.1	6474970.8	.068	.375
1000.2	500.0	3791.0	288.3	4165.9	280293.2	6500314.2	.069	.375
1051.8	500.0	3761.2	290.7	4149.5	275802.5	6522491.3	.070	.375
1104.5	500.0	3728.2	293.5	4131.3	270737.8	6547836.0	.071	.375
1150.5	500.0	3699.7	296.2	4115.5	266268.1	6572938.5	.072	.375
1203.0	500.0	3667.5	299.4	4097.5	261113.3	6595354.0	.073	.375
1250.0	500.0	3636.2	302.7	4080.0	256005.5	6620692.9	.074	.375
1301.4	500.0	3608.0	306.0	4064.2	251302.7	6638329.9	.075	.375
1353.8	500.0	3576.8	309.9	4046.6	245985.6	6668186.9	.077	.375
1400.2	500.0	3546.9	313.6	4029.6	240765.7	6693506.8	.078	.375
1451.9	500.0	3519.3	318.1	4013.9	235838.2	6715653.0	.079	.375
1504.2	500.0	3489.1	322.9	3996.6	230321.8	6740952.1	.081	.375
1551.1	500.0	3462.1	327.6	3981.1	225244.2	6766029.5	.082	.375
1600.1	500.0	3432.0	333.3	3963.8	219462.1	6789895.1	.084	.375
1650.2	500.0	3406.4	338.6	3949.0	214405.6	6814721.9	.086	.375
1702.2	500.0	3377.5	345.2	3932.2	208543.4	6837063.7	.088	.375
1754.2	500.0	3348.9	352.4	3915.5	202562.2	6862337.0	.090	.375
1800.2	500.0	3321.4	359.3	3899.4	196633.1	6887631.8	.092	.375
1851.7	500.0	3296.0	367.8	3884.5	190984.6	6909781.3	.095	.375
1903.7	500.0	3268.2	377.3	3868.0	184589.7	6935117.4	.098	.375
1950.2	500.0	3241.1	387.7	3852.0	178147.6	6960479.3	.101	.375
2001.2	500.0	3216.7	398.3	3837.4	172109.3	6966656.8	.104	.375
2053.2	500.0	3189.6	411.6	3821.2	165148.6	7008116.6	.108	.375
2100.2	500.0	3162.9	426.6	3805.2	158009.1	7033577.0	.112	.375
2150.7	500.0	3139.3	441.8	3791.0	151395.3	7058154.9	.117	.375
2202.7	500.0	3112.7	461.8	3774.9	143607.8	7081455.5	.122	.375
2254.7	500.0	3086.2	485.5	3758.8	135432.6	7107102.6	.129	.375
2300.4	500.0	3060.7	513.0	3743.2	127109.2	7132402.7	.137	.375
2350.4	500.0	3035.3	544.2	3727.6	118287.9	7156761.5	.146	.375
2400.5	500.0	3009.6	586.7	3711.8	108766.8	7181240.0	.158	.375
2454.4	500.0	2983.5	645.6	3695.7	98414.1	7206316.9	.175	.375
2502.4	500.0	2957.1	721.6	3679.3	87242.7	7234194.2	.196	.375
2550.0	500.0	2926.1	833.8	3660.0	73529.6	7261606.3	.228	.375
2602.1	500.0	2889.0	1066.9	3636.7	57538.7	7291739.8	.293	.375
2650.1	500.0	2748.5	2072.0	3547.2	27789.5	7325811.6	.584	.375

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor - 0.075.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	4454.2	213.7	4515.7	357442.5	7258849.3	.047	.635
51.9	1933.5	4441.0	214.8	4509.0	355837.9	7276254.5	.048	.634
100.2	1933.5	4426.2	216.1	4501.4	354013.3	7301128.1	.048	.632
154.0	1933.5	4412.4	217.4	4494.4	352285.1	7322166.9	.048	.631
200.0	1933.5	4398.5	227.8	4487.3	350427.1	7522215.5	.051	.617
254.2	1933.5	4384.3	229.4	4480.1	348417.5	7521209.0	.051	.616
300.4	1933.5	4370.0	231.0	4472.8	346381.2	7545583.1	.052	.614
351.5	1933.5	4357.0	232.5	4466.1	344486.6	7566700.6	.052	.613
400.9	1933.5	4342.3	234.1	4458.6	342301.7	7591581.0	.052	.612
454.6	1933.5	4328.4	235.7	4451.4	340214.4	7615383.4	.053	.611
500.3	1933.5	4314.6	237.4	4444.3	338092.2	7640088.2	.053	.609
552.9	1933.5	4301.4	239.1	4437.5	336036.8	7661330.6	.054	.608
600.3	1933.5	4287.1	246.9	4430.1	333654.1	7782113.4	.056	.600
652.0	1933.5	4274.1	248.8	4423.4	331452.6	7803363.2	.056	.598
701.4	1933.5	4260.6	250.7	4416.4	329113.6	7826630.5	.057	.597
750.2	1933.5	4246.2	252.7	4409.0	326591.8	7853272.9	.057	.596
800.4	1933.5	4232.4	260.4	4401.8	323903.7	7959943.2	.059	.589
850.9	1933.5	4218.6	270.4	4394.6	321099.7	8099885.4	.062	.579
900.2	1933.5	4205.0	273.1	4387.5	318280.7	8125300.5	.062	.578
950.2	1933.5	4191.3	275.7	4380.4	315406.2	8150518.3	.063	.577
1000.3	1933.5	4177.7	278.5	4373.3	312484.3	8174072.8	.064	.576
1050.3	1933.5	4164.2	281.3	4366.2	309518.3	8198363.7	.064	.575
1100.4	1933.5	4150.7	284.2	4359.1	306501.7	8221760.9	.065	.574
1154.7	1933.5	4137.4	287.2	4352.1	303451.4	8248338.6	.066	.573
1203.5	1933.5	4124.3	290.3	4345.2	300413.1	8271804.9	.067	.572
1254.8	1933.5	4110.7	293.6	4338.0	297170.1	8297972.1	.068	.571
1303.2	1933.5	4097.9	296.9	4331.3	294057.5	8322379.8	.069	.569
1353.3	1933.5	4084.5	318.8	4324.2	290203.4	8588273.6	.074	.552
1402.9	1933.5	4071.2	323.1	4317.1	286394.2	8614973.7	.075	.551
1450.6	1933.5	4057.3	327.5	4309.8	282319.3	8638710.5	.076	.550
1503.4	1933.5	4044.3	332.5	4302.9	278429.5	8663858.9	.077	.549
1550.0	1933.5	4030.8	337.3	4295.7	274277.3	8689474.1	.079	.548
1602.7	1933.5	4018.1	342.8	4288.9	270244.6	8713999.5	.080	.547
1650.5	1933.5	4004.4	348.7	4281.6	265797.4	8739484.6	.081	.546
1701.3	1933.5	3992.3	354.1	4275.1	261772.6	8755080.7	.083	.545
1754.3	1933.5	3978.5	360.8	4267.7	257055.7	8788921.9	.085	.544
1803.0	1933.5	3965.8	367.2	4260.9	252615.7	8814459.9	.086	.543
1850.4	1933.5	3952.5	374.4	4253.7	247783.4	8840262.8	.088	.542
1902.6	1933.5	3939.8	409.9	4246.9	242310.5	9173378.2	.097	.523
1951.8	1933.5	3926.8	420.0	4239.9	236554.1	9198831.6	.099	.523
2003.8	1933.5	3913.1	431.4	4232.5	230284.0	9223557.5	.102	.522
2050.3	1933.5	3899.7	443.5	4225.2	223938.6	9251189.0	.105	.521
2101.2	1933.5	3887.5	455.8	4218.6	217957.6	9255323.6	.108	.520
2154.2	1933.5	3873.5	471.1	4211.0	210874.8	9303657.7	.112	.519
2204.1	1933.5	3860.3	515.8	4203.8	203510.2	9648544.6	.123	.504
2250.1	1933.5	3846.6	536.1	4196.4	195084.0	9623866.3	.128	.503
2300.6	1933.5	3832.8	563.7	4188.8	186194.6	9645984.3	.135	.502
2351.5	1933.5	3819.5	592.3	4181.6	177298.6	9677449.4	.142	.501
2400.3	3258.0	3806.5	695.7	4174.5	165991.7	9336168.7	.167	.476
2450.1	3258.0	3799.2	759.5	4170.4	151999.2	9218481.7	.182	.475
2500.9	3258.0	3790.4	854.5	4165.6	136661.9	9251346.6	.205	.473
2550.2	3258.0	3777.1	996.7	4158.3	117481.9	9287060.3	.240	.472
2601.8	3258.0	3755.0	1235.7	4146.1	95335.6	9337263.2	.298	.469
2650.4	3258.0	3614.2	2370.8	4067.6	50803.9	9576984.3	.583	.452

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	4241.0	337.4	4406.3	301023.1	18261453.2	.077	1.124
50.7	1933.5	4234.9	340.1	4403.1	298922.1	18289107.6	.077	1.123
100.3	1933.5	4228.7	343.2	4399.9	296744.7	18325534.7	.078	1.121
151.7	1933.5	4222.9	346.2	4396.8	294696.9	18350094.5	.079	1.119
201.2	1933.5	4216.4	349.5	4393.5	292325.4	18874698.8	.080	1.117
251.7	1933.5	4210.6	355.5	4390.4	290141.1	18493672.5	.081	1.112
300.0	1933.5	4204.2	358.7	4387.1	287727.5	18541419.9	.082	1.110
353.2	1933.5	4198.1	362.4	4383.9	285401.1	18578769.7	.083	1.108
401.6	1933.5	4192.2	365.9	4380.8	283093.9	18601636.7	.084	1.107
453.0	1933.5	4185.8	369.7	4377.5	280609.3	18650554.5	.084	1.105
503.0	1933.5	4179.7	373.5	4374.3	278155.1	18685880.0	.085	1.104
550.2	1933.5	4173.4	377.5	4371.0	275575.9	18728102.6	.086	1.102
600.4	1933.5	4167.2	383.3	4367.8	273002.8	18806559.0	.088	1.098
651.1	1933.5	4161.6	387.4	4364.8	270605.1	18828192.7	.089	1.096
701.1	1933.5	4155.4	391.8	4361.6	267971.1	18865089.8	.090	1.095
753.1	1933.5	4149.1	396.5	4358.2	265182.5	18913641.1	.091	1.093
803.1	1933.5	4143.0	402.7	4355.0	262399.5	18990171.8	.092	1.089
850.9	1933.5	4136.6	409.4	4351.7	259456.9	19074532.0	.094	1.085
900.9	1933.5	4130.5	414.7	4348.5	256577.6	19112269.8	.095	1.084
951.7	1933.5	4124.8	420.2	4345.5	253840.1	19133118.8	.097	1.082
1000.3	1933.5	4118.3	426.1	4342.0	250677.6	19186457.1	.098	1.080
1051.1	1933.5	4112.6	431.6	4339.0	247872.1	19205924.1	.099	1.079
1100.9	1933.5	4106.3	437.9	4335.7	244693.2	19259890.0	.101	1.077
1150.0	1933.5	4099.9	444.4	4332.4	241421.9	19301819.7	.103	1.076
1202.3	1933.5	4093.8	451.0	4329.1	238222.0	19338283.2	.104	1.074
1254.9	1933.5	4087.6	458.0	4325.8	234912.0	19379036.8	.106	1.072
1301.1	1933.5	4081.9	465.0	4322.8	231820.0	19394489.2	.108	1.071
1350.1	1933.5	4075.5	477.4	4319.4	228125.8	19544749.2	.111	1.064
1404.4	1933.5	4069.2	485.9	4316.1	224487.3	19582903.9	.113	1.063
1451.4	1933.5	4063.4	494.1	4313.0	221043.2	19596743.5	.115	1.061
1502.8	1933.5	4057.0	503.6	4309.6	217215.1	19669551.2	.117	1.060
1550.3	1933.5	4050.6	513.4	4306.2	213258.3	19700686.2	.119	1.058
1600.3	1933.5	4044.9	523.3	4303.2	209690.1	19744688.1	.122	1.056
1652.6	1933.5	4038.4	534.8	4299.7	205487.5	19778000.8	.124	1.055
1702.4	1933.5	4032.1	546.6	4296.4	201334.8	19824112.5	.127	1.053
1753.4	1933.5	4025.6	559.4	4292.9	196997.3	19864204.9	.130	1.051
1802.1	1933.5	4019.5	572.6	4289.6	192736.9	19902968.7	.133	1.050
1850.2	1933.5	4013.3	586.8	4286.3	188372.0	19907173.3	.137	1.048
1900.3	1933.5	4006.4	608.5	4282.6	183261.4	20087523.8	.142	1.042
1950.2	1933.5	3999.8	627.7	4279.1	178313.7	20125577.3	.147	1.040
2000.1	1933.5	3993.8	645.5	4275.9	173679.6	20175928.2	.151	1.038
2053.8	1933.5	3986.5	668.3	4272.0	167991.3	20216543.9	.156	1.037
2100.5	1933.5	3979.5	692.6	4268.2	162330.2	20249904.7	.162	1.035
2150.5	1933.5	3972.5	718.9	4264.5	156630.4	20299135.5	.169	1.033
2200.3	1933.5	3965.1	743.8	4260.6	150524.3	20956288.3	.175	1.035
2250.9	1933.5	3957.6	789.6	4256.5	144025.5	20473788.7	.186	1.026
2300.2	1933.5	3949.4	831.3	4252.1	137036.6	20511279.0	.196	1.024
2350.6	1933.5	3941.5	875.5	4247.9	130292.3	20574945.9	.206	1.022
2400.4	1933.5	3931.3	922.7	4242.3	121767.5	21791993.8	.217	1.029
2450.7	1933.5	3920.7	1025.2	4236.6	112991.5	20797426.2	.242	1.012
2500.3	1933.5	3906.8	1128.9	4229.1	102642.6	20886523.1	.267	1.009
2552.2	1933.5	3889.8	1267.5	4219.9	91628.8	20967194.3	.300	1.006
2600.2	1933.5	3861.0	1505.2	4204.2	77309.0	21110717.4	.358	1.001
2650.4	1933.5	3775.0	2178.7	4157.1	54859.1	21863119.6	.524	.975

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 6 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	3678.7	377.5	4103.8	182965.8	20275241.4	.092	1.518
51.7	1933.5	3675.2	380.6	4101.8	181585.6	20294239.3	.093	1.516
103.6	1933.5	3671.8	384.3	4099.9	180207.0	20324394.9	.094	1.515
151.5	1933.5	3668.3	387.8	4098.0	178787.6	20353331.6	.095	1.513
201.6	1933.5	3664.7	387.2	4096.0	177323.1	21094427.1	.095	1.519
250.7	1933.5	3661.3	396.3	4094.1	175854.4	20446584.0	.097	1.507
301.3	1933.5	3658.0	400.4	4092.2	174428.6	20463872.1	.098	1.505
353.2	1933.5	3654.3	404.5	4090.1	172825.6	20504367.3	.099	1.504
402.3	1933.5	3651.0	408.6	4088.3	171364.3	20530374.1	.100	1.502
451.6	1933.5	3647.4	412.9	4086.3	169762.1	20562325.3	.101	1.500
502.0	1933.5	3643.8	417.3	4084.3	168174.6	20587458.5	.102	1.499
551.9	1933.5	3640.4	421.8	4082.3	166579.7	20623646.9	.103	1.497
600.4	1933.5	3636.8	427.3	4080.3	164922.1	20673579.6	.105	1.494
650.2	1933.5	3633.3	432.2	4078.4	163276.7	20699309.9	.106	1.492
703.4	1933.5	3629.9	437.2	4076.5	161642.0	20729430.4	.107	1.491
752.0	1933.5	3626.5	442.4	4074.6	159989.8	20748959.1	.109	1.489
804.0	1933.5	3622.9	448.5	4072.5	158195.5	20800882.6	.110	1.486
854.4	1933.5	3619.3	455.1	4070.5	156411.9	20854167.9	.112	1.483
900.1	1933.5	3615.8	461.0	4068.5	154606.0	20868302.5	.113	1.481
952.7	1933.5	3612.4	467.0	4066.6	152844.3	20917009.7	.115	1.480
1000.3	1933.5	3608.7	473.3	4064.5	150915.0	20925065.5	.116	1.478
1052.4	1933.5	3605.1	480.2	4062.5	149006.4	20974247.9	.118	1.476
1105.0	1933.5	3601.6	487.2	4060.5	147075.6	20996987.2	.120	1.475
1151.2	1933.5	3598.0	493.8	4058.5	145123.0	21034168.6	.122	1.473
1200.4	1933.5	3594.6	501.6	4056.6	143203.1	21058535.6	.124	1.471
1250.1	1933.5	3590.9	509.7	4054.5	141087.9	21097791.7	.126	1.470
1300.3	1933.5	3587.4	517.9	4052.5	139058.9	21128508.9	.128	1.468
1352.1	1933.5	3583.7	528.7	4050.4	136866.2	21198601.9	.131	1.464
1400.2	1933.5	3580.1	537.2	4048.4	134704.8	21230976.9	.133	1.462
1450.3	1933.5	3576.4	547.8	4046.3	132424.5	21258603.2	.135	1.460
1500.7	1933.5	3572.9	557.6	4044.3	130253.9	21301773.3	.138	1.459
1550.1	1933.5	3569.3	568.1	4042.3	128019.1	21322736.0	.141	1.457
1600.4	1933.5	3565.2	580.8	4040.0	125395.5	21358194.1	.144	1.455
1654.2	1933.5	3561.5	593.1	4037.9	122964.1	21382921.3	.147	1.453
1700.5	1933.5	3557.6	606.0	4035.7	120413.1	21413991.7	.150	1.452
1751.0	1933.5	3553.8	620.5	4033.5	117820.6	21446667.3	.154	1.450
1801.1	1933.5	3550.0	635.3	4031.3	115232.0	21488802.1	.158	1.448
1850.4	1933.5	3545.8	652.1	4029.0	112391.7	21520173.6	.162	1.447
1900.3	1933.5	3541.8	672.2	4026.7	109551.0	21604561.0	.167	1.442
1951.8	1933.5	3537.8	691.0	4024.4	106768.0	21632271.5	.172	1.440
2000.4	1933.5	3533.3	713.5	4021.8	103509.0	21673481.0	.177	1.438
2052.9	1933.5	3529.0	736.3	4019.4	100447.1	21706518.6	.183	1.437
2102.5	1933.5	3524.5	762.5	4016.8	97152.8	21731285.4	.190	1.434
2150.0	1933.5	3519.8	790.8	4014.1	93784.1	21748950.0	.197	1.433
2200.3	1933.5	3514.3	814.2	4011.1	89959.0	22357319.7	.203	1.440
2250.3	1933.5	3508.8	863.2	4007.9	86039.7	21896985.8	.215	1.427
2302.7	1933.5	3502.8	911.9	4004.5	81902.6	21898873.9	.228	1.424
2352.3	1933.5	3496.1	964.5	4000.6	77499.6	21948240.9	.241	1.422
2401.2	1933.5	3488.8	996.4	3996.4	73077.2	23057466.5	.249	1.439
2450.8	1933.5	3479.3	1113.9	3991.0	67659.5	22135407.2	.279	1.413
2500.4	1933.5	3467.0	1219.4	3983.9	61640.4	22116013.0	.306	1.409
2552.0	1933.5	3450.3	1374.6	3974.3	54990.4	22315986.9	.346	1.404
2600.1	1933.5	3420.2	1631.8	3957.0	46406.5	22507118.8	.412	1.396
2650.5	1933.5	3320.4	2356.7	3898.8	32359.8	23338782.9	.604	1.369

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 8 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	2967.8	359.8	3686.0	86297.2	13557352.9	.098	1.702
54.8	1933.5	2965.8	362.8	3684.7	85639.4	13558943.3	.098	1.700
104.8	1933.5	2963.7	366.2	3683.4	84970.2	13576690.5	.099	1.699
154.8	1933.5	2961.6	369.6	3682.1	84292.7	13593729.3	.100	1.697
200.5	1933.5	2959.6	367.7	3680.9	83639.7	14137349.8	.100	1.708
253.7	1933.5	2957.5	377.6	3679.6	82920.5	13643106.1	.103	1.692
303.7	1933.5	2955.4	381.3	3678.3	82213.3	13657291.4	.104	1.690
353.7	1933.5	2953.4	385.1	3677.0	81497.0	13675625.4	.105	1.688
403.7	1933.5	2951.3	389.1	3675.7	80771.2	13690265.3	.106	1.687
453.7	1933.5	2949.2	393.2	3674.4	80035.7	13708346.7	.107	1.685
503.7	1933.5	2947.1	397.4	3673.1	79290.2	13722000.7	.108	1.683
553.7	1933.5	2945.0	401.7	3671.8	78534.6	13743058.0	.109	1.682
601.4	1933.5	2943.0	406.6	3670.6	77797.6	13772699.7	.111	1.679
651.4	1933.5	2940.9	411.3	3669.2	77017.8	13783253.3	.112	1.677
701.4	1933.5	2938.8	416.1	3667.9	76226.7	13800190.4	.113	1.675
751.4	1933.5	2936.7	421.1	3666.6	75423.7	13813353.6	.115	1.673
803.6	1933.5	2934.5	426.8	3665.2	74574.9	13844134.7	.116	1.671
851.5	1933.5	2932.5	432.6	3664.0	73773.5	13868227.7	.118	1.668
901.5	1933.5	2930.4	438.3	3662.7	72927.2	13886700.1	.120	1.666
951.5	1933.5	2928.2	444.0	3661.3	72067.3	13902823.0	.121	1.665
1001.5	1933.5	2926.1	450.1	3660.0	71193.0	13918467.6	.123	1.663
1051.5	1933.5	2923.9	456.4	3658.6	70303.8	13934363.0	.125	1.661
1101.5	1933.5	2921.8	462.9	3657.3	69399.0	13949809.8	.127	1.659
1151.5	1933.5	2919.6	469.8	3655.9	68478.0	13967395.0	.128	1.658
1201.5	1933.5	2917.5	476.9	3654.6	67540.2	13983902.8	.130	1.656
1251.5	1933.5	2915.3	484.3	3653.2	66584.7	14002786.1	.133	1.654
1301.5	1933.5	2913.1	492.2	3651.8	65610.1	14019811.6	.135	1.653
1354.3	1933.5	2910.7	502.3	3650.4	64552.5	14068223.6	.138	1.649
1404.3	1933.5	2908.5	510.8	3649.0	63531.3	14073768.6	.140	1.647
1454.3	1933.5	2906.2	520.1	3647.6	62487.4	14088228.3	.143	1.645
1504.3	1933.5	2904.0	529.6	3646.1	61420.7	14113113.8	.145	1.644
1554.3	1933.5	2901.7	540.0	3644.7	60328.8	14123768.2	.148	1.642
1604.3	1933.5	2899.3	550.9	3643.2	59211.1	14144019.5	.151	1.640
1654.3	1933.5	2897.0	562.6	3641.7	58065.4	14155746.3	.154	1.638
1704.3	1933.5	2894.6	574.9	3640.2	56890.5	14177311.2	.158	1.636
1754.3	1933.5	2892.1	588.1	3638.7	55683.9	14195577.5	.162	1.635
1804.3	1933.5	2889.6	602.2	3637.1	54443.4	14214356.2	.166	1.633
1854.3	1933.5	2887.1	617.5	3635.5	53166.1	14230739.0	.170	1.631
1904.2	1933.5	2884.5	636.9	3633.9	51847.4	14309283.7	.175	1.627
1954.7	1933.5	2881.7	654.2	3632.1	50461.8	14288241.0	.180	1.625
2004.7	1933.5	2878.9	673.6	3630.4	49044.3	14309896.6	.186	1.623
2054.7	1933.5	2876.0	695.3	3628.5	47572.3	14326288.9	.192	1.621
2104.7	1933.5	2872.9	719.5	3626.6	46040.6	14338101.5	.198	1.619
2154.7	1933.5	2869.6	746.1	3624.5	44443.7	14361507.8	.206	1.617
2200.2	1933.5	2866.2	766.5	3622.4	42817.7	14698861.3	.212	1.627
2250.1	1933.5	2862.3	815.1	3619.9	40976.9	14475834.0	.225	1.611
2303.5	1933.5	2858.2	856.0	3617.3	39124.8	14496228.9	.237	1.608
2351.1	1933.5	2853.2	904.6	3614.1	37060.0	14530440.5	.250	1.606
2401.0	1933.5	2848.0	930.0	3610.8	35067.8	15183743.3	.258	1.626
2450.3	1933.5	2840.6	1039.4	3606.1	32482.5	14621251.6	.288	1.596
2501.0	1933.5	2831.6	1134.7	3600.4	29826.9	14645064.1	.315	1.592
2553.1	1933.5	2818.4	1270.7	3592.0	26701.9	14736912.0	.354	1.586
2600.1	1933.5	2796.3	1483.9	3577.9	22926.3	14859089.1	.415	1.576
2650.0	1933.5	2730.0	2046.2	3535.2	16887.7	15398746.2	.579	1.544

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 10 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.9	1933.5	2364.1	325.1	3289.8	38929.2	7656940.6	.099	1.759
54.3	1933.5	2363.1	327.9	3289.1	38635.7	7656904.4	.100	1.758
104.3	1933.5	2362.1	330.9	3288.4	38334.4	7666110.5	.101	1.756
154.3	1933.5	2361.0	334.1	3287.7	38029.3	7674886.5	.102	1.754
204.7	1933.5	2360.0	332.3	3286.9	37727.3	7989701.9	.101	1.766
250.7	1933.5	2359.0	341.2	3286.3	37429.2	7700229.2	.104	1.749
300.7	1933.5	2358.0	344.7	3285.5	37111.1	7707329.5	.105	1.747
350.7	1933.5	2357.0	348.2	3284.8	36788.8	7716790.5	.106	1.745
400.7	1933.5	2355.9	351.9	3284.1	36462.2	7724230.2	.107	1.744
450.7	1933.5	2354.9	355.7	3283.4	36131.3	7733546.1	.108	1.742
500.7	1933.5	2353.8	359.6	3282.6	35795.9	7740361.5	.110	1.740
550.7	1933.5	2352.8	363.5	3281.9	35455.9	7751385.5	.111	1.739
600.7	1933.5	2351.7	368.0	3281.2	35110.1	7765863.5	.112	1.736
650.7	1933.5	2350.7	372.4	3280.4	34759.1	7771966.5	.114	1.734
700.7	1933.5	2349.6	376.8	3279.7	34403.1	7780658.7	.115	1.732
750.7	1933.5	2348.6	381.5	3279.0	34041.7	7787258.7	.116	1.730
802.2	1933.5	2347.5	386.6	3278.2	33665.2	7801794.7	.118	1.728
851.4	1933.5	2346.4	392.0	3277.5	33295.4	7815456.2	.120	1.725
901.4	1933.5	2345.3	397.1	3276.7	32914.6	7825215.8	.121	1.723
951.4	1933.5	2344.2	402.5	3276.0	32527.7	7833430.1	.123	1.722
1001.4	1933.5	2343.2	408.0	3275.2	32134.3	7841364.3	.125	1.720
1051.4	1933.5	2342.1	413.8	3274.4	31734.1	7849438.8	.126	1.718
1101.4	1933.5	2341.0	419.9	3273.7	31327.0	7857308.1	.128	1.716
1151.4	1933.5	2339.8	426.1	3272.9	30912.5	7866345.3	.130	1.715
1201.4	1933.5	2338.7	432.7	3272.1	30490.4	7874775.3	.132	1.713
1251.4	1933.5	2337.6	439.5	3271.3	30060.3	7884565.0	.134	1.711
1301.4	1933.5	2336.4	446.7	3270.5	29621.6	7893327.6	.137	1.709
1351.8	1933.5	2335.3	455.3	3269.7	29168.8	7912792.5	.139	1.706
1401.8	1933.5	2334.1	463.4	3268.9	28709.3	7921031.6	.142	1.704
1451.8	1933.5	2332.9	471.8	3268.0	28239.9	7928315.3	.144	1.702
1501.8	1933.5	2331.7	480.6	3267.2	27760.3	7941442.9	.147	1.701
1551.8	1933.5	2330.5	490.1	3266.3	27269.3	7946684.4	.150	1.699
1601.8	1933.5	2329.2	500.0	3265.4	26766.7	7957169.2	.153	1.697
1651.8	1933.5	2327.9	510.7	3264.5	26251.5	7962965.7	.156	1.695
1701.8	1933.5	2326.6	521.9	3263.6	25723.1	7974300.7	.160	1.693
1751.8	1933.5	2325.3	534.0	3262.7	25180.4	7983802.4	.164	1.691
1801.8	1933.5	2323.9	546.9	3261.7	24622.4	7993551.3	.168	1.689
1851.8	1933.5	2322.4	560.8	3260.7	24047.8	8001939.6	.172	1.687
1902.5	1933.5	2320.9	577.4	3259.6	23445.7	8031901.2	.177	1.684
1952.5	1933.5	2319.4	594.0	3258.5	22829.2	8031441.0	.182	1.681
2002.5	1933.5	2317.7	611.9	3257.4	22191.3	8043265.8	.188	1.680
2052.5	1933.5	2315.9	631.7	3256.1	21529.2	8051772.2	.194	1.677
2102.5	1933.5	2314.1	653.7	3254.8	20840.2	8057736.7	.201	1.675
2152.5	1933.5	2312.1	678.0	3253.4	20121.7	8070210.8	.208	1.673
2200.6	1933.5	2309.9	696.5	3251.9	19390.7	8277372.7	.214	1.683
2250.1	1933.5	2307.5	736.5	3250.2	18604.3	8101278.5	.227	1.667
2300.1	1933.5	2304.7	772.9	3248.2	17763.8	8109306.2	.238	1.664
2350.1	1933.5	2301.5	814.8	3245.9	16869.8	8125639.3	.251	1.661
2401.9	1933.5	2297.4	846.6	3243.0	15856.5	8504769.7	.261	1.683
2454.0	1933.5	2292.3	937.2	3239.4	14754.7	8160466.4	.289	1.651
2504.0	1933.5	2285.8	1019.8	3234.9	13577.6	8179230.3	.315	1.647
2554.0	1933.5	2276.5	1133.4	3228.2	12232.9	8195771.3	.351	1.640
2603.3	1933.5	2261.1	1309.7	3217.4	10627.1	8233338.0	.407	1.629
2650.4	1933.5	2212.3	1811.7	3182.4	7921.3	8636850.7	.569	1.595

