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THEORETICAL PERFORMANCE OF ROCKET ENGINES USING GASEOUS HYDROGEN IN THE IDEAL STATE AT STAGNATION TEMPERATURES UP TO 200,000 R

by R. Roback

Prepared by
UNITED AIRCRAFT CORPORATION
East Hartford, Conn.
for

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UNITED AIRCRAFT CORPORATION
East Hartford, Conn.

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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FOREWORD

An exploratory experimental and theoretical investigation of gaseous nuclear rocket technology is being conducted by the United Aircraft Corporation Research Laboratories under Contract NASw-847 with the joint AEC-NASA Space Nuclear Propulsion Office. The Technical Supervisor of the Contract for NASA is Captain W. A. Yingling (USAF). Results of the investigation conducted during the period between September 15, 1965 and September 15, 1966 are described in the following six reports (including the present report) which comprise the required fourth Interim Summary Technical Report under the Contract:

1. Krascella, N. L.: Theoretical Investigation of the Absorptive Properties of Small Particles and Heavy-Atom Gases. UAC Research Laboratories Report E-910092-7, September 1966 (Unclassified)

2. Kinney, R. B.: Theoretical Effect of Seed Opacity and Turbulence on Temperature Distributions in the Propellant Region of a Vortex-Stabilized Gaseous Nuclear Rocket (U). UAC Research Laboratories Report E-910092-8, September 1966. (report classified Confidential)

3. Kesten, A. S., and N. L. Krascella: Theoretical Investigation of Radiant Heat Transfer in the Fuel Region of a Gaseous Nuclear Rocket Engine. UAC Research Laboratories Report E-910092-9, September 1966. (Unclassified)

4. Roback, R.: Theoretical Performance of Rocket Engines Using Gaseous Hydrogen in the Ideal State at Stagnation Temperatures up to 20,000 R. UAC Research Laboratories Report E-910093-30, September 1966. (Unclassified)(present report)

5. Latham, T. S.: Nuclear Criticality Study of a Specific Vortex-Stabilized Gaseous Nuclear Rocket Engine (U). UAC Research Laboratories Report E-910375-1, September 1966. (report classified Confidential)

6. McLafferty, G. H., H. E. Bauer, and D. E. Sheldon: Preliminary Conceptual Design Study of a Specific Vortex-Stabilized Gaseous Nuclear Rocket Engine (U). UAC Research Laboratories Report E-910093-29, September 1966. (report classified Confidential)

Theoretical Performance of Rocket Engines

Using Gaseous Hydrogen in the Ideal State at

Stagnation Temperatures Up to 200,000 R

TABLE OF CONTENTS

		Page
SUMMARY		1
INTRODUCTION		2
DISCUSSION AND RESULTS		3
REFERENCES		6
LIST OF SYMBOLS		7
TABLES 1-18	Stagnation Pressure = 1 atm, Stagnation Temperatures = 5000-200,000 R	8-25
TABLES 19-36	Stagnation Pressure = 2 atm, Stagnation Temperatures = 5000-200,000 R	26-43
TABLES 37-54	Stagnation Pressure = 5 atm, Stagnation Temperatures = 5000-200,000 R	44-61
TABLES 55-72	Stagnation Pressure = 10 atm, Stagnation Temperatures = 5000-200,000 R	62-79
TABLES 73-90	Stagnation Pressure = 20 atm, Stagnation Temperatures = 5000-200,000 R	80-97
TABLES 91-108	Stagnation Pressure = 50 atm, Stagnation Temperatures = 5000-200,000 R	98-115

TABLE OF CONTENTS (cont'd)

		Page
TABLES 109-126	Stagnation Pressure = 100 atm, Stagnation Temperatures = 5000-200,000 R	116-133
TABLES 127-144	Stagnation Pressure = 200 atm, Stagnation Temperatures = 5000-200,000 R	134-151
TABLES 145-162	Stagnation Pressure = 500 atm, Stagnation Temperatures = 5000-200,000 R	152-169
TABLES 163-180	Stagnation Pressure = 1000 atm, Stagnation Temperatures = 5000-200,000 R	170-187
TABLES 181-198	Stagnation Pressure = 2000 atm, Stagnation Temperatures = 5000-200,000 R	188-205
FIGURES 1-10	. . . . .	206-215

Theoretical Performance of Rocket Engines Using Gaseous Hydrogen in the Ideal State at Stagnation Temperatures Up to 200,000 R

SUMMARY

Theoretical performance parameters for rocket engines utilizing normal gaseous hydrogen in the ideal state were calculated using two different assumptions: first, that the chemical composition remained in equilibrium during the isentropic expansion through the engine exhaust nozzle; and, second, that the chemical composition remained fixed (frozen) during the expansion. Data are presented for stagnation temperatures ranging from 5000 to 200,000 R, stagnation pressures ranging from 1 to 2000 atm, and ratios of exhaust pressure to stagnation pressure ranging from 1 to 10^{-7}. The following performance parameters were calculated as a function of the ratio of nozzle exhaust pressure to stagnation pressure: temperature, enthalpy, entropy, molecular weight, density, velocity, Mach number, specific impulse and ratio of nozzle-exit area to throat area. Also calculated were several other properties of the gaseous mixture at the throat of the nozzle, such as the weight flow per unit area and a throat flow parameter defined as the product of the weight flow per unit area at the throat and the square root of the stagnation temperature divided by the stagnation pressure, $(W\sqrt{T_T}/A^* P_T)$.

INTRODUCTION

As part of the investigation of gaseous nuclear rocket technology conducted under Contract NASw-847, calculations were undertaken to determine the performance capability of nuclear rocket engines utilizing hydrogen as the working fluid for those conditions of stagnation pressure and stagnation temperature which might exist in such an engine. Although there is considerable information in the literature concerning properties of hydrogen (Refs. 1 to 3), this information is usually presented in the form of tables of thermodynamic properties or Mollier Charts, and considerable hand calculation is then required in using these data to determine the performance capability. Other sources of data, such as Ref. 4, are useful but the information does not cover the entire range of conditions of possible interest.

The data reported herein were calculated using an existing procedure which was patterned after the method described in Ref. 5, and which had been programmed for use with a high-speed digital computer. The data are presented in tables and figures for stagnation temperatures from 5000 to 200,000 R, stagnation pressures from 1 to 2000 atm, and ratios of exhaust pressure to stagnation pressure from 1 to 10^{-7}. A comparison of data produced in this study with that reported in Ref. 4 is also shown.

DISCUSSION AND RESULTS

The calculation of performance parameters of a gaseous core nuclear rocket using hydrogen as a working fluid is complicated by the fact that hydrogen dissociates and ionizes at the temperatures likely to be encountered in such an engine. However, these calculations may be simplified if the following assumptions are made: (1) that all gases behave as perfect gases; and (2) that the ionization potential of the hydrogen atom remains constant. The equilibrium composition and several thermodynamic properties of the gas mixture may then be easily calculated from equations for chemical equilibrium and Dalton's law of partial pressures as long as the temperature and pressure of the gas are known. For this study, an existing procedure, similar to that described in Ref. 5, for calculating the performance parameters for chemical rocket propellants which form many products of reaction was employed to compute the performance of rocket engines using hydrogen as the working fluid.

The thermodynamic data used for the products of reaction considered in the calculations (H_2, H, e^-, H^-, and H^+) were represented by a power series obtained by a least-squares fit of the data obtained from the literature. Data for the temperature range 300 to 6000 K were obtained from Ref. 6 for H, H_2, H^-, and e^- and from Ref. 7 for H^+. Data for H and H^- were obtained from Ref. 8 for temperatures exceeding 6000 K while data for e^- and H^+ were extrapolated to temperatures above 6000 K by assuming that the heat capacity for these reaction products remained constant. Data for H_2 at temperatures in the range 6000 to 20,000 K were obtained by extrapolating the data from Ref. 6. This extrapolated data was subsequently smoothed by a least-squares fit and the power series obtained from this fit was used for all temperatures above 20,000 K. Any errors in thermodynamic data for H_2 introduced by this extrapolation would have little effect on the performance parameters since, in general, the concentration of H_2 becomes insignificant at temperatures above 15,000 K for the stagnation pressures considered in this study. The base enthalpy used in the calculations was zero enthalpy for H_2 gas at a temperature of absolute zero.

The calculated values of performance parameters are presented as a function of the ratio of nozzle exhaust pressure to stagnation pressure in Tables 1 to 198. The tables also include values of parameters which were calculated for the rocket chamber and throat and which are labelled "CHAMBER" and "THROAT" under the pressure ratio column. Since the thermodynamic properties of the products of reaction were curve-fit only for temperatures of 540 R and above, the calculation of the properties of the exhaust gas for a particular set of stagnation conditions was terminated at the first ratio of exhaust pressure to stagnation pressure which led to an exhaust temperature below 500 R. Therefore, for the lower stagnation temperatures, the calculations were not performed for the complete range of pressure ratios.

Two sets of values of specific impulse are presented in the tables. The set labelled "IDEAL ISP" is the specific impulse calculated assuming that the nozzle is designed to permit complete expansion of the working fluid to the ambient pressure. The set labelled "VAC ISP" was calculated assuming that the ambient pressure was zero and therefore includes the pressure-area term at the exit. Also included in the tables are values of pressure ratio and weight flow per unit area at the throat of the nozzle. A throat flow parameter is also shown which is defined as the product of the weight flow per unit area at the throat and the square root of the stagnation temperature divided by the stagnation pressure, $(W\sqrt{T_T}/A^* P_T)$.

The values of parameters listed under the columns labelled "FROZEN" were calculated assuming that the composition determined for the particular stagnation conditions remained fixed during expansion through the exhaust nozzle. Although it is possible that the residence time in the exhaust nozzle may not be long enough for equilibrium recombination of hydrogen atoms, it is less likely that any ionized species would fail to reach equilibrium. Therefore, the frozen value probably represents a low estimate of the performance and a more realistic estimate would probably be some value closer to the equilibrium value, especially at the high stagnation temperatures where the hydrogen is completely ionized.

Since the compositions of the hydrogen which were necessarily determined in order to calculate the various parameters shown in the tables were not themselves included in the tables, a plot of the stagnation composition of hydrogen for selected stagnation pressures is shown in Fig. 1 as a function of stagnation temperature. Variations in stagnation molecular weight, stagnation enthalpy, and the nozzle throat flow parameter as stagnation pressure and temperature are changed are shown in Figs. 2, 3, and 4 respectively.

In order to illustrate the effect of an isentropic expansion on the equilibrium composition of hydrogen, the equilibrium composition calculated for a ratio of exhaust pressure to stagnation pressure of 10^{-5} is shown in Fig. 5. The partial recovery of energy of dissociation and ionization during the expansion process leads to a much more complex variation of composition as a function of stagnation temperature and pressure at the nozzle exit than in the chamber, as can be seen by comparing Figs. 1 and 5. The parameter plotted in Fig. 6 is a measure of the fraction of the stagnation thermal energy (including that required to produce dissociation and ionization) which has not been converted to kinetic energy at the nozzle exit. It can be seen that the fraction of unconverted thermal energy is much greater at the high temperatures associated with the operation of gaseous-core nuclear rockets than at the lower temperatures which are encountered with solid-core nuclear rockets. The ratio of nozzle-exit area to throat area required to provide a given pressure ratio is shown in Fig. 7, and values of vacuum specific impulse for the same pressure ratio are plotted in Figs. 8 and 9. The

local reversal of the effect of pressure on specific impulse at temperatures on the order of 15,000 R and 60,000 R and the maxima and minima indicated in the plots shown in Figs. 4, 6, and 7 can be attributed to the effects of pressure on the composition at a particular temperature.

Although data is not shown in the tables for stagnation temperatures below 5000 R, the curves shown in Figs. 2 through 4 and Figs. 6 through 8 were extended to temperatures below 5000 R. These curves were extended by utilizing stagnation data which was calculated for other studies and by making hand calculations of the exhaust parameters using the hydrogen data from Ref. 2.

A comparison of vacuum specific impulse data calculated in this study with that presented in Ref. 4 is shown in Fig. 10. It can be seen that there is excellent agreement between the two sets of data.

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LIST OF SYMBOLS

A^*	Nozzle throat cross-sectional area, ft^2
A_{EX}	Nozzle exit cross-sectional area, ft^2
A_{EX}/A^*	Ratio of nozzle-exit area to throat area, dimensionless
H_{EX}	Exhaust enthalpy, Btu/lb
H_T	Stagnation enthalpy, Btu/lb
H_{EX}/H_T	Ratio of exhaust enthalpy to stagnation enthalpy, dimensionless
I	Specific impulse with ambient and exhaust pressures equal, sec
I_{VAC}	Vacuum specific impulse, $I + P_{EX}(A_{EX}/W)$, sec
P_{EX}	Exhaust pressure, atm or lb/ft^2
P_T	Stagnation pressure, atm
P_{EX}/P_T	Ratio of exhaust pressure to stagnation pressure, dimensionless
T_T	Stagnation temperature, deg R
W	Mass flow rate, (lb mass)/sec
x_i	Mole fraction of ith species

TABLE 1

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 273.94 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 285.11 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.874 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4.032 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5686
THROAT PRESSURE RATIO(FROZEN) = 0.5425
ENTROPY = 2.451E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	2.268E 04	2.268E 04	1.9429	1.9429
THROAT	4661.	4323.	1.991E 04	1.977E 04	1.9682	1.9429
1.000E-01	3488.	2828.	1.281E 04	1.366E 04	2.0127	1.9429
1.000E-02	1947.	1487.	6.749E 03	8.709E 03	2.0160	1.9429
1.000E-03	1022.	718.	3.485E 03	6.204E 03	2.0160	1.9429
1.000E-04	530.	322.	1.784E 03	5.034E 03	2.0160	1.9429
5.000E-05	433.		1.456E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.323E-04	5.323E-04				
THROAT	3.289E-04	3.340E-04	11779.	12073.	1.000	1.000
1.000E-01	7.904E-05	9.411E-05	22226.	21253.	2.115	2.146
1.000E-02	1.419E-05	1.790E-05	28239.	26444.	3.475	3.593
1.000E-03	2.702E-06	3.706E-06	30997.	28717.	5.226	5.469
1.000E-04	5.215E-07	8.255E-07	32341.	29719.	7.551	8.276
5.000E-05	3.186E-07		32594.		8.401	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	366.1	375.2	676.7	659.9
1.000E-01	2.205E 00	2.016E 00	690.8	660.6	811.2	766.3
1.000E-02	9.671E 00	8.517E 00	877.7	821.9	930.5	866.6
1.000E-03	4.625E 01	3.789E 01	963.4	892.6	988.7	912.4
1.000E-04	2.297E 02	1.644E 02	1005.2	923.7	1017.7	932.3
5.000E-05	3.731E 02		1013.1		1023.2	

TABLE 2

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 253.17 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 268.63 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.268 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.468 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5760
THROAT PRESSURE RATIO(FROZEN) = 0.5354
ENTROPY = 2.808E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	4.249E 04	4.249E 04	1.6884	1.6884
THROAT	5712.	5098.	3.873E 04	3.842E 04	1.7244	1.6884
1.000E-01	4914.	3225.	2.836E 04	3.032E 04	1.8335	1.6884
1.000E-02	3984.	1620.	1.762E 04	2.396E 04	1.9569	1.6884
1.000E-03	2746.	754.	9.759E 03	2.088E 04	2.0152	1.6884
1.000E-04	1479.	329.	5.083E 03	1.948E 04	2.0160	1.6884
5.000E-05	1217.		4.165E 03		2.0160	
1.000E-05	771.		2.614E 03		2.0160	
5.000E-06	632.		2.137E 03		2.0160	
1.000E-06	397.		1.334E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.855E-04	3.855E-04				
THROAT	2.382E-04	2.429E-04	13722.	14279.	1.000	1.000
1.000E-01	5.111E-05	7.171E-05	26602.	24685.	2.165	2.145
1.000E-02	6.728E-06	1.428E-05	35288.	30457.	3.277	3.647
1.000E-03	1.005E-06	3.068E-06	40480.	32896.	4.273	5.639
1.000E-04	1.867E-07	7.024E-07	43275.	33941.	6.080	8.652
5.000E-05	1.134E-07		43803.		6.773	
1.000E-05	3.582E-08		44680.		8.664	
5.000E-06	2.184E-08		44947.		9.614	
1.000E-06	6.949E-09		45392.		12.211	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	426.5	443.8	759.4	770.5
1.000E-01	2.404E 00	1.959E 00	826.8	767.2	982.4	886.8
1.000E-02	1.377E 01	7.976E 00	1096.8	946.6	1185.9	995.3
1.000E-03	8.032E 01	3.436E 01	1258.2	1022.4	1310.2	1043.4
1.000E-04	4.045E 02	1.455E 02	1345.0	1054.9	1371.2	1063.8
5.000E-05	6.577E 02		1361.4		1382.7	
1.000E-05	2.042E 03		1388.7		1401.9	
5.000E-06	3.330E 03		1397.0		1407.8	
1.000E-06	1.036E 04		1410.8		1417.5	

TABLE 3

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 223.90 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 243.18 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.676 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.907 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5734
THROAT PRESSURE RATIO(FROZEN) = 0.5153
ENTROPY = 3.410E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	8.179E 04	8.179E 04	1.3047	1.3047
THROAT	6643.	5658.	7.609E 04	7.542E 04	1.3398	1.3047
1.000E-01	5735.	3289.	6.072E 04	6.449E 04	1.4484	1.3047
1.000E-02	4856.	1470.	4.480E 04	5.654E 04	1.5870	1.3047
1.000E-03	4188.	627.	3.230E 04	5.306E 04	1.7196	1.3047
1.000E-04	3638.	259.	2.227E 04	5.160E 04	1.8445	1.3047
5.000E-05	3483.		1.963E 04		1.8800	
1.000E-05	3115.		1.412E 04		1.9558	
5.000E-06	2932.		1.201E 04		1.9837	
1.000E-06	2234.		7.817E 03		2.0156	
5.000E-07	1856.		6.422E 03		2.0160	
1.000E-07	1184.		4.048E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.553E-04	2.553E-04				
THROAT	1.584E-04	1.628E-04	16892.	17856.	1.000	1.000
1.000E-01	3.460E-05	5.434E-05	32476.	29425.	2.172	2.138
1.000E-02	4.477E-06	1.216E-05	43032.	35554.	3.302	3.797
1.000E-03	5.624E-07	2.852E-06	49772.	37926.	4.304	6.118
1.000E-04	6.945E-08	6.903E-07	54588.	38879.	5.259	9.680
5.000E-05	3.696E-08		55782.		5.543	
1.000E-05	8.601E-09		58201.		6.201	
5.000E-06	4.635E-09		59104.		6.477	
1.000E-06	1.236E-09		60853.		7.069	
5.000E-07	7.439E-10		61424.		7.734	
1.000E-07	2.333E-10		62384.		9.780	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	525.0	555.0	978.4	930.1
1.000E-01	2.382E 00	1.818E 00	1009.4	914.5	1197.7	1046.9
1.000E-02	1.389E 01	6.725E 00	1337.5	1105.1	1447.3	1154.0
1.000E-03	9.560E 01	2.687E 01	1547.0	1178.8	1622.6	1198.3
1.000E-04	7.059E 02	1.083E 02	1696.6	1208.4	1752.4	1216.3
5.000E-05	1.298E 03		1733.8		1785.1	
1.000E-05	5.346E 03		1808.9		1851.2	
5.000E-06	9.770E 03		1837.0		1875.6	
1.000E-06	3.558E 04		1891.4		1919.5	
5.000E-07	5.856E 04		1909.1		1932.3	
1.000E-07	1.839E 05		1939.0		1953.5	

TABLE 4

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 207.98 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 228.46 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.325 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.554 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5701
THROAT PRESSURE RATIO(FROZEN) = 0.4971
ENTROPY = 3.877E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	1.165E 05	1.165E 05	1.0918	1.0916
THROAT	7440.	6164.	1.087E 05	1.075E 05	1.1225	1.0916
1.000E-01	6237.	3366.	8.861E 04	9.400E 04	1.2208	1.0916
1.000E-02	5216.	1389.	6.830E 04	8.462E 04	1.3497	1.0916
1.000E-03	4498.	564.	5.260E 04	8.078E 04	1.4751	1.0916
1.000E-04	3950.	227.	4.004E 04	7.923E 04	1.5968	1.0916
5.000E-05	3808.		3.673E 04		1.6327	
1.000E-05	3507.		2.974E 04		1.7145	
5.000E-06	3388.		2.700E 04		1.7491	
1.000E-06	3128.		2.117E 04		1.8272	
5.000E-07	3021.		1.888E 04		1.8598	
1.000E-07	2769.		1.399E 04		1.9320	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.869E-04	1.869E-04				
THROAT	1.178E-04	1.206E-04	19733.	21183.	1.000	1.000
1.000E-01	2.681E-05	4.442E-05	37347.	33542.	2.187	2.133
1.000E-02	3.545E-06	1.077E-05	49105.	39931.	3.344	3.926
1.000E-03	4.492E-07	2.653E-06	56544.	42269.	4.368	6.494
1.000E-04	5.537E-08	6.600E-07	61857.	43178.	5.333	10.438
5.000E-05	2.937E-08		63182.		5.617	
1.000E-05	6.696E-09		65892.		6.269	
5.000E-06	3.536E-09		66925.		6.549	
1.000E-06	8.002E-10		69070.		7.197	
5.000E-07	4.217E-10		69897.		7.477	
1.000E-07	9.557E-11		71626.		8.135	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	613.3	658.4	1132.1	1070.1
1.000E-01	2.322E 00	1.714E 00	1160.8	1042.5	1372.1	1184.5
1.000E-02	1.336E 01	5.940E 00	1526.2	1241.1	1647.8	1290.3
1.000E-03	9.154E 01	2.277E 01	1757.5	1313.8	1840.8	1332.6
1.000E-04	6.788E 02	8.964E 01	1922.6	1342.0	1984.4	1349.4
5.000E-05	1.253E 03		1963.8		2020.8	
1.000E-05	5.270E 03		2048.0		2095.9	
5.000E-06	9.826E 03		2080.1		2124.8	
1.000E-06	4.207E 04		2146.8		2185.0	
5.000E-07	7.888E 04		2172.5		2208.4	
1.000E-07	3.397E 05		2226.2		2257.1	

TABLE 5

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 207.25 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 224.31 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.185 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.364 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5698
THROAT PRESSURE RATIO(FROZEN) = 0.4903
ENTROPY = 4.062E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	1.320E 05	1.320E 05	1.0315	1.0315
THROAT	8049.	6808.	1.229E 05	1.213E 05	1.0556	1.0315
1.000E-01	6484.	3644.	1.004E 05	1.058E 05	1.1463	1.0315
1.000E-02	5353.	1466.	7.808E 04	9.513E 04	1.2704	1.0315
1.000E-03	4599.	587.	6.102E 04	9.087E 04	1.3920	1.0315
1.000E-04	4037.	234.	4.742E 04	8.917E 04	1.5105	1.0315
5.000E-05	3892.		4.385E 04		1.5456	
1.000E-05	3591.		3.631E 04		1.6258	
5.000E-06	3473.		3.335E 04		1.6598	
1.000E-06	3220.		2.705E 04		1.7374	
5.000E-07	3119.		2.456E 04		1.7702	
1.000E-07	2895.		1.924E 04		1.8445	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.570E-04	1.570E-04				
THROAT	1.024E-04	1.018E-04	21343.	23234.	1.000	1.000
1.000E-01	2.422E-05	3.877E-05	39824.	36280.	2.209	2.131
1.000E-02	3.251E-06	9.636E-06	51978.	42986.	3.385	3.972
1.000E-03	4.146E-07	2.407E-06	59630.	45400.	4.421	6.620
1.000E-04	5.126E-08	6.028E-07	65086.	46330.	5.397	10.684
5.000E-05	2.720E-08		66446.		5.683	
1.000E-05	6.202E-09		69229.		6.341	
5.000E-06	3.274E-09		70291.		6.621	
1.000E-06	7.391E-10		72500.		7.269	
5.000E-07	3.888E-10		73354.		7.548	
1.000E-07	8.728E-11		75147.		8.198	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	663.4	722.1	1215.3	1160.9
1.000E-01	2.265E 00	1.681E 00	1237.8	1127.6	1457.2	1278.0
1.000E-02	1.293E 01	5.709E 00	1615.5	1336.0	1740.7	1387.1
1.000E-03	8.835E 01	2.164E 01	1853.4	1411.1	1938.9	1430.4
1.000E-04	6.548E 02	8.466E 01	2022.9	1440.0	2086.3	1447.6
5.000E-05	1.209E 03		2065.2		2123.7	
1.000E-05	5.088E 03		2151.7		2201.0	
5.000E-06	9.494E 03		2184.7		2230.7	
1.000E-06	4.077E 04		2253.4		2292.8	
5.000E-07	7.661E 04		2279.9		2317.0	
1.000E-07	3.331E 05		2335.7		2367.9	

TABLE 6

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF
1. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 211.16 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.26 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.112 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.233 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5709
THROAT PRESSURE RATIO(FROZEN) = 0.4883
ENTROPY = 4.145E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	1.399E 05	1.399E 05	1.0159	1.0159
THROAT	8567.	7523.	1.299E 05	1.277E 05	1.0316	1.0159
1.000E-01	6622.	4005.	1.058E 05	1.104E 05	1.1155	1.0159
1.000E-02	5418.	1601.	8.257E 04	9.861E 04	1.2371	1.0159
1.000E-03	4643.	639.	6.488E 04	9.390E 04	1.3569	1.0159
1.000E-04	4072.	254.	5.081E 04	9.202E 04	1.4739	1.0159
5.000E-05	3927.		4.712E 04		1.5085	
1.000E-05	3624.		3.932E 04		1.5878	
5.000E-06	3506.		3.626E 04		1.6215	
1.000E-06	3254.		2.975E 04		1.6985	
5.000E-07	3154.		2.718E 04		1.7312	
1.000E-07	2935.		2.167E 04		1.8055	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.392E-04	1.392E-04				
THROAT	9.417E-05	9.033E-05	22424.	24715.	1.000	1.000
1.000E-01	2.307E-05	3.475E-05	41319.	38438.	2.233	2.130
1.000E-02	3.128E-06	8.694E-06	53589.	45483.	3.420	3.985
1.000E-03	4.003E-07	2.179E-06	61300.	48008.	4.464	6.656
1.000E-04	4.958E-08	5.469E-07	66797.	48979.	5.446	10.753
5.000E-05	2.631E-08		68167.		5.734	
1.000E-05	6.002E-09		70972.		6.394	
5.000E-06	3.168E-09		72043.		6.676	
1.000E-06	7.150E-10		74270.		7.326	
5.000E-07	3.760E-10		75132.		7.605	
1.000E-07	8.427E-11		76944.		8.255	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	696.9	768.2	1269.0	1231.0
1.000E-01	2.215E 00	1.672E 00	1284.2	1194.7	1506.2	1353.1
1.000E-02	1.260E 01	5.646E 00	1665.6	1413.7	1791.8	1467.2
1.000E-03	8.604E 01	2.134E 01	1905.3	1492.1	1991.5	1512.4
1.000E-04	6.376E 02	8.335E 01	2076.1	1522.3	2140.0	1530.2
5.000E-05	1.177E 03		2118.7		2177.7	
1.000E-05	4.957E 03		2205.9		2255.5	
5.000E-06	9.252E 03		2239.2		2285.5	
1.000E-06	3.976E 04		2308.4		2348.2	
5.000E-07	7.475E 04		2335.2		2372.6	
1.000E-07	3.256E 05		2391.5		2424.1	

TABLE 7

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 206.82 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 212.39 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.888 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.939 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5372
THROAT PRESSURE RATIO(FROZEN) = 0.4593
ENTROPY = 4.247E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.497E 05	1.497E 05	1.0093	1.0093
THROAT	9566.	8799.	1.380E 05	1.353E 05	1.0147	1.0093
1.000E-01	6837.	4785.	1.127E 05	1.155E 05	1.0802	1.0093
1.000E-02	5502.	1906.	8.815E 04	1.013E 05	1.1983	1.0093
1.000E-03	4697.	759.	6.964E 04	9.569E 04	1.3159	1.0093
1.000E-04	4115.	302.	5.499E 04	9.344E 04	1.4309	1.0093
5.000E-05	3967.		5.115E 04		1.4650	
1.000E-05	3661.		4.304E 04		1.5432	
5.000E-06	3543.		3.986E 04		1.5764	
1.000E-06	3291.		3.309E 04		1.6526	
5.000E-07	3192.		3.042E 04		1.6849	
1.000E-07	2976.		2.469E 04		1.7588	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.152E-04	1.152E-04				
THROAT	7.806E-05	7.217E-05	24187.	26865.	1.000	1.000
1.000E-01	2.164E-05	2.889E-05	43047.	41374.	2.246	2.088
1.000E-02	2.983E-06	7.253E-06	55518.	49211.	3.457	3.934
1.000E-03	3.838E-07	1.821E-06	63313.	52004.	4.512	6.588
1.000E-04	4.764E-08	4.573E-07	68863.	53076.	5.502	10.654
5.000E-05	2.529E-08		70246.		5.792	
1.000E-05	5.774E-09		73077.		6.457	
5.000E-06	3.048E-09		74159.		6.740	
1.000E-06	6.879E-10		76408.		7.394	
5.000E-07	3.616E-10		77280.		7.674	
1.000E-07	8.096E-11		79113.		8.323	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	751.8	835.0	1353.8	1336.2
1.000E-01	2.027E 00	1.622E 00	1337.9	1285.9	1565.1	1462.9
1.000E-02	1.140E 01	5.432E 00	1725.5	1529.5	1853.3	1588.8
1.000E-03	7.770E 01	2.047E 01	1967.8	1616.3	2054.9	1638.7
1.000E-04	5.755E 02	7.987E 01	2140.3	1649.7	2204.8	1658.4
5.000E-05	1.063E 03		2183.3		2242.9	
1.000E-05	4.475E 03		2271.3		2321.5	
5.000E-06	8.353E 03		2304.9		2351.7	
1.000E-06	3.592E 04		2374.8		2415.1	
5.000E-07	6.756E 04		2401.9		2439.8	
1.000E-07	2.948E 05		2458.9		2491.9	

TABLE 8

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 219.89 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 213.75 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.858 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.807 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5609
THROAT PRESSURE RATIO(FROZEN) = 0.4630
ENTROPY = 4.325E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.598E 05	1.598E 05	1.0084	1.0084
THROAT	11148.	10297.	1.455E 05	1.429E 05	1.0094	1.0084
1.000E-01	7062.	5579.	1.181E 05	1.196E 05	1.0557	1.0084
1.000E-02	5572.	2222.	9.244E 04	1.031E 05	1.1703	1.0084
1.000E-03	4739.	885.	7.330E 04	9.648E 04	1.2862	1.0084
1.000E-04	4146.	352.	5.819E 04	9.386E 04	1.3997	1.0084
5.000E-05	3997.		5.423E 04		1.4334	
1.000E-05	3688.		4.589E 04		1.5106	
5.000E-06	3569.		4.261E 04		1.5435	
1.000E-06	3317.		3.565E 04		1.6189	
5.000E-07	3217.		3.290E 04		1.6510	
1.000E-07	3003.		2.701E 04		1.7243	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.867E-05	9.867E-05				
THROAT	6.957E-05	6.211E-05	26713.	29084.	1.000	1.000
1.000E-01	2.048E-05	2.476E-05	45680.	44830.	2.311	2.094
1.000E-02	2.877E-06	6.218E-06	58055.	53273.	3.546	3.943
1.000E-03	3.718E-07	1.562E-06	65791.	56283.	4.613	6.602
1.000E-04	4.625E-08	3.922E-07	71307.	57438.	5.612	10.677
5.000E-05	2.456E-08		72683.		5.905	
1.000E-05	5.611E-09		75502.		6.576	
5.000E-06	2.962E-09		76580.		6.861	
1.000E-06	6.686E-10		78822.		7.520	
5.000E-07	3.515E-10		79691.		7.802	
1.000E-07	7.865E-11		81521.		8.456	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	830.3	903.9	1468.9	1446.3
1.000E-01	1.987E 00	1.628E 00	1419.8	1393.4	1646.0	1584.0
1.000E-02	1.113E 01	5.454E 00	1804.4	1655.8	1931.1	1719.6
1.000E-03	7.597E 01	2.055E 01	2044.8	1749.3	2131.3	1773.4
1.000E-04	5.636E 02	8.019E 01	2216.3	1785.2	2280.5	1794.6
5.000E-05	1.041E 03		2259.1		2318.3	
1.000E-05	4.387E 03		2346.7		2396.6	
5.000E-06	8.192E 03		2380.2		2426.8	
1.000E-06	3.526E 04		2449.9		2490.0	
5.000E-07	6.635E 04		2476.9		2514.7	
1.000E-07	2.899E 05		2533.8		2566.8	