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 12 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
1.8	1933.5	1913.5	292.4	2959.7	18572.1	4314658.2	.099	1.769
51.8	1933.5	1913.4	294.9	2959.6	18439.0	4314072.8	.100	1.767
101.8	1933.5	1913.3	297.8	2959.5	18295.1	4318817.7	.101	1.766
151.8	1932.4	1913.2	300.8	2959.4	18149.3	4323917.4	.102	1.764
200.1	1932.3	1913.0	299.3	2959.3	17998.6	4501733.8	.101	1.776
253.0	1932.1	1912.9	307.7	2959.2	17847.4	4337460.5	.104	1.759
303.0	1931.9	1912.7	310.9	2959.1	17695.1	4341110.9	.105	1.757
353.0	1931.7	1912.6	314.2	2959.0	17540.9	4346094.2	.106	1.755
403.0	1931.6	1912.5	317.6	2958.9	17384.5	4349946.7	.107	1.753
453.0	1931.4	1912.3	321.2	2958.8	17226.0	4354851.0	.109	1.752
503.0	1931.2	1912.2	324.8	2958.7	17065.3	4358349.3	.110	1.750
553.0	1931.0	1912.0	328.5	2958.6	16902.4	4364221.7	.111	1.748
600.7	1930.8	1911.9	332.6	2958.5	16743.8	4372163.0	.112	1.746
650.7	1930.6	1911.7	336.7	2958.3	16575.6	4375108.2	.114	1.744
700.7	1930.4	1911.5	340.8	2958.2	16404.9	4379673.9	.115	1.742
750.7	1930.2	1911.4	345.2	2958.1	16231.6	4383068.1	.117	1.740
801.1	1930.0	1911.2	349.9	2957.9	16054.6	4390927.3	.118	1.738
852.6	1929.8	1911.0	355.1	2957.8	15869.5	4398214.2	.120	1.735
902.6	1929.5	1910.8	359.9	2957.6	15686.7	4403401.3	.122	1.733
952.6	1929.3	1910.6	364.9	2957.5	15500.9	4407711.7	.123	1.731
1002.6	1929.1	1910.4	370.1	2957.3	15311.9	4411867.7	.125	1.730
1052.6	1928.8	1910.2	375.6	2957.2	15119.6	4416106.7	.127	1.728
1102.6	1928.6	1910.0	381.2	2957.0	14923.8	4420239.5	.129	1.726
1152.6	1928.3	1909.8	387.1	2956.8	14724.5	4425030.9	.131	1.724
1202.6	1928.1	1909.6	393.3	2956.7	14521.4	4429486.5	.133	1.722
1252.6	1927.8	1909.3	399.6	2956.5	14314.4	4434714.9	.135	1.721
1302.6	1927.5	1909.1	406.5	2956.3	14103.1	4439373.9	.137	1.719
1354.0	1927.2	1908.8	414.6	2956.1	13882.2	4448529.3	.140	1.715
1404.0	1926.9	1908.5	422.1	2955.8	13660.7	4454352.7	.143	1.713
1454.0	1926.6	1908.2	430.1	2955.6	13434.3	4458203.9	.146	1.712
1504.0	1926.2	1907.9	438.3	2955.4	13202.9	4465347.9	.148	1.710
1554.0	1925.9	1907.5	447.3	2955.1	12965.8	4468082.5	.151	1.708
1604.0	1925.5	1907.2	456.7	2954.8	12723.0	4473763.3	.155	1.706
1654.0	1925.1	1906.8	466.7	2954.5	12473.9	4476834.2	.158	1.704
1704.0	1924.6	1906.4	477.3	2954.2	12218.3	4483034.6	.162	1.702
1754.0	1924.2	1905.9	488.7	2953.9	11955.6	4488226.7	.165	1.700
1804.0	1923.7	1905.4	501.0	2953.5	11685.2	4493576.7	.170	1.699
1854.0	1923.1	1904.9	514.2	2953.1	11406.6	4498187.8	.174	1.697
1901.3	1922.6	1904.4	528.9	2952.6	11135.0	4514648.2	.179	1.693
1951.3	1921.9	1903.7	544.6	2952.1	10836.1	4514575.1	.184	1.691
2001.3	1921.2	1903.0	561.6	2951.6	10526.5	4521236.3	.190	1.689
2051.3	1920.3	1902.2	580.4	2950.9	10204.8	4526090.5	.197	1.687
2101.3	1919.4	1901.2	601.4	2950.2	9869.5	4529585.0	.204	1.684
2151.3	1918.3	1900.2	624.5	2949.4	9519.4	4536811.5	.212	1.682
2200.0	1917.0	1898.9	643.1	2948.4	9155.4	4660323.7	.218	1.692
2253.3	1915.6	1897.4	683.3	2947.2	8744.1	4554966.0	.232	1.676
2303.3	1913.8	1895.6	718.9	2945.8	8330.1	4560103.8	.244	1.673
2353.3	1911.6	1893.3	760.3	2944.1	7888.1	4570108.6	.258	1.670
2400.5	1908.5	1890.7	787.9	2942.0	7443.7	4786166.6	.268	1.692
2451.8	1905.1	1886.8	875.0	2939.0	6898.9	4591472.3	.298	1.660
2501.8	1899.9	1881.4	957.7	2934.8	6311.7	4605581.7	.326	1.655
2551.8	1891.9	1873.1	1074.1	2928.3	5632.8	4618548.9	.367	1.648
2601.1	1877.6	1858.1	1262.0	2916.6	4803.7	4644944.6	.433	1.637
2652.1	1820.8	1789.9	1928.9	2862.6	3193.1	4944333.7	.674	1.601

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 14 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
3.6	1595.9	1581.6	262.4	2690.8	9533.4	2645582.8	.098	1.769
53.6	1595.8	1581.4	264.7	2690.7	9463.8	2645318.1	.098	1.767
103.6	1595.7	1581.3	267.2	2690.6	9391.3	2648290.0	.099	1.766
153.6	1595.5	1581.2	269.8	2690.5	9317.8	2651112.2	.100	1.764
203.3	1595.4	1581.1	268.2	2690.4	9246.8	2756038.7	.100	1.776
250.9	1595.3	1580.9	275.7	2690.3	9172.6	2659420.2	.102	1.759
300.9	1595.2	1580.8	278.5	2690.1	9096.1	2661662.0	.104	1.757
350.9	1595.0	1580.7	281.4	2690.0	9018.6	2664721.5	.105	1.755
400.9	1594.9	1580.5	284.5	2689.9	8940.0	2667087.7	.106	1.753
450.9	1594.8	1580.4	287.6	2689.8	8860.4	2670099.0	.107	1.752
500.9	1594.6	1580.3	290.8	2689.7	8779.7	2672247.9	.108	1.750
550.9	1594.5	1580.1	294.0	2689.6	8697.9	2675853.5	.109	1.748
601.9	1594.3	1580.0	297.8	2689.4	8613.0	2680474.1	.111	1.746
651.9	1594.2	1579.8	301.4	2689.3	8528.6	2682541.2	.112	1.744
701.9	1594.0	1579.7	305.0	2689.2	8443.0	2685345.5	.113	1.742
751.9	1593.9	1579.5	308.8	2689.0	8356.1	2687431.3	.115	1.740
804.4	1593.7	1579.3	313.0	2688.9	8265.3	2692231.9	.116	1.738
851.1	1593.5	1579.2	317.2	2688.8	8180.8	2696734.5	.118	1.735
901.1	1593.4	1579.0	321.4	2688.6	8089.3	2699910.1	.120	1.733
951.1	1593.2	1578.9	325.8	2688.5	7996.4	2702558.4	.121	1.731
1001.1	1593.0	1578.7	330.3	2688.3	7902.0	2705112.0	.123	1.730
1051.1	1592.8	1578.5	335.0	2688.2	7805.9	2707716.7	.125	1.728
1101.1	1592.6	1578.3	339.9	2688.0	7708.2	2710256.6	.126	1.726
1151.1	1592.5	1578.1	345.0	2687.8	7608.8	2713200.8	.128	1.724
1201.1	1592.3	1577.9	350.3	2687.7	7507.6	2715938.9	.130	1.722
1251.1	1592.0	1577.7	355.8	2687.5	7404.5	2719151.8	.132	1.721
1301.1	1591.8	1577.5	361.6	2687.3	7299.3	2722015.7	.135	1.719
1354.7	1591.6	1577.2	368.9	2687.1	7184.4	2727629.3	.137	1.715
1404.7	1591.4	1577.0	375.4	2686.9	7074.3	2731210.1	.140	1.713
1454.7	1591.1	1576.7	382.2	2686.7	6961.8	2733577.9	.142	1.712
1504.7	1590.8	1576.5	389.2	2686.5	6846.9	2737967.8	.145	1.710
1554.7	1590.6	1576.2	396.8	2686.2	6729.3	2739651.1	.148	1.708
1604.7	1590.3	1575.9	404.8	2686.0	6609.0	2743142.8	.151	1.706
1654.7	1590.0	1575.6	413.4	2685.7	6485.8	2745032.4	.154	1.704
1704.7	1589.6	1575.2	422.3	2685.4	6359.5	2748845.0	.157	1.702
1754.7	1589.3	1574.9	431.9	2685.1	6229.8	2752038.8	.161	1.700
1804.7	1588.9	1574.5	442.2	2684.8	6096.6	2755329.6	.165	1.699
1854.7	1588.5	1574.1	453.2	2684.4	5959.5	2758166.1	.169	1.697
1902.6	1588.0	1573.7	465.6	2684.1	5824.8	2766576.1	.173	1.693
1952.6	1587.5	1573.2	478.7	2683.6	5678.2	2768277.7	.178	1.691
2002.6	1586.9	1572.6	492.6	2683.2	5526.7	2772381.9	.184	1.689
2052.6	1586.3	1572.0	508.1	2682.6	5369.8	2775376.2	.189	1.687
2102.6	1585.6	1571.3	525.1	2682.1	5206.6	2777535.0	.196	1.684
2152.6	1584.9	1570.5	543.8	2681.4	5036.9	2781995.4	.203	1.682
2203.6	1584.0	1569.7	557.6	2680.6	4860.0	2845928.7	.208	1.692
2254.6	1583.0	1568.6	590.3	2679.7	4665.0	2793156.6	.220	1.676
2304.6	1581.8	1567.3	618.0	2678.7	4467.2	2796352.3	.231	1.673
2354.6	1580.4	1565.9	649.6	2677.4	4257.7	2802562.7	.243	1.670
2404.0	1578.3	1564.2	667.6	2676.0	4047.5	2916620.1	.249	1.692
2451.6	1576.3	1561.9	732.7	2674.0	3805.6	2815957.5	.274	1.660
2501.6	1573.2	1558.8	790.1	2671.3	3538.8	2824996.3	.296	1.655
2551.6	1568.9	1554.4	866.4	2667.6	3238.9	2833654.5	.325	1.648
2601.6	1562.2	1547.5	978.4	2661.6	2886.7	2852735.4	.368	1.637
2653.3	1545.5	1529.5	1256.2	2646.1	2344.6	2990292.4	.475	1.601

TABLE IIIB (Cont.)

Initial temperature = 4500°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 16 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
5.0	1449.4	1313.9	221.9	2452.5	4979.6	1509347.4	.090	1.769
50.0	1449.3	1314.1	223.7	2452.7	4950.2	1509225.6	.091	1.767
100.0	1449.2	1314.3	225.7	2452.9	4917.1	1510840.0	.092	1.766
150.0	1449.0	1314.5	227.7	2453.1	4883.6	1512368.8	.093	1.764
201.1	1448.9	1314.8	226.4	2453.4	4847.8	1574211.6	.092	1.776
254.0	1448.8	1315.0	232.6	2453.6	4812.2	1516946.9	.095	1.759
304.0	1448.6	1315.2	234.8	2453.8	4777.4	1518143.5	.096	1.757
354.0	1448.5	1315.4	237.0	2454.0	4742.2	1519808.1	.097	1.755
404.0	1448.4	1315.6	239.3	2454.2	4706.5	1521076.8	.098	1.753
454.0	1448.2	1315.8	241.7	2454.4	4670.5	1522714.1	.098	1.752
504.0	1448.1	1316.0	244.1	2454.5	4633.9	1523858.4	.099	1.750
554.0	1448.0	1316.3	246.6	2454.7	4597.0	1525836.1	.100	1.748
601.8	1447.8	1316.4	249.3	2454.9	4561.0	1528391.3	.102	1.746
651.8	1447.7	1316.7	252.0	2455.1	4523.0	1529491.7	.103	1.744
701.8	1447.5	1316.8	254.7	2455.3	4484.6	1531011.8	.104	1.742
751.8	1447.4	1317.0	257.5	2455.5	4445.6	1532121.6	.105	1.740
801.1	1447.2	1317.2	260.5	2455.7	4406.9	1534782.6	.106	1.738
852.6	1447.1	1317.4	263.9	2455.8	4365.4	1537263.3	.107	1.735
902.6	1446.9	1317.6	267.0	2456.0	4324.5	1539004.8	.109	1.733
952.6	1446.8	1317.8	270.1	2456.2	4283.1	1540437.0	.110	1.731
1002.6	1446.6	1318.0	273.4	2456.4	4241.1	1541815.2	.111	1.730
1052.6	1446.4	1318.2	276.8	2456.5	4198.5	1543223.1	.113	1.728
1102.6	1446.3	1318.4	280.3	2456.7	4155.2	1544595.1	.114	1.726
1152.6	1446.1	1318.5	283.9	2456.9	4111.3	1546198.5	.116	1.724
1202.6	1445.9	1318.7	287.6	2457.0	4066.7	1547684.3	.117	1.722
1252.6	1445.7	1318.9	291.4	2457.2	4021.4	1549443.2	.119	1.721
1302.6	1445.5	1319.0	295.5	2457.3	3975.3	1551003.6	.120	1.719
1353.6	1445.3	1319.2	300.4	2457.5	3927.3	1554130.5	.122	1.715
1403.6	1445.1	1319.3	304.8	2457.6	3879.3	1556109.6	.124	1.713
1453.6	1444.9	1319.5	309.3	2457.7	3830.6	1557387.5	.126	1.712
1503.6	1444.6	1319.6	314.0	2457.9	3780.9	1559826.4	.128	1.710
1553.6	1444.4	1319.7	319.0	2458.0	3730.4	1560716.2	.130	1.708
1603.6	1444.1	1319.8	324.2	2458.1	3678.8	1562642.3	.132	1.706
1653.6	1443.9	1320.0	329.7	2458.2	3626.3	1563652.0	.134	1.704
1703.6	1443.6	1320.1	335.3	2458.3	3572.7	1565769.0	.136	1.702
1753.6	1443.3	1320.2	341.3	2458.4	3518.0	1567533.7	.139	1.700
1803.6	1442.9	1320.2	347.6	2458.5	3462.1	1569355.7	.141	1.699
1853.6	1442.6	1320.3	354.2	2458.5	3404.9	1570918.4	.144	1.697
1902.7	1442.2	1320.4	361.9	2458.6	3347.9	1575667.8	.147	1.693
1952.7	1441.8	1320.4	369.4	2458.6	3287.7	1576591.1	.150	1.691
2002.7	1441.4	1320.5	377.3	2458.7	3225.9	1578902.1	.153	1.689
2052.7	1440.9	1320.5	385.9	2458.7	3162.6	1580579.4	.157	1.687
2102.7	1440.4	1320.4	395.1	2458.7	3097.4	1581780.9	.161	1.684
2152.7	1439.8	1320.4	404.8	2458.6	3030.4	1584327.1	.165	1.682
2204.9	1439.1	1320.3	410.0	2458.6	2960.0	1621274.2	.167	1.692
2252.9	1438.4	1320.2	427.4	2458.5	2889.6	1590770.6	.174	1.676
2302.9	1437.5	1320.1	440.2	2458.3	2815.4	1592665.5	.179	1.673
2352.9	1436.5	1319.9	453.9	2458.1	2738.5	1596347.5	.185	1.670
2401.4	1435.2	1319.7	455.9	2457.9	2663.6	1667976.7	.185	1.692
2450.9	1433.8	1319.3	487.9	2457.6	2576.5	1604436.7	.199	1.660
2500.9	1432.0	1318.9	508.0	2457.2	2487.7	1610101.8	.207	1.655
2550.9	1429.5	1318.3	532.0	2456.7	2393.2	1615752.5	.217	1.648
2600.9	1426.1	1317.6	563.0	2456.0	2290.6	1628828.6	.229	1.637
2651.4	1419.6	1316.3	622.6	2454.8	2162.8	1694659.3	.254	1.601

TABLE IVA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of:
Temperature = 5954°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.015

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	370440.0	366502.3	36142.1	5954.0	5939.3	3616.4	557.0	3322.6	500.0	500.0	4341.5	3387.7	200.14	.375	0.0
.1	369441.9	365739.3	38296.2	5950.3	5936.5	4060.9	540.6	3428.4	2248.3	1558.9	4340.4	3589.9	193.94	.375	.2
.2	368471.8	365403.7	39428.3	5946.7	5935.2	4385.7	492.5	3558.3	3258.0	2396.4	4340.0	3730.7	191.86	.375	.4
.3	367431.5	364920.3	50642.3	5942.8	5933.4	4611.1	445.9	3654.8	3258.0	3095.2	4339.3	3825.3	240.82	.375	.6
.4	366026.5	363267.9	55788.9	5937.6	5927.2	4588.5	468.1	3707.5	1933.5	3258.0	4337.0	3815.9	343.24	.421	.9
.5	364014.7	360770.4	57583.5	5930.0	5917.8	4518.9	508.8	3956.1	1933.5	3258.0	4333.6	3786.9	494.24	.474	1.3
.6	361143.1	357281.3	64071.6	5919.2	5904.5	4707.2	557.1	3737.3	1933.5	1933.5	4328.7	3865.0	695.90	.566	1.9
.7	357175.3	352725.7	65936.2	5904.1	5887.1	4798.8	600.7	3739.7	1933.5	1933.5	4322.3	3902.4	941.28	.657	2.8
.8	351898.9	346891.9	63350.0	5883.9	5864.4	4819.9	641.1	3912.3	1933.5	1933.5	4314.0	3911.0	1230.43	.749	3.9
.9	345124.3	339621.5	67303.2	5857.5	5835.8	4899.6	677.3	3782.2	1933.5	1933.5	4303.5	3943.2	1556.67	.840	5.3
1.0	336704.3	330781.5	68556.2	5824.2	5800.4	4929.6	709.7	3759.4	1933.5	1933.5	4290.4	3955.2	1911.07	.928	7.1
1.1	326553.9	320262.5	63867.9	5783.2	5757.3	4892.4	740.3	3902.6	1933.5	1933.5	4274.4	3940.3	2287.74	1.018	9.2
1.2	314634.0	308115.1	67367.5	5733.8	5706.2	4924.9	764.6	3762.0	1933.5	1933.5	4255.4	3953.4	2658.53	1.104	11.8
1.3	301035.7	294369.6	65353.4	5675.7	5646.4	4893.8	786.7	3781.4	1933.5	1933.5	4233.1	3940.9	3018.17	1.188	14.8
1.4	285913.0	279199.5	64197.8	5608.6	5577.9	4866.9	805.5	3737.5	1933.5	1933.5	4207.3	3930.0	3347.04	1.270	18.1
1.5	269501.1	262838.7	61326.2	5532.6	5500.7	4813.6	821.1	3736.6	1933.5	1933.5	4178.1	3908.4	3629.64	1.347	21.7
1.6	252104.1	245552.1	57090.0	5448.0	5415.0	4742.5	835.6	3754.1	1933.5	1933.5	4145.4	3879.5	3862.88	1.420	25.6
1.7	234042.2	227724.5	54203.0	5355.4	5321.6	4677.6	844.5	3720.0	1933.5	1933.5	4109.5	3852.8	4017.59	1.487	29.8
1.8	215716.4	209677.3	51203.2	5255.5	5221.2	4609.8	852.2	3643.3	1933.5	1933.5	4070.5	3824.8	4108.76	1.549	34.0
1.9	197476.1	191788.1	47833.1	5149.5	5114.8	4529.3	855.8	3602.7	1933.5	1933.5	4028.9	3791.2	4123.69	1.606	38.4
2.0	179650.8	174332.1	43192.7	5038.3	5003.4	4427.0	858.3	3612.9	1933.5	1933.5	3984.8	3748.2	4080.50	1.658	42.7
2.1	162508.4	157589.1	39745.7	4923.0	4888.2	4336.1	858.0	3555.2	1933.5	1933.5	3938.6	3709.5	3977.97	1.704	46.9
2.2	146263.7	141746.3	36299.5	4804.8	4770.1	4240.7	856.3	3495.8	1933.5	1933.5	3890.7	3668.5	3831.34	1.746	51.1
2.3	131065.8	126944.2	32275.5	4684.7	4650.3	4130.1	853.3	3491.6	1933.5	1933.5	3841.5	3620.3	3650.51	1.783	55.0
2.4	117013.0	113280.6	29485.3	4563.7	4529.6	4036.8	848.3	3405.0	1933.5	1933.5	3791.4	3579.2	3442.28	1.816	58.8
2.5	104149.7	100784.9	26346.9	4442.6	4409.1	3932.3	842.4	3364.5	1933.5	1933.5	3740.6	3532.6	3220.01	1.845	62.3
2.6	92473.1	89453.2	23521.8	4322.4	4289.4	3829.4	835.5	3316.6	1933.5	1933.5	3689.5	3486.0	2990.37	1.870	65.6
2.7	81950.3	79249.5	20598.5	4203.6	4171.2	3717.4	827.7	3312.6	1933.5	1933.5	3638.3	3434.7	2760.44	1.892	68.7
2.8	72524.3	70115.9	18383.6	4086.7	4054.9	3619.2	819.3	3253.9	1933.5	1933.5	3587.2	3389.0	2535.21	1.911	71.5
2.9	64123.7	61980.8	16251.6	3972.2	3941.2	3518.3	810.3	3216.8	1933.5	1933.5	3536.6	3341.4	2318.84	1.927	74.1
3.0	56665.7	54762.1	14445.3	3860.5	3830.1	3423.1	800.9	3163.7	1933.5	1933.5	3486.4	3295.9	2113.76	1.941	76.4
3.1	50065.5	48376.6	12826.3	3751.7	3722.1	3330.4	791.3	3113.9	1933.5	1933.5	3436.9	3251.0	1921.67	1.953	78.6
3.2	44238.5	42740.3	11401.2	3646.1	3617.2	3240.7	781.6	3062.3	1933.5	1933.5	3388.1	3206.9	1743.93	1.964	80.5
3.3	39103.1	37774.9	10103.1	3543.7	3515.6	3152.6	771.7	3015.0	1933.5	1933.5	3340.2	3163.0	1579.92	1.973	82.3
3.4	34583.2	33406.0	8956.4	3444.7	3417.3	3066.5	761.7	2973.8	1933.5	1933.5	3293.1	3119.5	1429.71	1.980	83.9
3.5	30607.8	29564.0	7902.2	3349.0	3322.3	2981.6	751.7	2942.5	1933.5	1933.5	3247.0	3076.1	1292.91	1.987	85.3

TABLE IVA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	27113.2	26187.0	6975.3	3256.6	3230.6	2899.8	741.9	2908.7	1933.5	1933.5	3201.9	3033.5	1168.97	1.992	86.6
3.7	24041.1	23219.2	6165.8	3167.4	3142.1	2820.9	732.0	2879.5	1933.5	1933.5	3157.8	2992.0	1056.43	1.997	87.8
3.8	21340.4	20610.6	5480.2	3081.5	3056.9	2747.0	722.1	2841.9	1933.5	1933.5	3114.6	2952.5	954.80	2.001	88.9
3.9	18965.2	18316.3	4871.8	2998.8	2974.8	2675.3	712.5	2808.5	1933.5	1933.5	3072.5	2913.8	863.36	2.004	89.8
4.0	16874.6	16297.1	4341.7	2919.0	2895.6	2607.1	703.0	2766.8	1933.5	1933.5	3031.4	2876.4	780.95	2.007	90.7
4.1	15033.1	14518.6	3920.5	2842.2	2819.4	2546.6	693.8	2703.7	1933.5	1933.5	2991.2	2842.8	706.86	2.009	91.5
4.2	13409.6	12950.6	3478.5	2768.2	2746.1	2480.9	684.7	2680.3	1933.5	1933.5	2952.0	2805.9	640.24	2.011	92.2
4.3	11976.8	11566.9	3126.3	2697.0	2675.4	2422.2	675.8	2634.5	1933.5	1933.5	2913.8	2772.5	580.37	2.013	92.9
4.4	10710.8	10344.2	2729.8	2628.3	2607.3	2354.7	667.1	2650.1	1933.5	1933.5	2876.5	2733.6	526.54	2.014	93.5
4.5	9591.0	9262.7	2473.0	2562.2	2541.7	2303.4	658.7	2590.6	1933.5	1933.5	2840.1	2703.6	478.13	2.015	94.0
4.6	8599.2	8304.9	2229.0	2498.5	2478.5	2250.3	650.5	2538.9	1933.5	1933.5	2804.5	2672.3	434.57	2.016	94.5
4.7	7719.8	7455.6	1926.2	2437.0	2417.5	2185.5	642.4	2579.1	1933.5	1933.5	2769.8	2633.6	395.36	2.016	94.9
4.8	6941.7	6707.0	2201.6	2378.0	2359.2	2206.1	630.6	2089.5	1933.5	1933.5	2736.2	2645.9	358.01	2.017	95.3
4.9	6252.5	6043.1	2128.7	2321.3	2303.1	2172.4	620.1	1941.0	1933.5	1933.5	2703.5	2625.7	325.11	2.017	95.7
5.0	5641.6	5455.3	2098.4	2266.9	2249.4	2142.4	608.5	1749.3	1933.5	1933.5	2671.8	2607.4	294.98	2.018	96.0
5.1	5101.7	4936.8	2056.0	2214.9	2198.1	2109.9	595.0	1604.0	1933.5	1933.5	2641.2	2587.6	267.22	2.018	96.3
5.2	4626.3	4481.5	2053.3	2165.4	2149.6	2079.9	578.8	1430.4	1933.5	1933.5	2611.8	2569.2	241.34	2.018	96.6
5.3	4208.7	4083.3	2077.0	2118.7	2103.9	2050.9	558.3	1252.3	1933.5	1933.5	2583.9	2551.2	216.77	2.019	96.8
5.4	3838.3	3734.5	2172.7	2074.1	2061.0	2024.1	526.0	1039.4	1933.5	1933.5	2557.5	2534.4	190.71	2.019	97.0

TABLE IVB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:

Temperature = 5954°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.015.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	5938.9	557.0	4341.3	366462.7	11466668.1	.128	.375
52.4	500.0	5894.7	558.6	4325.1	362679.0	11500662.7	.129	.375
100.5	500.0	5846.2	560.5	4307.3	358467.4	11545393.2	.130	.375
152.9	500.0	5802.4	562.4	4291.1	354619.1	11584582.9	.131	.375
200.4	500.0	5755.4	564.3	4273.7	350437.6	11629429.8	.132	.375
253.2	500.0	5711.8	566.6	4257.5	346503.6	11668719.2	.133	.375
300.1	500.0	5670.1	568.7	4241.9	342695.5	11713251.9	.134	.375
353.5	500.0	5622.9	571.2	4224.2	338326.0	11753065.7	.135	.375
400.3	500.0	5582.0	573.6	4208.9	334486.7	11797704.4	.136	.375
453.8	500.0	5535.8	576.4	4191.4	330079.5	11837612.5	.138	.375
500.5	500.0	5495.6	579.0	4176.2	326205.4	11881609.6	.139	.375
553.9	500.0	5450.2	582.2	4158.9	321756.3	11922350.2	.140	.375
600.6	500.0	5410.9	585.1	4143.8	317843.5	11966411.1	.141	.375
653.9	500.0	5366.3	588.6	4126.7	313347.8	12007270.2	.143	.375
700.5	500.0	5327.7	591.9	4111.9	309392.1	12051387.8	.144	.375
753.8	500.0	5284.0	595.8	4095.0	304844.6	12092363.8	.145	.375
800.4	500.0	5246.1	599.4	4080.3	300841.0	12137376.7	.147	.375
853.6	500.0	5203.3	603.7	4063.6	296235.8	12177622.9	.149	.375
900.1	500.0	5166.1	607.7	4049.0	292178.9	12222717.7	.150	.375
953.3	500.0	5124.0	612.5	4032.5	287509.3	12263038.0	.152	.375
1000.4	500.0	5083.7	617.1	4016.6	282954.1	12308654.1	.154	.375
1052.8	500.0	5046.3	622.4	4001.8	278651.2	12348600.1	.156	.375
1100.3	500.0	5006.2	628.0	3985.9	273958.8	12394294.2	.158	.375
1152.1	500.0	4970.1	633.5	3971.4	269645.6	12434309.4	.160	.375
1200.1	500.0	4930.3	639.9	3955.5	264822.3	12480078.6	.162	.375
1251.3	500.0	4895.2	645.9	3941.4	260473.9	12513340.0	.164	.375
1304.1	500.0	4855.9	653.2	3925.6	255507.1	12565997.1	.166	.375
1350.3	500.0	4821.8	659.9	3911.8	251114.5	12611417.7	.169	.375
1402.7	500.0	4783.4	668.1	3896.1	246066.8	12651940.9	.171	.375
1453.8	500.0	4746.3	676.6	3881.0	241082.7	12696789.4	.174	.375
1503.6	500.0	4710.4	685.5	3866.3	236150.6	12740596.8	.177	.375
1552.4	500.0	4675.6	694.9	3852.0	231256.7	12783492.6	.180	.375
1600.1	500.0	4641.8	704.6	3838.1	226391.5	12829754.6	.184	.375
1651.8	500.0	4604.3	716.4	3822.5	220866.2	12871330.6	.187	.375
1703.9	500.0	4569.1	728.6	3807.9	215526.6	12917475.1	.191	.375
1750.1	500.0	4534.0	741.7	3793.2	210068.5	12961177.2	.196	.375
1803.2	500.0	4500.6	755.4	3779.2	204731.7	13005777.1	.200	.375
1850.5	500.0	4465.2	770.8	3764.3	198925.0	13047594.6	.205	.375
1902.0	500.0	4431.4	788.2	3750.1	193197.8	13094240.9	.210	.375
1950.1	500.0	4397.8	806.7	3735.8	187318.1	13139806.5	.216	.375
2001.6	500.0	4364.0	827.5	3721.4	181211.7	13184211.6	.222	.375
2050.4	500.0	4330.6	850.5	3707.2	174968.1	13227626.7	.229	.375
2100.3	500.0	4297.5	876.1	3693.0	168552.6	13276133.1	.237	.375
2150.4	500.0	4264.0	905.4	3678.6	161814.4	13322030.8	.246	.375
2200.2	500.0	4230.8	938.6	3664.2	154864.4	13366865.1	.256	.375
2250.6	500.0	4197.5	977.2	3649.7	147574.2	13414755.6	.268	.375
2300.5	500.0	4164.2	1022.1	3635.2	139970.3	13458242.1	.281	.375
2350.0	500.0	4129.9	1076.7	3620.2	131762.3	13509825.1	.297	.375
2401.5	500.0	4096.4	1140.5	3605.5	123374.2	13523483.6	.316	.375
2450.2	500.0	4060.0	1224.8	3589.5	113851.0	13609770.2	.341	.375
2500.3	500.0	4019.6	1342.1	3571.6	102838.2	13658459.4	.376	.375
2550.0	500.0	3976.9	1499.9	3552.6	91015.8	13728786.2	.422	.375
2600.5	500.0	3917.7	1781.0	3526.0	75441.0	13803686.2	.505	.375
2650.4	500.0	3764.5	2638.0	3456.4	48601.8	13940298.5	.763	.375

TABLE IVB (Cont.)

Initial temperature = 5954°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.015.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	5003.4	858.3	3984.7	174321.1	46530135.0	.215	1.815
54.5	1933.5	4998.9	864.3	3983.0	173145.4	46560428.5	.217	1.814
104.5	1933.5	4994.4	871.0	3981.2	171939.2	46601955.9	.219	1.812
154.5	1933.5	4989.9	877.9	3979.4	170719.9	46653325.3	.221	1.811
200.5	1933.5	4985.4	886.5	3977.6	169456.1	46640386.1	.223	1.808
252.1	1933.5	4981.1	892.2	3975.8	168292.8	46765603.1	.224	1.808
302.1	1933.5	4976.5	899.6	3974.0	167031.4	46819692.3	.226	1.806
352.1	1933.5	4972.0	907.1	3972.2	165754.7	46876956.9	.228	1.805
400.3	1933.5	4967.2	928.0	3970.3	164263.8	45804847.5	.234	1.792
450.1	1933.5	4962.7	924.7	3968.5	163102.4	47038490.8	.233	1.800
500.2	1933.5	4958.1	933.0	3966.7	161769.7	47092466.0	.235	1.799
551.0	1933.5	4953.5	941.6	3964.8	160411.0	47116019.4	.238	1.797
600.7	1933.5	4949.2	949.4	3963.1	159166.3	47169365.6	.240	1.796
650.7	1933.5	4944.6	958.5	3961.3	157785.0	47213552.3	.242	1.794
700.7	1933.5	4939.9	967.7	3959.4	156387.4	47275056.7	.244	1.793
750.7	1933.5	4935.3	977.2	3957.5	154970.4	47333364.8	.247	1.791
800.7	1933.5	4930.6	987.0	3955.6	153533.2	47391072.9	.250	1.790
850.7	1933.5	4925.9	997.1	3953.8	152075.6	47448425.3	.252	1.788
900.0	1933.5	4920.8	1017.4	3951.7	150385.0	46807060.4	.257	1.780
951.8	1933.5	4916.1	1020.4	3949.8	149000.3	47615960.5	.258	1.784
1000.4	1933.5	4911.2	1032.9	3947.9	147419.3	47681055.9	.262	1.783
1051.2	1933.5	4906.8	1044.1	3946.1	145972.9	47729048.7	.265	1.781
1100.1	1933.5	4901.6	1056.7	3944.0	144287.2	47800119.9	.268	1.780
1150.1	1933.5	4897.1	1068.6	3942.2	142820.1	47850967.2	.271	1.778
1200.1	1933.5	4891.8	1082.6	3940.1	141047.8	47914591.7	.275	1.777
1251.1	1933.5	4887.1	1095.9	3938.1	139457.7	47974815.2	.278	1.775
1301.8	1933.5	4881.8	1111.0	3936.0	137674.5	48016228.9	.282	1.773
1352.1	1933.5	4877.0	1125.1	3934.1	136030.5	48048103.0	.286	1.772
1401.3	1933.5	4871.6	1142.1	3931.9	134173.2	48216002.6	.290	1.769
1450.3	1933.5	4866.5	1159.3	3929.9	132388.3	48240405.3	.295	1.768
1500.5	1933.5	4861.3	1175.4	3927.7	130560.3	48305206.5	.299	1.766
1550.2	1933.5	4855.9	1194.4	3925.6	128645.6	48369599.2	.304	1.764
1603.6	1933.5	4850.4	1213.9	3923.4	126705.3	48437631.0	.309	1.763
1654.1	1933.5	4845.0	1233.6	3921.2	124769.6	48496821.8	.315	1.761
1700.1	1933.5	4839.3	1254.8	3918.9	122733.7	48556303.8	.320	1.759
1750.4	1933.5	4833.6	1277.3	3916.5	120651.4	48628468.6	.326	1.758
1800.1	1933.5	4827.7	1301.4	3914.2	118533.0	48690628.4	.332	1.756
1850.5	1933.5	4821.9	1315.2	3911.8	116505.0	50027665.1	.336	1.764
1900.3	1933.5	4815.5	1356.0	3909.2	114073.0	48868623.1	.347	1.751
1950.4	1933.5	4809.1	1385.2	3906.6	111732.2	48948487.7	.355	1.750
2004.8	1933.5	4802.4	1416.9	3903.9	109317.0	48996095.9	.363	1.748
2050.0	1933.5	4795.5	1451.3	3901.1	106826.3	49059460.8	.372	1.746
2100.2	1933.5	4788.2	1487.7	3898.1	104233.7	49186158.9	.382	1.744
2150.2	1933.5	4780.4	1529.4	3895.0	101505.3	49245666.3	.393	1.742
2200.4	1933.5	4772.2	1574.7	3891.6	98653.6	49361943.7	.405	1.740
2250.1	1933.5	4763.4	1625.1	3888.0	95689.2	49438124.0	.418	1.737
2300.2	1933.5	4754.5	1658.9	3884.4	92842.9	50789940.0	.427	1.743
2350.4	1933.5	4743.1	1750.4	3879.7	89097.3	49709203.7	.451	1.731
2401.4	1933.5	4730.9	1826.8	3874.7	85443.7	49724881.7	.471	1.728
2450.8	1933.5	4716.8	1917.3	3868.9	81485.7	49980839.7	.496	1.724
2500.4	1933.5	4699.2	2032.0	3861.7	76958.4	50137023.2	.526	1.720
2550.4	1933.5	4676.4	2183.6	3852.3	71746.5	50422337.3	.567	1.714
2600.5	1933.5	4649.1	2313.8	3841.1	66480.1	52046880.9	.602	1.725
2650.1	1933.5	4559.8	2927.7	3804.0	53894.8	51378438.2	.770	1.685

TABLE IVB (Cont.)

Initial temperature = 5954°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.015.
Time = 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
2.5	1933.5	2895.6	703.0	3031.4	16296.1	8874323.0	.232	2.183
52.5	1933.5	2893.9	707.8	3030.5	16191.6	8876572.8	.234	2.182
102.5	1933.5	2892.1	713.3	3029.5	16079.8	8884284.2	.235	2.180
152.5	1933.5	2890.3	719.0	3028.6	15966.8	8891866.5	.237	2.178
204.5	1933.5	2888.4	725.6	3027.6	15847.1	8881735.8	.240	2.176
254.5	1933.5	2886.6	731.0	3026.6	15732.5	8908492.9	.242	2.175
304.5	1933.5	2884.8	737.0	3025.7	15615.7	8916565.7	.244	2.174
354.5	1933.5	2883.0	743.2	3024.7	15497.6	8925386.4	.246	2.172
403.0	1933.5	2881.2	762.2	3023.8	15364.2	8671287.8	.252	2.154
451.6	1933.5	2879.4	756.2	3022.9	15267.0	8943485.5	.250	2.168
501.6	1933.5	2877.6	763.0	3021.9	15144.5	8951622.3	.252	2.166
551.6	1933.5	2875.7	769.9	3020.9	15020.5	8959081.6	.255	2.165
601.6	1933.5	2873.8	777.0	3019.9	14894.9	8967830.8	.257	2.163
651.6	1933.5	2871.9	784.4	3018.9	14767.6	8974078.9	.260	2.162
701.6	1933.5	2870.0	791.9	3017.9	14638.9	8983530.8	.262	2.160
751.6	1933.5	2868.1	799.6	3016.9	14508.4	8992513.5	.265	2.158
801.6	1933.5	2866.2	807.6	3015.9	14376.1	9001220.9	.268	2.157
851.6	1933.5	2864.3	815.8	3014.9	14242.0	9010030.7	.271	2.155
900.7	1933.5	2862.2	834.1	3013.8	14084.9	8845645.3	.277	2.143
954.4	1933.5	2860.3	834.0	3012.8	13962.8	9030113.9	.277	2.151
1004.4	1933.5	2858.3	843.2	3011.8	13822.3	9037806.0	.280	2.150
1054.4	1933.5	2856.3	852.7	3010.7	13679.5	9045569.4	.283	2.148
1104.4	1933.5	2854.2	862.4	3009.6	13534.9	9055531.7	.287	2.146
1154.4	1933.5	2852.2	872.7	3008.5	13387.5	9063103.6	.290	2.145
1204.4	1933.5	2850.1	883.3	3007.4	13237.9	9072544.2	.294	2.143
1254.4	1933.5	2848.0	894.2	3006.3	13085.6	9081493.7	.297	2.141
1304.4	1933.5	2845.9	905.8	3005.2	12930.5	9089028.1	.301	2.140
1354.4	1933.5	2843.7	917.6	3004.1	12772.8	9099149.2	.305	2.138
1403.2	1933.5	2841.6	929.9	3003.0	12619.5	9118770.9	.310	2.136
1453.2	1933.5	2839.4	943.3	3001.8	12454.8	9119569.5	.314	2.134
1503.2	1933.5	2837.1	956.9	3000.6	12287.2	9129388.5	.319	2.132
1553.2	1933.5	2834.8	971.2	2999.3	12116.2	9139035.7	.324	2.130
1603.2	1933.5	2832.4	986.2	2998.1	11941.3	9149590.6	.329	2.128
1653.2	1933.5	2829.9	1002.0	2996.8	11762.4	9158238.6	.334	2.127
1703.2	1933.5	2827.4	1018.6	2995.5	11579.2	9168327.3	.340	2.125
1753.2	1933.5	2824.8	1036.2	2994.1	11391.5	9179165.7	.346	2.123
1803.2	1933.5	2822.2	1055.0	2992.7	11198.5	9188273.0	.353	2.121
1850.2	1933.5	2819.6	1059.2	2991.3	11024.3	9473277.9	.354	2.134
1904.8	1933.5	2816.5	1097.4	2989.7	10790.3	9212172.6	.367	2.116
1954.8	1933.5	2813.5	1120.2	2988.1	10579.2	9224439.6	.375	2.114
2004.8	1933.5	2810.4	1144.7	2986.4	10361.1	9236234.6	.383	2.112
2054.8	1933.5	2807.0	1171.3	2984.6	10134.9	9246300.8	.392	2.110
2104.8	1933.5	2803.5	1199.8	2982.8	9900.6	9260272.8	.402	2.107
2154.8	1933.5	2799.8	1231.3	2980.8	9655.7	9272682.3	.413	2.105
2204.8	1933.5	2795.7	1265.8	2978.6	9399.9	9286599.9	.425	2.102
2254.8	1933.5	2791.3	1304.5	2976.2	9130.4	9298447.6	.438	2.099
2304.6	1933.5	2787.0	1326.0	2974.0	8888.5	9568312.0	.446	2.111
2354.7	1933.5	2781.1	1396.4	2970.8	8548.6	9335776.7	.470	2.093
2404.7	1933.5	2774.8	1453.1	2967.5	8222.3	9353207.8	.490	2.089
2454.7	1933.5	2767.4	1520.2	2963.5	7866.6	9375127.5	.513	2.085
2504.7	1933.5	2758.3	1602.4	2958.6	7470.5	9397887.5	.542	2.079
2552.3	1933.5	2746.6	1712.1	2952.3	7018.9	9491250.0	.580	2.073
2602.5	1933.5	2731.8	1815.3	2944.4	6533.7	9623439.3	.617	2.083
2651.6	1933.5	2683.0	2260.2	2917.9	5378.9	9650526.1	.775	2.038

TABLE VA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of: Temperature = 5954°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.075.

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (0/0)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	370440.0	369584.5	14587.6	5954.0	5950.8	3357.7	259.2	3318.9	500.0	500.0	4345.7	3264.3	93.74	.375	0.0
.1	369966.0	369145.5	15603.5	5952.2	5949.2	3661.0	254.0	3354.0	1636.0	1090.1	4345.1	3408.5	91.76	.375	.1
.2	369502.2	368708.1	16416.1	5950.5	5947.6	3917.6	250.0	3383.7	2491.4	1613.2	4344.5	3526.0	90.23	.375	.2
.3	369046.3	368273.5	16826.5	5948.8	5945.9	4127.6	246.7	3440.2	3156.1	2070.6	4343.9	3619.2	88.97	.375	.3
.4	368596.8	368027.0	17263.0	5947.2	5945.0	4275.1	211.9	3658.4	3258.0	2478.9	4343.5	3683.4	95.17	.375	.4
.5	368116.2	367586.0	20789.5	5945.4	5943.4	4431.7	204.5	3639.1	3258.0	2840.1	4342.9	3750.2	109.06	.375	.5
.6	367565.6	366995.8	24461.4	5943.3	5941.2	4540.7	212.1	3783.6	3258.0	3234.3	4342.1	3796.0	131.53	.375	.6
.7	366901.7	366261.8	26085.4	5940.8	5938.4	4661.3	225.0	3679.5	3258.0	3258.0	4341.1	3846.1	157.01	.406	.7
.8	366109.6	365451.8	23313.9	5937.9	5935.4	4521.9	228.3	3751.3	1933.5	3258.0	4340.0	3788.1	188.90	.436	.9
.9	365157.2	364454.4	28329.0	5934.3	5931.7	4505.7	236.2	3672.9	1933.5	3258.0	4338.7	3781.4	227.71	.469	1.1
1.0	364009.7	363221.4	30411.2	5930.0	5927.0	4530.7	250.5	3724.1	1933.5	3258.0	4337.0	3791.9	278.40	.495	1.3
1.1	362607.7	361741.5	30323.0	5924.7	5921.4	4583.7	263.0	3785.5	1933.5	1933.5	4334.9	3813.9	334.85	.544	1.6
1.2	360923.0	359976.6	28712.1	5918.3	5914.8	4615.2	275.4	3931.2	1933.5	1933.5	4332.5	3827.1	398.91	.593	2.0
1.3	358918.2	357894.3	29299.5	5910.7	5906.8	4660.4	287.1	3958.0	1933.5	1933.5	4329.6	3845.8	469.88	.642	2.4
1.4	356559.7	355459.8	33113.1	5901.8	5897.6	4772.3	298.3	3719.6	1933.5	1933.5	4326.2	3891.6	548.15	.693	2.9
1.5	353812.5	352637.8	33073.9	5891.2	5886.7	4793.0	309.2	3768.6	1933.5	1933.5	4322.2	3900.1	633.75	.744	3.5
1.6	350642.0	349395.1	32630.7	5879.0	5874.2	4801.8	319.7	3833.1	1933.5	1933.5	4317.6	3903.6	726.28	.796	4.1
1.7	347016.1	345694.4	30647.6	5864.9	5859.8	4800.4	330.5	3970.7	1933.5	1933.5	4312.3	3903.1	827.09	.848	4.9
1.8	342896.8	341511.5	32035.0	5848.8	5843.3	4836.5	339.9	3917.6	1933.5	1933.5	4306.2	3917.7	931.69	.899	5.8
1.9	338269.4	336819.7	31277.1	5830.5	5824.7	4832.5	349.6	3982.9	1933.5	1933.5	4299.4	3916.1	1043.03	.950	6.7
2.0	333105.1	331598.2	33858.1	5809.8	5803.7	4897.6	358.5	3778.3	1933.5	1933.5	4291.6	3942.4	1157.87	1.002	7.8
2.1	327392.6	325836.8	33888.5	5786.7	5780.3	4895.8	366.7	3799.2	1933.5	1933.5	4283.0	3941.7	1274.55	1.052	9.1
2.2	321129.4	319526.4	33937.4	5760.9	5754.3	4902.1	375.1	3761.8	1933.5	1933.5	4273.3	3944.2	1394.54	1.103	10.4
2.3	314307.2	312667.0	32661.7	5732.5	5725.5	4867.4	382.5	3868.8	1933.5	1933.5	4262.6	3930.2	1513.14	1.153	11.9
2.4	306941.3	305266.9	31576.5	5701.2	5694.0	4853.3	390.1	3843.1	1933.5	1933.5	4250.8	3924.5	1632.10	1.202	13.5
2.5	299039.6	297342.7	31815.0	5667.0	5659.5	4851.0	396.7	3796.1	1933.5	1933.5	4238.0	3923.6	1745.88	1.249	15.2
2.6	290637.9	288930.6	31458.3	5629.8	5622.2	4823.9	402.3	3864.2	1933.5	1933.5	4224.0	3912.6	1852.16	1.295	17.0
2.7	281783.1	280069.6	32163.1	5589.8	5581.9	4828.7	407.8	3761.8	1933.5	1933.5	4208.8	3914.5	1953.45	1.342	19.0
2.8	272510.5	270795.1	29866.6	5546.8	5538.7	4771.1	413.4	3848.2	1933.5	1933.5	4192.5	3891.2	2048.49	1.387	21.0
2.9	262861.6	261157.1	29834.7	5500.8	5492.6	4753.3	417.8	3797.8	1933.5	1933.5	4175.0	3883.9	2130.85	1.430	23.2
3.0	252907.9	251218.6	28527.2	5452.0	5443.6	4714.0	422.2	3789.4	1933.5	1933.5	4156.3	3867.8	2204.20	1.472	25.4
3.1	242702.8	241033.0	25389.1	5400.4	5391.8	4611.3	426.5	3900.0	1933.5	1933.5	4136.5	3825.4	2267.66	1.512	27.8
3.2	232303.3	230673.0	28338.8	5346.1	5337.5	4667.5	428.6	3657.6	1933.5	1933.5	4115.6	3848.7	2309.26	1.553	30.2
3.3	221819.5	220223.8	25500.9	5289.5	5280.7	4581.5	431.6	3800.6	1933.5	1933.5	4093.7	3813.1	2345.19	1.590	32.6
3.4	211285.4	209735.1	25424.1	5230.4	5221.5	4554.2	433.5	3712.1	1933.5	1933.5	4070.7	3801.7	2364.00	1.626	35.1
3.5	200785.4	199282.6	24024.4	5169.2	5160.3	4497.0	435.2	3725.1	1933.5	1933.5	4046.7	3777.7	2371.53	1.660	37.6

TABLE VA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	190375.2	188921.8	23247.7	5106.1	5097.1	4462.3	436.9	3648.0	1933.5	1933.5	4021.9	3763.1	2368.11	1.693	40.1
3.7	180106.8	178704.3	21634.8	5041.2	5032.1	4399.7	438.4	3635.2	1933.5	1933.5	3996.2	3736.6	2354.27	1.723	42.6
3.8	170028.3	168684.5	20000.2	4974.7	4965.6	4323.1	438.8	3717.9	1933.5	1933.5	3969.6	3704.0	2324.94	1.751	45.1
3.9	160206.8	158921.5	20171.1	4906.8	4897.7	4308.5	439.1	3529.8	1933.5	1933.5	3942.4	3697.7	2286.91	1.778	47.5
4.0	150677.6	149453.4	18675.7	4837.9	4828.8	4235.2	438.8	3578.9	1933.5	1933.5	3914.6	3666.1	2238.71	1.803	49.9
4.1	141480.3	140316.0	17876.1	4768.1	4759.0	4185.4	438.4	3520.4	1933.5	1933.5	3886.2	3644.5	2184.03	1.826	52.3
4.2	132637.2	131532.3	16869.6	4697.6	4688.5	4127.5	437.8	3487.9	1933.5	1933.5	3857.3	3619.2	2123.11	1.848	54.6
4.3	124167.8	123120.3	14751.2	4626.6	4617.5	4026.4	437.2	3601.3	1933.5	1933.5	3828.0	3574.6	2058.03	1.869	56.9
4.4	116082.1	115096.5	15002.0	4555.2	4546.3	4005.9	435.2	3452.2	1933.5	1933.5	3798.4	3565.5	1983.22	1.887	59.0
4.5	108410.4	107480.3	13940.5	4483.9	4475.0	3944.1	434.1	3422.0	1933.5	1933.5	3768.5	3537.9	1910.28	1.905	61.1
4.6	101136.6	100263.3	13140.0	4412.6	4403.8	3886.9	432.0	3391.5	1933.5	1933.5	3738.4	3512.1	1831.92	1.922	63.2
4.7	94272.0	93451.9	12075.1	4341.6	4332.9	3816.0	430.2	3405.9	1933.5	1933.5	3708.1	3480.0	1754.07	1.937	65.1
4.8	87805.0	87033.0	10716.9	4271.0	4262.3	3731.2	428.9	3422.8	1933.5	1933.5	3677.8	3441.0	1678.82	1.951	67.0
4.9	81716.0	80992.6	10184.5	4200.8	4192.2	3678.5	426.8	3333.7	1933.5	1933.5	3647.4	3416.7	1600.95	1.963	68.7
5.0	76005.0	75332.2	9958.4	4131.1	4122.7	3639.3	423.3	3305.0	1933.5	1933.5	3617.1	3398.4	1519.11	1.976	70.4
5.1	70675.8	70044.7	9080.6	4062.4	4054.0	3574.5	421.5	3319.6	1933.5	1933.5	3586.8	3368.0	1445.81	1.987	72.0
5.2	65688.1	65096.8	8466.2	3994.4	3986.0	3521.0	419.7	3222.0	1933.5	1933.5	3556.6	3342.7	1373.89	1.997	73.6
5.3	61027.9	60478.4	7989.2	3927.1	3918.9	3461.9	416.2	3247.2	1933.5	1933.5	3526.6	3314.6	1298.98	2.006	75.0
5.4	56696.0	56181.6	7253.8	3860.9	3852.8	3399.6	414.3	3195.7	1933.5	1933.5	3496.7	3284.6	1231.68	2.014	76.4
5.5	52657.7	52179.9	6937.3	3795.7	3787.7	3355.2	410.8	3164.9	1933.5	1933.5	3467.0	3263.1	1162.36	2.021	77.7
5.6	48911.1	48466.8	6625.3	3731.6	3723.7	3307.6	407.5	3105.2	1933.5	1933.5	3437.6	3239.9	1097.01	2.028	78.9
5.7	45434.9	45020.0	5848.7	3668.6	3660.9	3231.1	405.1	3176.3	1933.5	1933.5	3408.5	3202.2	1036.79	2.035	80.1
5.8	42204.9	41819.5	5803.8	3606.7	3599.1	3202.7	401.7	3033.3	1933.5	1933.5	3379.6	3188.1	976.82	2.041	81.2
5.9	39213.1	38853.5	5134.9	3546.0	3538.5	3133.9	399.2	3084.9	1933.5	1933.5	3351.0	3153.7	922.01	2.046	82.2
6.0	36436.7	36102.5	4889.5	3486.4	3479.0	3086.7	395.8	3039.4	1933.5	1933.5	3322.7	3129.8	868.09	2.051	83.2
6.1	33866.6	33555.9	4664.4	3428.1	3420.8	3048.0	392.6	2960.0	1933.5	1933.5	3294.8	3110.1	817.33	2.056	84.1
6.2	31487.3	31197.5	4283.5	3370.9	3363.8	2994.1	389.8	2961.9	1933.5	1933.5	3267.2	3082.5	770.42	2.060	85.0
6.3	29281.9	29012.4	4016.5	3314.9	3307.9	2946.8	386.6	2926.3	1933.5	1933.5	3240.0	3058.0	725.06	2.064	85.8
6.4	27240.8	26989.8	3766.6	3260.1	3253.2	2903.7	383.6	2885.4	1933.5	1933.5	3213.1	3035.6	682.83	2.067	86.6
6.5	25350.4	25116.7	3482.7	3206.4	3199.6	2853.3	380.6	2879.1	1933.5	1933.5	3186.5	3009.1	642.89	2.070	87.3
6.6	23599.9	23382.2	3269.6	3153.9	3147.2	2811.3	377.6	2840.4	1933.5	1933.5	3160.3	2986.9	605.26	2.073	88.0
6.7	21978.9	21775.9	3046.1	3102.6	3095.9	2766.9	374.7	2818.4	1933.5	1933.5	3134.5	2963.2	569.91	2.075	88.6
6.8	20477.3	20288.2	2741.6	3052.3	3045.8	2709.2	371.7	2866.0	1933.5	1933.5	3109.0	2932.2	536.64	2.078	89.2
6.9	19086.4	18910.0	2606.0	3003.2	2996.7	2675.1	368.8	2805.5	1933.5	1933.5	3083.8	2913.7	505.36	2.080	89.8
7.0	17797.6	17632.9	2389.6	2955.1	2948.8	2627.8	366.0	2816.8	1933.5	1933.5	3059.1	2887.8	476.19	2.082	90.3
7.1	16602.6	16449.0	2220.1	2908.1	2901.9	2586.7	363.1	2800.6	1933.5	1933.5	3034.6	2865.1	448.54	2.083	90.8
7.2	15494.9	15351.6	2204.1	2862.1	2856.0	2569.9	360.2	2661.2	1933.5	1933.5	3010.5	2855.8	422.59	2.085	91.3
7.3	14467.8	14333.9	2217.9	2817.2	2811.1	2559.1	357.4	2471.5	1933.5	1933.5	2986.8	2849.8	398.26	2.086	91.7
7.4	13515.0	13390.0	2200.4	2773.2	2767.3	2538.7	354.6	2343.2	1933.5	1933.5	2963.4	2838.4	375.43	2.087	92.2
7.5	12630.9	12514.0	2177.3	2730.3	2724.4	2517.0	351.8	2194.7	1933.5	1933.5	2940.4	2826.3	354.01	2.089	92.6