TABLE 9

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.73 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.71 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.745 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.761 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5516
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 4.391E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.697E 05	1.697E 05	1.0082	1.0082
THROAT	12627.	12005.	1.530E 05	1.500E 05	1.0085	1.0082
1.000E-01	7339.	6352.	1.228E 05	1.222E 05	1.0370	1.0082
1.000E-02	5638.	2472.	9.615E 04	1.035E 05	1.1473	1.0082
1.000E-03	4775.	946.	7.645E 04	9.632E 04	1.2616	1.0082
1.000E-04	4172.	359.	6.094E 04	9.357E 04	1.3739	1.0082
5.000E-05	4022.		5.689E 04		1.4072	
1.000E-05	3710.		4.834E 04		1.4836	
5.000E-06	3590.		4.498E 04		1.5162	
1.000E-06	3338.		3.786E 04		1.5909	
5.000E-07	3238.		3.504E 04		1.6227	
1.000E-07	3025.		2.900E 04		1.6956	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.632E-05	8.632E-05				
THROAT	6.035E-05	5.606E-05	28915.	31409.	1.000	1.000
1.000E-01	1.936E-05	2.174E-05	48422.	48736.	2.373	2.124
1.000E-02	2.788E-06	5.587E-06	60671.	57541.	3.645	3.989
1.000E-03	3.619E-07	1.460E-06	68316.	60599.	4.724	6.760
1.000E-04	4.511E-08	3.847E-07	73778.	61725.	5.733	11.155
5.000E-05	2.397E-08		75142.		6.029	
1.000E-05	5.477E-09		77938.		6.706	
5.000E-06	2.892E-09		79007.		6.994	
1.000E-06	6.530E-10		81234.		7.659	
5.000E-07	3.433E-10		82098.		7.944	
1.000E-07	7.679E-11		83918.		8.603	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	898.7	976.2	1567.6	1561.9
1.000E-01	1.862E 00	1.662E 00	1505.0	1514.8	1730.8	1714.4
1.000E-02	1.032E 01	5.477E 00	1885.7	1788.4	2010.8	1854.2
1.000E-03	7.057E 01	1.990E 01	2123.3	1883.5	2208.9	1907.4
1.000E-04	5.244E 02	7.415E 01	2293.1	1918.5	2356.7	1927.4
5.000E-05	9.690E 02		2335.5		2394.2	
1.000E-05	4.088E 03		2422.4		2472.0	
5.000E-06	7.636E 03		2455.6		2501.9	
1.000E-06	3.290E 04		2524.8		2564.7	
5.000E-07	6.192E 04		2551.7		2589.2	
1.000E-07	2.708E 05		2608.2		2641.1	

TABLE 10

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF
1. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 221.27 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.69 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.649 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.660 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5427
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 4.449E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.796E 05	1.796E 05	1.0081	1.0081
THROAT	14105.	13508.	1.603E 05	1.574E 05	1.0082	1.0081
1.000E-01	7710.	7156.	1.272E 05	1.262E 05	1.0234	1.0081
1.000E-02	5701.	2793.	9.945E 04	1.051E 05	1.1277	1.0081
1.000E-03	4808.	1070.	7.924E 04	9.692E 04	1.2407	1.0081
1.000E-04	4195.	407.	6.338E 04	9.381E 04	1.3518	1.0081
5.000E-05	4043.		5.923E 04		1.3848	
1.000E-05	3729.		5.050E 04		1.4605	
5.000E-06	3609.		4.708E 04		1.4928	
1.000E-06	3355.		3.980E 04		1.5669	
5.000E-07	3255.		3.693E 04		1.5985	
1.000E-07	3042.		3.077E 04		1.6709	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.672E-05	7.672E-05				
THROAT	5.314E-05	4.983E-05	31039.	33311.	1.000	1.000
1.000E-01	1.818E-05	1.930E-05	51193.	51703.	2.421	2.125
1.000E-02	2.710E-06	4.945E-06	63330.	61063.	3.748	3.986
1.000E-03	3.535E-07	1.290E-06	70869.	64321.	4.841	6.748
1.000E-04	4.414E-08	3.397E-07	76265.	65522.	5.861	11.129
5.000E-05	2.346E-08		77613.		6.160	
1.000E-05	5.365E-09		80380.		6.844	
5.000E-06	2.833E-09		81439.		7.135	
1.000E-06	6.398E-10		83645.		7.806	
5.000E-07	3.363E-10		84501.		8.093	
1.000E-07	7.524E-11		86306.		8.758	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	964.7	1035.3	1661.0	1656.7
1.000E-01	1.772E 00	1.663E 00	1591.1	1607.0	1818.4	1819.0
1.000E-02	9.611E 00	5.497E 00	1968.4	1897.9	2091.7	1968.0
1.000E-03	6.583E 01	2.000E 01	2202.7	1999.2	2287.1	2024.7
1.000E-04	4.900E 02	7.457E 01	2370.4	2036.5	2433.2	2046.0
5.000E-05	9.058E 02		2412.3		2470.4	
1.000E-05	3.825E 03		2498.3		2547.4	
5.000E-06	7.148E 03		2531.2		2577.0	
1.000E-06	3.082E 04		2599.8		2639.3	
5.000E-07	5.803E 04		2626.4		2663.6	
1.000E-07	2.540E 05		2682.5		2715.1	

TABLE 11

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 198.16 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 218.18 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.401 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.543 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5658
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 4.659E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	2.177E 05	2.177E 05	0.9678	0.9678
THROAT	18132.	15012.	1.956E 05	1.920E 05	0.9855	0.9678
1.000E-01	10957.	7960.	1.449E 05	1.559E 05	1.0082	0.9678
1.000E-02	6017.	3119.	1.117E 05	1.314E 05	1.0629	0.9678
1.000E-03	4936.	1201.	8.944E 04	1.219E 05	1.1700	0.9678
1.000E-04	4279.	458.	7.226E 04	1.182E 05	1.2770	0.9678
5.000E-05	4119.		6.779E 04		1.3089	
1.000E-05	3795.		5.839E 04		1.3821	
5.000E-06	3671.		5.471E 04		1.4134	
1.000E-06	3412.		4.690E 04		1.4852	
5.000E-07	3312.		4.381E 04		1.5158	
1.000E-07	3098.		3.720E 04		1.5862	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.629E-05	6.629E-05				
THROAT	4.212E-05	4.305E-05	33266.	35837.	1.000	1.000
1.000E-01	1.260E-05	1.666E-05	60369.	55630.	2.040	2.127
1.000E-02	2.420E-06	4.251E-06	72838.	65723.	4.056	3.984
1.000E-03	3.247E-07	1.104E-06	80120.	69251.	5.237	6.732
1.000E-04	4.088E-08	2.893E-07	85319.	70556.	6.305	11.079
5.000E-05	2.176E-08		86621.		6.617	
1.000E-05	4.989E-09		89296.		7.329	
5.000E-06	2.637E-09		90321.		7.631	
1.000E-06	5.962E-10		92461.		8.328	
5.000E-07	3.135E-10		93293.		8.626	
1.000E-07	7.015E-11		95049.		9.314	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1033.9	1113.9	1888.3	1782.4
1.000E-01	1.842E 00	1.665E 00	1876.3	1729.0	2154.4	1957.4
1.000E-02	7.950E 00	5.522E 00	2263.9	2042.7	2383.9	2118.5
1.000E-03	5.386E 01	2.018E 01	2490.2	2152.4	2571.5	2180.1
1.000E-04	4.017E 02	7.557E 01	2651.8	2193.0	2712.5	2203.3
5.000E-05	7.433E 02		2692.3		2748.4	
1.000E-05	3.145E 03		2775.4		2822.9	
5.000E-06	5.883E 03		2807.3		2851.7	
1.000E-06	2.542E 04		2873.8		2912.2	
5.000E-07	4.791E 04		2899.6		2935.8	
1.000E-07	2.102E 05		2954.2		2985.9	

TABLE 12

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 156.34 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 174.39 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.903 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.007 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5586
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 6.511E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	6.947E 05	6.947E 05	0.6202	0.6202
THROAT	28041.	22569.	6.415E 05	6.346E 05	0.6407	0.6202
1.000E-01	23521.	11981.	5.106E 05	5.497E 05	0.7019	0.6202
1.000E-02	19260.	4761.	3.792E 05	4.920E 05	0.7836	0.6202
1.000E-03	16116.	1883.	2.811E 05	4.691E 05	0.8630	0.6202
1.000E-04	13521.	743.	2.058E 05	4.601E 05	0.9379	0.6202
5.000E-05	12758.	561.	1.868E 05	4.586E 05	0.9588	0.6202
1.000E-05	10571.	292.	1.497E 05	4.565E 05	0.9994	0.6202
5.000E-06	8865.		1.363E 05		1.0073	
1.000E-06	4725.		1.154E 05		1.0086	
5.000E-07	3998.		1.095E 05		1.0204	
1.000E-07	3519.		9.815E 04		1.0719	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.832E-05	2.832E-05				
THROAT	1.748E-05	1.835E-05	51626.	54862.	1.000	1.000
1.000E-01	4.088E-06	7.091E-06	96011.	85198.	2.171	2.129
1.000E-02	5.573E-07	1.784E-06	125675.	100743.	3.369	3.988
1.000E-03	7.336E-08	4.511E-07	143896.	106280.	4.465	6.680
1.000E-04	9.502E-09	1.144E-07	156441.	108389.	5.549	10.840
5.000E-05	5.147E-09	7.571E-08	159466.	108721.	5.884	12.509
1.000E-05	1.295E-09	2.905E-08	165173.	109209.	6.659	17.399
5.000E-06	7.783E-10		167196.		6.631	
1.000E-06	2.924E-10		170301.		10.576	
5.000E-07	1.748E-10		171156.		11.725	
1.000E-07	4.169E-11		172814.		13.002	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1604.6	1705.2	2914.1	2729.7
1.000E-01	2.300E 00	1.667E 00	2984.1	2648.0	3523.3	2998.3
1.000E-02	1.289E 01	5.601E 00	3906.1	3131.2	4208.2	3248.9
1.000E-03	8.551E 01	2.100E 01	4472.4	3303.3	4672.9	3347.4
1.000E-04	6.072E 02	8.120E 01	4862.3	3368.8	5004.7	3385.9
5.000E-05	1.100E 03	1.223E 02	4956.4	3379.1	5085.3	3392.0
1.000E-05	4.219E 03	3.174E 02	5133.7	3394.3	5232.7	3401.0
5.000E-06	6.936E 03		5196.6		5277.9	
1.000E-06	1.813E 04		5293.1		5335.6	
5.000E-07	3.017E 04		5319.7		5355.1	
1.000E-07	1.253E 05		5371.2		5400.6	

TABLE 13

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 148.19 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.73 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.741 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.794 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4906
THROAT PRESSURE RATIO(FROZEN) = 0.4878
ENTROPY = 7.546E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	40000.	40000.	1.042E 06	1.042E 06	0.5118	0.5118
THROAT	33770.	30032.	9.420E 05	9.450E 05	0.5260	0.5118
1.000E-01	26711.	15936.	7.695E 05	8.081E 05	0.5701	0.5118
1.000E-02	21286.	6344.	5.893E 05	7.150E 05	0.6403	0.5118
1.000E-03	17805.	2525.	4.573E 05	6.780E 05	0.7113	0.5118
1.000E-04	15266.	1005.	3.561E 05	6.632E 05	0.7815	0.5118
5.000E-05	14621.	761.	3.301E 05	6.609E 05	0.8024	0.5118
1.000E-05	13273.	400.	2.762E 05	6.574E 05	0.8501	0.5118
5.000E-06	12743.		2.553E 05		0.8704	
1.000E-06	11589.		2.118E 05		0.9162	
5.000E-07	11108.		1.949E 05		0.9354	
1.000E-07	9915.		1.610E 05		0.9770	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.753E-05	1.753E-05				
THROAT	1.047E-05	1.139E-05	70777.	69694.	1.000	1.000
1.000E-01	2.924E-06	4.400E-06	116805.	108207.	2.123	2.130
1.000E-02	4.121E-07	1.105E-06	150552.	127943.	3.421	3.992
1.000E-03	5.473E-08	2.777E-07	171089.	134998.	4.560	6.676
1.000E-04	7.012E-09	6.980E-08	185303.	137705.	5.644	10.795
5.000E-05	3.759E-09	4.606E-08	188781.	138134.	5.966	12.440
1.000E-05	8.774E-10	1.754E-08	195805.	138768.	6.712	17.247
5.000E-06	4.678E-10		198449.		7.034	
1.000E-06	1.083E-10		203869.		7.792	
5.000E-07	5.767E-11		205931.		8.126	
1.000E-07	1.350E-11		210011.		8.941	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2199.8	2166.2	3601.0	3466.6
1.000E-01	2.170E 00	1.867E 00	3630.4	3363.2	4250.0	3807.7
1.000E-02	1.194E 01	5.613E 00	4679.3	3976.6	5020.4	4126.2
1.000E-03	7.914E 01	2.117E 01	5317.6	4195.9	5543.6	4252.3
1.000E-04	5.702E 02	8.257E 01	5759.4	4280.0	5922.2	4302.0
5.000E-05	1.044E 03	1.247E 02	5867.5	4293.3	6016.6	4310.0
1.000E-05	4.313E 03	3.260E 02	6085.8	4313.0	6209.0	4321.7
5.000E-06	7.981E 03		6168.0		6282.0	
1.000E-06	3.356E 04		6336.4		6432.3	
5.000E-07	6.239E 04		6400.5		6489.6	
1.000E-07	2.614E 05		6527.3		6602.0	

TABLE 14

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 154.61 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.64 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.691 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.705 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4843
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 7.813E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	1.161E 06	1.161E 06	0.5051	0.5051
THROAT	38629.	37520.	1.036E 06	1.038E 06	0.5094	0.5051
1.000E-01	28001.	19915.	8.423E 05	8.645E 05	0.5438	0.5051
1.000E-02	21827.	7929.	6.467E 05	7.466E 05	0.6103	0.5051
1.000E-03	18165.	3158.	5.052E 05	6.997E 05	0.6788	0.5051
1.000E-04	15564.	1258.	3.972E 05	6.810E 05	0.7470	0.5051
5.000E-05	14911.	954.	3.695E 05	6.780E 05	0.7673	0.5051
1.000E-05	13560.	501.	3.119E 05	6.735E 05	0.8140	0.5051
5.000E-06	13036.	380.	2.897E 05	6.723E 05	0.8339	0.5051
1.000E-06	11918.		2.431E 05		0.8793	
5.000E-07	11468.		2.250E 05		0.8985	
1.000E-07	10435.		1.882E 05		0.9415	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.384E-05	1.384E-05				
THROAT	8.748E-06	8.988E-06	79038.	78436.	1.000	1.000
1.000E-01	2.660E-06	3.474E-06	126238.	121746.	2.096	2.130
1.000E-02	3.831E-07	8.727E-07	160397.	143958.	3.483	3.992
1.000E-03	5.119E-08	2.191E-07	181131.	151902.	4.656	6.675
1.000E-04	6.575E-09	5.500E-08	195491.	154952.	5.758	10.789
5.000E-05	3.525E-09	3.628E-08	199008.	155436.	6.084	12.430
1.000E-05	8.223E-10	1.380E-08	206120.	156151.	6.836	17.225
5.000E-06	4.381E-10	9.105E-09	208802.	156343.	7.160	19.808
1.000E-06	1.011E-10		214312.		7.916	
5.000E-07	5.366E-11		216418.		8.245	
1.000E-07	1.236E-11		220635.		9.031	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2456.6	2437.9	3938.6	3900.7
1.000E-01	2.059E 00	1.667E 00	3923.6	3784.0	4553.7	4284.2
1.000E-02	1.125E 01	5.612E 00	4985.3	4474.4	5329.7	4642.8
1.000E-03	7.457E 01	2.118E 01	5629.7	4721.3	5857.9	4784.8
1.000E-04	5.380E 02	8.272E 01	6076.1	4816.1	6240.7	4840.9
5.000E-05	9.858E 02	1.250E 02	6185.4	4831.1	6336.2	4849.9
1.000E-05	4.079E 03	3.271E 02	6406.4	4853.3	6531.3	4863.2
5.000E-06	7.558E 03	4.952E 02	6489.8	4859.3	6605.4	4866.7
1.000E-06	3.192E 04		6661.0		6758.7	
5.000E-07	5.954E 04		6726.5		6817.6	
1.000E-07	2.536E 05		6857.6		6935.2	