TABLE VA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
7.6	11810.1	11700.9	2173.9	2688.3	2682.5	2495.9	349.1	2010.8	1933.5	1933.5	2917.7	2814.4	333.92	2.090	92.9
7.7	11047.9	10945.7	2068.2	2647.2	2641.5	2463.3	346.3	1966.9	1933.5	1933.5	2895.3	2795.9	315.00	2.091	93.3
7.8	10339.7	10245.4	2225.5	2607.0	2601.5	2453.5	341.4	1785.4	1933.5	1933.5	2873.3	2790.4	295.32	2.091	93.6
7.9	9685.9	9597.6	2184.3	2568.0	2562.6	2426.7	338.8	1660.1	1933.5	1933.5	2851.7	2775.1	278.95	2.092	93.9
8.0	9077.6	8994.8	2080.8	2529.9	2524.5	2395.1	336.3	1586.7	1933.5	1933.5	2830.5	2757.0	263.56	2.093	94.2
8.1	8511.4	8434.5	2146.2	2492.5	2487.3	2374.5	332.1	1438.7	1933.5	1933.5	2809.5	2745.0	247.89	2.093	94.5
8.2	7986.7	7915.6	2225.3	2456.2	2451.2	2352.7	327.2	1350.9	1933.5	1933.5	2789.0	2732.4	232.70	2.094	94.8
8.3	7501.3	7434.6	2145.5	2420.9	2415.9	2323.7	324.9	1232.2	1933.5	1933.5	2768.9	2715.6	220.25	2.095	95.0
8.4	7048.6	6987.3	2225.2	2386.4	2381.6	2300.7	318.9	1171.4	1933.5	1933.5	2749.2	2702.1	206.19	2.095	95.3
8.5	6630.7	6573.0	2138.2	2353.0	2348.2	2272.4	316.6	1076.6	1933.5	1933.5	2729.9	2685.4	195.41	2.095	95.5
8.6	6240.3	6186.9	2177.3	2320.3	2315.7	2248.2	311.7	985.0	1933.5	1933.5	2710.9	2671.1	183.68	2.096	95.7
8.7	5878.3	5828.1	2032.2	2288.5	2284.0	2219.1	309.6	987.8	1933.5	1933.5	2692.2	2653.7	174.27	2.096	95.9
8.8	5539.7	5493.5	2097.4	2257.4	2253.0	2196.2	303.4	889.2	1933.5	1933.5	2673.9	2640.0	163.27	2.096	96.1
8.9	5226.7	5184.9	2202.3	2227.3	2223.1	2174.0	295.4	782.2	1933.5	1933.5	2656.1	2626.6	152.07	2.097	96.2
9.0	4939.1	4899.6	2069.7	2198.4	2194.3	2147.9	293.5	782.1	1933.5	1933.5	2638.9	2610.8	144.67	2.097	96.4
9.1	4669.0	4633.9	2224.2	2170.0	2166.2	2127.0	282.7	666.4	1933.5	1933.5	2621.9	2598.1	133.54	2.097	96.5
9.2	4422.9	4389.6	2099.9	2143.1	2139.3	2102.8	281.0	665.1	1933.5	1933.5	2605.6	2583.2	127.31	2.097	96.7
9.3	4191.2	4161.2	2140.7	2116.6	2113.1	2081.2	272.7	602.0	1933.5	1933.5	2589.6	2570.0	118.58	2.097	96.8
9.4	3978.1	3949.5	2026.2	2091.3	2087.8	2058.5	271.0	600.7	1933.5	1933.5	2574.0	2555.9	113.24	2.097	96.9
9.5	3777.0	3751.8	2110.6	2066.4	2063.2	2038.5	259.7	526.4	1933.5	1933.5	2558.8	2543.5	104.31	2.098	97.1

TABLE VB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:

Temperature = 5954°R, Pressure = 175 Atm, Mass = 571,500 lbs, Friction factor = 0.075.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	5950.3	259.2	4345.5	369541.3	5365984.1	.060	.375
52.0	500.0	5899.3	259.9	4326.8	365476.9	5384380.0	.060	.375
100.1	500.0	5842.8	260.6	4306.1	360913.3	5408520.4	.061	.375
151.6	500.0	5793.0	261.4	4287.6	356828.1	5430461.2	.061	.375
204.7	500.0	5737.2	262.2	4267.0	352196.1	5453888.9	.061	.375
251.2	500.0	5689.0	263.1	4249.0	348130.9	5475683.9	.062	.375
304.2	500.0	5634.4	264.1	4228.6	343470.3	5499390.0	.062	.375
350.6	500.0	5587.2	265.0	4210.8	339378.4	5523185.4	.063	.375
403.7	500.0	5533.8	266.2	4190.7	334685.2	5545018.1	.064	.375
450.1	500.0	5487.7	267.3	4173.1	330563.1	5569171.9	.064	.375
503.1	500.0	5435.5	268.6	4153.2	325833.1	5590764.6	.065	.375
550.0	500.0	5385.5	269.8	4134.1	321227.9	5615209.0	.065	.375
602.3	500.0	5339.3	271.2	4116.3	316905.0	5636622.8	.066	.375
650.3	500.0	5289.3	272.8	4097.0	312154.5	5661124.0	.067	.375
701.5	500.0	5245.2	274.2	4079.9	307891.4	5681925.5	.067	.375
754.4	500.0	5195.8	276.0	4060.6	303045.4	5707138.1	.068	.375
800.6	500.0	5153.1	277.6	4043.9	298781.3	5731156.6	.069	.375
853.4	500.0	5104.8	279.6	4024.9	293879.0	5753244.6	.069	.375
900.2	500.0	5058.6	281.5	4006.7	289094.5	5777868.8	.070	.375
952.3	500.0	5015.9	283.7	3989.7	284596.6	5799433.0	.071	.375
1000.0	500.0	4969.7	286.1	3971.3	279641.2	5824098.1	.072	.375
1051.1	500.0	4928.9	288.3	3954.9	275183.4	5843561.4	.073	.375
1103.7	500.0	4883.2	291.0	3936.6	270103.7	5870395.5	.074	.375
1150.3	500.0	4839.5	293.6	3918.9	265134.5	5895112.7	.075	.375
1202.3	500.0	4799.1	296.6	3902.6	260455.8	5916752.1	.076	.375
1254.8	500.0	4755.0	299.9	3884.6	255238.2	5941496.5	.077	.375
1300.6	500.0	4716.9	303.0	3869.0	250628.1	5965664.1	.078	.375
1353.0	500.0	4673.8	306.7	3851.3	245304.7	5987921.8	.080	.375
1400.4	500.0	4631.6	310.7	3833.8	239970.5	6012696.3	.081	.375
1451.1	500.0	4594.3	314.5	3818.4	235150.8	6029486.2	.082	.375
1503.4	500.0	4552.6	319.1	3801.0	229634.0	6059165.4	.084	.375
1551.3	500.0	4514.8	323.7	3785.2	224495.4	6084239.2	.086	.375
1600.1	500.0	4476.7	328.8	3769.2	219187.8	6108002.5	.087	.375
1650.5	500.0	4434.2	334.9	3751.2	213109.6	6131542.4	.089	.375
1701.0	500.0	4399.0	340.5	3736.3	207927.2	6155762.7	.091	.375
1753.0	500.0	4359.6	347.5	3719.5	201959.2	6178067.1	.093	.375
1805.0	500.0	4320.6	355.1	3702.9	195863.7	6202927.9	.096	.375
1850.5	500.0	4286.7	362.4	3688.3	190415.2	6227577.4	.098	.375
1902.5	500.0	4248.5	371.5	3671.8	184043.6	6249623.8	.101	.375
1954.5	500.0	4210.6	381.8	3655.4	177500.3	6274574.4	.104	.375
2000.5	500.0	4174.2	391.9	3639.6	170968.7	6299559.2	.108	.375
2052.0	500.0	4140.5	404.6	3624.9	164693.5	6321447.0	.112	.375
2104.0	500.0	4103.7	419.3	3608.7	157525.2	6346494.7	.116	.375
2150.5	500.0	4067.8	435.7	3592.9	150222.7	6371579.5	.121	.375
2201.5	500.0	4035.4	453.2	3578.6	143291.5	6371207.4	.127	.375
2253.5	500.0	3999.3	476.1	3562.6	135180.2	6418728.4	.134	.375
2304.1	500.0	3964.1	503.1	3546.8	126766.6	6443675.1	.142	.375
2350.2	500.0	3929.7	533.4	3531.4	117999.4	6467841.6	.151	.375
2400.2	500.0	3897.1	574.7	3516.7	109084.4	6491746.1	.163	.375
2450.1	500.0	3860.7	627.9	3500.3	98342.2	6496496.1	.179	.375
2500.2	500.0	3825.1	708.3	3484.1	86821.9	6540973.1	.203	.375
2550.2	500.0	3787.4	827.5	3466.9	73537.4	6566652.0	.239	.375
2600.4	500.0	3742.1	1044.0	3446.1	56963.9	6591571.1	.303	.375
2650.1	500.0	3620.8	1970.0	3389.8	29113.8	6612739.4	.581	.375

TABLE VB (Cont.)

Initial temperature = 5954°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	5803.6	358.5	4291.6	331573.7	19423913.3	.084	1.168
50.4	1933.5	5793.9	361.7	4288.0	329088.5	19449364.4	.084	1.167
100.1	1933.5	5784.3	364.9	4284.4	326575.4	19498264.2	.085	1.165
151.1	1933.5	5775.3	368.1	4281.1	324197.7	19527085.4	.086	1.163
200.2	1933.5	5764.9	371.6	4277.2	321416.1	19579301.1	.087	1.162
254.0	1933.5	5755.3	375.2	4273.7	318822.4	19616610.2	.088	1.160
300.4	1933.5	5745.5	378.8	4270.0	316111.5	19661332.9	.089	1.158
350.2	1933.5	5735.9	382.6	4266.5	313430.5	19699915.0	.090	1.157
400.1	1933.5	5727.1	386.2	4263.2	310924.9	19744443.3	.091	1.155
450.2	1933.5	5716.7	390.1	4259.3	307920.8	19784169.4	.092	1.153
501.6	1933.5	5707.2	394.5	4255.8	305147.8	19823317.8	.093	1.151
552.4	1933.5	5697.7	398.6	4252.3	302327.1	19865725.7	.094	1.150
601.2	1933.5	5688.4	402.9	4248.8	299491.6	19894255.0	.095	1.148
652.0	1933.5	5678.6	407.6	4245.1	296490.9	19943691.3	.096	1.146
702.5	1933.5	5668.9	412.3	4241.5	293459.3	19985923.0	.097	1.145
751.4	1933.5	5659.1	417.1	4237.8	290331.9	20032791.6	.098	1.143
800.2	1933.5	5649.4	421.9	4234.2	287202.8	20073359.5	.100	1.141
854.4	1933.5	5639.9	427.4	4230.6	284039.5	20117710.9	.101	1.140
903.8	1933.5	5630.4	432.9	4227.1	280869.1	20160894.5	.102	1.138
953.0	1933.5	5620.7	468.8	4223.4	277255.1	19534317.1	.111	1.100
1003.5	1933.5	5611.4	449.8	4219.9	274151.0	20363457.8	.107	1.128
1050.4	1933.5	5601.6	455.8	4216.2	270596.8	20405435.7	.108	1.126
1103.9	1933.5	5592.1	462.8	4212.7	267089.2	20448121.2	.110	1.125
1150.3	1933.5	5582.4	469.9	4209.0	263405.4	20487957.9	.112	1.123
1203.2	1933.5	5573.1	476.8	4205.5	259837.6	20544953.2	.113	1.122
1252.5	1933.5	5563.7	484.6	4201.9	256123.9	20572055.4	.115	1.120
1300.1	1933.5	5553.7	492.6	4198.2	252114.3	20623279.4	.117	1.118
1350.0	1933.5	5544.1	501.1	4194.5	248188.4	20673081.8	.119	1.116
1402.8	1933.5	5534.9	509.6	4191.0	244312.0	20713127.2	.122	1.115
1450.3	1933.5	5524.9	518.6	4187.3	240061.5	20755790.3	.124	1.113
1503.0	1933.5	5515.7	528.8	4183.8	235985.9	20799007.6	.126	1.112
1550.3	1933.5	5505.8	538.9	4180.0	231546.4	20846842.7	.129	1.110
1602.3	1933.5	5496.6	550.4	4176.5	227326.7	20888399.4	.132	1.108
1650.1	1933.5	5486.5	561.8	4172.7	222604.4	20929467.0	.135	1.107
1702.4	1933.5	5477.3	574.9	4169.2	218137.8	20970535.1	.138	1.105
1754.2	1933.5	5467.3	588.9	4165.4	213176.7	21027333.4	.141	1.103
1803.3	1933.5	5457.7	603.4	4161.7	208327.6	21066151.0	.145	1.102
1854.7	1933.5	5447.7	619.6	4157.9	203089.0	21115553.0	.149	1.100
1900.5	1933.5	5438.7	635.6	4154.5	198276.0	21160767.2	.153	1.098
1953.8	1933.5	5428.1	655.4	4150.4	192482.5	21203595.3	.158	1.097
2002.4	1933.5	5418.4	675.7	4146.7	186956.6	21245744.4	.163	1.095
2050.1	1933.5	5408.5	727.5	4142.9	180937.3	20076263.8	.176	1.072
2101.7	1933.5	5398.0	734.4	4138.9	174688.7	21480076.3	.177	1.085
2150.5	1933.5	5387.0	765.7	4134.7	167759.7	21526538.8	.185	1.083
2200.1	1933.5	5376.4	796.3	4130.6	160877.9	21576064.6	.193	1.081
2252.3	1933.5	5365.8	836.8	4126.5	153829.5	21623239.6	.203	1.079
2300.3	1933.5	5353.7	884.8	4121.9	145628.3	21683630.2	.215	1.078
2351.0	1933.5	5342.5	935.9	4117.6	137879.0	21724037.7	.227	1.076
2400.0	1933.5	5328.5	1007.0	4112.2	128199.0	21679372.0	.245	1.074
2450.2	1933.5	5313.8	1094.6	4106.5	118200.6	21837531.9	.267	1.071
2500.1	1933.5	5296.6	1207.8	4099.8	107061.3	21933908.0	.295	1.070
2551.0	1933.5	5274.1	1375.9	4091.1	94055.6	22020897.2	.336	1.067
2600.1	1933.5	5237.9	1652.3	4077.1	77866.8	22146873.9	.405	1.062
2650.3	1933.5	5116.2	2537.9	4029.4	50789.1	22340585.5	.630	1.048

TABLE VB (Cont.)

Initial temperature = 5954°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	4828.7	438.8	3914.6	149441.7	23522593.8	.112	1.995
51.7	1933.5	4824.8	442.6	3913.0	148324.6	23524849.7	.113	1.993
100.2	1933.5	4820.4	446.2	3911.2	147091.9	23576994.1	.114	1.992
152.7	1933.5	4816.2	450.6	3909.5	145872.9	23589197.8	.115	1.990
200.5	1933.5	4812.0	454.5	3907.8	144626.2	23626614.4	.116	1.989
252.3	1933.5	4807.8	459.1	3906.1	143394.3	23633593.4	.118	1.987
300.0	1933.5	4803.4	463.6	3904.3	142078.6	23676535.9	.119	1.985
355.0	1933.5	4799.1	468.4	3902.5	140777.4	23705643.4	.120	1.984
400.3	1933.5	4795.0	472.7	3900.9	139519.4	23737868.7	.121	1.982
452.0	1933.5	4790.7	477.9	3899.1	138199.3	23765110.8	.123	1.980
501.6	1933.5	4786.4	482.7	3897.4	136847.2	23789549.1	.124	1.978
550.8	1933.5	4782.3	487.8	3895.7	135543.8	23799055.5	.125	1.977
600.8	1933.5	4778.2	492.9	3894.0	134226.3	23822942.0	.127	1.975
650.8	1933.5	4774.0	498.5	3892.3	132841.4	23849449.4	.128	1.973
700.8	1933.5	4769.7	504.2	3890.6	131436.9	23869842.9	.130	1.972
750.8	1933.5	4765.4	510.0	3888.8	130013.2	23903782.2	.131	1.970
800.8	1933.5	4761.2	516.2	3887.1	128567.5	23927768.9	.133	1.968
850.8	1933.5	4756.9	522.5	3885.3	127101.1	23963648.9	.134	1.967
900.8	1933.5	4752.6	529.1	3883.6	125611.4	23988080.6	.136	1.965
950.8	1933.5	4748.0	555.8	3881.7	123847.8	23615433.2	.143	1.931
1000.4	1933.5	4743.7	545.4	3879.9	122441.8	24078567.2	.141	1.960
1052.9	1933.5	4739.5	552.8	3878.3	120927.1	24121505.6	.143	1.958
1104.8	1933.5	4735.1	560.9	3876.4	119264.9	24124899.2	.145	1.956
1150.3	1933.5	4731.0	568.8	3874.7	117722.0	24177137.4	.147	1.954
1200.6	1933.5	4726.6	577.1	3873.0	116074.3	24206836.6	.149	1.953
1251.1	1933.5	4722.1	586.8	3871.1	114307.3	24206638.4	.152	1.951
1300.6	1933.5	4717.6	596.1	3869.3	112551.2	24265413.8	.154	1.949
1350.4	1933.5	4713.2	606.0	3867.5	110793.1	24304655.5	.157	1.948
1401.6	1933.5	4708.8	616.5	3865.7	109017.7	24330419.6	.159	1.946
1451.9	1933.5	4704.6	627.1	3863.9	107270.4	24352527.1	.162	1.944
1500.1	1933.5	4700.0	638.9	3862.0	105328.8	24391341.5	.165	1.943
1550.2	1933.5	4695.4	651.4	3860.1	103380.3	24424240.1	.169	1.941
1600.2	1933.5	4690.8	664.6	3858.3	101417.3	24456117.4	.172	1.940
1650.7	1933.5	4686.3	678.7	3856.4	99440.3	24429267.8	.176	1.937
1700.8	1933.5	4681.6	693.7	3854.5	97347.2	24500534.2	.180	1.936
1750.3	1933.5	4676.9	709.4	3852.5	95243.3	24537214.2	.184	1.934
1800.8	1933.5	4672.3	726.0	3850.7	93149.3	24570847.9	.189	1.932
1850.0	1933.5	4667.3	744.9	3848.6	90820.0	24609628.0	.194	1.931
1900.2	1933.5	4662.4	765.3	3846.5	88497.6	24630502.7	.199	1.929
1950.2	1933.5	4657.3	787.3	3844.5	86106.2	24657329.4	.205	1.927
2000.5	1933.5	4652.3	810.8	3842.4	83684.9	24691074.5	.211	1.925
2050.3	1933.5	4646.8	883.7	3840.1	80861.7	22932493.1	.230	1.875
2104.0	1933.5	4641.4	868.4	3837.9	78460.0	24788079.3	.226	1.919
2150.5	1933.5	4635.6	900.7	3835.5	75607.7	24821478.5	.235	1.917
2203.5	1933.5	4629.6	938.0	3833.0	72738.7	24865275.9	.245	1.915
2250.7	1933.5	4623.4	978.8	3830.4	69774.4	24889110.4	.256	1.913
2300.1	1933.5	4615.9	1029.1	3827.3	66285.5	24955802.7	.269	1.911
2350.4	1933.5	4608.0	1089.0	3824.1	62742.5	24990954.6	.285	1.908
2400.2	1933.5	4599.1	1160.8	3820.4	58951.0	25039544.3	.304	1.906
2451.8	1933.5	4588.7	1249.1	3816.0	54875.0	25060788.7	.327	1.902
2501.1	1933.5	4575.6	1361.4	3810.6	50331.1	25160976.0	.357	1.899
2550.4	1933.5	4555.8	1533.7	3802.4	44684.1	25241957.1	.403	1.894
2600.2	1933.5	4523.3	1811.6	3788.7	37886.6	25401758.7	.478	1.886
2650.3	1933.5	4413.7	2594.6	3742.6	26348.7	25706565.3	.693	1.859

TABLE VB (Cont.)

Initial temperature = 5954°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 6 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.9	1933.5	3479.0	395.8	3322.7	36099.7	9004397.8	.119	2.259
54.4	1933.5	3476.6	399.2	3321.6	35813.1	9000994.0	.120	2.257
104.4	1933.5	3474.1	402.6	3320.4	35520.0	9016841.2	.121	2.256
154.4	1933.5	3471.6	406.4	3319.2	35223.2	9026136.5	.122	2.254
204.4	1933.5	3469.1	410.2	3318.0	34923.0	9032453.9	.124	2.252
254.4	1933.5	3466.6	414.1	3316.8	34619.3	9039151.6	.125	2.251
304.4	1933.5	3464.1	418.2	3315.6	34312.1	9048026.9	.126	2.249
354.4	1933.5	3461.6	422.3	3314.4	34001.1	9057799.2	.127	2.247
404.4	1933.5	3459.1	426.6	3313.2	33686.3	9068089.0	.129	2.246
454.4	1933.5	3456.6	431.0	3312.0	33367.6	9076662.3	.130	2.244
504.4	1933.5	3454.1	435.6	3310.8	33044.6	9085111.3	.132	2.242
554.4	1933.5	3451.6	440.2	3309.6	32717.7	9093298.4	.133	2.240
604.4	1933.5	3449.1	445.1	3308.4	32386.2	9101629.6	.135	2.239
654.4	1933.5	3446.6	450.2	3307.2	32050.3	9110708.0	.136	2.237
704.4	1933.5	3444.1	455.4	3306.0	31709.8	9116529.7	.138	2.235
754.4	1933.5	3441.6	460.7	3304.8	31364.6	9127895.5	.139	2.233
804.4	1933.5	3439.1	466.3	3303.6	31014.2	9135647.3	.141	2.232
854.4	1933.5	3436.5	472.0	3302.4	30659.0	9148025.0	.143	2.230
904.4	1933.5	3434.0	478.0	3301.2	30298.1	9155699.8	.145	2.228
951.2	1933.5	3431.4	498.4	3299.9	29906.6	9033544.9	.151	2.195
1002.9	1933.5	3429.0	491.1	3298.8	29583.9	9180868.5	.149	2.223
1052.9	1933.5	3426.4	497.9	3297.5	29204.2	9188383.4	.151	2.221
1102.9	1933.5	3423.9	505.0	3296.3	28818.4	9197999.5	.153	2.220
1152.9	1933.5	3421.3	512.4	3295.1	28425.9	9205828.6	.155	2.218
1202.9	1933.5	3418.7	519.8	3293.8	28026.9	9219139.7	.158	2.217
1252.9	1933.5	3416.1	528.2	3292.6	27619.8	9224875.6	.160	2.214
1302.9	1933.5	3413.5	536.5	3291.3	27205.7	9234316.9	.163	2.213
1352.9	1933.5	3410.8	545.2	3290.0	26783.6	9246915.6	.166	2.211
1402.9	1933.5	3408.2	554.6	3288.7	26352.9	9254453.6	.169	2.209
1452.9	1933.5	3405.5	564.5	3287.5	25913.1	9262298.0	.172	2.207
1502.9	1933.5	3402.8	574.8	3286.2	25464.3	9273385.2	.175	2.206
1552.9	1933.5	3400.1	585.7	3284.8	25005.2	9284300.9	.178	2.204
1602.9	1933.5	3397.4	597.4	3283.5	24535.6	9294191.3	.182	2.202
1652.9	1933.5	3394.6	610.0	3282.2	24054.1	9297457.6	.186	2.200
1702.9	1933.5	3391.8	623.1	3280.8	23561.3	9307276.2	.190	2.199
1752.9	1933.5	3388.9	637.1	3279.4	23055.4	9318166.8	.194	2.197
1802.9	1933.5	3386.0	652.3	3278.0	22535.3	9328865.6	.199	2.195
1852.9	1933.5	3383.0	668.5	3276.6	22000.3	9341220.4	.204	2.193
1902.9	1933.5	3379.9	686.3	3275.1	21448.4	9346305.6	.210	2.191
1952.9	1933.5	3376.8	705.6	3273.6	20878.6	9354540.4	.216	2.189
2002.9	1933.5	3373.6	726.6	3272.0	20289.1	9363989.3	.222	2.187
2050.3	1933.5	3370.0	795.5	3270.3	19587.7	8715882.9	.243	2.128
2101.0	1933.5	3367.0	774.4	3268.8	19092.8	9389596.8	.237	2.181
2151.0	1933.5	3363.3	802.8	3267.0	18429.0	9401413.0	.246	2.179
2201.0	1933.5	3359.4	834.5	3265.1	17734.2	9411634.3	.256	2.177
2251.0	1933.5	3355.1	871.1	3263.0	17002.7	9415396.4	.267	2.175
2301.0	1933.5	3350.5	912.6	3260.8	16230.1	9435243.6	.280	2.173
2351.0	1933.5	3345.4	961.9	3258.3	15406.1	9443556.4	.295	2.170
2401.0	1933.5	3339.4	1020.8	3255.4	14520.3	9453511.7	.314	2.167
2451.0	1933.5	3332.3	1094.4	3251.9	13554.1	9454287.1	.337	2.162
2501.0	1933.5	3323.4	1186.9	3247.6	12485.4	9476307.4	.365	2.159
2550.7	1933.5	3311.2	1314.3	3241.6	11268.1	9488161.7	.405	2.153
2600.7	1933.5	3291.7	1511.7	3232.1	9784.8	9505043.6	.468	2.143
2650.5	1933.5	3227.2	2108.0	3200.2	7126.8	9696646.1	.659	2.112

TABLE VB (Cont.)

Initial temperature = 5954°R, pressure = 175 Atm, mass = 571,500 lbs, friction factor = 0.075.
Time = 8 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
5.0	1933.5	2524.5	336.3	2830.4	8992.9	2952680.3	.119	2.305
50.0	1933.5	2523.4	339.0	2829.8	8928.8	2951279.6	.120	2.303
100.0	1933.5	2522.1	342.0	2829.1	8856.9	2956181.2	.121	2.301
150.0	1933.5	2520.9	345.2	2828.4	8784.1	2958966.6	.122	2.300
200.0	1933.5	2519.6	348.4	2827.7	8710.5	2960726.5	.123	2.298
250.0	1933.5	2518.4	351.8	2827.0	8636.1	2962613.9	.124	2.296
300.0	1933.5	2517.2	355.3	2826.3	8560.7	2965244.2	.126	2.294
350.0	1933.5	2515.9	358.8	2825.6	8484.5	2968177.0	.127	2.293
400.0	1933.5	2514.7	362.4	2824.9	8407.4	2971261.3	.128	2.291
450.0	1933.5	2513.4	366.2	2824.2	8329.3	2973774.2	.130	2.289
500.0	1933.5	2512.2	370.1	2823.5	8250.1	2976280.3	.131	2.287
550.0	1933.5	2510.9	374.1	2822.8	8170.0	2978637.3	.133	2.286
600.0	1933.5	2509.7	378.2	2822.1	8088.9	2981101.3	.134	2.284
650.0	1933.5	2508.4	382.5	2821.4	8006.6	2983812.1	.136	2.282
700.0	1933.5	2507.1	387.0	2820.7	7923.2	2985408.5	.137	2.280
750.0	1933.5	2505.9	391.5	2820.0	7838.7	2988840.4	.139	2.279
800.0	1933.5	2504.6	396.2	2819.3	7753.0	2991094.8	.141	2.277
850.0	1933.5	2503.3	401.0	2818.6	7666.1	2994870.0	.142	2.275
900.0	1933.5	2502.1	406.1	2817.8	7577.8	2997088.8	.144	2.274
954.5	1933.5	2500.7	424.4	2817.1	7473.0	2957849.2	.151	2.240
1005.0	1933.5	2499.4	417.9	2816.3	7389.6	3004631.8	.148	2.268
1055.0	1933.5	2498.1	423.7	2815.6	7296.7	3006832.9	.150	2.266
1105.0	1933.5	2496.8	429.7	2814.9	7202.2	3009696.6	.153	2.265
1155.0	1933.5	2495.5	435.9	2814.1	7106.2	3011967.9	.155	2.263
1205.0	1933.5	2494.2	442.2	2813.4	7008.6	3016009.3	.157	2.262
1255.0	1933.5	2492.9	449.3	2812.7	6909.0	3017642.0	.160	2.259
1305.0	1933.5	2491.5	456.3	2811.9	6807.8	3020433.5	.162	2.258
1355.0	1933.5	2490.2	463.7	2811.1	6704.6	3024254.9	.165	2.256
1405.0	1933.5	2488.8	471.6	2810.4	6599.4	3026429.0	.168	2.254
1455.0	1933.5	2487.4	479.9	2809.6	6492.0	3028705.9	.171	2.252
1505.0	1933.5	2486.1	488.5	2808.8	6382.4	3032036.2	.174	2.251
1555.0	1933.5	2484.7	497.7	2808.0	6270.4	3035333.5	.177	2.249
1605.0	1933.5	2483.2	507.5	2807.2	6155.8	3038285.9	.181	2.247
1655.0	1933.5	2481.8	518.1	2806.4	6038.5	3039072.5	.185	2.245
1705.0	1933.5	2480.3	529.0	2805.6	5918.4	3041979.3	.189	2.243
1755.0	1933.5	2478.8	540.6	2804.7	5795.3	3045242.8	.193	2.242
1805.0	1933.5	2477.3	553.3	2803.8	5668.7	3048487.0	.197	2.240
1855.0	1933.5	2475.7	566.7	2802.9	5538.7	3052243.8	.202	2.238
1905.0	1933.5	2474.0	581.4	2802.0	5404.6	3053608.4	.207	2.236
1955.0	1933.5	2472.4	597.3	2801.1	5266.3	3056016.4	.213	2.234
2005.0	1933.5	2470.6	614.5	2800.1	5123.5	3058845.1	.219	2.232
2050.2	1933.5	2468.7	665.4	2799.0	4963.1	2847312.9	.238	2.172
2102.8	1933.5	2467.0	653.4	2798.0	4835.0	3066552.8	.234	2.226
2152.8	1933.5	2464.9	676.4	2796.9	4674.9	3070174.9	.242	2.224
2202.8	1933.5	2462.7	702.0	2795.6	4507.7	3073272.5	.251	2.222
2252.8	1933.5	2460.4	731.3	2794.3	4332.0	3074230.8	.262	2.219
2302.8	1933.5	2457.7	764.2	2792.8	4147.1	3080538.7	.274	2.217
2352.8	1933.5	2454.7	803.0	2791.1	3950.6	3083095.5	.288	2.214
2402.8	1933.5	2451.3	848.8	2789.1	3740.5	3086262.1	.304	2.211
2452.8	1933.5	2447.2	905.1	2786.8	3512.8	3086530.6	.325	2.206
2502.8	1933.5	2442.0	974.2	2783.8	3263.3	3093985.0	.350	2.203
2552.8	1933.5	2435.1	1067.2	2779.9	2981.8	3098559.0	.384	2.196
2602.8	1933.5	2424.6	1203.6	2773.9	2649.5	3106574.5	.434	2.186
2650.1	1933.5	2400.0	1528.4	2759.8	2148.4	3173207.6	.554	2.154

TABLE VIA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of: Temperature = 4500°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.015.

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (0/0)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	1037232.0	1026680.1	100149.1	4500.0	4486.9	2846.0	548.2	3462.4	500.0	500.0	4532.2	3609.5	545.23	.375	0.0
.1	1034284.6	1024582.8	101795.9	4496.3	4484.3	3289.7	526.1	3766.1	2649.9	1903.6	4530.9	3880.7	522.50	.375	.2
.2	1031412.5	1024188.8	113994.3	4492.8	4483.8	3548.5	454.2	3847.7	3258.0	2760.0	4530.6	4030.5	552.79	.375	.4
.3	1027966.3	1020109.8	141662.2	4488.5	4478.6	3631.3	474.3	4059.9	3258.0	3258.0	4528.0	4077.3	753.19	.383	.6
.4	1023167.7	1015528.8	172752.0	4482.5	4472.9	3520.4	468.5	3892.7	1933.5	3258.0	4525.1	4014.5	1098.03	.420	1.0
.5	1015972.8	1006736.2	221373.8	4473.5	4461.8	3613.0	516.6	3984.5	1933.5	3258.0	4519.5	4067.0	1666.63	.462	1.5
.6	1005049.6	993167.0	198041.1	4459.7	4444.5	3656.4	588.5	4073.6	1933.5	1933.5	4510.8	4091.3	2521.52	.580	2.2
.7	989156.3	975199.5	204306.9	4439.4	4421.4	3694.5	641.7	3982.5	1933.5	1933.5	4499.0	4112.6	3541.33	.707	3.3
.8	967344.7	951493.3	199391.6	4411.2	4390.4	3691.5	689.6	3990.7	1933.5	1933.5	4483.2	4110.9	4748.32	.828	4.9
.9	938951.2	921585.1	200959.7	4373.8	4350.5	3695.6	729.8	3924.0	1933.5	1933.5	4462.8	4113.2	6076.82	.947	6.9
1.0	903576.0	884736.2	174418.2	4326.1	4300.1	3582.7	770.9	4028.4	1933.5	1933.5	4436.9	4049.8	7533.49	1.060	9.4
1.1	861179.2	841652.2	171266.6	4267.1	4239.2	3550.8	798.7	4011.6	1933.5	1933.5	4405.3	4031.8	8906.75	1.167	12.4
1.2	812449.1	792996.8	183581.1	4196.7	4167.7	3576.9	814.1	3880.8	1933.5	1933.5	4368.0	4046.6	10083.99	1.267	16.0
1.3	758677.1	739226.3	163802.9	4115.4	4084.9	3475.0	834.5	3965.9	1933.5	1933.5	4324.4	3988.5	11180.92	1.360	20.0
1.4	701210.4	682441.2	164812.8	4023.8	3992.7	3447.6	843.3	3799.8	1933.5	1933.5	4275.3	3972.8	11933.53	1.446	24.4
1.5	641819.4	623830.4	152424.9	3923.3	3891.6	3367.3	852.3	3752.7	1933.5	1933.5	4220.8	3926.3	12454.07	1.523	29.0
1.6	582153.0	565272.1	139233.8	3815.4	3783.5	3273.0	855.1	3729.1	1933.5	1933.5	4161.8	3870.8	12644.35	1.592	33.8
1.7	523792.1	508146.8	128277.1	3702.0	3670.1	3189.0	855.0	3642.8	1933.5	1933.5	4099.0	3820.9	12565.01	1.653	38.6
1.8	468012.7	453685.9	115394.1	3584.8	3553.1	3090.0	851.9	3593.0	1933.5	1933.5	4033.1	3761.1	12246.52	1.705	43.4
1.9	415760.6	402774.1	103414.2	3465.6	3434.3	2991.1	846.2	3533.3	1933.5	1933.5	3965.1	3700.4	11738.94	1.750	48.0
2.0	367647.9	355975.9	91985.2	3345.9	3315.2	2890.2	838.3	3476.4	1933.5	1933.5	3895.8	3637.4	11094.75	1.788	52.3
2.1	323970.8	313552.9	81774.1	3227.2	3197.2	2792.4	828.6	3409.3	1933.5	1933.5	3825.8	3575.4	10363.21	1.819	56.4
2.2	284785.0	275533.8	72266.5	3110.5	3081.2	2694.5	817.7	3348.7	1933.5	1933.5	3755.8	3512.2	9589.09	1.845	60.3
2.3	249954.4	241770.3	63355.1	2996.7	2968.3	2595.7	805.8	3302.1	1933.5	1933.5	3686.3	3447.2	8806.27	1.866	63.8
2.4	219211.9	211993.2	55965.2	2886.4	2858.9	2504.9	793.1	3234.5	1933.5	1933.5	3617.7	3386.4	8038.93	1.883	67.1
2.5	192232.5	185874.9	49285.7	2780.1	2753.5	2416.0	780.1	3174.1	1933.5	1933.5	3550.4	3325.7	7306.45	1.897	70.0
2.6	168644.4	163047.0	42859.3	2678.0	2652.3	2324.2	767.0	3143.9	1933.5	1933.5	3484.6	3261.9	6620.88	1.907	72.7
2.7	148074.9	143150.3	38308.5	2580.3	2555.5	2250.4	753.7	3053.1	1933.5	1933.5	3420.4	3209.7	5984.50	1.915	75.1
2.8	130167.8	125835.2	33430.0	2487.0	2463.1	2167.2	740.2	3021.6	1933.5	1933.5	3358.0	3149.8	5400.52	1.921	77.3
2.9	114596.8	110780.9	29787.8	2398.1	2375.0	2097.9	727.0	2946.8	1933.5	1933.5	3297.4	3099.0	4870.44	1.926	79.3
3.0	101055.2	97690.2	25734.6	2313.5	2291.2	2017.1	714.1	2941.1	1933.5	1933.5	3238.7	3038.8	4391.56	1.929	81.0
3.1	89272.2	86299.6	23047.8	2233.0	2211.5	1956.7	701.5	2865.3	1933.5	1933.5	3181.8	2993.0	3961.21	1.931	82.7
3.2	79009.4	76378.5	20422.6	2156.4	2135.6	1893.3	689.4	2810.2	1933.5	1933.5	3126.8	2944.1	3575.31	1.931	84.1
3.3	70059.3	67726.4	17981.4	2083.6	2063.5	1829.9	677.7	2775.0	1933.5	1912.4	3073.5	2894.3	3229.74	1.932	85.4
3.4	62242.6	60170.0	15737.2	2014.3	1994.9	1766.8	666.3	2751.7	1933.5	1843.0	3022.0	2844.0	2920.52	1.932	86.6
3.5	55404.7	53559.9	13949.4	1948.5	1929.7	1710.7	655.3	2706.6	1933.5	1775.5	2972.2	2798.5	2643.90	1.932	87.7

TABLE VIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	49412.7	47767.3	12220.7	1885.8	1867.6	1649.1	644.7	2693.6	1879.8	1713.7	2924.0	2747.6	2396.83	1.932	88.6
3.7	44150.9	42680.8	10856.6	1826.1	1808.5	1594.9	634.4	2660.0	1820.1	1657.8	2877.4	2702.1	2176.33	1.932	89.5
3.8	39520.8	38204.8	9602.1	1769.2	1752.1	1540.8	624.5	2638.3	1763.2	1603.6	2832.2	2655.9	1979.17	1.932	90.3
3.9	35438.0	34258.0	8942.7	1714.9	1698.4	1506.7	614.8	2521.3	1708.9	1549.9	2788.4	2626.3	1802.58	1.932	91.0
4.0	31830.9	30771.0	7933.2	1663.1	1647.1	1457.2	605.4	2503.1	1657.2	1502.6	2746.0	2582.8	1644.12	1.932	91.7
4.1	28637.9	27684.3	6990.3	1613.6	1598.1	1407.1	596.4	2499.2	1607.7	1455.9	2704.8	2538.0	1501.70	1.932	92.3
4.2	25806.3	24947.0	6390.0	1566.3	1551.2	1370.8	587.6	2435.5	1560.4	1409.8	2664.9	2505.1	1373.49	1.932	92.9
4.3	23290.5	22515.0	5616.6	1521.1	1506.4	1322.9	579.0	2443.6	1515.3	1366.1	2626.1	2460.9	1257.89	1.932	93.4
4.4	21051.5	20350.5	5097.2	1477.8	1463.6	1286.5	570.7	2401.4	1472.0	1325.6	2588.5	2426.9	1153.51	1.932	93.8
4.5	19055.5	18421.0	4791.9	1436.3	1422.5	1261.0	562.7	2296.9	1430.6	1285.5	2551.9	2402.7	1059.10	1.932	94.2
4.6	17273.1	16697.9	4353.0	1396.6	1383.1	1226.8	554.8	2259.9	1390.9	1254.4	2516.3	2369.9	973.60	1.932	94.6
4.7	15679.0	15156.9	3782.4	1358.5	1345.4	1181.3	547.2	2293.2	1352.8	1206.2	2481.8	2325.5	896.06	1.932	95.0
4.8	14251.0	13776.4	3389.2	1321.9	1309.2	1145.9	539.8	2279.7	1316.3	1171.1	2448.1	2290.4	825.63	1.932	95.3
4.9	12969.9	12538.0	3074.6	1286.8	1274.4	1114.8	532.6	2254.2	1281.3	1135.5	2415.4	2259.1	761.59	1.932	95.6
5.0	11818.9	11425.3	2914.4	1253.1	1241.0	1094.8	525.5	2155.3	1247.6	1139.2	2383.6	2238.7	703.28	1.932	95.9
5.1	10783.3	10424.2	2608.3	1220.7	1208.9	1061.9	518.7	2157.9	1215.3	1099.7	2352.5	2204.8	650.12	1.932	96.2

TABLE VIB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:

Temperature = 4500°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.015.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	4486.6	548.2	4532.0	1026573.8	35496799.8	.121	.375
50.4	500.0	4459.3	550.4	4518.2	1015854.7	35584135.2	.122	.375
101.9	500.0	4433.7	552.9	4505.3	1005706.0	35673184.5	.123	.375
153.9	500.0	4405.6	555.7	4491.0	994432.8	35775056.8	.124	.375
200.4	500.0	4378.3	558.5	4477.0	983318.7	35877037.0	.125	.375
251.4	500.0	4353.6	561.1	4464.4	973132.7	35959795.1	.126	.375
303.4	500.0	4326.1	564.2	4450.2	961680.7	36068542.5	.127	.375
350.4	500.0	4299.1	567.4	4436.3	950272.0	36170835.0	.128	.375
400.9	500.0	4275.1	570.4	4423.9	940022.9	36270846.0	.129	.375
452.9	500.0	4248.2	573.9	4410.0	928367.2	36362928.5	.130	.375
504.9	500.0	4221.5	577.6	4396.1	916634.1	36465541.3	.131	.375
550.4	500.0	4198.3	581.0	4384.0	906301.3	36567264.4	.133	.375
602.4	500.0	4172.0	585.0	4370.3	894412.9	36658240.0	.134	.375
654.4	500.0	4145.8	589.3	4356.5	882435.9	36761178.4	.135	.375
700.4	500.0	4120.6	593.2	4343.3	870730.1	36864235.4	.137	.375
751.9	500.0	4097.3	597.7	4331.0	859724.1	36954506.6	.138	.375
803.9	500.0	4071.7	602.6	4317.4	847466.3	37057788.7	.140	.375
850.4	500.0	4046.7	607.6	4304.2	835340.4	37161195.4	.141	.375
901.4	500.0	4024.1	612.4	4292.1	824188.6	37233855.3	.143	.375
953.4	500.0	3999.0	618.0	4278.7	811605.9	37355432.9	.144	.375
1004.7	500.0	3974.4	623.8	4265.5	799044.3	37458317.8	.146	.375
1054.5	500.0	3950.6	629.8	4252.7	786693.3	37558622.6	.148	.375
1103.1	500.0	3927.5	636.0	4240.3	774539.9	37656392.7	.150	.375
1150.3	500.0	3905.2	642.3	4228.2	762565.0	37729653.2	.152	.375
1202.7	500.0	3881.0	649.5	4215.1	749392.6	37857169.0	.154	.375
1252.6	500.0	3857.1	657.2	4202.1	736068.7	37958250.5	.156	.375
1303.1	500.0	3834.6	664.8	4189.8	723369.5	38060325.6	.159	.375
1350.3	500.0	3811.9	673.1	4177.4	710245.1	38156117.4	.161	.375
1400.4	500.0	3788.1	682.4	4164.3	696229.5	38262657.4	.164	.375
1450.4	500.0	3767.4	690.9	4153.0	683829.5	38365995.9	.166	.375
1500.9	500.0	3744.7	701.1	4140.4	669887.2	38466805.1	.169	.375
1550.4	500.0	3722.5	711.7	4128.1	655997.1	38569124.3	.172	.375
1600.5	500.0	3698.1	724.2	4114.6	640405.8	38669236.4	.176	.375
1650.2	500.0	3676.1	736.3	4102.3	625949.1	38766891.7	.179	.375
1703.0	500.0	3654.7	749.4	4090.4	611607.1	38875459.9	.183	.375
1750.1	500.0	3632.0	764.2	4077.6	595984.7	38977397.8	.187	.375
1803.7	500.0	3610.5	779.5	4065.5	580821.5	39012841.7	.192	.375
1850.1	500.0	3588.2	796.8	4053.0	564699.0	39185719.3	.197	.375
1900.9	500.0	3567.8	814.1	4041.4	549558.5	39276255.6	.201	.375
1950.1	500.0	3544.5	835.8	4028.2	531793.3	39393074.6	.207	.375
2000.3	500.0	3522.7	858.4	4015.8	514623.8	39499295.8	.214	.375
2054.5	500.0	3500.8	883.4	4003.3	496903.2	39604187.5	.221	.375
2103.5	500.0	3479.3	910.8	3991.0	479012.2	39709169.7	.228	.375
2152.5	500.0	3457.7	941.7	3978.6	460397.2	39816296.1	.237	.375
2200.1	500.0	3434.4	976.1	3965.2	439867.2	39936363.1	.246	.375
2250.4	500.0	3411.6	1020.8	3952.0	418863.0	40049936.7	.258	.375
2301.9	500.0	3389.7	1067.1	3939.3	398262.8	40105065.7	.271	.375
2350.5	500.0	3364.2	1129.0	3924.5	373556.5	40279185.6	.288	.375
2401.1	500.0	3340.5	1196.4	3910.6	349994.4	40412639.3	.306	.375
2450.3	500.0	3311.8	1284.3	3893.8	321503.2	40554597.2	.330	.375
2502.7	500.0	3280.9	1414.3	3875.5	290684.1	40622115.7	.365	.375
2551.5	500.0	3243.2	1589.4	3853.2	255584.4	40881504.1	.412	.375
2602.9	500.0	3189.2	1875.1	3821.0	212874.0	41156888.5	.491	.375
2650.3	500.0	3019.9	2756.3	3718.2	136102.7	41674085.2	.741	.375

TABLE VIB (Cont.)

Initial temperature = 4500°R, pressure = 490 Atm, Mass = 1,519,000 lbs, friction factor = 0.015.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	3315.2	838.3	3895.7	355953.7	132219742.0	.215	1.997
51.3	1933.5	3313.5	844.2	3894.8	353720.8	132277414.8	.217	1.996
101.5	1933.5	3311.6	850.9	3893.6	351180.4	132327264.5	.219	1.994
151.8	1933.5	3309.9	857.2	3892.6	348829.3	132503370.9	.220	1.993
203.3	1933.5	3307.9	864.3	3891.5	346233.8	132624588.4	.222	1.992
250.8	1933.5	3306.2	873.4	3890.5	343852.6	132158020.9	.224	1.988
301.3	1933.5	3304.3	879.1	3889.4	341360.0	132920636.6	.226	1.988
350.8	1933.5	3302.4	886.3	3888.2	338653.2	133020335.2	.228	1.987
400.4	1933.5	3300.5	894.2	3887.1	336035.1	133112814.4	.230	1.985
450.2	1933.5	3298.6	901.9	3886.0	333420.2	133256718.2	.232	1.984
501.3	1933.5	3296.8	909.5	3884.9	330938.5	133351275.5	.234	1.983
550.5	1933.5	3294.7	918.0	3883.7	328054.1	133469628.9	.236	1.982
600.4	1933.5	3292.8	926.2	3882.5	325342.0	133599419.4	.239	1.980
651.2	1933.5	3290.9	934.4	3881.5	322779.6	133686586.7	.241	1.979
700.4	1933.5	3288.8	943.9	3880.2	319782.3	133807643.2	.243	1.978
751.4	1933.5	3286.8	953.0	3879.0	316961.2	133930914.9	.246	1.976
800.1	1933.5	3284.7	962.1	3877.8	314108.2	133954373.6	.248	1.975
851.5	1933.5	3282.7	971.7	3876.6	311251.0	134197217.7	.251	1.974
903.4	1933.5	3280.5	990.2	3875.3	308002.8	133783140.2	.256	1.965
950.0	1933.5	3278.5	993.2	3874.1	305247.5	134452009.2	.256	1.970
1000.2	1933.5	3276.5	1004.3	3872.9	302345.4	134507572.1	.259	1.968
1050.4	1933.5	3274.3	1014.9	3871.6	299263.5	134642923.8	.262	1.967
1100.4	1933.5	3272.1	1026.5	3870.3	296124.6	134797234.0	.265	1.965
1153.1	1933.5	3269.9	1038.2	3869.0	293049.3	134994615.8	.268	1.964
1203.1	1933.5	3267.5	1051.0	3867.6	289692.2	135063242.7	.272	1.963
1250.1	1933.5	3265.3	1052.9	3866.3	286750.5	137051627.7	.272	1.971
1302.6	1933.5	3262.8	1078.3	3864.8	283039.0	135429434.2	.279	1.959
1352.2	1933.5	3260.5	1091.8	3863.5	279759.4	135553682.4	.283	1.957
1401.9	1933.5	3258.0	1106.4	3862.0	276242.5	135715152.5	.286	1.956
1450.5	1933.5	3255.3	1122.0	3860.4	272618.0	135856408.9	.291	1.954
1501.5	1933.5	3252.8	1137.7	3858.9	269100.7	135975627.2	.295	1.953
1552.0	1933.5	3250.0	1155.0	3857.3	265277.7	136098387.7	.299	1.951
1600.2	1933.5	3247.2	1172.7	3855.6	261487.5	136267730.8	.304	1.949
1651.0	1933.5	3244.4	1191.0	3853.9	257676.3	136432725.9	.309	1.948
1700.9	1933.5	3241.6	1213.0	3852.3	253871.9	136147430.2	.315	1.944
1750.4	1933.5	3238.4	1233.0	3850.3	249671.5	136853751.2	.320	1.943
1802.6	1933.5	3235.2	1254.8	3848.4	245532.6	137031419.5	.326	1.941
1850.1	1933.5	3231.7	1278.3	3846.4	241211.5	137214628.8	.332	1.939
1900.3	1933.5	3228.5	1301.5	3844.5	237171.4	137361180.8	.339	1.937
1950.4	1933.5	3224.4	1329.3	3842.0	232247.5	137569090.6	.346	1.935
2000.2	1933.5	3220.4	1359.0	3839.7	227533.8	137772048.6	.354	1.933
2050.4	1933.5	3216.2	1390.2	3837.1	222640.8	137919634.4	.362	1.931
2100.1	1933.5	3211.7	1423.9	3834.4	217616.9	138165739.0	.371	1.929
2154.2	1933.5	3206.8	1460.0	3831.5	212406.8	138477310.9	.381	1.926
2200.1	1933.5	3201.4	1500.5	3828.3	206869.2	138724496.3	.392	1.924
2250.2	1933.5	3195.4	1546.2	3824.7	201062.5	138962431.4	.404	1.920
2300.5	1933.5	3190.2	1547.2	3821.6	196450.8	143503383.6	.405	1.941
2350.0	1933.5	3181.7	1655.6	3816.5	188587.6	139748561.4	.434	1.912
2400.4	1933.5	3172.7	1723.8	3811.1	181411.9	140146129.8	.452	1.908
2450.3	1933.5	3162.5	1801.7	3805.0	173918.8	140587586.4	.474	1.903
2500.2	1933.5	3149.4	1899.1	3797.1	165328.5	141247891.6	.500	1.897
2550.2	1933.5	3132.0	2030.1	3786.6	155326.4	141997757.9	.536	1.888
2600.7	1933.5	3100.9	2293.9	3767.7	140566.6	138937119.8	.609	1.857
2650.1	1933.5	3048.1	2614.0	3735.5	122720.4	147364028.9	.700	1.845

TABLE VIB (Cont.)

Initial temperature = 4500°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.015.
Time = 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
1.3	1657.2	1647.1	605.4	2746.0	30769.1	22740055.7	.220	2.169
51.3	1656.9	1646.8	609.5	2745.7	30578.3	22737644.9	.222	2.167
101.3	1656.6	1646.5	614.4	2745.5	30369.0	22752665.5	.224	2.166
151.3	1656.3	1646.2	619.3	2745.3	30157.7	22768370.9	.226	2.164
201.3	1656.0	1645.9	624.4	2745.0	29944.1	22786525.9	.227	2.163
251.5	1655.8	1645.6	631.1	2744.8	29731.9	22696469.4	.230	2.159
301.4	1655.4	1645.3	635.4	2744.5	29517.1	22829491.0	.232	2.159
351.4	1655.1	1645.0	640.9	2744.2	29295.8	22844609.9	.234	2.158
401.4	1654.8	1644.7	646.5	2744.0	29072.3	22863278.0	.236	2.157
451.4	1654.4	1644.3	652.3	2743.7	28846.1	22880251.6	.238	2.155
501.4	1654.1	1644.0	658.2	2743.4	28617.0	22894140.2	.240	2.154
551.4	1653.7	1643.6	664.3	2743.1	28385.5	22913311.8	.242	2.152
601.4	1653.3	1643.3	670.5	2742.8	28151.2	22932009.0	.244	2.151
651.4	1653.0	1642.9	677.0	2742.4	27913.6	22948208.8	.247	2.150
701.4	1652.6	1642.5	683.6	2742.1	27673.1	22963783.3	.249	2.148
751.4	1652.2	1642.1	690.4	2741.8	27429.6	22982624.6	.252	2.147
801.4	1651.8	1641.7	697.4	2741.4	27182.8	23000567.3	.254	2.145
851.4	1651.3	1641.2	704.6	2741.1	26933.0	23023681.2	.257	2.144
901.4	1650.9	1640.8	717.0	2740.7	26661.8	22959651.3	.262	2.135
953.2	1650.4	1640.3	720.5	2740.3	26411.7	23062716.8	.263	2.140
1004.2	1650.0	1639.9	729.2	2740.0	26156.4	23077639.6	.266	2.138
1054.2	1649.5	1639.4	736.8	2739.5	25892.8	23106532.0	.269	2.137
1104.2	1649.0	1638.9	745.5	2739.1	25622.8	23127165.3	.272	2.135
1154.2	1648.4	1638.3	754.3	2738.7	25348.6	23146856.8	.275	2.134
1204.2	1647.9	1637.8	763.6	2738.2	25069.9	23167633.3	.279	2.132
1250.0	1647.3	1637.2	765.3	2737.7	24813.4	23459345.6	.280	2.141
1301.7	1646.7	1636.6	783.3	2737.2	24510.4	23214916.2	.286	2.128
1351.7	1646.1	1636.0	793.7	2736.7	24216.5	23235185.1	.290	2.126
1401.7	1645.4	1635.3	804.5	2736.1	23917.2	23261069.8	.294	2.125
1451.7	1644.7	1634.6	815.9	2735.5	23611.7	23284217.1	.298	2.123
1501.7	1643.9	1633.9	827.8	2734.9	23300.0	23304882.2	.303	2.121
1551.7	1643.1	1633.1	840.2	2734.3	22981.7	23326391.1	.307	2.119
1601.7	1642.3	1632.2	853.3	2733.6	22656.6	23352949.9	.312	2.118
1651.7	1641.4	1631.4	867.0	2732.8	22324.2	23381099.5	.317	2.116
1703.2	1640.6	1630.4	885.6	2732.0	21961.3	23338064.3	.324	2.111
1753.2	1639.6	1629.5	898.0	2731.2	21630.0	23448292.9	.329	2.111
1803.2	1638.5	1628.4	914.3	2730.3	21270.6	23478637.1	.335	2.109
1853.2	1637.3	1627.2	931.6	2729.4	20901.0	23510482.6	.341	2.107
1903.2	1636.1	1626.0	950.2	2728.3	20519.8	23537981.5	.348	2.104
1953.2	1634.7	1624.6	969.9	2727.2	20127.4	23573422.8	.356	2.102
2003.2	1633.3	1623.1	991.3	2725.9	19721.3	23609467.6	.364	2.099
2053.2	1631.6	1621.5	1014.3	2724.6	19300.2	23647569.8	.372	2.097
2103.2	1629.9	1619.7	1039.5	2723.1	18862.4	23684027.9	.382	2.094
2153.2	1627.9	1617.7	1066.5	2721.4	18407.2	23736540.4	.392	2.091
2203.2	1625.7	1615.5	1096.7	2719.5	17929.5	23783960.7	.403	2.088
2253.2	1623.1	1612.9	1130.2	2717.3	17426.6	23830492.2	.416	2.084
2300.9	1619.6	1610.8	1135.2	2715.5	17023.1	24587707.4	.418	2.105
2350.6	1617.2	1606.9	1210.0	2712.3	16357.9	23970493.0	.446	2.075
2400.6	1613.2	1602.8	1259.6	2708.8	15744.8	24047474.5	.465	2.069
2450.6	1608.3	1597.8	1318.8	2704.6	15073.5	24135440.8	.488	2.063
2500.6	1602.0	1591.4	1391.3	2699.2	14323.4	24256089.8	.515	2.056
2551.5	1592.2	1581.2	1508.0	2690.5	13323.3	24536214.4	.560	2.044
2600.7	1581.3	1562.6	1727.5	2674.6	11897.7	24080088.3	.646	2.010
2650.6	1536.6	1522.6	2046.1	2640.2	9926.3	25722145.4	.775	1.993

TABLE VIIA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of: Temperature = 4500°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.075.