TABLE 15

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.44 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.575 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.575 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.218E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.410E 06	1.410E 06	0.5041	0.5041
THROAT	56302.	56261.	1.226E 06	1.226E 06	0.5042	0.5041
1.000E-01	32052.	29861.	9.625E 05	9.654E 05	0.5126	0.5041
1.000E-02	22799.	11888.	7.371E 05	7.882E 05	0.5693	0.5041
1.000E-03	18717.	4733.	5.800E 05	7.177E 05	0.6339	0.5041
1.000E-04	15980.	1884.	4.612E 05	6.896E 05	0.6989	0.5041
5.000E-05	15306.	1428.	4.308E 05	6.851E 05	0.7183	0.5041
1.000E-05	13930.	750.	3.677E 05	6.785E 05	0.7632	0.5041
5.000E-06	13403.	569.	3.433E 05	6.767E 05	0.7824	0.5041
1.000E-06	12297.	299.	2.923E 05	6.740E 05	0.8264	0.5041
5.000E-07	11862.		2.724E 05		0.8452	
1.000E-07	10923.		2.303E 05		0.8881	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.207E-06	9.207E-06				
THROAT	5.978E-06	5.981E-06	96176.	96164.	1.000	1.000
1.000E-01	2.191E-06	2.312E-06	149717.	149243.	2.094	2.130
1.000E-02	3.421E-07	5.808E-07	183579.	176468.	3.666	3.992
1.000E-03	4.640E-08	1.459E-07	203873.	186202.	4.956	6.676
1.000E-04	5.991E-09	3.665E-08	217977.	189938.	6.113	10.792
5.000E-05	3.214E-09	2.418E-08	221440.	190530.	6.452	12.436
1.000E-05	7.505E-10	9.205E-09	228459.	191406.	7.230	17.236
5.000E-06	3.998E-10	6.073E-09	231112.	191640.	7.563	19.823
1.000E-06	9.207E-11	2.312E-09	236578.	191987.	8.337	27.400
5.000E-07	4.880E-11		238675.		8.671	
1.000E-07	1.114E-11		243043.		9.454	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2989.2	2988.9	4782.6	4781.7
1.000E-01	1.753E 00	1.667E 00	4653.4	4638.6	5298.5	5251.7
1.000E-02	9.155E 00	5.611E 00	5705.8	5484.8	6042.8	5691.2
1.000E-03	6.078E 01	2.117E 01	6336.6	5787.3	6560.3	5865.2
1.000E-04	4.402E 02	8.263E 01	6774.9	5903.5	6937.0	5933.9
5.000E-05	8.077E 02	1.249E 02	6882.6	5921.9	7031.2	5944.8
1.000E-05	3.353E 03	3.265E 02	7100.7	5949.1	7224.1	5961.1
5.000E-06	6.222E 03	4.942E 02	7183.2	5956.4	7297.7	5965.4
1.000E-06	2.639E 04	1.296E 03	7353.1	5967.1	7450.2	5971.9
5.000E-07	4.936E 04		7418.2		7509.1	
1.000E-07	2.124E 05		7554.0		7632.2	

TABLE 16

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF
1. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.49 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.498 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.498 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.502E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.657E 06	1.657E 06	0.5040	0.5040
THROAT	75015.	75010.	1.411E 06	1.411E 06	0.5040	0.5040
1.000E-01	40031.	39814.	1.063E 06	1.064E 06	0.5046	0.5040
1.000E-02	23731.	15850.	8.030E 05	8.274E 05	0.5436	0.5040
1.000E-03	19130.	6310.	6.337E 05	7.334E 05	0.6055	0.5040
1.000E-04	16260.	2512.	5.069E 05	6.960E 05	0.6682	0.5040
5.000E-05	15566.	1904.	4.746E 05	6.900E 05	0.6870	0.5040
1.000E-05	14160.	1000.	4.075E 05	6.811E 05	0.7306	0.5040
5.000E-06	13626.	758.	3.817E 05	6.787E 05	0.7492	0.5040
1.000E-06	12514.	398.	3.275E 05	6.751E 05	0.7921	0.5040
5.000E-07	12080.		3.063E 05		0.8105	
1.000E-07	11156.		2.617E 05		0.8526	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.904E-06	6.904E-06				
THROAT	4.485E-06	4.485E-06	111046.	111047.	1.000	1.000
1.000E-01	1.727E-06	1.734E-06	172367.	172335.	2.127	2.130
1.000E-02	3.139E-07	4.356E-07	206748.	203773.	3.794	3.992
1.000E-03	4.336E-08	1.094E-07	226321.	215013.	5.276	6.676
1.000E-04	5.629E-09	2.748E-08	239934.	219328.	6.506	10.792
5.000E-05	3.023E-09	1.813E-08	243285.	220011.	6.861	12.436
1.000E-05	7.067E-10	6.904E-09	250085.	221022.	7.671	17.237
5.000E-06	3.766E-10	4.555E-09	252660.	221293.	8.017	19.824
1.000E-06	8.672E-11	1.734E-09	257975.	221693.	8.818	27.401
5.000E-07	4.595E-11		260018.		9.163	
1.000E-07	1.047E-11		264283.		9.967	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3451.4	3451.4	5521.7	5521.6
1.000E-01	1.673E 00	1.667E 00	5357.3	5356.3	6068.0	6064.4
1.000E-02	7.673E 00	5.611E 00	6425.9	6333.5	6751.9	6571.9
1.000E-03	5.076E 01	2.117E 01	7034.3	6682.8	7249.9	6772.8
1.000E-04	3.687E 02	8.262E 01	7457.4	6816.9	7614.1	6852.0
5.000E-05	6.772E 02	1.248E 02	7561.5	6838.2	7705.4	6864.7
1.000E-05	2.818E 03	3.264E 02	7772.9	6869.6	7892.6	6883.5
5.000E-06	5.234E 03	4.941E 02	7852.9	6878.0	7964.1	6888.5
1.000E-06	2.226E 04	1.296E 03	8018.1	6890.5	8112.7	6896.0
5.000E-07	4.168E 04		8081.6		8170.2	
1.000E-07	1.800E 05		8214.2		8290.7	

TABLE 17

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.407 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.407 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.902E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.150E 06	2.150E 06	0.5040	0.5040
THROAT	112512.	112512.	1.780E 06	1.780E 06	0.5040	0.5040
1.000E-01	59725.	59718.	1.260E 06	1.260E 06	0.5040	0.5040
1.000E-02	26312.	23775.	9.021E 05	9.056E 05	0.5143	0.5040
1.000E-03	19812.	9465.	7.115E 05	7.645E 05	0.5691	0.5040
1.000E-04	16660.	3768.	5.727E 05	7.084E 05	0.6287	0.5040
5.000E-05	15927.	2856.	5.375E 05	6.994E 05	0.6467	0.5040
1.000E-05	14464.	1500.	4.648E 05	6.860E 05	0.6883	0.5040
5.000E-06	13914.	1137.	4.367E 05	6.824E 05	0.7062	0.5040
1.000E-06	12781.	597.	3.780E 05	6.771E 05	0.7475	0.5040
5.000E-07	12343.	453.	3.552E 05	6.757E 05	0.7652	0.5040
1.000E-07	11420.		3.068E 05		0.8059	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.603E-06	4.603E-06				
THROAT	2.990E-06	2.990E-06	136008.	136008.	1.000	1.000
1.000E-01	1.156E-06	1.156E-06	211068.	211068.	2.130	2.130
1.000E-02	2.678E-07	2.904E-07	249914.	249572.	3.887	3.992
1.000E-03	3.935E-08	7.294E-08	268333.	263339.	5.827	6.676
1.000E-04	5.169E-09	1.832E-08	280980.	268623.	7.260	10.792
5.000E-05	2.781E-09	1.209E-08	284097.	269460.	7.653	12.435
1.000E-05	6.519E-10	4.602E-09	290436.	270699.	8.538	17.236
5.000E-06	3.476E-10	3.036E-09	292841.	271030.	8.912	19.823
1.000E-06	8.012E-11	1.156E-09	297816.	271521.	9.775	27.399
5.000E-07	4.246E-11	7.626E-10	299733.	271652.	10.144	31.488
1.000E-07	9.667E-12		303744.		11.002	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4227.3	4227.3	6762.6	6762.6
1.000E-01	1.667E 00	1.667E 00	6560.2	6560.2	7427.4	7427.3
1.000E-02	6.077E 00	5.611E 00	7767.6	7756.9	8083.8	8048.9
1.000E-03	3.852E 01	2.117E 01	8340.1	8184.8	8540.5	8295.0
1.000E-04	2.800E 02	8.263E 01	8733.1	8349.1	8878.8	8392.1
5.000E-05	5.147E 02	1.249E 02	8830.0	8375.1	8963.9	8407.6
1.000E-05	2.148E 03	3.265E 02	9027.0	8413.6	9138.8	8430.6
5.000E-06	3.995E 03	4.942E 02	9101.8	8423.9	9205.7	8436.7
1.000E-06	1.704E 04	1.296E 03	9256.4	8439.1	9345.1	8445.9
5.000E-07	3.195E 04	1.963E 03	9316.0	8443.2	9399.1	8448.3
1.000E-07	1.385E 05		9440.7		9512.7	

TABLE 18

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.352 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.352 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 9.185E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.643E 06	2.643E 06	0.5040	0.5040
THROAT	150015.	150016.	2.150E 06	2.150E 06	0.5040	0.5040
1.000E-01	79624.	79622.	1.456E 06	1.456E 06	0.5040	0.5040
1.000E-02	31946.	31699.	9.835E 05	9.837E 05	0.5049	0.5040
1.000E-03	20453.	12620.	7.685E 05	7.956E 05	0.5458	0.5040
1.000E-04	16963.	5024.	6.204E 05	7.208E 05	0.6030	0.5040
5.000E-05	16192.	3808.	5.830E 05	7.088E 05	0.6204	0.5040
1.000E-05	14674.	2000.	5.061E 05	6.909E 05	0.6608	0.5040
5.000E-06	14109.	1516.	4.765E 05	6.862E 05	0.6782	0.5040
1.000E-06	12953.	796.	4.145E 05	6.791E 05	0.7183	0.5040
5.000E-07	12510.	604.	3.904E 05	6.772E 05	0.7355	0.5040
1.000E-07	11580.	317.	3.394E 05	6.744E 05	0.7751	0.5040

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.452E-06	3.452E-06				
THROAT	2.243E-06	2.243E-06	157050.	157049.	1.000	1.000
1.000E-01	8.671E-07	8.671E-07	243720.	243721.	2.130	2.130
1.000E-02	2.165E-07	2.178E-07	288201.	288180.	3.981	3.992
1.000E-03	3.656E-08	5.471E-08	306300.	304077.	6.190	6.676
1.000E-04	4.870E-09	1.374E-08	318177.	310179.	7.927	10.792
5.000E-05	2.625E-09	9.066E-09	321099.	311145.	8.365	12.436
1.000E-05	6.169E-10	3.452E-09	327044.	312575.	9.332	17.236
5.000E-06	3.292E-10	2.277E-09	329302.	312957.	9.736	19.824
1.000E-06	7.596E-11	8.670E-10	333977.	313524.	10.662	27.400
5.000E-07	4.027E-11	5.720E-10	335780.	313675.	11.058	31.490
1.000E-07	9.169E-12	2.178E-10	339559.	313901.	11.973	43.478

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4881.3	4881.2	7808.8	7808.8
1.000E-01	1.667E 00	1.667E 00	7575.1	7575.1	8576.3	8576.4
1.000E-02	5.644E 00	5.611E 00	8957.6	8956.9	9296.7	9294.1
1.000E-03	3.145E 01	2.117E 01	9520.1	9451.0	9709.1	9578.2
1.000E-04	2.273E 02	8.263E 01	9889.2	9640.7	10025.8	9690.3
5.000E-05	4.179E 02	1.249E 02	9980.1	9670.7	10105.6	9708.2
1.000E-05	1.746E 03	3.264E 02	10164.8	9715.1	10269.7	9734.7
5.000E-06	3.249E 03	4.942E 02	10235.0	9727.0	10332.6	9741.9
1.000E-06	1.388E 04	1.296E 03	10380.3	9744.6	10463.7	9752.4
5.000E-07	2.605E 04	1.963E 03	10436.4	9749.3	10514.6	9755.2
1.000E-07	1.131E 05	5.152E 03	10553.8	9756.3	10621.8	9759.4

TABLE 19

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 276.95 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 286.35 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 7.833 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 8.099 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5643
THROAT PRESSURE RATIO(FROZEN) = 0.5432
ENTROPY = 2.359E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	2.160E 04	2.160E 04	1.9637	1.9637
THROAT	4612.	4330.	1.883E 04	1.872E 04	1.9854	1.9637
1.000E-01	3314.	2842.	1.201E 04	1.265E 04	2.0149	1.9637
1.000E-02	1823.	1502.	6.302E 03	7.723E 03	2.0160	1.9637
1.000E-03	955.	729.	3.251E 03	5.213E 03	2.0160	1.9637
1.000E-04	494.	329.	1.662E 03	4.036E 03	2.0160	1.9637

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.076E-03	1.076E-03				
THROAT	6.655E-04	6.749E-04	11771.	12001.	1.000	1.000
1.000E-01	1.666E-04	1.893E-04	21917.	21164.	2.118	2.147
1.000E-02	3.031E-05	3.581E-05	27674.	26357.	3.514	3.588
1.000E-03	5.786E-06	7.377E-06	30308.	28642.	5.286	5.449
1.000E-04	1.118E-06	1.637E-06	31593.	29653.	7.633	8.231

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	365.9	373.0	670.7	656.8
1.000E-01	2.146E 00	2.022E 00	681.2	657.8	797.1	763.4
1.000E-02	9.340E 00	8.580E 00	860.1	819.2	910.6	864.0
1.000E-03	4.467E 01	3.833E 01	942.0	890.2	966.1	910.2
1.000E-04	2.218E 02	1.668E 02	981.9	921.6	993.9	930.3