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	1037232.0	1034951.7	40007.8	4500.0	4497.2	2653.7	254.5	3504.8	500.0	500.0	4537.4	3485.5	254.55	.375	0.0
.1	1035828.8	1033688.4	43493.5	4498.3	4495.6	3030.9	246.6	3610.3	2101.9	1409.5	4536.6	3725.0	246.52	.375	.1
.2	1034470.3	1032412.9	45465.1	4496.6	4494.0	3286.6	241.9	3691.0	3002.9	2082.5	4535.8	3878.9	241.59	.375	.2
.3	1033139.6	1031576.0	45463.6	4494.9	4493.0	3390.2	211.0	3965.8	3258.0	2550.1	4535.3	3939.6	256.34	.375	.3
.4	1031728.1	1030119.6	59301.0	4493.2	4491.2	3532.0	214.1	3831.3	3258.0	2867.1	4534.4	4021.1	304.51	.375	.4
.5	1030052.0	1028340.2	58983.3	4491.1	4488.9	3511.5	221.0	3967.5	3258.0	3258.0	4533.2	4009.4	363.28	.396	.5
.6	1028053.4	1026168.5	62630.1	4488.6	4486.2	3545.0	232.1	4016.0	3258.0	3258.0	4531.9	4028.5	427.29	.421	.6
.7	1025703.9	1023948.3	68754.7	4485.7	4483.5	3508.5	224.1	3959.4	1933.5	3258.0	4530.5	4007.7	515.90	.444	.8
.8	1022869.0	1020841.0	76553.3	4482.1	4479.6	3367.3	241.2	4017.3	1933.5	3258.0	4528.5	3926.2	668.92	.464	1.0
.9	1019196.2	1016877.9	97990.1	4477.5	4474.6	3496.9	258.2	3903.5	1933.5	3258.0	4526.0	4001.1	853.77	.482	1.2
1.0	1014513.2	1011891.4	91231.2	4471.6	4468.3	3500.8	275.0	3951.0	1933.5	1933.5	4522.8	4003.3	1073.27	.559	1.6
1.1	1008634.1	1005701.4	85904.5	4464.2	4460.5	3508.8	291.5	4050.3	1933.5	1933.5	4518.8	4007.9	1329.34	.633	2.0
1.2	1001364.3	998136.6	83624.2	4455.0	4450.9	3517.3	306.6	4117.6	1933.5	1933.5	4514.0	4012.7	1618.68	.701	2.5
1.3	992530.5	989018.8	84486.5	4443.7	4439.2	3539.4	320.9	4121.8	1933.5	1933.5	4508.1	4025.3	1942.20	.767	3.1
1.4	981957.8	978182.2	89205.0	4430.1	4425.3	3579.6	334.0	4037.6	1933.5	1933.5	4501.0	4048.1	2296.57	.833	3.8
1.5	969494.4	965463.3	88063.9	4414.0	4408.7	3584.1	346.7	4065.7	1933.5	1933.5	4492.6	4050.7	2683.10	.900	4.7
1.6	954986.2	950713.0	82423.5	4395.0	4389.4	3538.5	358.9	4195.0	1933.5	1933.5	4482.7	4024.8	3098.17	.964	5.7
1.7	938305.7	933830.6	94735.7	4373.0	4367.0	3632.3	369.6	3931.3	1933.5	1933.5	4471.2	4077.8	3527.89	1.025	6.9
1.8	919407.0	914755.8	94201.0	4347.6	4341.3	3612.9	379.6	3958.3	1933.5	1933.5	4458.1	4066.9	3970.83	1.089	8.3
1.9	898258.7	893438.8	93079.5	4318.8	4312.2	3610.0	389.7	3931.7	1933.5	1933.5	4443.1	4065.3	4428.95	1.151	9.8
2.0	874826.9	869895.9	95122.2	4286.3	4279.4	3603.0	397.9	3890.2	1933.5	1933.5	4426.2	4061.3	4872.75	1.210	11.5
2.1	849241.1	844212.9	90148.5	4250.1	4242.9	3554.1	406.1	3975.6	1933.5	1933.5	4407.2	4033.7	5313.39	1.269	13.3
2.2	821577.2	816467.5	86306.8	4210.1	4202.6	3515.8	414.3	3829.1	1933.5	1933.5	4386.3	4011.9	5743.55	1.326	15.3
2.3	791955.3	786831.6	85059.2	4166.1	4158.4	3496.2	420.3	3859.3	1933.5	1933.5	4363.2	4000.7	6125.89	1.381	17.5
2.4	760691.2	755596.8	85607.6	4118.5	4110.6	3480.9	425.2	3877.1	1933.5	1933.5	4338.0	3991.9	6462.52	1.435	19.9
2.5	728086.5	723039.1	80125.1	4067.2	4059.2	3416.1	430.0	3943.1	1933.5	1933.5	4310.8	3954.6	6761.13	1.486	22.3
2.6	694399.5	689440.8	78970.5	4012.6	4004.4	3383.9	433.4	3903.3	1933.5	1933.5	4281.6	3935.9	6999.78	1.535	24.9
2.7	659992.4	655137.6	77891.0	3954.7	3946.4	3353.7	436.7	3791.0	1933.5	1933.5	4250.5	3924.2	7190.68	1.581	27.6
2.8	625156.4	620419.5	71336.9	3893.9	3885.5	3289.3	439.9	3777.0	1933.5	1933.5	4217.5	3880.5	7331.90	1.625	30.3
2.9	590182.3	585621.0	70592.6	3830.4	3821.9	3256.9	440.6	3784.6	1933.5	1933.5	4182.9	3861.3	7386.67	1.664	33.2
3.0	555521.7	551142.5	67052.5	3764.7	3756.2	3196.6	441.2	3777.0	1933.5	1933.5	4146.8	3825.5	7392.13	1.701	36.0
3.1	521430.2	517237.5	65551.7	3697.2	3688.7	3167.3	441.6	3663.8	1933.5	1933.5	4109.3	3807.8	7351.25	1.737	38.8
3.2	488135.3	484131.8	60731.2	3628.2	3619.6	3107.9	441.8	3641.4	1933.5	1933.5	4070.7	3772.0	7267.79	1.770	41.6
3.3	455833.0	452019.8	49700.8	3557.9	3549.4	2960.0	441.9	3827.9	1933.5	1933.5	4031.0	3681.1	7146.11	1.799	44.4
3.4	424686.9	421100.4	52501.4	3486.7	3478.2	2975.4	439.5	3645.2	1933.5	1933.5	3990.4	3690.7	6955.28	1.823	47.2
3.5	394979.3	391592.5	48565.2	3415.2	3406.8	2921.1	438.3	3568.8	1933.5	1933.5	3949.2	3656.9	6758.82	1.847	49.8

TABLE VIIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	366702.9	363526.1	46799.3	3343.5	3335.1	2877.5	435.9	3462.4	1933.5	1933.5	3907.5	3629.5	6524.50	1.868	52.4
3.7	339979.9	337006.9	41209.4	3271.9	3263.7	2782.1	433.3	3579.4	1933.5	1933.5	3865.4	3568.8	6272.77	1.887	54.9
3.8	314837.5	312067.0	39087.8	3200.9	3192.8	2729.1	429.9	3540.0	1933.5	1933.5	3823.2	3534.6	6001.97	1.904	57.3
3.9	291302.8	288710.8	33801.2	3130.6	3122.6	2637.0	427.5	3583.3	1933.5	1933.5	3780.9	3474.5	5740.50	1.920	59.6
4.0	269287.5	266891.4	35913.0	3061.1	3053.3	2641.3	422.7	3358.4	1933.5	1933.5	3738.7	3477.3	5446.20	1.933	61.8
4.1	248864.7	246634.1	33763.3	2992.9	2985.2	2598.6	419.5	3277.3	1933.5	1933.5	3696.8	3449.1	5175.51	1.946	63.9
4.2	229889.3	227805.1	26716.3	2925.9	2918.3	2464.4	417.2	3456.0	1933.5	1933.5	3655.1	3358.9	4919.07	1.957	65.9
4.3	212258.2	210333.9	27356.1	2859.9	2852.5	2461.3	412.5	3303.6	1933.5	1933.5	3613.7	3356.8	4640.85	1.965	67.8
4.4	195999.3	194222.4	26342.6	2795.5	2788.3	2419.8	407.8	3221.6	1933.5	1933.5	3572.8	3328.3	4373.28	1.973	69.6
4.5	181022.7	179371.5	22955.1	2732.8	2725.6	2342.6	404.4	3288.5	1933.5	1933.5	3532.4	3274.8	4129.67	1.981	71.3
4.6	167197.9	165672.9	23126.2	2671.4	2664.4	2328.3	399.8	3103.0	1933.5	1933.5	3492.5	3264.8	3884.26	1.987	72.8
4.7	154486.5	153075.7	21360.1	2611.7	2604.9	2275.9	395.6	3075.3	1933.5	1933.5	3453.3	3227.8	3653.53	1.993	74.3
4.8	142797.3	141483.1	17139.6	2553.7	2547.0	2172.6	392.7	3254.6	1933.5	1933.5	3414.7	3153.7	3446.00	1.998	75.7
4.9	132017.1	130802.2	17490.2	2497.1	2490.5	2169.1	388.3	3046.5	1933.5	1933.5	3376.6	3151.2	3236.14	2.001	77.1
5.0	122118.0	120994.2	16233.8	2442.1	2435.6	2115.8	384.0	3061.8	1933.5	1933.5	3339.2	3112.3	3038.56	2.004	78.3
5.1	113028.0	111987.8	15298.5	2388.7	2382.4	2077.6	379.8	3001.5	1933.5	1933.5	3302.5	3084.0	2852.88	2.007	79.5
5.2	104679.9	103716.6	14501.5	2336.9	2330.7	2044.2	375.7	2927.8	1933.5	1933.5	3266.5	3059.1	2678.63	2.009	80.6
5.3	97011.7	96119.0	13159.4	2286.6	2280.6	1991.5	371.6	2942.1	1933.5	1933.5	3231.2	3019.4	2515.31	2.011	81.6
5.4	89965.9	89138.0	12467.5	2237.9	2232.0	1960.9	367.6	2871.5	1933.5	1933.5	3196.6	2996.2	2362.38	2.012	82.6
5.5	83489.5	82721.2	11375.0	2190.6	2184.9	1914.2	363.7	2876.0	1933.5	1933.5	3162.6	2960.2	2219.27	2.013	83.5
5.6	77533.9	76820.4	10754.0	2144.8	2139.2	1885.8	359.9	2806.6	1933.5	1933.5	3129.4	2938.2	2085.45	2.014	84.3
5.7	72054.6	71391.5	9702.7	2100.4	2094.8	1836.9	356.1	2834.2	1933.5	1933.5	3096.8	2899.9	1960.35	2.014	85.1
5.8	67010.6	66393.9	9065.9	2057.3	2051.8	1804.6	352.5	2791.7	1933.5	1933.5	3064.8	2874.3	1843.44	2.014	85.9
5.9	62364.8	61790.9	8304.0	2015.5	2010.1	1765.6	348.9	2780.9	1933.5	1903.0	3033.5	2843.1	1734.20	2.014	86.6
6.0	58083.2	57548.6	7356.1	1974.9	1969.7	1713.6	345.3	2840.2	1933.5	1857.2	3002.9	2800.9	1632.13	2.014	87.2
6.1	54134.5	53636.3	6851.9	1935.6	1930.5	1681.3	341.9	2816.2	1933.5	1816.8	2972.8	2774.4	1536.77	2.014	87.9
6.2	50490.7	50026.0	6548.8	1897.4	1892.4	1661.4	338.5	2706.3	1930.5	1783.0	2943.4	2757.8	1447.66	2.014	88.5
6.3	47125.7	46692.1	6343.1	1860.4	1855.5	1641.8	335.2	2619.9	1892.4	1723.9	2914.5	2741.6	1364.56	2.014	89.0
6.4	44015.9	43610.8	5693.4	1824.5	1819.7	1596.7	331.9	2658.3	1855.5	1697.2	2886.2	2703.6	1287.01	2.014	89.5
6.5	41139.4	40760.8	5483.8	1789.6	1784.9	1576.3	328.7	2585.3	1819.7	1657.2	2858.5	2686.3	1214.57	2.014	90.0
6.6	38476.8	38122.7	5027.5	1755.7	1751.1	1540.0	325.6	2592.2	1784.9	1631.0	2831.3	2655.2	1146.87	2.014	90.5
6.7	36010.1	35678.7	4786.7	1722.8	1718.2	1516.3	322.5	2510.7	1751.1	1596.7	2804.6	2634.7	1083.55	2.014	90.9
6.8	33723.4	33413.0	4450.1	1690.8	1686.3	1485.9	319.5	2498.8	1718.2	1547.8	2778.5	2608.1	1024.30	2.014	91.3
6.9	31601.8	31311.0	3946.0	1659.7	1655.3	1441.0	316.6	2561.5	1686.3	1517.4	2752.8	2568.4	968.81	2.014	91.7
7.0	29632.1	29359.4	3765.4	1629.4	1625.1	1420.2	313.7	2511.2	1655.3	1477.0	2727.6	2549.9	916.82	2.014	92.1
7.1	27802.0	27546.2	3377.6	1600.0	1595.8	1380.4	310.8	2556.1	1625.1	1454.0	2702.9	2513.8	868.07	2.014	92.5
7.2	26100.6	25860.4	3161.8	1571.4	1567.3	1355.1	308.0	2537.9	1595.8	1417.8	2678.6	2490.7	822.33	2.014	92.8
7.3	24517.6	24292.8	3267.3	1543.6	1539.5	1360.6	304.7	2403.1	1567.3	1392.2	2654.8	2495.8	777.90	2.014	93.1
7.4	23046.7	22835.4	2919.2	1516.5	1512.5	1319.7	302.0	2472.1	1539.5	1427.6	2631.4	2458.0	737.72	2.014	93.4
7.5	21676.1	21477.4	2803.2	1490.2	1486.3	1302.9	299.4	2421.2	1512.5	1387.8	2608.5	2442.3	699.96	2.014	93.7

TABLE VIIA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (O/O)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
7.6	20398.4	20211.4	2535.2	1464.5	1460.7	1271.4	296.8	2448.9	1486.3	1366.2	2585.9	2412.5	664.44	2.014	94.0
7.7	19206.3	19030.2	2448.4	1439.6	1435.8	1256.3	294.3	2394.7	1460.7	1343.2	2563.8	2398.2	631.01	2.014	94.2
7.8	18093.5	17927.6	2353.4	1415.2	1411.5	1239.8	291.8	2329.5	1435.8	1321.8	2542.0	2382.4	599.54	2.014	94.5
7.9	17054.1	16897.7	2156.8	1391.5	1387.8	1211.8	289.3	2349.3	1411.5	1285.8	2520.6	2355.3	569.90	2.014	94.7
8.0	16082.6	15935.2	2085.0	1368.4	1364.8	1198.2	286.9	2295.8	1387.8	1260.6	2499.6	2342.1	541.96	2.014	94.9
8.1	15174.1	15035.0	2040.2	1345.8	1342.3	1187.6	284.5	2199.3	1364.8	1243.1	2478.9	2331.7	515.61	2.014	95.1
8.2	14324.1	14192.8	2151.8	1323.8	1320.4	1193.3	282.2	1988.5	1342.3	1211.3	2458.6	2337.2	490.75	2.014	95.3
8.3	13528.2	13404.2	2055.4	1302.4	1299.0	1176.3	279.9	1954.8	1320.4	1211.3	2438.6	2320.6	467.28	2.014	95.5
8.4	12782.7	12666.2	2150.7	1281.5	1278.1	1177.5	276.8	1857.9	1299.0	1211.3	2418.9	2321.7	443.85	2.014	95.7
8.5	12085.9	11975.8	2089.1	1261.1	1257.8	1164.0	274.6	1766.1	1278.1	1197.1	2399.6	2308.4	423.03	2.014	95.8
8.6	11432.4	11328.2	2138.8	1241.2	1238.0	1158.2	272.5	1608.2	1257.8	1175.7	2380.7	2302.7	403.34	2.014	96.0
8.7	10819.1	10721.3	2159.9	1221.8	1218.7	1148.3	269.1	1577.2	1238.0	1175.7	2362.0	2292.8	383.07	2.014	96.2

TABLE VIIB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:

Temperature = 4500°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.075.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	4496.9	254.5	4537.2	1034836.6	16555503.4	.056	.375
51.0	500.0	4465.4	255.5	4521.3	1023426.2	16601348.3	.057	.375
100.5	500.0	4433.5	256.6	4505.1	1011698.3	16655498.7	.057	.375
150.1	500.0	4405.2	257.7	4490.7	1001186.3	16708704.8	.057	.375
200.4	500.0	4374.0	258.9	4474.8	989438.0	16762066.6	.058	.375
250.2	500.0	4343.3	260.1	4459.1	977724.4	16815068.8	.058	.375
300.2	500.0	4310.0	261.5	4442.0	964857.6	16868269.3	.059	.375
351.0	500.0	4279.7	263.0	4426.3	952948.4	16920609.6	.059	.375
400.3	500.0	4249.8	264.4	4410.8	941030.4	16972645.2	.060	.375
454.2	500.0	4220.4	266.0	4395.5	929156.9	17024394.6	.061	.375
502.4	500.0	4192.0	267.5	4380.7	917528.0	17081700.9	.061	.375
550.2	500.0	4164.0	269.2	4366.1	905898.5	17135055.4	.062	.375
600.2	500.0	4132.3	271.1	4349.4	892568.9	17186518.5	.062	.375
653.0	500.0	4104.6	272.9	4334.8	880674.7	17237209.9	.063	.375
700.1	500.0	4077.7	274.8	4320.6	869009.4	17295526.6	.064	.375
754.7	500.0	4046.9	277.0	4304.2	855371.8	17346284.7	.064	.375
801.3	500.0	4020.7	279.1	4290.3	843652.4	17402741.3	.065	.375
850.3	500.0	3991.0	281.5	4274.4	830064.9	17454401.0	.066	.375
901.4	500.0	3965.3	283.8	4260.6	818139.3	17510459.3	.067	.375
955.0	500.0	3936.0	286.5	4244.9	804317.8	17561651.3	.068	.375
1000.6	500.0	3911.2	289.0	4231.5	792415.4	17617649.8	.068	.375
1053.7	500.0	3882.7	292.1	4216.0	778456.7	17668110.9	.069	.375
1100.0	500.0	3855.6	295.1	4201.3	764954.5	17725132.3	.070	.375
1151.9	500.0	3829.1	298.4	4186.8	751485.3	17775446.0	.071	.375
1200.0	500.0	3802.9	301.8	4172.5	737938.9	17832572.4	.072	.375
1250.5	500.0	3779.0	305.1	4159.3	725304.4	17887563.5	.073	.375
1302.5	500.0	3752.2	309.1	4144.5	710849.7	17937997.8	.075	.375
1354.5	500.0	3725.5	313.3	4129.8	696200.2	17994290.1	.076	.375
1400.0	500.0	3702.4	317.3	4117.0	683211.3	18050079.6	.077	.375
1452.0	500.0	3676.2	322.2	4102.4	668158.4	18099949.0	.079	.375
1504.0	500.0	3650.3	327.4	4087.9	652867.4	18156363.6	.080	.375
1550.0	500.0	3625.2	332.3	4073.8	637781.1	18212824.5	.082	.375
1601.5	500.0	3602.1	338.3	4060.8	623489.5	18262263.1	.083	.375
1653.5	500.0	3576.8	344.8	4046.5	607403.8	18318808.9	.085	.375
1700.0	500.0	3552.1	351.7	4032.5	591314.5	18375403.4	.087	.375
1751.0	500.0	3529.7	358.6	4019.8	576350.3	18395524.2	.089	.375
1803.0	500.0	3504.9	366.9	4005.7	559254.7	18481661.1	.092	.375
1850.0	500.0	3480.5	376.0	3991.7	541911.0	18538413.0	.094	.375
1900.5	500.0	3458.9	385.0	3979.3	526037.1	18593604.3	.097	.375
1952.5	500.0	3434.6	396.1	3965.3	507612.7	18644998.7	.100	.375
2004.5	500.0	3410.5	408.6	3951.3	488620.7	18701963.7	.103	.375
2050.0	500.0	3389.5	420.9	3939.2	471480.8	18758455.4	.107	.375
2102.0	500.0	3365.6	436.6	3925.3	451218.2	18809028.6	.111	.375
2154.0	500.0	3341.9	454.8	3911.4	430134.7	18866313.2	.116	.375
2200.0	500.0	3318.9	473.3	3897.9	408786.3	18923773.1	.121	.375
2250.3	500.0	3296.0	499.3	3884.5	386406.5	18978668.8	.129	.375
2304.9	500.0	3273.2	527.9	3871.0	362897.2	19032769.6	.136	.375
2350.4	500.0	3250.3	562.9	3857.4	337887.1	19087139.7	.146	.375
2403.5	500.0	3227.8	605.7	3844.0	311800.9	19143750.6	.158	.375
2450.0	500.0	3203.5	664.8	3829.5	281893.5	19204245.5	.174	.375
2502.4	500.0	3179.5	742.0	3815.2	250595.0	19259759.1	.194	.375
2551.4	500.0	3152.2	861.9	3798.8	213777.7	19309694.5	.227	.375
2601.1	500.0	3113.3	1104.9	3775.3	164479.1	19399715.5	.293	.375
2650.2	500.0	2984.2	2039.4	3696.2	84423.6	19518023.6	.552	.375

TABLE VIIB (Cont.)

Initial temperature = 4500°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.075.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	4279.3	397.9	4426.1	869828.8	76345255.9	.090	1.396
50.2	1933.5	4275.5	401.4	4424.1	863079.9	76435736.5	.091	1.395
100.3	1933.5	4271.6	405.0	4422.1	856152.5	76535506.4	.092	1.393
153.0	1933.5	4267.8	408.8	4420.2	849361.4	76609490.5	.092	1.392
201.1	1933.5	4264.1	412.4	4418.2	842547.2	76669193.6	.093	1.391
254.2	1933.5	4259.9	416.6	4416.1	834934.2	76820745.0	.094	1.389
305.0	1933.5	4256.0	420.9	4414.0	827557.4	76888558.8	.095	1.388
350.3	1933.5	4252.1	425.1	4412.0	820224.4	77006816.6	.096	1.387
401.4	1933.5	4248.5	429.1	4410.1	813284.2	77052947.0	.097	1.385
451.1	1933.5	4244.5	433.6	4408.1	805627.7	77205326.2	.098	1.384
503.7	1933.5	4240.5	438.4	4406.0	797737.7	77304801.1	.100	1.382
551.4	1933.5	4236.8	442.9	4404.1	790339.4	77355240.8	.101	1.381
603.4	1933.5	4232.7	448.0	4401.9	782158.4	77506272.1	.102	1.380
650.1	1933.5	4228.7	452.8	4399.9	774001.6	77626062.2	.103	1.379
703.2	1933.5	4224.9	458.3	4397.9	766133.4	77716532.1	.104	1.377
751.9	1933.5	4220.8	463.9	4395.8	757634.8	77813754.1	.106	1.376
804.5	1933.5	4216.9	469.5	4393.7	749366.9	77912636.9	.107	1.374
850.0	1933.5	4213.0	475.4	4391.7	740887.3	78031894.5	.108	1.373
902.1	1933.5	4209.3	481.3	4389.7	732681.1	78108426.9	.110	1.372
950.3	1933.5	4205.1	487.8	4387.6	723496.3	78204249.2	.111	1.370
1002.2	1933.5	4201.3	489.0	4385.6	714997.9	83225914.4	.111	1.376
1050.2	1933.5	4197.2	506.4	4383.5	705228.2	78818429.9	.116	1.361
1102.7	1933.5	4193.4	513.4	4381.4	696179.4	78923294.0	.117	1.360
1150.1	1933.5	4189.2	521.5	4379.3	686220.2	79001006.0	.119	1.358
1204.7	1933.5	4185.2	529.5	4377.2	676433.5	79118070.8	.121	1.357
1250.4	1933.5	4181.3	537.5	4375.2	666930.9	79241304.4	.123	1.356
1302.4	1933.5	4177.3	546.6	4373.0	656796.2	79303048.5	.125	1.354
1354.4	1933.5	4173.1	556.2	4370.8	646026.4	79410591.9	.127	1.353
1400.2	1933.5	4169.0	566.1	4368.7	635379.3	79518080.1	.130	1.352
1450.3	1933.5	4164.8	575.6	4366.5	624564.6	79638212.8	.132	1.350
1500.3	1933.5	4161.1	586.5	4364.5	614502.3	79755826.8	.134	1.349
1550.3	1933.5	4156.5	598.6	4362.2	602195.1	79852816.2	.137	1.347
1601.8	1933.5	4152.5	610.9	4360.0	591026.5	80003005.4	.140	1.346
1650.9	1933.5	4148.3	624.2	4357.8	579254.4	80051390.5	.143	1.345
1700.6	1933.5	4144.0	638.1	4355.6	567196.8	80171272.1	.147	1.343
1750.6	1933.5	4139.6	653.3	4353.3	554480.5	80298405.3	.150	1.342
1800.0	1933.5	4135.2	669.2	4350.9	541701.6	80440106.8	.154	1.341
1850.8	1933.5	4130.6	687.2	4348.5	528135.9	80523005.3	.158	1.339
1900.2	1933.5	4126.0	706.2	4346.1	514546.3	80608033.6	.162	1.338
1950.6	1933.5	4121.3	727.3	4343.6	500197.5	80711707.7	.167	1.336
2003.6	1933.5	4116.5	749.9	4341.1	485695.2	80626907.8	.173	1.335
2051.8	1933.5	4111.7	773.8	4338.6	471032.4	81013092.5	.178	1.333
2102.2	1933.5	4106.5	801.6	4335.8	455069.8	81141226.1	.185	1.332
2150.7	1933.5	4101.0	833.5	4332.9	438195.7	81265841.9	.192	1.330
2201.4	1933.5	4095.4	867.6	4330.0	421319.2	81410687.5	.200	1.329
2250.4	1933.5	4088.9	911.6	4326.5	401894.3	81490404.5	.211	1.326
2300.3	1933.5	4082.3	956.7	4323.0	382869.0	81707626.3	.221	1.325
2350.9	1933.5	4075.2	1010.3	4319.3	363079.0	81417666.1	.234	1.323
2400.4	1933.5	4066.1	1080.9	4314.5	339453.6	82074326.0	.251	1.321
2452.8	1933.5	4055.9	1176.2	4309.0	315131.2	82575789.2	.273	1.313
2500.3	1933.5	4042.3	1290.3	4301.8	287165.9	82986317.5	.300	1.311
2550.4	1933.5	4022.5	1463.6	4291.2	254181.6	82965721.8	.341	1.305
2600.4	1933.5	3995.8	1720.4	4277.0	216886.6	83814938.8	.402	1.296
2650.4	1933.5	3857.0	2781.2	4202.0	142244.8	82749834.9	.662	1.235

TABLE VIIB (Cont.)

Initial temperature = 4500°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.075.
Time = 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	3053.3	422.7	3738.7	266870.5	60891941.7	.113	2.184
51.6	1933.5	3052.0	426.3	3737.9	264823.6	60933005.7	.114	2.182
100.4	1933.5	3050.6	430.1	3737.1	262711.8	60942306.2	.115	2.181
151.3	1933.5	3049.2	434.2	3736.2	260471.6	61015742.1	.116	2.179
203.7	1933.5	3047.7	438.4	3735.3	258144.6	61068331.7	.117	2.178
251.2	1933.5	3046.3	442.2	3734.4	255908.1	61121413.3	.118	2.177
300.1	1933.5	3044.9	447.0	3733.5	253648.7	61140475.3	.120	2.175
350.3	1933.5	3043.4	451.4	3732.7	251344.3	61204941.9	.121	2.174
400.7	1933.5	3042.1	455.7	3731.8	249139.4	61207958.1	.122	2.173
452.1	1933.5	3040.6	460.5	3730.9	246752.0	61285773.0	.123	2.171
500.2	1933.5	3039.2	465.1	3730.0	244326.3	61349115.3	.125	2.170
550.2	1933.5	3037.7	470.4	3729.1	241879.2	61393032.2	.126	2.169
600.4	1933.5	3036.3	475.2	3728.3	239466.0	61449248.7	.127	2.167
651.0	1933.5	3034.8	480.5	3727.4	236960.4	61504198.8	.129	2.166
703.2	1933.5	3033.4	486.4	3726.5	234526.5	61545780.8	.131	2.164
751.7	1933.5	3031.9	492.2	3725.6	231966.6	61590533.8	.132	2.163
801.6	1933.5	3030.5	497.9	3724.7	229494.5	61604651.9	.134	2.162
854.2	1933.5	3028.9	504.3	3723.8	226741.5	61695652.1	.135	2.160
901.1	1933.5	3027.5	510.4	3722.9	224253.2	61685988.7	.137	2.159
950.9	1933.5	3025.9	517.3	3721.9	221416.0	61765530.4	.139	2.157
1003.8	1933.5	3024.5	502.1	3721.0	219041.0	67590575.0	.135	2.201
1050.0	1933.5	3022.9	532.4	3720.0	215982.0	61989044.0	.143	2.152
1103.0	1933.5	3021.3	540.0	3719.1	213115.2	62038524.5	.145	2.151
1150.4	1933.5	3019.8	548.1	3718.1	210222.7	62062388.9	.147	2.149
1200.3	1933.5	3018.2	556.0	3717.2	207292.0	62107352.5	.150	2.148
1253.1	1933.5	3016.6	564.4	3716.2	204359.1	62191779.2	.152	2.146
1303.2	1933.5	3015.0	573.7	3715.2	201345.8	62203844.6	.154	2.144
1350.2	1933.5	3013.4	583.2	3714.2	198164.4	62183279.5	.157	2.143
1402.3	1933.5	3011.8	592.8	3713.2	195131.4	62310933.0	.160	2.142
1452.1	1933.5	3010.0	603.7	3712.1	191732.1	62373683.4	.163	2.140
1500.7	1933.5	3008.4	613.8	3711.1	188716.0	62437248.2	.165	2.139
1553.3	1933.5	3006.5	626.2	3710.0	185164.5	62486646.5	.169	2.137
1601.9	1933.5	3004.8	638.0	3708.9	181819.3	62571994.5	.172	2.136
1654.2	1933.5	3002.9	652.0	3707.7	178126.8	62584258.4	.176	2.134
1701.5	1933.5	3000.9	666.2	3706.5	174466.3	62655800.4	.180	2.133
1750.5	1933.5	2999.0	681.2	3705.3	170733.3	62727138.1	.184	2.131
1801.6	1933.5	2997.0	696.6	3704.1	167080.1	62792860.2	.188	2.130
1853.9	1933.5	2994.9	714.6	3702.7	163040.2	62840294.6	.193	2.128
1900.4	1933.5	2992.6	733.5	3701.4	158944.0	62874163.6	.198	2.126
1950.5	1933.5	2990.3	754.5	3699.9	154753.2	62925120.2	.204	2.124
2001.8	1933.5	2987.9	776.8	3698.4	150452.3	62992660.1	.210	2.122
2050.8	1933.5	2985.3	800.8	3696.8	146021.5	63121779.7	.217	2.121
2100.2	1933.5	2982.5	827.9	3695.1	141309.3	63215402.9	.224	2.119
2151.0	1933.5	2979.5	858.6	3693.2	136435.3	63252556.0	.232	2.116
2200.6	1933.5	2976.4	889.8	3691.3	131769.0	63352674.1	.241	2.114
2250.3	1933.5	2972.4	932.3	3688.9	125958.9	63423883.7	.253	2.111
2301.6	1933.5	2968.2	976.2	3686.2	120334.6	63564771.9	.265	2.109
2351.4	1933.5	2963.2	1030.7	3683.2	114207.5	63623610.9	.280	2.105
2400.2	1933.5	2957.3	1093.0	3679.5	107702.2	63615672.0	.297	2.103
2450.4	1933.5	2949.9	1174.5	3674.9	100517.3	64432095.4	.320	2.097
2500.9	1933.5	2940.2	1276.0	3668.8	92717.1	64330738.2	.348	2.092
2550.0	1933.5	2925.1	1430.0	3659.3	83172.9	64428510.6	.391	2.080
2601.0	1933.5	2912.5	1624.6	3651.5	73581.1	65070670.0	.445	2.070
2650.2	1933.5	2829.1	2351.0	3598.8	53290.2	65038498.9	.653	1.988

TABLE VIIB (Cont.)