TABLE 20

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 259.77 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 273.72 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 6.707 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 7.067 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5746
THROAT PRESSURE RATIO(FROZEN) = 0.5388
ENTROPY = 2.637E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	6000.	6000.	3.703E 04	3.703E 04	1.7707	1.7707
THROAT	5688.	5141.	3.343E 04	3.317E 04	1.8061	1.7707
1.000E-01	4804.	3306.	2.363E 04	2.530E 04	1.9089	1.7707
1.000E-02	3614.	1702.	1.375E 04	1.901E 04	2.0039	1.7707
1.000E-03	2097.	809.	7.293E 03	1.589E 04	2.0160	1.7707
1.000E-04	1104.	359.	3.771E 03	1.445E 04	2.0160	1.7707
5.000E-05	907.		3.086E 03		2.0160	
1.000E-05	573.		1.932E 03		2.0160	
5.000E-06	469.		1.577E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	8.086E-04	8.086E-04				
THROAT	4.998E-04	5.084E-04	13419.	13900.	1.000	1.000
1.000E-01	1.089E-04	1.467E-04	25897.	24238.	2.161	2.146
1.000E-02	1.519E-05	2.850E-05	34141.	30034.	3.261	3.620
1.000E-03	2.634E-06	5.995E-06	38584.	32533.	4.585	5.547
1.000E-04	5.002E-07	1.351E-06	40805.	33622.	6.621	8.441
5.000E-05	3.044E-07		41223.		7.374	
1.000E-05	9.642E-08		41918.		9.415	
5.000E-06	5.887E-08		42129.		10.443	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	417.1	432.0	779.6	754.7
1.000E-01	2.379E 00	1.987E 00	804.9	753.3	955.0	872.3
1.000E-02	1.293E 01	8.257E 00	1061.1	933.5	1142.7	982.9
1.000E-03	6.599E 01	3.624E 01	1199.2	1011.2	1240.9	1032.9
1.000E-04	3.286E 02	1.556E 02	1268.3	1045.0	1289.0	1054.3
5.000E-05	5.345E 02		1281.2		1298.1	
1.000E-05	1.659E 03		1302.8		1313.3	
5.000E-06	2.704E 03		1309.4		1317.9	

TABLE 21

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 233.60 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 250.93 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 5.584 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 5.998 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5733
THROAT PRESSURE RATIO(FROZEN) = 0.5233
ENTROPY = 3.130E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	6.921E 04	6.921E 04	1.4219	1.4219
THROAT	6642.	5773.	6.398E 04	6.345E 04	1.4589	1.4219
1.000E-01	5719.	3465.	4.986E 04	5.297E 04	1.5725	1.4219
1.000E-02	4804.	1619.	3.525E 04	4.512E 04	1.7157	1.4219
1.000E-03	4081.	712.	2.387E 04	4.155E 04	1.8490	1.4219
1.000E-04	3406.	300.	1.487E 04	4.001E 04	1.9642	1.4219
5.000E-05	3167.		1.258E 04		1.9909	
1.000E-05	2326.		8.148E 03		2.0158	
5.000E-06	1932.		6.696E 03		2.0160	
1.000E-06	1234.		4.223E 03		2.0160	
5.000E-07	1014.		3.458E 03		2.0160	
1.000E-07	641.		2.167E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.565E-04	5.565E-04				
THROAT	3.450E-04	3.531E-04	16188.	16988.	1.000	1.000
1.000E-01	7.533E-05	1.124E-04	31124.	28517.	2.171	2.141
1.000E-02	9.784E-06	2.407E-05	41229.	34727.	3.302	3.738
1.000E-03	1.241E-06	5.471E-06	47644.	37211.	4.312	5.930
1.000E-04	1.580E-07	1.300E-06	52156.	38231.	5.283	9.282
5.000E-05	8.612E-08		53244.		5.561	
1.000E-05	2.374E-08		55289.		6.279	
5.000E-06	1.429E-08		55942.		6.910	
1.000E-06	4.477E-09		57038.		8.761	
5.000E-07	2.723E-09		57373.		9.711	
1.000E-07	8.615E-10		57933.		12.307	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	503.1	528.0	937.6	897.2
1.000E-01	2.382E 00	1.871E 00	967.4	886.3	1147.9	1018.3
1.000E-02	1.384E 01	7.177E 00	1281.4	1079.4	1386.4	1130.0
1.000E-03	9.442E 01	2.946E 01	1480.8	1156.5	1552.4	1177.3
1.000E-04	6.777E 02	1.207E 02	1621.1	1188.3	1672.4	1196.8
5.000E-05	1.218E 03		1654.9		1701.0	
1.000E-05	4.254E 03		1718.4		1750.7	
5.000E-06	6.984E 03		1738.7		1765.2	
1.000E-06	2.187E 04		1772.8		1789.4	
5.000E-07	3.574E 04		1783.2		1796.7	
1.000E-07	1.119E 05		1800.6		1809.1	

TABLE 22

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 212.83 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 232.66 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4.759 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 5.202 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5694
THROAT PRESSURE RATIO(FROZEN) = 0.5034
ENTROPY = 3.631E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	1.067E 05	1.067E 05	1.1535	1.1535
THROAT	7491.	6269.	9.925E 04	9.826E 04	1.1873	1.1535
1.000E-01	6323.	3495.	8.007E 04	8.502E 04	1.2919	1.1535
1.000E-02	5282.	1480.	6.062E 04	7.569E 04	1.4276	1.1535
1.000E-03	4538.	610.	4.561E 04	7.179E 04	1.5590	1.1535
1.000E-04	3963.	247.	3.364E 04	7.020E 04	1.6856	1.1535
5.000E-05	3812.		3.049E 04		1.7226	
1.000E-05	3488.		2.388E 04		1.8063	
5.000E-06	3357.		2.130E 04		1.8412	
1.000E-06	3057.		1.584E 04		1.9183	
5.000E-07	2921.		1.371E 04		1.9490	
1.000E-07	2508.		9.289E 03		2.0061	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.950E-04	3.950E-04				
THROAT	2.473E-04	2.538E-04	19248.	20502.	1.000	1.000
1.000E-01	5.598E-05	9.042E-05	36480.	32908.	2.181	2.135
1.000E-02	7.405E-06	2.135E-05	48007.	39368.	3.338	3.882
1.000E-03	9.413E-07	5.180E-06	55282.	41775.	4.366	6.366
1.000E-04	1.165E-07	1.278E-06	60459.	42721.	5.340	10.183
5.000E-05	6.191E-08		61746.		5.627	
1.000E-05	1.419E-08		64371.		6.290	
5.000E-06	7.514E-09		65369.		6.576	
1.000E-06	1.719E-09		67426.		7.243	
5.000E-07	9.139E-10		68212.		7.532	
1.000E-07	2.192E-10		69815.		8.127	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	598.2	637.2	1104.6	1046.7
1.000E-01	2.331E 00	1.748E 00	1133.8	1022.8	1341.1	1165.0
1.000E-02	1.339E 01	6.190E 00	1492.1	1223.6	1611.1	1274.0
1.000E-03	9.145E 01	2.404E 01	1718.2	1298.4	1759.5	1318.0
1.000E-04	6.754E 02	9.531E 01	1879.1	1327.8	1939.2	1335.6
5.000E-05	1.245E 03		1919.1		1974.5	
1.000E-05	5.211E 03		2000.7		2047.1	
5.000E-06	9.690E 03		2031.7		2074.8	
1.000E-06	4.105E 04		2095.7		2132.2	
5.000E-07	7.634E 04		2120.1		2154.0	
1.000E-07	3.110E 05		2169.9		2197.6	

TABLE 23

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 207.43 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 225.74 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4.373 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4.759 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5675
THROAT PRESSURE RATIO(FROZEN) = 0.4930
ENTROPY = 3.886E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	9000.	9000.	1.281E 05	1.281E 05	1.0529	1.0529
THROAT	8180.	6857.	1.191E 05	1.176E 05	1.0815	1.0529
1.000E-01	6663.	3699.	9.658E 04	1.022E 05	1.1779	1.0529
1.000E-02	5489.	1503.	7.432E 04	9.156E 04	1.3073	1.0529
1.000E-03	4697.	605.	5.736E 04	8.727E 04	1.4336	1.0529
1.000E-04	4106.	242.	4.391E 04	8.554E 04	1.5564	1.0529
5.000E-05	3955.		4.038E 04		1.5926	
1.000E-05	3637.		3.296E 04		1.6752	
5.000E-06	3512.		3.005E 04		1.7102	
1.000E-06	3243.		2.388E 04		1.7895	
5.000E-07	3133.		2.145E 04		1.8228	
1.000E-07	2886.		1.627E 04		1.8974	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	3.205E-04	3.205E-04				
THROAT	2.055E-04	2.074E-04	21275.	22950.	1.000	1.000
1.000E-01	4.844E-05	7.798E-05	39723.	36031.	2.199	2.132
1.000E-02	6.526E-06	1.919E-05	51885.	42770.	3.380	3.954
1.000E-03	8.362E-07	4.767E-06	59507.	45212.	4.425	6.570
1.000E-04	1.038E-07	1.191E-06	64919.	46156.	5.412	10.586
5.000E-05	5.517E-08		66265.		5.702	
1.000E-05	1.262E-08		69013.		6.368	
5.000E-06	6.671E-09		70060.		6.653	
1.000E-06	1.512E-09		72231.		7.314	
5.000E-07	7.969E-10		73068.		7.599	
1.000E-07	1.801E-10		74820.		8.266	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	661.2	713.3	1210.4	1151.7
1.000E-01	2.273E 00	1.694E 00	1234.6	1119.9	1454.6	1270.5
1.000E-02	1.292E 01	5.799E 00	1612.6	1329.3	1737.6	1380.9
1.000E-03	8.789E 01	2.208E 01	1849.6	1405.2	1934.6	1424.9
1.000E-04	6.487E 02	8.659E 01	2017.8	1434.6	2080.5	1442.3
5.000E-05	1.196E 03		2059.6		2117.5	
1.000E-05	5.021E 03		2145.0		2193.6	
5.000E-06	9.357E 03		2177.5		2222.8	
1.000E-06	4.004E 04		2245.0		2283.7	
5.000E-07	7.510E 04		2271.0		2307.4	
1.000E-07	3.245E 05		2325.5		2356.9	

TABLE 24

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 209.59 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.75 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4.192 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4.475 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5677
THROAT PRESSURE RATIO(FROZEN) = 0.4894
ENTROPY = 3.995E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	1.385E 05	1.385E 05	1.0236	1.0236
THROAT	8734.	7545.	1.283E 05	1.264E 05	1.0445	1.0236
1.000E-01	6845.	4028.	1.040E 05	1.091E 05	1.1341	1.0236
1.000E-02	5581.	1616.	8.040E 04	9.728E 04	1.2603	1.0236
1.000E-03	4762.	646.	6.255E 04	9.255E 04	1.3843	1.0236
1.000E-04	4160.	258.	4.845E 04	9.066E 04	1.5051	1.0236
5.000E-05	4007.		4.475E 04		1.5407	
1.000E-05	3687.		3.698E 04		1.6223	
5.000E-06	3563.		3.393E 04		1.6569	
1.000E-06	3297.		2.747E 04		1.7358	
5.000E-07	3190.		2.492E 04		1.7691	
1.000E-07	2956.		1.948E 04		1.8445	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.804E-04	2.804E-04				
THROAT	1.860E-04	1.819E-04	22534.	24603.	1.000	1.000
1.000E-01	4.539E-05	6.961E-05	41542.	38344.	2.221	2.131
1.000E-02	6.187E-06	1.735E-05	53915.	45404.	3.416	3.978
1.000E-03	7.964E-07	4.341E-06	61645.	47940.	4.471	6.636
1.000E-04	9.912E-08	1.088E-06	67128.	48917.	5.466	10.716
5.000E-05	5.267E-08		68491.		5.758	
1.000E-05	1.205E-08		71276.		6.428	
5.000E-06	6.371E-09		72338.		6.715	
1.000E-06	1.442E-09		74541.		7.376	
5.000E-07	7.596E-10		75392.		7.661	
1.000E-07	1.710E-10		77177.		8.325	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	700.4	764.7	1273.6	1227.5
1.000E-01	2.223E 00	1.677E 00	1291.2	1191.8	1515.6	1350.3
1.000E-02	1.257E 01	5.679E 00	1675.7	1411.2	1802.6	1464.9
1.000E-03	8.538E 01	2.150E 01	1916.0	1490.0	2002.2	1510.4
1.000E-04	6.300E 02	8.406E 01	2086.4	1520.4	2150.0	1528.3
5.000E-05	1.162E 03		2128.8		2187.4	
1.000E-05	4.879E 03		2215.3		2264.6	
5.000E-06	9.096E 03		2248.3		2294.3	
1.000E-06	3.898E 04		2316.8		2356.2	
5.000E-07	7.319E 04		2343.3		2380.2	
1.000E-07	3.177E 05		2398.7		2430.8	

TABLE 25

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 205.48 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 212.48 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.752 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.879 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5351
THROAT PRESSURE RATIO(FROZEN) = 0.4595
ENTROPY = 4.109E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.495E 05	1.495E 05	1.0107	1.0107
THROAT	9685.	8804.	1.377E 05	1.351E 05	1.0197	1.0107
1.000E-01	7085.	4790.	1.119E 05	1.153E 05	1.0922	1.0107
1.000E-02	5682.	1910.	8.679E 04	1.011E 05	1.2146	1.0107
1.000E-03	4828.	761.	6.799E 04	9.546E 04	1.3361	1.0107
1.000E-04	4212.	303.	5.320E 04	9.321E 04	1.4546	1.0107
5.000E-05	4057.		4.933E 04		1.4897	
1.000E-05	3735.		4.119E 04		1.5701	
5.000E-06	3610.		3.800E 04		1.6042	
1.000E-06	3345.		3.124E 04		1.6823	
5.000E-07	3240.		2.857E 04		1.7154	
1.000E-07	3011.		2.287E 04		1.7907	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.307E-04	2.307E-04				
THROAT	1.544E-04	1.445E-04	24305.	26844.	1.000	1.000
1.000E-01	4.223E-05	5.780E-05	43370.	41358.	2.229	2.088
1.000E-02	5.857E-06	1.450E-05	56013.	49198.	3.449	3.933
1.000E-03	7.582E-07	3.639E-06	63861.	51995.	4.517	6.584
1.000E-04	9.460E-08	9.137E-07	69418.	53068.	5.520	10.647
5.000E-05	5.030E-08		70799.		5.815	
1.000E-05	1.152E-08		73621.		6.490	
5.000E-06	6.088E-09		74697.		6.778	
1.000E-06	1.378E-09		76930.		7.443	
5.000E-07	7.253E-10		77794.		7.728	
1.000E-07	1.629E-10		79607.		8.391	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	755.4	834.3	1359.1	1335.6
1.000E-01	2.048E 00	1.623E 00	1348.0	1285.5	1579.0	1462.5
1.000E-02	1.144E 01	5.439E 00	1741.0	1529.1	1869.9	1588.5
1.000E-03	7.748E 01	2.050E 01	1984.9	1616.0	2072.3	1638.4
1.000E-04	5.712E 02	8.001E 01	2157.6	1649.4	2222.0	1658.1
5.000E-05	1.053E 03		2200.5		2259.9	
1.000E-05	4.424E 03		2288.2		2338.1	
5.000E-06	8.250E 03		2321.6		2368.2	
1.000E-06	3.539E 04		2391.1		2431.0	
5.000E-07	6.649E 04		2417.9		2455.4	
1.000E-07	2.893E 05		2474.3		2506.9	

TABLE 26

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 219.57 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 213.78 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.711 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.613 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5603
THROAT PRESSURE RATIO(FROZEN) = 0.4631
ENTROPY = 4.188E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.597E 05	1.597E 05	1.0088	1.0088
THROAT	11179.	10299.	1.454E 05	1.428E 05	1.0107	1.0088
1.000E-01	7312.	5581.	1.176E 05	1.195E 05	1.0656	1.0088
1.000E-02	5758.	2223.	9.130E 04	1.030E 05	1.1845	1.0088
1.000E-03	4874.	885.	7.182E 04	9.641E 04	1.3041	1.0088
1.000E-04	4248.	352.	5.653E 04	9.379E 04	1.4211	1.0088
5.000E-05	4090.		5.254E 04		1.4558	
1.000E-05	3765.		4.415E 04		1.5352	
5.000E-06	3640.		4.086E 04		1.5690	
1.000E-06	3375.		3.389E 04		1.6464	
5.000E-07	3270.		3.114E 04		1.6792	
1.000E-07	3044.		2.526E 04		1.7542	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.974E-04	1.974E-04				
THROAT	1.388E-04	1.243E-04	26739.	29077.	1.000	1.000
1.000E-01	3.993E-05	4.952E-05	45921.	44825.	2.288	2.094
1.000E-02	5.636E-06	1.243E-05	58510.	53269.	3.530	3.943
1.000E-03	7.331E-07	3.122E-06	66321.	56280.	4.610	6.601
1.000E-04	9.166E-08	7.842E-07	71859.	57435.	5.623	10.675
5.000E-05	4.876E-08		73236.		5.921	
1.000E-05	1.117E-08		76051.		6.602	
5.000E-06	5.905E-09		77125.		6.892	
1.000E-06	1.337E-09		79356.		7.562	
5.000E-07	7.035E-10		80219.		7.849	
1.000E-07	1.579E-10		82033.		8.516	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	831.1	903.7	1470.0	1446.0
1.000E-01	2.024E 00	1.628E 00	1427.3	1393.2	1658.1	1583.8
1.000E-02	1.125E 01	5.456E 00	1818.6	1655.7	1946.9	1719.5
1.000E-03	7.634E 01	2.056E 01	2061.3	1749.2	2148.4	1773.3
1.000E-04	5.635E 02	8.023E 01	2233.4	1785.1	2297.7	1794.5
5.000E-05	1.039E 03		2276.2		2335.5	
1.000E-05	4.369E 03		2363.7		2413.5	
5.000E-06	8.149E 03		2397.1		2443.6	
1.000E-06	3.499E 04		2466.5		2506.3	
5.000E-07	6.577E 04		2493.3		2530.8	
1.000E-07	2.866E 05		2549.7		2582.3	

TABLE 27

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.64 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.72 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.489 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.522 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5515
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 4.254E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.696E 05	1.696E 05	1.0083	1.0083
THROAT	12638.	12006.	1.529E 05	1.499E 05	1.0090	1.0083
1.000E-01	7576.	6353.	1.225E 05	1.222E 05	1.0452	1.0083
1.000E-02	5827.	2473.	9.515E 04	1.035E 05	1.1601	1.0083
1.000E-03	4913.	946.	7.507E 04	9.629E 04	1.2782	1.0083
1.000E-04	4277.	359.	5.937E 04	9.354E 04	1.3938	1.0083
5.000E-05	4118.		5.527E 04		1.4281	
1.000E-05	3790.		4.666E 04		1.5068	
5.000E-06	3664.		4.329E 04		1.5403	
1.000E-06	3398.		3.614E 04		1.6170	
5.000E-07	3293.		3.332E 04		1.6496	
1.000E-07	3069.		2.729E 04		1.7241	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.727E-04	1.727E-04				
THROAT	1.206E-04	1.121E-04	28922.	31405.	1.000	1.000
1.000E-01	3.779E-05	4.349E-05	48578.	48734.	2.347	2.124
1.000E-02	5.454E-06	1.117E-05	61068.	57539.	3.621	3.988
1.000E-03	7.127E-07	2.919E-06	68805.	60598.	4.714	6.759
1.000E-04	8.929E-08	7.693E-07	74300.	61724.	5.737	11.154
5.000E-05	4.751E-08		75667.		6.037	
1.000E-05	1.089E-08		78464.		6.725	
5.000E-06	5.759E-09		79532.		7.018	
1.000E-06	1.304E-09		81751.		7.694	
5.000E-07	6.861E-10		82610.		7.984	
1.000E-07	1.539E-10		84418.		8.655	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	898.9	976.1	1567.9	1561.8
1.000E-01	1.900E 00	1.662E 00	1509.9	1514.7	1740.4	1714.4
1.000E-02	1.047E 01	5.478E 00	1898.1	1788.4	2025.1	1854.2
1.000E-03	7.114E 01	1.991E 01	2138.5	1883.4	2224.8	1907.4
1.000E-04	5.258E 02	7.417E 01	2309.3	1918.4	2373.1	1927.3
5.000E-05	9.704E 02		2351.8		2410.7	
1.000E-05	4.082E 03		2438.7		2488.3	
5.000E-06	7.617E 03		2471.9		2518.1	
1.000E-06	3.273E 04		2540.9		2580.6	
5.000E-07	6.155E 04		2567.6		2604.9	
1.000E-07	2.685E 05		2623.8		2656.4	

TABLE 28

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 221.25 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.69 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.298 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.320 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5426
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 4.312E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.795E 05	1.795E 05	1.0082	1.0082
THROAT	14110.	13509.	1.603E 05	1.574E 05	1.0084	1.0082
1.000E-01	7914.	7156.	1.270E 05	1.262E 05	1.0298	1.0082
1.000E-02	5894.	2793.	9.857E 04	1.051E 05	1.1394	1.0082
1.000E-03	4949.	1071.	7.795E 04	9.691E 04	1.2561	1.0082
1.000E-04	4302.	407.	6.187E 04	9.379E 04	1.3706	1.0082
5.000E-05	4141.		5.768E 04		1.4046	
1.000E-05	3811.		4.888E 04		1.4825	
5.000E-06	3684.		4.543E 04		1.5157	
1.000E-06	3417.		3.813E 04		1.5918	
5.000E-07	3313.		3.525E 04		1.6242	
1.000E-07	3089.		2.908E 04		1.6983	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.535E-04	1.535E-04				
THROAT	1.062E-04	9.966E-05	31042.	33309.	1.000	1.000
1.000E-01	3.565E-05	3.860E-05	51282.	51702.	2.395	2.125
1.000E-02	5.297E-06	9.890E-06	63671.	61062.	3.717	3.986
1.000E-03	6.954E-07	2.580E-06	71316.	64321.	4.824	6.747
1.000E-04	8.729E-08	6.794E-07	76753.	65521.	5.858	11.129
5.000E-05	4.646E-08		78107.		6.162	
1.000E-05	1.066E-08		80879.		6.856	
5.000E-06	5.636E-09		81938.		7.152	
1.000E-06	1.276E-09		84140.		7.834	
5.000E-07	6.716E-10		84993.		8.127	
1.000E-07	1.506E-10		86789.		8.804	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	964.8	1035.3	1661.1	1656.7
1.000E-01	1.804E 00	1.664E 00	1593.9	1606.9	1825.4	1819.0
1.000E-02	9.780E 00	5.497E 00	1979.0	1897.9	2104.5	1968.0
1.000E-03	6.650E 01	2.000E 01	2216.6	1999.2	2301.9	2024.7
1.000E-04	4.923E 02	7.458E 01	2385.6	2036.5	2448.7	2046.0
5.000E-05	9.088E 02		2427.7		2486.0	
1.000E-05	3.826E 03		2513.8		2562.9	
5.000E-06	7.142E 03		2546.7		2592.5	
1.000E-06	3.072E 04		2615.2		2654.6	
5.000E-07	5.778E 04		2641.7		2678.7	
1.000E-07	2.523E 05		2697.5		2729.8	

TABLE 29

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 201.93 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 219.46 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.856 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.104 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5576
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 4.476E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	2.094E 05	2.094E 05	0.9793	0.9793
THROAT	17746.	15012.	1.872E 05	1.841E 05	0.9949	0.9793
1.000E-01	10047.	7960.	1.414E 05	1.483E 05	1.0095	0.9793
1.000E-02	6129.	3118.	1.084E 05	1.241E 05	1.0853	0.9793
1.000E-03	5054.	1200.	8.613E 04	1.147E 05	1.1975	0.9793
1.000E-04	4372.	457.	6.896E 04	1.111E 05	1.3088	0.9793
5.000E-05	4206.		6.451E 04		1.3418	
1.000E-05	3867.		5.516E 04		1.4177	
5.000E-06	3738.		5.150E 04		1.4501	
1.000E-06	3468.		4.376E 04		1.5244	
5.000E-07	3363.		4.071E 04		1.5561	
1.000E-07	3139.		3.418E 04		1.6287	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.342E-04	1.342E-04				
THROAT	8.564E-05	8.712E-05	33344.	35626.	1.000	1.000
1.000E-01	2.753E-05	3.371E-05	58341.	55303.	2.334	2.126
1.000E-02	4.851E-06	8.606E-06	71114.	65337.	3.961	3.984
1.000E-03	6.492E-07	2.237E-06	78559.	68841.	5.127	6.733
1.000E-04	8.201E-08	5.869E-07	83849.	70137.	6.199	11.087
5.000E-05	4.370E-08		85170.		6.512	
1.000E-05	1.004E-08		87875.		7.229	
5.000E-06	5.314E-09		88909.		7.534	
1.000E-06	1.204E-09		91063.		8.236	
5.000E-07	6.339E-10		91899.		8.537	
1.000E-07	1.422E-10		93659.		9.232	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1036.4	1107.3	1862.7	1771.9
1.000E-01	1.778E 00	1.665E 00	1813.3	1718.9	2076.8	1945.9
1.000E-02	8.278E 00	5.520E 00	2210.3	2030.7	2333.0	2106.0
1.000E-03	5.600E 01	2.016E 01	2441.7	2139.7	2524.7	2167.1
1.000E-04	4.153E 02	7.540E 01	2606.1	2179.9	2667.7	2190.2
5.000E-05	7.672E 02		2647.2		2704.0	
1.000E-05	3.236E 03		2731.2		2779.2	
5.000E-06	6.044E 03		2763.4		2808.2	
1.000E-06	2.604E 04		2830.3		2868.9	
5.000E-07	4.902E 04		2856.3		2892.6	
1.000E-07	2.145E 05		2911.0		2942.8	

TABLE 30

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 163.05 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 181.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.883 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.099 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5632
THROAT PRESSURE RATIO(FROZEN) = 0.4877
ENTROPY = 5.978E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	5.986E 05	5.986E 05	0.6752	0.6752
THROAT	28087.	22601.	5.503E 05	5.433E 05	0.6972	0.6752
1.000E-01	23475.	11999.	4.294E 05	4.652E 05	0.7637	0.6752
1.000E-02	19012.	4764.	3.093E 05	4.121E 05	0.8504	0.6752
1.000E-03	15531.	1879.	2.208E 05	3.911E 05	0.9327	0.6752
1.000E-04	11844.	737.	1.554E 05	3.828E 05	0.9984	0.6752
5.000E-05	9917.	556.	1.417E 05	3.815E 05	1.0074	0.6752
1.000E-05	5322.	289.	1.182E 05	3.796E 05	1.0091	0.6752
5.000E-06	4513.		1.116E 05		1.0227	
1.000E-06	3923.		9.892E 04		1.0780	
5.000E-07	3766.		9.407E 04		1.1029	
1.000E-07	3471.		8.385E 04		1.1607	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.166E-05	6.166E-05				
THROAT	3.830E-05	3.991E-05	49154.	52594.	1.000	1.000
1.000E-01	8.913E-06	1.542E-05	92026.	81703.	2.178	2.129
1.000E-02	1.226E-06	3.883E-06	120331.	96612.	3.382	3.986
1.000E-03	1.644E-07	9.847E-07	137522.	101913.	4.505	6.682
1.000E-04	2.309E-08	2.508E-07	148957.	103925.	5.634	10.863
5.000E-05	1.391E-08	1.663E-07	151232.	104240.	5.717	12.543
1.000E-05	5.195E-09	6.403E-08	155071.	104703.	9.013	17.477
5.000E-06	3.104E-09		156129.		10.017	
1.000E-06	7.528E-10		158156.		11.255	
5.000E-07	4.012E-10		158922.		11.698	
1.000E-07	9.162E-11		160522.		12.670	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1527.8	1634.7	2793.7	2617.8
1.000E-01	2.296E 00	1.667E 00	2860.3	2539.4	3376.2	2875.4
1.000E-02	1.277E 01	5.596E 00	3740.0	3002.8	4026.9	3115.6
1.000E-03	8.325E 01	2.092E 01	4274.3	3167.6	4461.4	3209.7
1.000E-04	5.473E 02	8.053E 01	4629.7	3230.1	4752.7	3246.3
5.000E-05	8.951E 02	1.211E 02	4700.4	3239.9	4801.0	3252.1
1.000E-05	2.337E 03	3.131E 02	4819.8	3254.3	4872.3	3260.6
5.000E-06	3.885E 03		4852.6		4896.3	
1.000E-06	1.581E 04		4915.6		4951.2	
5.000E-07	2.953E 04		4939.5		4972.6	
1.000E-07	1.280E 05		4989.2		5018.0	

TABLE 31

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 147.88 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 159.87 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.479 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.595 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5008
THROAT PRESSURE RATIO(FROZEN) = 0.4882
ENTROPY = 7.225E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	40000.	40000.	1.021E 06	1.021E 06	0.5192	0.5192
THROAT	34676.	30059.	9.235E 05	9.249E 05	0.5362	0.5192
1.000E-01	27603.	15948.	7.472E 05	7.898E 05	0.5841	0.5192
1.000E-02	21926.	6349.	5.658E 05	6.980E 05	0.6576	0.5192
1.000E-03	18242.	2526.	4.339E 05	6.614E 05	0.7317	0.5192
1.000E-04	15549.	1004.	3.334E 05	6.469E 05	0.8047	0.5192
5.000E-05	14862.	761.	3.077E 05	6.446E 05	0.8264	0.5192
1.000E-05	13419.	399.	2.546E 05	6.411E 05	0.8757	0.5192
5.000E-06	12845.		2.342E 05		0.8965	
1.000E-06	11565.		1.918E 05		0.9430	
5.000E-07	11003.		1.754E 05		0.9619	
1.000E-07	9336.		1.434E 05		0.9997	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.556E-05	3.556E-05				
THROAT	2.127E-05	2.310E-05	69700.	69196.	1.000	1.000
1.000E-01	5.797E-06	8.920E-06	116995.	107481.	2.135	2.130
1.000E-02	8.217E-07	2.241E-06	150890.	127083.	3.425	3.992
1.000E-03	1.099E-07	5.632E-07	171379.	134089.	4.574	6.676
1.000E-04	1.418E-08	1.416E-07	185471.	136776.	5.675	10.798
5.000E-05	7.617E-09	9.348E-08	188904.	137201.	6.003	12.445
1.000E-05	1.788E-09	3.562E-08	195816.	137830.	6.767	17.257
5.000E-06	9.560E-10		198408.		7.100	
1.000E-06	2.234E-10		203693.		7.889	
5.000E-07	1.198E-10		205688.		8.243	
1.000E-07	2.934E-11		209550.		9.078	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2166.4	2150.7	3599.6	3443.0
1.000E-01	2.180E 00	1.668E 00	3636.3	3340.6	4260.3	3782.1
1.000E-02	1.193E 01	5.614E 00	4689.8	3949.9	5031.1	4098.5
1.000E-03	7.852E 01	2.117E 01	5326.6	4167.6	5551.3	4223.7
1.000E-04	5.623E 02	8.253E 01	5764.6	4251.1	5925.5	4273.0
5.000E-05	1.028E 03	1.247E 02	5871.3	4264.3	6018.4	4280.8
1.000E-05	4.224E 03	3.256E 02	6086.2	4283.9	6207.0	4292.5
5.000E-06	7.796E 03		6166.7		6278.3	
1.000E-06	3.250E 04		6331.0		6424.0	
5.000E-07	6.003E 04		6393.0		6478.9	
1.000E-07	2.406E 05		6513.0		6581.9	