Initial temperature = 4500°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.075.
Time = 6 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.6	1933.5	1969.7	345.3	3002.9	57544.1	19688612.8	.115	2.288
50.6	1933.5	1969.5	348.0	3002.7	57123.6	19685488.3	.116	2.286
100.6	1933.5	1969.3	351.2	3002.5	56656.6	19699168.7	.117	2.285
150.6	1933.5	1969.0	354.6	3002.3	56184.2	19707172.5	.118	2.283
200.6	1933.5	1968.8	358.0	3002.2	55706.8	19721200.0	.119	2.282
250.6	1933.5	1968.5	361.5	3002.0	55223.9	19735702.9	.120	2.281
300.6	1933.5	1968.3	365.3	3001.8	54735.0	19739016.8	.122	2.279
350.6	1933.5	1968.0	369.0	3001.6	54240.9	19756983.1	.123	2.278
400.6	1933.5	1967.8	372.8	3001.4	53740.7	19770742.1	.124	2.276
450.6	1933.5	1967.5	376.7	3001.2	53234.3	19780336.3	.126	2.275
500.6	1933.5	1967.3	380.8	3001.0	52721.6	19795244.4	.127	2.273
550.6	1933.5	1967.0	385.0	3000.8	52202.5	19806634.2	.128	2.272
600.6	1933.5	1966.7	389.3	3000.6	51676.6	19821934.8	.130	2.271
650.6	1933.5	1966.4	393.8	3000.4	51143.9	19836563.2	.131	2.269
700.6	1933.5	1966.2	398.5	3000.2	50603.7	19847401.8	.133	2.268
750.6	1933.5	1965.9	403.3	2999.9	50056.2	19859237.3	.134	2.266
800.6	1933.5	1965.6	408.2	2999.7	49500.9	19871156.7	.136	2.265
850.6	1933.5	1965.3	413.4	2999.5	48937.7	19887090.6	.138	2.264
900.6	1933.5	1965.0	418.8	2999.3	48365.9	19892570.5	.140	2.262
950.6	1933.5	1964.7	424.3	2999.0	47785.6	19903821.9	.141	2.260
1000.0	1933.5	1964.3	411.6	2998.8	47228.6	21851891.8	.137	2.310
1053.9	1933.5	1964.0	437.2	2998.5	46574.3	19966038.9	.146	2.255
1103.9	1933.5	1963.7	443.4	2998.3	45962.3	19979241.4	.148	2.254
1153.9	1933.5	1963.3	450.2	2998.0	45339.1	19983971.4	.150	2.252
1203.9	1933.5	1962.9	457.0	2997.7	44706.0	19995797.6	.152	2.251
1253.9	1933.5	1962.6	464.1	2997.4	44061.5	20019267.0	.155	2.250
1303.9	1933.5	1962.2	471.9	2997.1	43403.9	20020164.9	.157	2.247
1353.9	1933.5	1961.8	479.7	2996.8	42734.9	20036307.2	.160	2.246
1403.9	1933.5	1961.3	488.0	2996.5	42052.5	20047800.0	.163	2.245
1453.9	1933.5	1960.9	496.7	2996.1	41356.1	20064459.1	.166	2.243
1503.9	1933.5	1960.4	505.9	2995.8	40645.1	20083821.1	.169	2.242
1553.9	1933.5	1959.9	515.8	2995.4	39917.9	20093607.8	.172	2.240
1603.9	1933.5	1959.4	525.9	2995.0	39174.9	20117074.2	.176	2.239
1653.9	1933.5	1958.8	537.2	2994.6	38412.9	20117897.3	.179	2.237
1703.9	1933.5	1958.3	548.9	2994.1	37632.6	20137008.2	.183	2.235
1753.9	1933.5	1957.6	561.3	2993.6	36832.2	20155813.9	.188	2.234
1803.9	1933.5	1956.9	574.7	2993.1	36009.8	20172334.3	.192	2.232
1853.9	1933.5	1956.2	589.3	2992.6	35162.6	20183858.6	.197	2.230
1903.9	1933.5	1955.4	605.1	2992.0	34289.4	20190805.3	.202	2.228
1953.9	1933.5	1954.5	622.3	2991.3	33388.0	20202799.1	.208	2.226
2003.9	1933.5	1953.6	640.9	2990.6	32455.5	20219272.4	.214	2.224
2053.9	1933.5	1952.5	661.0	2989.7	31489.4	20254085.1	.221	2.222
2103.9	1933.5	1951.3	683.4	2988.8	30484.4	20277774.2	.229	2.220
2153.9	1933.5	1950.0	708.8	2987.8	29434.2	20290081.8	.237	2.218
2203.9	1933.5	1948.4	737.0	2986.6	28335.5	20311614.2	.247	2.215
2253.9	1933.5	1946.6	769.8	2985.2	27176.5	20324303.1	.258	2.212
2303.9	1933.5	1944.4	806.4	2983.5	25953.8	20360010.4	.270	2.210
2353.9	1933.5	1941.7	850.9	2981.5	24644.8	20368976.2	.285	2.205
2403.9	1933.5	1938.4	902.6	2978.9	23239.8	20409886.5	.303	2.202
2450.9	1933.5	1934.0	976.7	2975.5	21650.7	20740822.2	.328	2.197
2500.5	1933.5	1928.0	1061.0	2970.9	19978.9	20664347.8	.357	2.190
2550.2	1933.5	1917.5	1199.7	2962.8	17787.4	20713558.8	.405	2.177
2600.4	1933.5	1909.6	1367.6	2956.7	15671.2	20938389.5	.463	2.166
2650.1	1903.2	1836.0	2093.3	2899.2	10653.8	21037323.0	.722	2.077

TABLE VIIB (Cont.)

Initial temperature = 4500°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.075.
Time = 8 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
2.0	1387.8	1364.8	286.9	2499.6	15933.9	7784504.4	.115	2.288
52.0	1387.7	1364.7	289.2	2499.5	15812.6	7783313.0	.116	2.286
102.0	1387.6	1364.5	291.9	2499.3	15682.0	7788868.4	.117	2.285
152.0	1387.5	1364.4	294.8	2499.2	15549.8	7792182.4	.118	2.283
202.0	1387.3	1364.2	297.6	2499.1	15416.3	7797881.6	.119	2.282
252.0	1387.2	1364.1	300.6	2499.0	15281.3	7803772.6	.120	2.281
302.0	1387.0	1364.0	303.7	2498.8	15144.6	7805242.7	.122	2.279
352.0	1386.9	1363.8	306.8	2498.7	15006.5	7812511.0	.123	2.278
402.0	1386.7	1363.7	310.0	2498.6	14866.7	7818119.9	.124	2.276
452.0	1386.6	1363.5	313.4	2498.4	14725.2	7822086.2	.125	2.275
502.0	1386.4	1363.4	316.8	2498.3	14581.9	7828158.9	.127	2.274
552.0	1386.3	1363.2	320.3	2498.1	14436.9	7832845.2	.128	2.272
602.0	1386.1	1363.0	324.0	2498.0	14290.0	7839083.8	.130	2.271
652.0	1386.0	1362.9	327.7	2497.8	14141.2	7845062.1	.131	2.270
702.0	1385.8	1362.7	331.7	2497.7	13990.3	7849547.8	.133	2.268
752.0	1385.6	1362.5	335.7	2497.5	13837.5	7854434.4	.134	2.267
802.0	1385.4	1362.4	339.9	2497.4	13682.4	7859361.1	.136	2.265
852.0	1385.3	1362.2	344.2	2497.2	13525.2	7865883.3	.138	2.264
902.0	1385.1	1362.0	348.7	2497.0	13365.6	7868278.7	.140	2.262
952.0	1384.9	1361.8	353.4	2496.9	13203.6	7872965.8	.142	2.261
1000.4	1384.7	1361.6	342.8	2496.7	13051.9	8643950.4	.137	2.310
1054.4	1384.5	1361.4	364.1	2496.5	12868.8	7898065.7	.146	2.255
1104.4	1384.3	1361.2	369.4	2496.3	12698.1	7903557.7	.148	2.254
1154.4	1384.0	1361.0	375.1	2496.1	12524.3	7905710.4	.150	2.252
1204.4	1383.8	1360.7	380.8	2495.9	12347.7	7910683.4	.153	2.251
1254.4	1383.6	1360.5	386.8	2495.7	12168.0	7920277.7	.155	2.250
1304.4	1383.3	1360.3	393.3	2495.4	11984.6	7920958.2	.158	2.248
1354.4	1383.1	1360.0	399.9	2495.2	11798.1	7927687.4	.160	2.246
1404.4	1382.8	1359.7	406.9	2494.9	11607.8	7932596.6	.163	2.245
1454.4	1382.5	1359.4	414.3	2494.7	11413.7	7939571.7	.166	2.243
1504.4	1382.2	1359.1	422.0	2494.4	11215.5	7947640.4	.169	2.242
1554.4	1381.9	1358.8	430.3	2494.1	11012.7	7951947.3	.173	2.240
1604.4	1381.5	1358.5	438.9	2493.8	10805.6	7961697.7	.176	2.239
1654.4	1381.1	1358.1	448.4	2493.4	10593.2	7962521.7	.180	2.237
1704.4	1380.8	1357.7	458.3	2493.1	10375.6	7970621.3	.184	2.235
1754.4	1380.3	1357.3	468.8	2492.7	10152.5	7978644.5	.188	2.234
1804.4	1379.9	1356.8	480.0	2492.3	9923.2	7985814.7	.193	2.232
1854.4	1379.4	1356.3	492.4	2491.8	9687.0	7991065.1	.198	2.230
1904.4	1378.8	1355.8	505.8	2491.3	9443.5	7994572.7	.203	2.228
1954.4	1378.2	1355.2	520.3	2490.8	9192.1	8000158.0	.209	2.226
2004.4	1377.6	1354.5	536.1	2490.2	8932.0	8007611.8	.215	2.224
2054.4	1376.8	1353.8	553.2	2489.5	8662.5	8022441.0	.222	2.222
2104.4	1376.0	1353.0	572.1	2488.7	8381.9	8033007.5	.230	2.220
2154.4	1375.1	1352.0	593.7	2487.9	8088.7	8039239.1	.239	2.218
2204.4	1374.0	1350.9	617.7	2486.8	7781.8	8049342.7	.248	2.215
2254.4	1372.7	1349.6	645.8	2485.6	7457.8	8056220.3	.260	2.212
2304.4	1371.1	1348.1	677.0	2484.2	7115.8	8072590.2	.273	2.210
2354.4	1369.3	1346.2	715.1	2482.5	6749.2	8078851.9	.288	2.205
2404.4	1366.9	1343.8	759.6	2480.3	6355.1	8098495.3	.306	2.202
2451.0	1363.7	1340.7	820.1	2477.4	5930.4	8235924.2	.331	2.197
2504.5	1359.7	1336.2	891.2	2473.2	5435.8	8155107.9	.360	2.190
2554.5	1353.2	1329.3	998.2	2466.9	4867.4	8166907.2	.405	2.177
2601.7	1347.5	1324.3	1141.3	2462.3	4299.6	8337176.9	.464	2.166
2650.1	1309.2	1263.4	1833.8	2405.0	2774.2	8387842.9	.762	2.077

TABLE VIIIA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of:

Temperature = 6271°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.015.

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (0/0)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	1037232.0	1026880.4	104271.8	6272.0	6257.5	4316.3	553.9	3631.5	500.0	500.0	4456.2	3701.0	529.25	.375	0.0
.1	1034422.7	1026723.8	145652.1	6268.1	6257.3	4977.1	477.9	3789.6	3258.0	3093.8	4456.2	3974.3	665.54	.375	.2
.2	1029163.3	1018250.6	176782.7	6260.7	6245.3	5053.2	570.5	3851.7	1933.5	1933.5	4451.9	4004.5	1648.65	.534	.6
.3	1016688.7	1001253.5	183813.9	6243.1	6221.1	5241.2	682.3	3990.2	1933.5	1933.5	4443.3	4078.3	3595.30	.773	1.5
.4	991913.8	972408.1	195568.4	6207.7	6179.3	5343.5	775.0	3991.8	1933.5	1933.5	4428.3	4118.0	6514.04	1.015	3.4
.5	950218.1	927610.4	207389.3	6146.5	6112.4	5388.6	848.9	3942.8	1933.5	1933.5	4404.3	4135.3	10227.06	1.259	6.5
.6	888743.3	864266.3	207795.0	6052.3	6013.4	5358.0	907.0	3919.0	1933.5	1933.5	4368.5	4123.5	14291.17	1.496	11.2
.7	807810.2	782748.7	194379.2	5920.4	5877.5	5261.6	952.7	3920.1	1933.5	1933.5	4318.8	4086.3	18086.40	1.719	17.5
.8	711939.8	687822.7	178933.3	5750.3	5704.8	5134.1	981.7	3865.0	1933.5	1933.5	4254.9	4036.4	20835.25	1.919	25.1
.9	608317.0	586181.5	155904.0	5545.3	5498.1	4959.5	999.6	3816.6	1933.5	1933.5	4177.1	3967.2	22180.01	2.093	33.7
1.0	505382.1	485973.5	130719.0	5313.1	5265.3	4752.7	1005.6	3759.7	1933.5	1933.5	4087.7	3883.6	22009.90	2.238	42.5
1.1	410117.6	393780.4	109987.5	5063.1	5015.8	4546.4	1000.1	3646.7	1933.5	1933.5	3989.7	3798.4	20580.86	2.356	51.0
1.2	326863.8	313465.1	88693.1	4804.8	4758.6	4317.8	988.5	3560.3	1933.5	1933.5	3886.0	3701.7	18414.32	2.450	58.9
1.3	257233.7	246461.0	70543.6	4546.4	4501.7	4089.4	972.1	3461.1	1933.5	1933.5	3779.7	3602.4	15930.52	2.522	65.8
1.4	200846.5	192285.0	54983.3	4294.0	4251.1	3860.6	953.3	3379.7	1933.5	1933.5	3673.0	3500.2	13463.71	2.577	71.7
1.5	156175.7	149444.0	43730.2	4051.8	4010.9	3653.8	931.2	3252.1	1933.5	1933.5	3567.7	3405.2	11178.34	2.618	76.7
1.6	121333.8	116066.4	34057.5	3822.6	3783.6	3449.4	907.8	3159.2	1933.5	1933.5	3465.1	3306.5	9180.18	2.648	80.8
1.7	94402.4	90280.7	26412.1	3607.4	3570.5	3253.7	884.4	3084.5	1933.5	1933.5	3366.1	3213.3	7497.68	2.671	84.2
1.8	73670.2	70444.6	20823.5	3406.8	3371.8	3079.2	860.7	2978.9	1933.5	1933.5	3271.1	3126.0	6103.78	2.687	86.9
1.9	57726.5	55193.2	16234.6	3220.4	3187.2	2910.4	837.8	2909.5	1933.5	1933.5	3180.3	3039.1	4969.12	2.699	89.2
2.0	45449.2	43453.3	12794.3	3047.5	3016.1	2756.8	815.3	2833.9	1933.5	1933.5	3093.8	2957.8	4049.45	2.707	91.0
2.1	35968.0	34387.6	10108.7	2887.3	2857.5	2614.1	793.8	2760.5	1933.5	1933.5	3011.4	2880.3	3308.79	2.713	92.5
2.2	28616.3	27358.9	8015.9	2738.9	2710.6	2481.2	773.1	2698.9	1933.5	1933.5	2932.9	2806.1	2712.02	2.717	93.7
2.3	22889.6	21883.8	6394.5	2601.3	2574.5	2359.1	753.5	2623.6	1933.5	1933.5	2858.3	2736.2	2231.24	2.720	94.7
2.4	18405.9	17597.2	5071.0	2473.7	2448.2	2243.5	734.8	2596.6	1933.5	1933.5	2787.3	2668.3	1842.95	2.722	95.5
2.5	14877.2	14223.5	4155.1	2355.1	2330.8	2143.4	716.9	2491.4	1933.5	1933.5	2719.7	2608.1	1528.39	2.723	96.2
2.6	12085.5	11555.5	3276.2	2244.9	2221.7	2038.0	699.3	2488.8	1933.5	1933.5	2655.3	2543.1	1271.48	2.724	96.7

TABLE VIIIB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:

Temperature = 6271°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.015.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	6257.2	553.9	4456.1	1026776.2	29600076.8	.124	.375
50.2	500.0	6223.6	556.3	4444.1	1016303.3	29665773.7	.125	.375
101.7	500.0	6192.0	559.2	4432.8	1006334.0	29733412.9	.126	.375
153.7	500.0	6157.3	562.3	4420.4	995255.5	29810817.9	.127	.375
200.2	500.0	6123.4	565.4	4408.2	984328.0	29888333.6	.128	.375
251.2	500.0	6092.7	568.4	4397.2	974308.1	29948756.9	.129	.375
303.2	500.0	6058.6	571.8	4384.9	963037.5	30033975.3	.130	.375
350.2	500.0	6025.1	575.3	4372.7	951804.0	30111810.8	.132	.375
400.7	500.0	5995.3	578.6	4361.9	941707.5	30187883.9	.133	.375
452.7	500.0	5961.8	582.5	4349.7	930220.1	30258054.3	.134	.375
504.7	500.0	5928.5	586.5	4337.5	918650.6	30336214.9	.135	.375
550.2	500.0	5899.6	590.2	4326.9	908457.2	30413725.1	.136	.375
602.2	500.0	5866.7	594.6	4314.8	896723.9	30483071.8	.138	.375
654.2	500.0	5834.0	599.2	4302.8	884897.2	30561551.2	.139	.375
700.2	500.0	5802.4	603.4	4291.1	873334.0	30640168.5	.141	.375
751.7	500.0	5773.2	608.4	4280.3	862455.2	30709046.2	.142	.375
803.7	500.0	5741.1	613.6	4268.4	850334.7	30787875.2	.144	.375
850.2	500.0	5709.8	619.0	4256.7	838338.9	30866825.5	.145	.375
901.2	500.0	5681.4	624.1	4246.2	827301.9	30919209.4	.147	.375
953.1	500.0	5649.9	630.2	4234.4	814858.4	31015161.7	.149	.375
1003.8	500.0	5619.2	636.4	4222.8	802537.3	31093053.3	.151	.375
1053.3	500.0	5589.4	642.7	4211.6	790409.2	31169053.0	.153	.375
1101.4	500.0	5560.6	649.2	4200.8	778466.3	31243234.7	.155	.375
1154.1	500.0	5529.1	656.7	4188.9	765216.6	31324481.5	.157	.375
1200.2	500.0	5499.8	663.6	4177.7	752649.0	31401696.3	.159	.375
1250.9	500.0	5472.7	671.4	4167.4	740798.9	31478784.3	.161	.375
1300.1	500.0	5441.3	680.3	4155.5	726858.1	31521930.8	.164	.375
1352.5	500.0	5412.1	689.3	4144.3	713612.9	31631425.3	.166	.375
1400.9	500.0	5385.6	697.9	4134.1	701356.5	31710412.2	.169	.375
1452.2	500.0	5356.1	708.1	4122.8	687468.3	31786374.6	.172	.375
1502.5	500.0	5327.3	718.7	4111.7	673643.7	31864779.5	.175	.375
1551.8	500.0	5299.3	729.8	4100.9	659858.3	31941848.8	.178	.375
1600.2	500.0	5271.8	741.5	4090.2	646088.3	32021778.0	.181	.375
1650.8	500.0	5241.3	755.6	4078.4	630410.1	32097088.7	.185	.375
1704.0	500.0	5213.4	769.5	4067.5	615730.3	32126816.1	.189	.375
1750.1	500.0	5187.6	783.3	4057.4	601847.6	32256907.8	.193	.375
1804.5	500.0	5157.3	801.0	4045.6	585070.5	32329443.3	.198	.375
1850.3	500.0	5129.3	817.6	4034.6	569234.8	32414787.1	.203	.375
1901.7	500.0	5103.3	837.1	4024.3	554008.3	32494032.1	.208	.375
1950.0	500.0	5074.0	857.5	4012.8	536493.6	32574745.2	.214	.375
2000.1	500.0	5046.8	882.7	4002.0	519525.8	32649499.6	.221	.375
2050.1	500.0	5018.7	909.2	3990.8	501572.3	32731634.1	.228	.375
2100.8	500.0	4990.8	938.6	3979.7	483168.1	32817316.0	.236	.375
2150.2	500.0	4963.0	971.3	3968.6	464171.7	32899742.7	.245	.375
2202.9	500.0	4935.7	1008.1	3957.7	444832.4	32979395.4	.255	.375
2251.9	500.0	4907.8	1050.6	3946.5	424420.2	33064066.7	.266	.375
2300.4	500.0	4877.7	1103.7	3934.4	401474.0	33153540.6	.281	.375
2350.3	500.0	4848.3	1164.7	3922.5	378127.8	33243110.8	.297	.375
2400.3	500.0	4820.1	1233.2	3911.1	355024.4	33335270.6	.315	.375
2451.6	500.0	4785.9	1332.5	3897.2	326198.0	33432271.0	.342	.375
2500.1	500.0	4749.5	1461.5	3882.3	294967.0	33536270.0	.376	.375
2550.4	500.0	4706.8	1648.1	3864.8	259126.4	33659315.7	.426	.375
2600.0	500.0	4647.4	1963.7	3840.4	214533.0	33811580.4	.511	.375
2650.0	500.0	4463.9	2989.9	3763.8	134166.3	34095762.4	.794	.375

TABLE VIIIB (Cont.)

Initial temperature = 6271°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.015.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.9	1933.5	3016.0	815.3	3093.8	43450.6	34391813.4	.264	2.885
54.4	1933.5	3014.7	820.6	3093.1	43163.3	34394252.2	.265	2.884
104.4	1933.5	3013.4	826.9	3092.4	42865.7	34399685.0	.267	2.883
154.4	1933.5	3012.0	832.9	3091.7	42567.4	34430235.9	.269	2.882
204.4	1933.5	3010.7	839.3	3091.0	42264.8	34445652.2	.272	2.880
254.4	1933.5	3009.3	845.7	3090.3	41959.7	34467107.6	.274	2.879
304.4	1933.5	3007.9	852.3	3089.6	41651.4	34489163.8	.276	2.878
354.4	1933.5	3006.6	859.2	3088.9	41339.2	34502008.9	.278	2.876
404.4	1933.5	3005.2	866.1	3088.2	41024.7	34526397.2	.280	2.875
454.4	1933.5	3003.7	873.2	3087.4	40706.5	34550971.1	.283	2.874
504.4	1933.5	3002.3	880.7	3086.7	40383.9	34565395.3	.285	2.872
554.4	1933.5	3000.9	888.2	3086.0	40058.5	34590441.7	.288	2.871
604.4	1933.5	2999.4	896.0	3085.2	39728.5	34607945.2	.290	2.869
654.4	1933.5	2998.0	904.0	3084.5	39395.4	34625850.7	.293	2.868
704.4	1933.5	2996.5	912.1	3083.7	39058.1	34649515.0	.296	2.867
754.4	1933.5	2995.0	920.6	3083.0	38716.2	34671497.7	.299	2.865
804.4	1933.5	2993.5	929.3	3082.2	38370.4	34694828.5	.301	2.864
854.4	1933.5	2992.0	938.3	3081.4	38019.7	34714636.2	.304	2.863
904.4	1933.5	2990.4	947.6	3080.6	37664.3	34735553.0	.308	2.861
954.4	1933.5	2988.9	957.2	3079.8	37303.8	34754092.9	.311	2.860
1004.4	1933.5	2987.3	967.0	3079.0	36938.8	34780813.7	.314	2.859
1054.5	1933.5	2986.0	984.2	3078.3	36604.6	34187212.1	.320	2.847
1101.3	1933.5	2984.5	985.9	3077.6	36293.9	34834315.3	.320	2.855
1151.3	1933.5	2982.9	996.5	3076.7	35913.7	34869113.9	.324	2.854
1201.3	1933.5	2981.2	1007.9	3075.8	35526.2	34894137.8	.328	2.852
1251.3	1933.5	2979.5	1019.8	3074.9	35131.3	34905952.6	.332	2.850
1301.3	1933.5	2977.7	1032.0	3074.0	34730.9	34929162.2	.336	2.849
1351.3	1933.5	2975.9	1044.8	3073.1	34323.1	34948340.1	.340	2.847
1401.3	1933.5	2974.1	1058.0	3072.2	33908.7	34975176.7	.344	2.846
1451.3	1933.5	2972.2	1072.0	3071.2	33485.5	34994867.7	.349	2.844
1501.3	1933.5	2970.2	1086.2	3070.2	33055.7	35030569.1	.354	2.843
1551.3	1933.5	2968.3	1101.5	3069.2	32615.3	35050909.9	.359	2.841
1601.3	1933.5	2966.2	1117.2	3068.1	32166.9	35077090.5	.364	2.839
1651.3	1933.5	2964.1	1133.8	3067.0	31708.8	35113070.0	.370	2.838
1701.3	1933.5	2961.9	1152.0	3065.9	31236.1	35113397.4	.376	2.835
1751.3	1933.5	2959.6	1169.8	3064.7	30758.5	35168352.5	.382	2.834
1801.3	1933.5	2957.2	1189.9	3063.5	30262.9	35178021.8	.388	2.832
1851.3	1933.5	2954.8	1210.3	3062.2	29758.0	35221307.6	.395	2.830
1901.3	1933.5	2952.2	1232.7	3060.8	29235.7	35244417.0	.403	2.828
1951.3	1933.5	2949.5	1256.0	3059.4	28700.3	35288363.5	.411	2.826
2001.3	1933.5	2946.6	1281.3	3057.9	28145.4	35320432.1	.419	2.824
2051.3	1933.5	2943.5	1308.7	3056.3	27570.6	35352633.7	.428	2.822
2101.3	1933.5	2940.2	1338.3	3054.6	26974.4	35389996.4	.438	2.819
2151.3	1933.5	2936.7	1370.6	3052.8	26352.8	35425108.4	.449	2.817
2201.3	1933.5	2932.8	1405.3	3050.8	25706.3	35481506.0	.461	2.814
2251.3	1933.5	2928.6	1444.5	3048.6	25023.4	35515231.7	.474	2.811
2301.3	1933.5	2923.9	1488.3	3046.1	24302.0	35563030.1	.489	2.808
2351.3	1933.5	2918.5	1537.5	3043.3	23535.3	35618438.9	.505	2.804
2401.3	1933.5	2912.4	1594.0	3040.1	22711.1	35685597.8	.524	2.800
2451.3	1933.5	2905.2	1660.6	3036.4	21811.7	35754592.3	.547	2.795
2501.3	1933.5	2896.2	1741.8	3031.7	20808.9	35830807.0	.575	2.789
2551.3	1933.5	2884.7	1845.1	3025.6	19659.5	35933083.1	.610	2.781
2600.6	1933.5	2863.2	2034.6	3017.0	18008.0	35969810.9	.674	2.766
2651.5	1933.5	2823.1	2394.8	2993.2	15331.3	36711695.2	.800	2.739

TABLE IXA

Time Variation of Vent Hole Entrance and Exit Properties for Initial Sphere Conditions of: Temperature = 6271°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.075.