TABLE 32

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 153.22 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.77 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.370 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.411 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4841
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 7.533E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	50000.	50000.	1.157E 06	1.157E 06	0.5062	0.5062
THROAT	39305.	37535.	1.032E 06	1.035E 06	0.5130	0.5062
1.000E-01	29096.	19925.	8.344E 05	8.616E 05	0.5512	0.5062
1.000E-02	22603.	7934.	6.344E 05	7.439E 05	0.6205	0.5062
1.000E-03	18708.	3161.	4.908E 05	6.971E 05	0.6916	0.5062
1.000E-04	15944.	1260.	3.820E 05	6.784E 05	0.7622	0.5062
5.000E-05	15251.	956.	3.542E 05	6.754E 05	0.7832	0.5062
1.000E-05	13816.	502.	2.966E 05	6.709E 05	0.8315	0.5062
5.000E-06	13758.	381.	2.745E 05	6.697E 05	0.8520	0.5062
1.000E-06	12059.		2.282E 05		0.8985	
5.000E-07	11570.		2.103E 05		0.9181	
1.000E-07	10415.		1.742E 05		0.9613	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	2.774E-05	2.774E-05				
THROAT	1.731E-05	1.801E-05	79175.	78347.	1.000	1.000
1.000E-01	5.190E-06	6.961E-06	127119.	121633.	2.105	2.130
1.000E-02	7.521E-07	1.748E-06	161776.	143828.	3.481	3.992
1.000E-03	1.013E-07	4.387E-07	182642.	151767.	4.665	6.674
1.000E-04	1.310E-08	1.101E-07	196996.	154817.	5.785	10.785
5.000E-05	7.035E-09	7.258E-08	200497.	155301.	6.117	12.425
1.000E-05	1.649E-09	2.760E-08	207556.	156017.	6.886	17.213
5.000E-06	8.803E-10	1.820E-08	210210.	156209.	7.217	19.792
1.000E-06	2.041E-10		215647.		7.995	
5.000E-07	1.087E-10		217716.		8.336	
1.000E-07	2.529E-11		221833.		9.159	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	2460.8	2435.1	3955.7	3897.0
1.000E-01	2.077E 00	1.667E 00	3951.0	3780.5	4592.4	4280.3
1.000E-02	1.126E 01	5.613E 00	5028.2	4470.3	5376.0	4638.6
1.000E-03	7.408E 01	2.119E 01	5676.7	4717.1	5905.5	4780.6
1.000E-04	5.312E 02	8.282E 01	6122.8	4811.9	6266.9	4836.7
5.000E-05	9.716E 02	1.252E 02	6231.6	4826.9	6381.7	4845.7
1.000E-05	4.004E 03	3.277E 02	6451.1	4849.2	6574.7	4859.0
5.000E-06	7.406E 03	4.963E 02	6533.5	4855.1	6647.9	4862.6
1.000E-06	3.113E 04		6702.5		6798.6	
5.000E-07	5.791E 04		6766.8		6856.3	
1.000E-07	2.443E 05		6894.8		6970.2	

TABLE 33

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.39 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.149 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.150 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4872
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 7.545E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.410E 06	1.410E 06	0.5042	0.5042
THROAT	56347.	56265.	1.225E 06	1.225E 06	0.5044	0.5042
1.000E-01	32944.	29865.	9.607E 05	9.652E 05	0.5163	0.5042
1.000E-02	23652.	11890.	7.294E 05	7.880E 05	0.5764	0.5042
1.000E-03	19322.	4734.	5.690E 05	7.175E 05	0.6434	0.5042
1.000E-04	16416.	1885.	4.485E 05	6.894E 05	0.7106	0.5042
5.000E-05	15703.	1428.	4.178E 05	6.849E 05	0.7307	0.5042
1.000E-05	14245.	750.	3.543E 05	6.783E 05	0.7771	0.5042
5.000E-06	13687.	569.	3.299E 05	6.765E 05	0.7969	0.5042
1.000E-06	12515.	299.	2.788E 05	6.738E 05	0.8423	0.5042
5.000E-07	12053.		2.589E 05		0.8616	
1.000E-07	11049.		2.171E 05		0.9055	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.842E-05	1.842E-05				
THROAT	1.195E-05	1.196E-05	96179.	96155.	1.000	1.000
1.000E-01	4.294E-06	4.625E-06	149991.	149235.	2.088	2.130
1.000E-02	6.676E-07	1.162E-06	184591.	176461.	3.650	3.992
1.000E-03	9.123E-08	2.918E-07	205190.	186195.	4.942	6.675
1.000E-04	1.186E-08	7.329E-08	219397.	189932.	6.115	10.792
5.000E-05	6.375E-09	4.835E-08	222870.	190523.	6.460	12.435
1.000E-05	1.495E-09	1.841E-08	229889.	191399.	7.253	17.235
5.000E-06	7.976E-10	1.214E-08	232535.	191633.	7.593	19.822
1.000E-06	1.844E-10	4.623E-09	237972.	191980.	8.384	27.398
5.000E-07	9.792E-11		240052.		8.727	
1.000E-07	2.245E-11		244372.		9.534	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2989.3	2988.6	4783.3	4781.4
1.000E-01	1.785E 00	1.667E 00	4661.9	4638.4	5319.0	5251.5
1.000E-02	9.326E 00	5.611E 00	5737.3	5484.6	6080.7	5691.0
1.000E-03	6.140E 01	2.117E 01	6377.5	5787.1	6603.6	5865.0
1.000E-04	4.417E 02	8.264E 01	6819.1	5903.3	6981.7	5933.7
5.000E-05	8.090E 02	1.249E 02	6927.0	5921.7	7076.0	5944.6
1.000E-05	3.345E 03	3.265E 02	7145.2	5948.9	7268.4	5960.9
5.000E-06	6.197E 03	4.943E 02	7227.4	5956.1	7341.5	5965.2
1.000E-06	2.619E 04	1.296E 03	7396.4	5966.9	7492.9	5971.7
5.000E-07	4.890E 04		7461.0		7551.1	
1.000E-07	2.095E 05		7595.3		7672.4	

TABLE 34

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.49 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.996 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.996 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.229E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.657E 06	1.657E 06	0.5040	0.5040
THROAT	75022.	75013.	1.411E 06	1.411E 06	0.5041	0.5040
1.000E-01	40226.	39816.	1.063E 06	1.064E 06	0.5055	0.5040
1.000E-02	24616.	15851.	7.979E 05	8.274E 05	0.5494	0.5040
1.000E-03	19768.	6311.	6.245E 05	7.333E 05	0.6133	0.5040
1.000E-04	16725.	2512.	4.956E 05	6.959E 05	0.6782	0.5040
5.000E-05	15990.	1904.	4.628E 05	6.899E 05	0.6977	0.5040
1.000E-05	14503.	1000.	3.952E 05	6.810E 05	0.7427	0.5040
5.000E-06	13939.	758.	3.691E 05	6.786E 05	0.7620	0.5040
1.000E-06	12764.	398.	3.147E 05	6.751E 05	0.8063	0.5040
5.000E-07	12305.		2.935E 05		0.8251	
1.000E-07	11326.		2.489E 05		0.8684	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.381E-05	1.381E-05				
THROAT	8.970E-06	8.970E-06	111043.	111043.	1.000	1.000
1.000E-01	3.443E-06	3.468E-06	172396.	172333.	2.124	2.130
1.000E-02	6.115E-07	8.712E-07	207364.	203772.	3.781	3.992
1.000E-03	8.500E-08	2.188E-07	227329.	215012.	5.246	6.675
1.000E-04	1.111E-08	5.497E-08	241107.	219327.	6.488	10.792
5.000E-05	5.977E-09	3.626E-08	244482.	220010.	6.848	12.435
1.000E-05	1.403E-09	1.381E-08	251314.	221022.	7.673	17.236
5.000E-06	7.488E-10	9.109E-09	253894.	221292.	8.026	19.823
1.000E-06	1.731E-10	3.468E-09	259204.	221692.	8.843	27.400
5.000E-07	9.186E-11		261240.		9.195	
1.000E-07	2.101E-11		265480.		10.020	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3451.3	3451.3	5521.6	5521.5
1.000E-01	1.678E 00	1.667E 00	5358.2	5356.3	6071.2	6064.3
1.000E-02	7.855E 00	5.611E 00	6445.1	6333.4	6778.8	6571.8
1.000E-03	5.155E 01	2.117E 01	7065.6	6682.8	7284.6	6772.7
1.000E-04	3.718E 02	8.263E 01	7493.8	6816.9	7651.8	6852.0
5.000E-05	6.816E 02	1.248E 02	7598.8	6838.1	7743.6	6864.7
1.000E-05	2.825E 03	3.264E 02	7811.1	6869.6	7931.1	6883.4
5.000E-06	5.239E 03	4.942E 02	7891.3	6878.0	8002.6	6888.5
1.000E-06	2.220E 04	1.296E 03	8056.3	6890.4	8150.7	6895.9
5.000E-07	4.151E 04		8119.6		8207.8	
1.000E-07	1.786E 05		8251.4		8327.3	

TABLE 35

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 15000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.813 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.813 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.628E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.150E 06	2.150E 06	0.5040	0.5040
THROAT	112513.	112513.	1.780E 06	1.780E 06	0.5040	0.5040
1.000E-01	59733.	59719.	1.260E 06	1.260E 06	0.5041	0.5040
1.000E-02	27090.	23776.	9.005E 05	9.055E 05	0.5177	0.5040
1.000E-03	20493.	9466.	7.049E 05	7.645E 05	0.5750	0.5040
1.000E-04	17159.	3769.	5.633E 05	7.083E 05	0.6366	0.5040
5.000E-05	16384.	2856.	5.275E 05	6.993E 05	0.655[illegible]	0.5040
1.000E-05	14838.	1501.	4.538E 05	6.860E 05	0.698[illegible]	0.5040
5.000E-06	14258.	1137.	4.255E 05	6.824E 05	0.716[illegible]	0.5040
1.000E-06	13063.	597.	3.663E 05	6.771E 05	0.759[illegible]	0.5040
5.000E-07	12602.	453.	3.433E 05	6.756E 05	0.777[illegible]	0.5040
1.000E-07	11630.		2.948E 05		0.819[illegible]	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.206E-06	9.206E-06				
THROAT	5.980E-06	5.980E-06	136007.	136007.	1.000	1.000
1.000E-01	2.312E-06	2.312E-06	211068.	211067.	2.130	2.130
1.000E-02	5.236E-07	5.808E-07	250082.	249572.	3.873	3.992
1.000E-03	7.688E-08	1.459E-07	268941.	263339.	5.781	6.675
1.000E-04	1.016E-08	3.664E-08	281814.	268625.	7.215	10.792
5.000E-05	5.478E-09	2.417E-08	284972.	269462.	7.612	12.435
1.000E-05	1.289E-09	9.202E-09	291375.	270700.	8.510	17.235
5.000E-06	6.886E-10	6.071E-09	293797.	271031.	8.891	19.821
1.000E-06	1.593E-10	2.311E-09	298795.	271522.	9.768	27.397
5.000E-07	8.452E-11	1.525E-09	300716.	271654.	10.145	31.485
1.000E-07	1.931E-11		304727.		11.021	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4227.2	4227.2	6762.6	6762.6
1.000E-01	1.667E 00	1.667E 00	6560.2	6560.2	7427.4	7427.3
1.000E-02	6.211E 00	5.611E 00	7772.8	7756.9	8096.0	8048.9
1.000E-03	3.934E 01	2.117E 01	8359.0	8184.9	8563.6	8295.0
1.000E-04	2.839E 02	8.264E 01	8759.1	8349.1	8906.8	8392.1
5.000E-05	5.210E 02	1.249E 02	8857.2	8375.1	8992.8	8407.6
1.000E-05	2.165E 03	3.265E 02	9056.2	8413.6	9168.9	8430.6
5.000E-06	4.020E 03	4.943E 02	9131.5	8423.9	9236.1	8436.8
1.000E-06	1.709E 04	1.296E 03	9286.9	8439.2	9375.8	8445.9
5.000E-07	3.200E 04	1.964E 03	9346.5	8443.3	9429.8	8448.4
1.000E-07	1.383E 05		9471.2		9543.1	

TABLE 36

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 0.704 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 0.704 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.912E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.643E 06	2.643E 06	0.5040	0.5040
THROAT	150016.	150016.	2.150E 06	2.150E 06	0.5040	0.5040
1.000E-01	79625.	79623.	1.456E 06	1.456E 06	0.5040	0.5040
1.000E-02	32154.	31700.	9.832E 05	9.837E 05	0.5057	0.5040
1.000E-03	21158.	12621.	7.639E 05	7.956E 05	0.5506	0.5040
1.000E-04	17485.	5025.	6.124E 05	7.207E 05	0.6097	0.5040
5.000E-05	16670.	3808.	5.744E 05	7.087E 05	0.6277	0.5040
1.000E-05	15067.	2000.	4.962E 05	6.909E 05	0.6694	0.5040
5.000E-06	14472.	1516.	4.662E 05	6.861E 05	0.6873	0.5040
1.000E-06	13254.	796.	4.037E 05	6.791E 05	0.7287	0.5040
5.000E-07	12787.	604.	3.793E 05	6.772E 05	0.7464	0.5040
1.000E-07	11809.	317.	3.281E 05	6.743E 05	0.7872	0.5040

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.904E-06	6.904E-06				
THROAT	4.485E-06	4.485E-06	157049.	157048.	1.000	1.000
1.000E-01	1.734E-06	1.734E-06	243719.	243720.	2.130	2.130
1.000E-02	4.309E-07	4.356E-07	288219.	288180.	3.972	3.992
1.000E-03	7.130E-08	1.094E-07	306673.	304077.	6.151	6.676
1.000E-04	9.554E-09	2.748E-08	318800.	310179.	7.863	10.792
5.000E-05	5.158E-09	1.813E-08	321770.	311145.	8.304	12.435
1.000E-05	1.217E-09	6.903E-09	327795.	312575.	9.282	17.236
5.000E-06	6.506E-10	4.554E-09	330077.	312957.	9.693	19.823
1.000E-06	1.506E-10	1.734E-09	334789.	313524.	10.634	27.399
5.000E-07	7.996E-11	1.144E-09	336602.	313676.	11.036	31.488
1.000E-07	1.826E-11	4.355E-10	340393.	313901.	11.969	43.475

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4881.2	4881.2	7808.8	7808.8
1.000E-01	1.667E 00	1.667E 00	7575.0	7575.1	8576.3	8576.3
1.000E-02	5.672E 00	5.611E 00	8958.1	8956.9	9298.9	9294.1
1.000E-03	3.221E 01	2.117E 01	9531.7	9451.0	9725.3	9578.2
1.000E-04	2.313E 02	8.263E 01	9908.6	9640.7	10047.6	9690.3
5.000E-05	4.244E 02	1.249E 02	10000.9	9670.7	10128.4	9708.2
1.000E-05	1.765E 03	3.265E 02	10188.2	9715.2	10294.3	9734.8
5.000E-06	3.280E 03	4.942E 02	10259.1	9727.0	10357.6	9741.9
1.000E-06	1.397E 04	1.296E 03	10405.6	9744.6	10489.5	9752.4
5.000E-07	2.617E 04	1.963E 03	10461.9	9749.4	10540.5	9755.3
1.000E-07	1.133E 05	5.153E 03	10579.8	9756.4	10647.8	9759.5

TABLE 37

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 280.38 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 287.47 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 19.826 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 20.327 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5587
THROAT PRESSURE RATIO(FROZEN) = 0.5438
ENTROPY = 2.248E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	FROZEN	ENTHALPY-BTU/LB EQUIL.	FROZEN	MOLECULAR WT. EQUIL.	FROZEN
CHAMBER	5000.	5000.	2.064E 04	2.064E 04	1.9826	1.9826
THROAT	4547.	4336.	1.787E 04	1.780E 04	1.9992	1.9826
1.000E-01	3153.	2855.	1.132E 04	1.176E 04	2.0157	1.9826
1.000E-02	1718.	1516.	5.929E 03	6.847E 03	2.0160	1.9826
1.000E-03	898.	739.	3.056E 03	4.334E 03	2.0160	1.9826
1.000E-04	464.	334.	1.561E 03	3.150E 03	2.0160	1.9826

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	FROZEN	VELOCITY-FT/SEC EQUIL.	FROZEN	MACH NUMBER EQUIL.	FROZEN
CHAMBER	2.716E-03	2.716E-03				
THROAT	1.682E-03	1.703E-03	11785.	11937.	1.000	1.000
1.000E-01	4.379E-04	4.756E-04	21598.	21084.	2.127	2.147
1.000E-02	8.037E-05	8.956E-05	27141.	26280.	3.546	3.583
1.000E-03	1.537E-05	1.837E-05	29672.	28574.	5.333	5.432
1.000E-04	2.973E-06	4.063E-06	30907.	29593.	7.699	8.192

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	FROZEN	IDEAL ISP-SEC EQUIL.	FROZEN	VAC ISP-SEC EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	366.3	371.0	664.4	654.1
1.000E-01	2.096E 00	2.027E 00	671.3	655.3	783.2	760.8
1.000E-02	9.089E 00	8.636E 00	843.6	816.8	852.1	861.8
1.000E-03	4.347E 01	3.873E 01	922.2	888.1	945.4	908.3
1.000E-04	2.158E 02	1.690E 02	960.6	919.8	972.1	928.6