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (0/0)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
0.0	1037232.0	1034961.7	44975.1	6272.0	6268.8	4003.8	259.0	3464.1	500.0	500.0	4460.3	3564.6	248.98	.375	0.0
.1	1035923.8	1033788.2	47002.1	6270.2	6267.2	4518.8	251.3	3640.3	2732.8	1938.6	4459.7	3786.9	241.38	.375	.1
.2	1034591.8	1033074.5	60267.1	6268.3	6266.2	4806.7	211.9	3767.0	3258.0	3034.0	4459.3	3905.6	301.44	.375	.2
.3	1032592.1	1030733.8	69662.0	6265.5	6262.9	4708.6	234.7	3875.8	1933.5	3258.0	4458.2	3865.6	504.84	.438	.3
.4	1029230.8	1026802.1	85050.7	6260.8	6257.4	4949.2	268.7	3847.8	1933.5	1933.5	4456.2	3963.1	849.09	.536	.6
.5	1023735.6	1020689.5	86113.9	6253.1	6248.8	5073.4	301.6	3995.6	1933.5	1933.5	4453.1	4012.5	1337.63	.665	1.0
.6	1015325.6	1011644.5	82091.7	6241.2	6236.0	5135.5	332.6	4173.7	1933.5	1933.5	4448.6	4037.0	1989.43	.800	1.6
.7	1003141.7	998859.8	87692.3	6223.8	6217.7	5214.6	360.4	4181.3	1933.5	1933.5	4442.0	4068.0	2806.27	.936	2.5
.8	986330.5	981494.4	97324.0	6199.6	6192.6	5292.1	385.6	4070.1	1933.5	1933.5	4433.1	4098.1	3784.79	1.075	3.8
.9	964106.8	958756.6	104499.6	6167.1	6159.2	5355.7	409.2	3942.8	1933.5	1933.5	4421.1	4122.6	4916.52	1.213	5.5
1.0	935852.2	930060.7	99250.5	6124.9	6116.1	5311.1	430.7	4106.5	1933.5	1933.5	4405.6	4105.4	6162.15	1.351	7.6
1.1	901212.0	895084.1	104397.4	6071.8	6062.3	5332.1	449.6	3969.3	1933.5	1933.5	4386.2	4113.6	7461.04	1.486	10.2
1.2	860204.6	853841.4	100385.6	6006.9	5996.6	5283.2	466.4	3997.2	1933.5	1933.5	4362.4	4094.6	8755.91	1.619	13.4
1.3	813278.1	806797.6	99174.7	5929.6	5918.7	5244.7	481.0	3924.8	1933.5	1933.5	4333.9	4079.7	9967.30	1.748	17.1
1.4	761246.7	754802.0	97929.8	5839.9	5828.4	5187.8	492.1	3894.7	1933.5	1933.5	4300.7	4057.5	10994.55	1.868	21.2
1.5	705314.6	698981.1	91423.0	5737.9	5726.0	5105.6	502.4	3865.7	1933.5	1933.5	4262.8	4025.2	11834.29	1.982	25.7
1.6	646910.5	640814.3	83666.3	5624.6	5612.3	4995.6	509.6	3904.6	1933.5	1933.5	4220.3	3981.6	12389.85	2.088	30.5
1.7	587583.0	581809.8	80126.5	5501.1	5488.6	4916.3	514.7	3782.9	1933.5	1933.5	4173.5	3949.9	12660.84	2.185	35.4
1.8	528883.8	523488.1	73014.1	5369.1	5356.4	4806.1	518.2	3712.4	1933.5	1933.5	4122.9	3905.4	12664.15	2.271	40.4
1.9	472115.0	467151.8	64366.4	5230.3	5217.5	4665.8	519.2	3765.0	1933.5	1933.5	4069.1	3848.0	12400.66	2.347	45.4
2.0	418387.7	413868.6	59161.5	5086.4	5073.7	4559.0	519.0	3637.2	1933.5	1933.5	4012.6	3803.7	11938.09	2.416	50.3
2.1	368443.4	364379.6	52432.2	4939.4	4926.8	4424.0	516.8	3632.1	1933.5	1933.5	3954.1	3746.9	11303.07	2.475	54.9
2.2	322773.4	319138.2	44981.2	4790.8	4778.3	4278.6	514.4	3616.0	1933.5	1933.5	3894.1	3684.9	10577.22	2.528	59.3
2.3	281557.9	278341.2	40774.2	4642.2	4629.9	4163.5	510.0	3515.5	1933.5	1933.5	3833.1	3634.9	9768.64	2.572	63.3
2.4	244811.5	241974.2	35564.6	4494.7	4482.7	4033.4	505.4	3447.8	1933.5	1933.5	3771.7	3577.7	8948.76	2.611	67.1
2.5	212329.9	209844.2	31683.1	4349.5	4337.7	3914.8	499.7	3352.0	1933.5	1933.5	3710.2	3524.7	8125.58	2.644	70.5
2.6	183867.9	181688.6	25973.4	4207.4	4195.8	3758.0	494.6	3393.7	1933.5	1933.5	3649.0	3453.4	7347.43	2.672	73.6
2.7	159054.6	157161.6	23810.7	4069.0	4057.7	3661.7	487.4	3261.1	1933.5	1933.5	3588.5	3408.9	6589.27	2.695	76.4
2.8	137528.0	135877.9	20567.4	3934.7	3923.7	3542.4	481.2	3197.4	1933.5	1933.5	3528.7	3352.9	5901.97	2.715	78.9
2.9	118916.8	117482.3	17448.9	3804.8	3794.2	3415.9	474.5	3200.2	1933.5	1933.5	3470.0	3292.5	5267.24	2.732	81.1
3.0	102869.8	101623.6	14814.2	3679.7	3669.3	3294.5	467.6	3193.9	1933.5	1933.5	3412.4	3233.4	4690.47	2.746	83.1
3.1	89054.9	87972.4	13519.6	3559.2	3549.2	3207.4	460.7	3060.5	1933.5	1933.5	3356.1	3190.4	4170.95	2.757	84.9
3.2	77176.7	76235.9	11737.5	3443.6	3433.8	3105.2	453.8	3008.1	1933.5	1933.5	3301.1	3139.2	3706.22	2.767	86.4
3.3	66965.8	66147.9	10318.5	3332.6	3323.2	3011.0	446.8	2936.9	1933.5	1933.5	3247.5	3091.1	3291.42	2.776	87.8
3.4	58189.1	57477.4	8897.6	3226.3	3217.2	2913.8	440.0	2906.4	1933.5	1933.5	3195.2	3040.8	2923.25	2.782	89.1
3.5	50640.9	50020.8	7661.6	3124.5	3115.6	2818.0	433.2	2886.5	1933.5	1933.5	3144.4	2990.5	2597.16	2.788	90.2

TABLE IXA (Cont.)

TIME (MIN)	PRESSURE (POUNDS/SQUARE FOOT)			TEMPERATURE (DEGREES R)			VELOCITY (FEET/SEC)		WALL TEMP (DEG R)		SOUND VEL (FEET/SEC)		MASS FLOW (LB/SEC)	MIN. RADIUS (FEET)	MASS VENTED (0/0)
	SPHERE	INLET	OUTLET	SPHERE	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET			
3.6	44144.0	43603.1	6761.9	3027.1	3018.5	2736.9	426.6	2816.4	1933.5	1933.5	3095.0	2947.1	2308.92	2.793	91.2
3.7	38545.4	38072.7	5951.1	2933.8	2925.4	2656.7	420.1	2761.7	1933.5	1933.5	3046.9	2903.6	2054.41	2.797	92.1
3.8	33715.6	33302.1	5162.2	2844.5	2836.4	2574.8	413.7	2735.2	1933.5	1933.5	3000.2	2858.5	1829.34	2.800	92.8
3.9	29542.9	29180.4	4543.6	2759.1	2751.3	2501.3	407.5	2686.4	1933.5	1933.5	2954.8	2817.4	1631.00	2.802	93.5
4.0	25932.3	25614.0	3952.9	2677.4	2669.7	2426.5	401.5	2662.0	1933.5	1933.5	2910.7	2775.0	1456.05	2.804	94.1
4.1	22802.6	22522.7	3430.9	2599.1	2591.7	2353.6	395.6	2644.9	1933.5	1933.5	2867.9	2733.0	1301.23	2.806	94.7
4.2	20085.8	19839.2	2952.2	2524.1	2516.9	2280.1	389.9	2650.6	1933.5	1933.5	2826.2	2690.0	1164.32	2.807	95.2
4.3	17723.4	17505.8	2552.5	2452.2	2445.2	2212.9	384.3	2628.4	1933.5	1933.5	2785.7	2650.0	1043.20	2.808	95.6
4.4	15665.6	15473.2	2316.5	2383.4	2376.6	2161.1	378.9	2549.3	1933.5	1933.5	2746.3	2618.8	935.94	2.809	96.0
4.5	13870.0	13699.7	2147.1	2317.3	2310.7	2117.4	373.6	2417.0	1933.5	1933.5	2708.0	2592.2	840.83	2.809	96.4
4.6	12300.5	12150.0	2191.6	2254.0	2247.6	2101.0	367.8	2155.1	1933.5	1933.5	2670.7	2582.2	755.15	2.810	96.7
4.7	10929.1	10796.0	2217.7	2193.3	2187.2	2072.3	361.9	1866.6	1933.5	1933.5	2634.6	2564.5	678.76	2.810	97.0

TABLE IXB

Spatial Variation of Flow Properties for Initial Sphere Conditions of:

Temperature = 6271°R, Pressure = 490 Atm, Mass = 1,519,000 lbs, Friction factor = 0.075.
Time = 0 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	500.0	6268.4	259.0	4460.1	1034847.2	13913438.6	.058	.375
50.6	500.0	6226.2	260.1	4445.1	1023555.6	13951555.2	.059	.375
101.3	500.0	6182.9	261.3	4429.6	1011836.3	13996655.7	.059	.375
150.3	500.0	6140.7	262.5	4414.4	1000272.0	14041469.1	.059	.375
200.3	500.0	6098.7	263.8	4399.3	988624.6	14086012.5	.060	.375
251.1	500.0	6057.0	265.1	4384.3	976886.7	14130301.0	.060	.375
300.4	500.0	6016.3	266.5	4369.5	965286.8	14174347.6	.061	.375
350.3	500.0	5974.8	268.0	4354.4	953315.9	14218166.9	.062	.375
403.9	500.0	5934.9	269.5	4339.9	941633.0	14261770.1	.062	.375
452.2	500.0	5896.0	271.1	4325.6	930073.6	14310073.1	.063	.375
500.2	500.0	5857.5	272.7	4311.5	918514.3	14355103.5	.063	.375
550.4	500.0	5814.1	274.6	4295.5	905265.2	14398548.1	.064	.375
603.4	500.0	5775.9	276.4	4281.3	893445.5	14441363.6	.065	.375
650.6	500.0	5739.0	278.3	4267.6	881853.9	14489474.3	.065	.375
700.4	500.0	5696.9	280.5	4252.0	868428.5	14533571.9	.066	.375
752.1	500.0	5660.6	282.5	4238.4	856662.6	14580818.0	.067	.375
800.3	500.0	5620.6	284.9	4223.4	843477.5	14625080.5	.067	.375
852.6	500.0	5584.2	287.2	4209.7	831326.0	14660493.2	.068	.375
900.3	500.0	5545.1	289.8	4194.9	818030.6	14715954.9	.069	.375
952.1	500.0	5509.7	292.4	4181.5	805792.5	14750016.7	.070	.375
1000.4	500.0	5470.7	295.3	4166.7	792073.8	14806253.1	.071	.375
1050.8	500.0	5437.0	298.0	4153.8	780007.3	14853557.5	.072	.375
1103.6	500.0	5398.6	301.3	4139.1	765998.4	14896036.0	.073	.375
1150.5	500.0	5361.5	304.7	4124.9	752230.6	14945096.8	.074	.375
1202.5	500.0	5327.4	308.1	4111.8	739338.9	14987485.7	.075	.375
1254.5	500.0	5290.5	312.0	4097.5	725068.8	15035190.5	.076	.375
1300.5	500.0	5254.8	315.6	4083.6	711039.7	15082960.4	.077	.375
1352.0	500.0	5221.9	319.9	4070.8	697803.8	15124810.2	.079	.375
1404.0	500.0	5185.8	324.6	4056.7	682967.0	15172698.1	.080	.375
1450.5	500.0	5150.6	329.6	4042.9	668197.8	15220649.3	.082	.375
1501.5	500.0	5118.8	334.4	4030.4	654529.7	15245666.1	.083	.375
1553.5	500.0	5083.5	340.1	4016.5	639000.9	15310728.8	.085	.375
1600.5	500.0	5048.7	346.3	4002.8	623347.9	15358861.1	.087	.375
1651.0	500.0	5018.0	352.2	3990.5	609117.7	15405883.2	.088	.375
1703.0	500.0	4983.4	359.4	3976.8	592726.0	15449277.3	.090	.375
1755.0	500.0	4949.1	367.3	3963.1	575981.8	15497594.4	.093	.375
1800.5	500.0	4919.3	374.9	3951.1	561015.6	15545503.2	.095	.375
1852.5	500.0	4885.5	384.3	3937.5	543516.8	15588355.8	.098	.375
1904.5	500.0	4852.0	394.7	3924.0	525555.3	15636856.1	.101	.375
1950.5	500.0	4819.6	404.8	3910.9	507638.2	15685426.1	.104	.375
2002.0	500.0	4789.7	417.5	3898.7	490443.4	15727979.5	.107	.375
2054.0	500.0	4756.8	431.9	3885.3	470829.1	15776679.9	.111	.375
2100.5	500.0	4724.7	447.9	3872.2	450888.7	15825456.5	.116	.375
2151.5	500.0	4695.6	464.6	3860.2	432011.7	15815715.8	.120	.375
2203.3	500.0	4663.2	486.1	3846.9	409997.9	15917144.1	.126	.375
2251.8	500.0	4632.5	510.2	3834.2	388066.8	15963964.9	.133	.375
2302.6	500.0	4601.6	539.2	3821.4	364721.3	16012843.7	.141	.375
2353.8	500.0	4569.9	575.7	3808.2	339175.7	16061593.4	.151	.375
2401.4	500.0	4540.1	618.5	3795.8	313606.5	16089164.3	.163	.375
2450.2	500.0	4506.2	681.8	3781.6	282310.0	16153821.4	.180	.375
2501.3	500.0	4475.7	759.1	3768.7	251788.4	16196842.5	.201	.375
2550.3	500.0	4441.2	881.9	3754.2	214945.6	16254135.2	.235	.375
2600.2	500.0	4393.8	1133.0	3734.1	163759.9	16303461.2	.303	.375
2650.1	500.0	4255.8	2189.6	3675.0	81661.9	16336911.0	.596	.375

TABLE IXB (Cont.)

Initial temperature = 6271°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.075.
Time = 2 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
.5	1933.5	5073.7	519.0	4012.6	413835.7	94217277.0	.129	2.610
50.1	1933.5	5070.9	523.4	4011.5	410484.4	94275331.0	.130	2.608
104.1	1933.5	5068.2	528.0	4010.4	407049.5	94372754.9	.132	2.607
152.0	1933.5	5065.5	532.6	4009.4	403793.6	94421623.3	.133	2.606
204.1	1933.5	5062.6	537.9	4008.2	400104.6	94459156.3	.134	2.604
250.5	1933.5	5060.0	542.4	4007.2	396876.0	94542423.0	.135	2.603
302.8	1933.5	5057.1	550.3	4006.1	393158.3	93563843.9	.137	2.596
351.9	1933.5	5054.4	553.5	4005.0	389620.1	94669140.4	.138	2.599
404.1	1933.5	5051.5	559.2	4003.8	385864.6	94733423.3	.140	2.598
450.5	1933.5	5048.6	564.3	4002.7	382131.9	94834983.9	.141	2.597
500.7	1933.5	5045.8	570.2	4001.6	378371.4	94902356.8	.142	2.596
550.1	1933.5	5043.0	576.1	4000.5	374629.8	94970878.9	.144	2.594
603.3	1933.5	5040.3	582.6	3999.4	370868.8	95055690.9	.146	2.593
652.5	1933.5	5037.4	589.3	3998.3	366935.0	95077432.3	.147	2.592
701.9	1933.5	5034.6	595.7	3997.2	363157.9	95154576.5	.149	2.590
754.8	1933.5	5031.6	602.9	3996.0	358937.7	95236809.3	.151	2.589
801.4	1933.5	5029.0	609.7	3994.9	355167.2	95236584.9	.153	2.587
852.9	1933.5	5025.9	617.5	3993.7	350820.5	95363585.1	.155	2.586
901.2	1933.5	5023.1	625.0	3992.6	346773.8	95417985.7	.157	2.585
950.5	1933.5	5020.1	633.2	3991.4	342401.2	95511421.3	.159	2.584
1003.8	1933.5	5017.2	641.4	3990.2	338212.6	95569445.5	.161	2.582
1050.3	1933.5	5014.5	649.5	3989.2	334167.4	95658399.5	.163	2.581
1103.9	1933.5	5011.4	659.6	3987.9	329469.4	95620481.5	.165	2.578
1151.8	1933.5	5008.4	668.7	3986.7	324977.0	95838682.6	.168	2.578
1200.3	1933.5	5005.3	678.9	3985.5	320318.5	95868409.1	.170	2.576
1250.7	1933.5	5002.5	688.8	3984.4	315881.1	95950450.8	.173	2.575
1302.6	1933.5	4999.4	699.7	3983.2	311126.0	96026760.8	.176	2.573
1353.6	1933.5	4996.3	710.9	3981.9	306214.3	96133971.9	.179	2.572
1400.2	1933.5	4993.1	723.3	3980.6	301179.5	96174540.7	.182	2.570
1453.5	1933.5	4990.0	735.6	3979.4	296282.8	96241521.8	.185	2.569
1500.2	1933.5	4986.8	749.0	3978.1	291038.1	96345048.4	.188	2.568
1551.1	1933.5	4983.6	763.0	3976.9	285879.8	96407658.6	.192	2.566
1602.0	1933.5	4980.3	778.2	3975.5	280418.8	96475536.5	.196	2.565
1651.1	1933.5	4977.2	792.9	3974.3	275359.8	96498932.7	.200	2.563
1700.4	1933.5	4973.6	811.1	3972.8	269333.2	96614122.1	.204	2.562
1752.2	1933.5	4970.3	828.1	3971.5	263886.1	96713821.0	.209	2.561
1802.3	1933.5	4966.6	848.2	3970.1	257773.2	96776513.1	.214	2.559
1850.3	1933.5	4963.1	871.7	3968.6	251814.8	96032116.9	.220	2.553
1900.1	1933.5	4959.2	892.4	3967.1	245358.1	96979911.2	.225	2.555
1950.3	1933.5	4955.2	916.8	3965.5	238810.6	97102211.1	.231	2.554
2001.5	1933.5	4951.1	944.0	3963.9	232127.0	96944933.5	.238	2.552
2054.4	1933.5	4946.9	973.6	3962.2	225158.8	97242419.7	.246	2.550
2100.1	1933.5	4942.3	1006.1	3960.4	217945.2	97386811.5	.254	2.549
2150.1	1933.5	4937.5	1042.1	3958.4	210410.2	97456484.0	.263	2.547
2200.2	1933.5	4932.5	1082.4	3956.4	202808.3	97575443.3	.274	2.545
2251.0	1933.5	4926.6	1131.5	3954.0	194109.7	97658348.7	.286	2.543
2301.6	1933.5	4920.3	1185.0	3951.5	185349.4	97649575.3	.300	2.541
2350.4	1933.5	4913.1	1247.8	3948.6	176031.0	98023818.9	.316	2.539
2401.6	1933.5	4904.7	1325.2	3945.2	166019.6	98008808.2	.336	2.534
2450.4	1933.5	4894.0	1421.6	3940.9	154667.5	98345508.6	.361	2.532
2500.2	1933.5	4880.3	1547.7	3935.4	142241.2	98390699.2	.393	2.527
2550.4	1933.5	4862.1	1672.7	3928.1	128784.9	102888219.7	.426	2.550
2600.4	1933.5	4826.4	2010.6	3913.6	109560.1	99338814.8	.514	2.511
2651.5	1933.5	4709.5	2826.8	3866.0	77855.5	100643088.6	.731	2.476

TABLE IXB (Cont.)

Initial temperature = 6271°R, pressure = 490 Atm, mass = 1,519,000 lbs, friction factor = 0.075.
Time = 4 min

DISTANCE UP VENT (FEET)	WALL TEMP. (DEG R)	GAS TEMP. (DEG R)	GAS VEL. (FT/SEC)	SOUND VEL. (FT/SEC)	GAS PRESS. (LB/FT SQ)	REYNOLDS NUMBER	MACH NUMBER	VENT RADIUS (FEET)
1.2	1933.5	2669.7	401.5	2910.7	25612.0	12246188.4	.138	3.021
51.2	1933.5	2668.8	404.5	2910.2	25419.0	12243685.9	.139	3.020
101.2	1933.5	2667.9	408.0	2909.7	25208.1	12254370.5	.140	3.019
151.2	1933.5	2666.9	411.8	2909.2	24994.8	12259095.0	.142	3.017
201.2	1933.5	2666.0	415.7	2908.7	24779.1	12262000.8	.143	3.016
251.2	1933.5	2665.0	419.5	2908.2	24561.5	12271152.1	.144	3.015
301.7	1933.5	2664.0	426.4	2907.6	24338.5	12109380.1	.147	3.004
351.7	1933.5	2663.1	427.9	2907.1	24121.5	12281886.9	.147	3.011
401.7	1933.5	2662.1	432.2	2906.6	23896.2	12288031.6	.149	3.009
451.7	1933.5	2661.1	436.5	2906.0	23668.6	12298358.0	.150	3.008
501.7	1933.5	2660.1	441.0	2905.5	23438.0	12305902.1	.152	3.007
551.7	1933.5	2659.2	445.6	2905.0	23204.8	12312399.5	.153	3.006
601.7	1933.5	2658.2	450.4	2904.4	22968.8	12321606.0	.155	3.004
651.7	1933.5	2657.2	455.5	2903.9	22729.6	12322197.3	.157	3.003
701.7	1933.5	2656.2	460.6	2903.3	22487.5	12330056.4	.159	3.001
751.7	1933.5	2655.2	465.9	2902.8	22242.3	12338682.2	.161	3.000
801.7	1933.5	2654.2	471.5	2902.2	21993.7	12344056.4	.162	2.998
851.7	1933.5	2653.1	477.2	2901.7	21741.9	12350685.3	.164	2.997
901.7	1933.5	2652.1	483.1	2901.1	21486.4	12356601.1	.167	2.996
951.7	1933.5	2651.1	489.2	2900.5	21227.4	12365309.0	.169	2.994
1001.7	1933.5	2650.0	495.7	2900.0	20964.4	12370943.1	.171	2.993
1051.7	1933.5	2649.0	502.3	2899.4	20697.6	12380180.9	.173	2.992
1101.9	1933.5	2647.9	509.7	2898.8	20431.0	12374100.7	.176	2.989
1151.9	1933.5	2646.9	516.4	2898.2	20156.2	12397827.7	.178	2.988
1201.9	1933.5	2645.8	524.1	2897.6	19875.8	12399673.2	.181	2.986
1251.9	1933.5	2644.7	532.0	2897.0	19591.0	12409246.9	.184	2.985
1301.9	1933.5	2643.6	540.3	2896.4	19301.0	12415846.3	.187	2.984
1351.9	1933.5	2642.4	548.7	2895.8	19006.2	12426889.4	.189	2.983
1401.9	1933.5	2641.3	558.0	2895.2	18705.3	12430091.4	.193	2.981
1451.9	1933.5	2640.1	567.6	2894.5	18398.6	12436070.4	.196	2.979
1501.9	1933.5	2638.9	577.5	2893.9	18086.1	12446564.3	.200	2.978
1551.9	1933.5	2637.7	588.3	2893.2	17766.7	12452143.4	.203	2.976
1601.9	1933.5	2636.4	599.6	2892.5	17440.2	12458125.4	.207	2.975
1651.9	1933.5	2635.2	611.6	2891.8	17106.4	12465691.7	.212	2.973
1701.9	1933.5	2633.9	624.4	2891.1	16764.5	12471088.5	.216	2.971
1751.9	1933.5	2632.5	638.0	2890.4	16414.2	12480814.4	.221	2.970
1801.9	1933.5	2631.1	652.7	2889.6	16054.4	12486772.9	.226	2.968
1850.4	1933.5	2629.6	671.6	2888.8	15671.7	12382957.6	.232	2.960
1900.3	1933.5	2628.2	684.8	2888.0	15319.3	12505187.2	.237	2.964
1950.3	1933.5	2626.6	703.0	2887.1	14927.1	12517039.4	.243	2.963
2000.3	1933.5	2624.9	723.0	2886.2	14521.5	12523224.9	.251	2.961
2050.3	1933.5	2623.1	744.9	2885.2	14101.5	12528248.9	.258	2.959
2100.3	1933.5	2621.1	768.8	2884.1	13665.9	12541995.3	.267	2.957
2150.3	1933.5	2619.0	795.7	2883.0	13211.5	12546795.4	.276	2.955
2200.3	1933.5	2616.7	825.5	2881.7	12736.7	12557226.8	.286	2.953
2250.3	1933.5	2614.2	859.6	2880.3	12237.7	12562678.8	.298	2.950
2300.3	1933.5	2611.3	898.2	2878.7	11711.5	12582425.0	.312	2.948
2350.3	1933.5	2608.0	943.1	2876.9	11151.8	12594846.2	.328	2.946
2400.3	1933.5	2604.0	998.1	2874.7	10548.6	12586297.7	.347	2.941
2450.3	1933.5	2599.1	1063.3	2871.9	9895.7	12614883.3	.370	2.938
2500.3	1933.5	2592.7	1147.8	2868.4	9169.7	12616197.6	.400	2.931
2551.2	1933.5	2583.5	1242.1	2863.4	8320.8	13291638.5	.434	2.961
2600.6	1933.5	2566.7	1470.6	2854.0	7204.6	12814025.6	.515	2.912
2650.4	1933.5	2516.2	1980.5	2825.8	5391.0	12930738.0	.701	2.870

APPENDIX

Material Properties

MATERIAL PROPERTIES

Gas

The numerical value of R can be calculated directly from the two sets of given input data:

$$\text{Case I:} \quad R = \frac{p_s}{\rho_s T_s} = 98.96 \ (\text{lbs-ft/lb}_m\text{-}^\circ\text{R}) \ , \tag{A1}$$

and

$$\text{Case II:} \quad R = 104.34 \ \ (\text{lbs-ft/lb}_m\text{-}^\circ\text{R}) \ . \tag{A2}$$

The discrepancy between these two values of R is not very great and may be ascribed to the lack of certainty in the given data. Therefore, a reasonable value for R to be used in the calculations is the mean of these two, namely,

$$R = 101.63 \ \ (\text{lbs-ft/lb}_m\text{-}^\circ\text{R}) \ . \tag{A3}$$

For an ideal gas, it is also known that

$$\text{molecular weight} = \frac{\mathcal{R}}{R} \ , \tag{A4}$$

where $\mathcal{R}$ is the universal gas constant, equal to 1545 (lbs-ft/lb$_m$-°R-mol wt). The calculated molecular weight is, using R from equation (A3),

$$\frac{\mathcal{R}}{R} = 15.202 \ . \tag{A5}$$

Using this molecular weight for the entire mixture, the mean molecular weight of the 5.5 weight percent of O, NO, and H calculates to 2.839 which must be predominately hydrogen. In fact, if only hydrogen and oxygen make up the 5.5 weight percent, the ratio is 87.8 atom percent hydrogen and 12.2 atom percent oxygen; and for hydrogen and NO only, the ratio is 93.7 atom percent hydrogen and 6.3 atom percent NO. A mean of these two extremes has been chosen which, when combined with the other given constituents, gives a gas composition as follows:

Constituent	Weight Percent	Mole Fraction
H_2O	34	0.2849
CO	29	0.1563
CO_2	17	0.0583
OH	6	0.0533
N_2	5	0.0269
O	2.3	0.0217
O_2	2.0	0.0094
H	1.8	0.2697
H_2	1.5	0.1123
NO	1.4	0.0070

Using the published data available for the various constituents, values of the specific heat, C_p, and the specific heat ratio, γ, were computed by means of a weighting equal to the mole fraction. The values obtained are given in the following table.

Temperature (°R)	C_p (BTU/lb_m-°R)	γ
540	0.4476	1.450
900	0.4640	1.439
1440	0.4936	1.418
1800	0.5133	1.407
2700	0.5529	1.384
3600	0.5796	1.371
4500	0.6041	1.363

In view of the uncertainties in the data, it was felt that R, C_p, and γ could be represented by constants over the entire temperature range. The values chosen were

$$R = 101.63 \quad (\text{lbs-ft}/\text{lb}_m\text{-}^\circ\text{R}) \ , \tag{A6a}$$

$$C_p = 0.537 \quad (\text{BTU}/\text{lb}_m\text{-}^\circ\text{R}) \ , \tag{A6b}$$

$$\gamma = 1.40 \ . \tag{A6c}$$

However, the high mole fraction of atomic hydrogen (0.2697) did not appear very probable. Consequently, a second possible composition was calculated in which no atomic hydrogen was present. Repeating the calculations given above with equal masses of NO and O being the only contributors to the 5.5 weight percent, the results were as follows.

Constituent	Weight Percent	Mole Fraction
H_2O	34	0.3843
CO	29	0.2108
CO_2	17	0.0787
OH	6	0.0718
N_2	5	0.0363
NO	2.75	0.0187
O	2.75	0.0350
O_2	2.0	0.0127
H_2	1.5	0.1515

From this composition, the mean molecular weight was calculated to be 20.367. Using this molecular weight, the gas constant, R, was calculated from equation (A5) as 75.87 (lbs-ft/lb_m-°R). C_p and γ were calculated also:

Temperature (°R)	C_p(BTU/lb_m-°R)	γ
540	0.4915	1.371
900	0.5134	1.356
1440	0.5535	1.327
1800	0.5806	1.312
2700	0.6340	1.281
3600	0.6701	1.263
4500	0.6934	1.253

As before, R, C_p, and γ were assumed constant, the values selected being

$$R = 75.87 \quad (\text{lbs-ft/lb}_m\text{-}^\circ\text{R}) \ , \tag{A7a}$$

$$C_p = 0.611 \ (\text{BTU/lb}_m\text{-}^\circ\text{R}) \ , \tag{A7b}$$

and

$$\gamma = 1.30 \ . \tag{A7c}$$

Both sets of values, equations (A6a, b, and c) and A7a, b, and c), were used in calculating the flow from the spherical cavity.

From the published data for the constituent gases, an estimate was made of the viscosity as a function of temperature:

$$\mu = 3.6 \times 10^{-6} \sqrt{T/460} \ (\text{lbs-sec/ft}^2) \ , \tag{A8}$$

where T is in degrees Rankine.

Ground

Although common salt (sodium chloride) is quite plentiful, it was surprising that so little information was available in the literature on its thermodynamic properties. By combining the little data there were with a variety of approximate relationships, the values listed below were obtained for solid sodium chloride.

Temp (°R)	Density (lbs/ft^3)	Specific Heat (constant press.) (BTU/lb$_m$-°R	Thermal Conductivity (BTU/ft-sec-°R)
492	135.3	0.204	0.000977
672	133.0	0.211	0.000676
852	130.8	0.219	0.000502
1032	128.6	0.227	0.000402
1212	126.6	0.238	0.000335
1392	124.6	0.240	0.000288
1572	122.6	0.247	0.000249
1752	120.7	0.255	0.000219
1932	118.9	0.262	0.000195

The melting point is given as 1932°R and the heat of fusion as 206.0 (BTU/lb$_m$). The value of specific heat was chosen as 0.240 (BTU/lb$_m$-°R), the density as 125.0 (lb$_m$/ft^3), the thermal conductivity as 0.0005 (BTU/ft-sec-°R), and the thermal diffusivity as 0.0000167 (ft^2/sec).

Iron Tube

The values for iron are readily available. The values used in the calculation here are a density of 490.0 (lb$_m$/ft^3), a specific heat of 0.11 (BTU/lb$_m$), and a heat of fusion of 117.0 (BTU/lb$_m$).

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