TABLE 38

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 266.71 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 278.71 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 17.216 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 17.991 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5719
THROAT PRESSURE RATIO(FROZEN) = 0.5419
ENTROPY = 2.454E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	3.207E 04	3.207E 04	1.8527	1.8527
THROAT	5645.	5179.	2.862E 04	2.841E 04	1.8856	1.8527
1.000E-01	4595.	3383.	1.942E 04	2.074E 04	1.9722	1.8527
1.000E-02	2987.	1783.	1.068E 04	1.453E 04	2.0156	1.8527
1.000E-03	1619.	866.	5.579E 03	1.137E 04	2.0160	1.8527
1.000E-04	846.	390.	2.873E 03	9.892E 03	2.0160	1.8527
4.000E-05	651.		2.201E 03		2.0160	
1.000E-05	437.		1.467E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.115E-03	2.115E-03				
THROAT	1.309E-03	1.328E-03	13157.	13550.	1.000	1.000
1.000E-01	2.940E-04	3.751E-04	25165.	23818.	2.152	2.148
1.000E-02	4.621E-05	7.117E-05	32726.	29633.	3.309	3.596
1.000E-03	8.526E-06	1.465E-05	36419.	32190.	4.896	5.460
1.000E-04	1.633E-06	3.250E-06	38234.	33323.	7.082	8.242
4.000E-05	8.485E-07		38671.		8.153	
1.000E-05	3.162E-07		39143.		10.052	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	408.9	421.2	760.4	739.8
1.000E-01	2.327E 00	2.014E 00	782.1	740.3	925.2	858.7
1.000E-02	1.138E 01	8.531E 00	1017.2	921.0	1087.1	971.2
1.000E-03	5.544E 01	3.815E 01	1131.9	1000.5	1166.0	1022.9
1.000E-04	2.757E 02	1.661E 02	1188.3	1035.7	1205.3	1045.5
4.000E-05	5.247E 02		1201.9		1214.8	
1.000E-05	1.391E 03		1216.6		1225.2	

TABLE 39

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 246.00 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 260.85 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 14.701 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 15.589 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5727
THROAT PRESSURE RATIO(FROZEN) = 0.5319
ENTROPY = 2.813E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	5.553E 04	5.553E 04	1.5759	1.5759
THROAT	6627.	5898.	5.080E 04	5.041E 04	1.6141	1.5759
1.000E-01	5652.	3677.	3.810E 04	4.048E 04	1.7299	1.5759
1.000E-02	4640.	1814.	2.505E 04	3.278E 04	1.8704	1.5759
1.000E-03	3701.	833.	1.513E 04	2.910E 04	1.9830	1.5759
1.000E-04	2331.	361.	8.156E 03	2.745E 04	2.0160	1.5759
4.000E-05	1819.		6.290E 03		2.0160	
1.000E-05	1235.		4.228E 03		2.0160	
4.000E-06	953.		3.245E 03		2.0160	
1.000E-06	642.		2.169E 03		2.0160	
4.000E-07	493.		1.659E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.542E-03	1.542E-03				
THROAT	9.554E-04	9.735E-04	15388.	16013.	1.000	1.000
1.000E-01	2.096E-04	2.936E-04	29543.	27450.	2.169	2.145
1.000E-02	2.761E-05	5.949E-05	39064.	33749.	3.305	3.672
1.000E-03	3.670E-06	1.295E-05	44974.	36378.	4.325	5.710
1.000E-04	5.925E-07	2.990E-06	48699.	37493.	5.510	8.798
4.000E-05	3.036E-07		49649.		6.310	
1.000E-05	1.118E-07		50678.		7.780	
4.000E-06	5.796E-08		51161.		8.931	
1.000E-06	2.152E-08		51685.		10.974	
4.000E-07	1.120E-08		51931.		12.559	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	478.3	497.7	890.4	858.7
1.000E-01	2.374E 00	1.934E 00	918.2	853.2	1089.1	984.5
1.000E-02	1.363E 01	7.764E 00	1214.1	1049.0	1312.2	1101.6
1.000E-03	8.907E 01	3.309E 01	1397.8	1130.7	1461.9	1153.1
1.000E-04	5.095E 02	1.390E 02	1513.6	1165.3	1550.3	1174.8
4.000E-05	9.753E 02		1543.1		1571.2	
1.000E-05	2.595E 03		1575.1		1593.8	
4.000E-06	4.957E 03		1590.1		1604.4	
1.000E-06	1.322E 04		1606.4		1615.9	
4.000E-07	2.527E 04		1614.1		1621.3	

TABLE 40

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 223.08 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 240.85 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 12.471 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 13.464 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5692
THROAT PRESSURE RATIO(FROZEN) = 0.5142
ENTROPY = 3.273E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	9.006E 04	9.006E 04	1.2758	1.2758
THROAT	7523.	6448.	8.335E 04	8.260E 04	1.3128	1.2758
1.000E-01	6372.	3736.	6.587E 04	6.991E 04	1.4257	1.2758
1.000E-02	5301.	1666.	4.811E 04	6.068E 04	1.5705	1.2758
1.000E-03	4513.	710.	3.444E 04	5.664E 04	1.7087	1.2758
1.000E-04	3880.	293.	2.363E 04	5.495E 04	1.8384	1.2758
4.000E-05	3649.		1.995E 04		1.8866	
1.000E-05	3293.		1.497E 04		1.9533	
4.000E-06	3018.		1.205E 04		1.9898	
1.000E-06	2364.		8.308E 03		2.0154	
4.000E-07	1853.		6.409E 03		2.0160	
1.000E-07	1258.		4.308E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.092E-03	1.092E-03				
THROAT	6.804E-04	6.969E-04	18329.	19321.	1.000	1.000
1.000E-01	1.532E-04	2.339E-04	34798.	31763.	2.176	2.138
1.000E-02	2.029E-05	5.245E-05	45827.	38353.	3.333	3.804
1.000E-03	2.593E-06	1.231E-05	52765.	40900.	4.366	6.130
1.000E-04	3.245E-07	2.981E-06	57667.	41924.	5.355	9.700
4.000E-05	1.416E-07		59243.		5.745	
1.000E-05	4.063E-08		61312.		6.335	
4.000E-06	1.806E-08		62492.		6.712	
1.000E-06	5.839E-09		63973.		7.251	
4.000E-07	2.981E-09		64711.		8.155	
1.000E-07	1.097E-09		65519.		9.966	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	569.7	600.5	1052.6	1004.6
1.000E-01	2.339E 00	1.812E 00	1081.5	987.2	1279.9	1129.6
1.000E-02	1.341E 01	6.693E 00	1424.4	1192.1	1538.1	1244.6
1.000E-03	9.114E 01	2.674E 01	1640.0	1271.2	1717.3	1292.2
1.000E-04	6.664E 02	1.077E 02	1792.3	1303.0	1848.9	1311.5
4.000E-05	1.486E 03		1841.3		1891.8	
1.000E-05	5.006E 03		1905.6		1948.1	
4.000E-06	1.105E 04		1942.3		1979.8	
1.000E-06	3.338E 04		1988.3		2016.7	
4.000E-07	6.464E 04		2011.3		2033.2	
1.000E-07	1.734E 05		2036.4		2051.1	

TABLE 41

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 210.83 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 229.40 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 11.112 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 12.090 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5657
THROAT PRESSURE RATIO(FROZEN) = 0.4993
ENTROPY = 3.612E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	1.187E 05	1.187E 05	1.1078	1.1078
THROAT	8305.	6976.	1.100E 05	1.088E 05	1.1413	1.1078
1.000E-01	6850.	3838.	8.826E 04	9.363E 04	1.2460	1.1078
1.000E-02	5632.	1599.	6.664E 04	8.304E 04	1.3837	1.1078
1.000E-03	4795.	653.	5.024E 04	7.868E 04	1.5172	1.1078
1.000E-04	4164.	263.	3.730E 04	7.690E 04	1.6460	1.1078
4.000E-05	3950.		3.288E 04		1.6958	
1.000E-05	3655.		2.683E 04		1.7693	
4.000E-06	3474.		2.321E 04		1.8165	
1.000E-06	3211.		1.824E 04		1.8851	
4.000E-07	3036.		1.526E 04		1.9278	
1.000E-07	2735.		1.118E 04		1.9850	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.431E-04	8.431E-04				
THROAT	5.324E-04	5.431E-04	20870.	22263.	1.000	1.000
1.000E-01	1.246E-04	1.977E-04	39032.	35420.	2.189	2.134
1.000E-02	1.683E-05	4.745E-05	51045.	42241.	3.372	3.910
1.000E-03	2.167E-06	1.162E-05	58539.	44756.	4.426	6.445
1.000E-04	2.708E-07	2.881E-06	63831.	45737.	5.425	10.339
4.000E-05	1.176E-07		65541.		5.815	
1.000E-05	3.315E-08		67810.		6.401	
4.000E-06	1.433E-08		69134.		6.787	
1.000E-06	4.021E-09		70912.		7.375	
4.000E-07	1.740E-09		71958.		7.767	
1.000E-07	4.970E-10		73360.		8.354	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	648.6	691.5	1187.3	1128.9
1.000E-01	2.285E 00	1.726E 00	1213.2	1100.9	1430.7	1252.0
1.000E-02	1.294E 01	6.032E 00	1586.5	1312.9	1709.7	1365.7
1.000E-03	8.758E 01	2.325E 01	1819.4	1391.1	1902.8	1411.4
1.000E-04	6.429E 02	9.176E 01	1983.9	1421.5	2045.1	1429.6
4.000E-05	1.441E 03		2037.1		2092.0	
1.000E-05	4.943E 03		2107.6		2154.7	
4.000E-06	1.122E 04		2148.7		2191.5	
1.000E-06	3.897E 04		2204.0		2241.1	
4.000E-07	8.877E 04		2236.5		2270.3	
1.000E-07	3.047E 05		2280.1		2309.1	

TABLE 42

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 208.91 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 225.16 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 10.446 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 11.258 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5642
THROAT PRESSURE RATIO(FROZEN) = 0.4922
ENTROPY = 3.778E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	1.344E 05	1.344E 05	1.0453	1.0453
THROAT	8945.	7604.	1.243E 05	1.226E 05	1.0730	1.0453
1.000E-01	7127.	4094.	9.989E 04	1.054E 05	1.1705	1.0453
1.000E-02	5788.	1660.	7.615E 04	9.363E 04	1.3037	1.0453
1.000E-03	4910.	667.	5.832E 04	8.886E 04	1.4338	1.0453
1.000E-04	4265.	267.	4.432E 04	8.694E 04	1.5599	1.0453
4.000E-05	4050.		3.954E 04		1.6090	
1.000E-05	3757.		3.301E 04		1.6819	
4.000E-06	3581.		2.909E 04		1.7290	
1.000E-06	3333.		2.370E 04		1.7987	
4.000E-07	3178.		2.044E 04		1.8434	
1.000E-07	2948.		1.594E 04		1.9082	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.159E-04	7.159E-04				
THROAT	4.636E-04	4.634E-04	22533.	24293.	1.000	1.000
1.000E-01	1.125E-04	1.749E-04	41571.	38083.	2.207	2.132
1.000E-02	1.543E-05	4.314E-05	54004.	45183.	3.410	3.958
1.000E-03	2.000E-06	1.073E-05	61717.	47752.	4.479	6.582
1.000E-04	2.505E-07	2.682E-06	67155.	48745.	5.489	10.610
4.000E-05	1.088E-07		68913.		5.882	
1.000E-05	3.066E-08		71246.		6.471	
4.000E-06	1.323E-08		72609.		6.858	
1.000E-06	3.696E-09		74446.		7.443	
4.000E-07	1.589E-09		75533.		7.831	
1.000E-07	4.433E-10		77010.		8.425	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	700.4	755.1	1271.8	1217.6
1.000E-01	2.233E 00	1.690E 00	1292.1	1183.6	1518.3	1342.5
1.000E-02	1.254E 01	5.776E 00	1678.5	1404.3	1805.5	1458.6
1.000E-03	8.463E 01	2.197E 01	1918.2	1484.2	2004.0	1504.8
1.000E-04	6.209E 02	8.612E 01	2087.3	1515.0	2150.1	1523.1
4.000E-05	1.393E 03		2141.9		2198.3	
1.000E-05	4.782E 03		2214.4		2262.8	
4.000E-06	1.087E 04		2256.8		2300.8	
1.000E-06	3.796E 04		2313.9		2352.3	
4.000E-07	8.703E 04		2347.6		2382.9	
1.000E-07	3.060E 05		2393.5		2424.5	

TABLE 43

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 203.33 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 212.74 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 9.280 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 9.710 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5316
THROAT PRESSURE RATIO(FROZEN) = 0.4601
ENTROPY = 3.923E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.487E 05	1.487E 05	1.0146	1.0146
THROAT	9908.	8820.	1.367E 05	1.344E 05	1.0304	1.0146
1.000E-01	7434.	4806.	1.104E 05	1.146E 05	1.1118	1.0146
1.000E-02	5930.	1920.	8.459E 04	1.004E 05	1.2403	1.0146
1.000E-03	5006.	766.	6.547E 04	9.476E 04	1.3671	1.0146
1.000E-04	4343.	305.	5.053E 04	9.250E 04	1.4906	1.0146
4.000E-05	4125.		4.544E 04		1.5387	
1.000E-05	3830.		3.848E 04		1.6104	
4.000E-06	3654.		3.431E 04		1.6571	
1.000E-06	3411.		2.856E 04		1.7264	
4.000E-07	3262.		2.509E 04		1.7712	
1.000E-07	3049.		2.027E 04		1.8373	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.791E-04	5.791E-04				
THROAT	3.787E-04	3.626E-04	24505.	26783.	1.000	1.000
1.000E-01	1.024E-04	1.446E-04	43806.	41312.	2.210	2.089
1.000E-02	1.433E-05	3.619E-05	56651.	49162.	3.441	3.930
1.000E-03	1.870E-06	9.073E-06	64551.	51966.	4.526	6.574
1.000E-04	2.351E-07	2.277E-06	70106.	53042.	5.549	10.627
4.000E-05	1.022E-07		71900.		5.946	
1.000E-05	2.880E-08		74282.		6.539	
4.000E-06	1.242E-08		75674.		6.928	
1.000E-06	3.466E-09		77553.		7.515	
4.000E-07	1.488E-09		78666.		7.903	
1.000E-07	4.128E-10		80184.		8.492	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	761.6	832.4	1367.7	1333.8
1.000E-01	2.068E 00	1.625E 00	1361.5	1284.0	1597.3	1461.1
1.000E-02	1.143E 01	5.457E 00	1760.8	1528.0	1891.1	1587.5
1.000E-03	7.687E 01	2.059E 01	2006.3	1615.1	2093.9	1637.6
1.000E-04	5.632E 02	8.040E 01	2179.0	1648.6	2243.2	1657.4
4.000E-05	1.263E 03		2234.7		2292.3	
1.000E-05	4.338E 03		2308.7		2358.2	
4.000E-06	9.872E 03		2352.0		2397.0	
1.000E-06	3.452E 04		2410.4		2449.8	
4.000E-07	7.930E 04		2445.0		2481.2	
1.000E-07	2.804E 05		2492.2		2524.2	

TABLE 44

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.76 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 213.85 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 9.244 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 9.037 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5589
THROAT PRESSURE RATIO(FROZEN) = 0.4633
ENTROPY = 4.006E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.594E 05	1.594E 05	1.0101	1.0101
THROAT	11259.	10304.	1.451E 05	1.426E 05	1.0144	1.0101
1.000E-01	7672.	5587.	1.166E 05	1.193E 05	1.0811	1.0101
1.000E-02	6018.	2227.	8.955E 04	1.028E 05	1.2061	1.0101
1.000E-03	5061.	887.	6.964E 04	9.619E 04	1.3310	1.0101
1.000E-04	4386.	353.	5.414E 04	9.356E 04	1.4528	1.0101
4.000E-05	4165.		4.887E 04		1.5003	
1.000E-05	3868.		4.167E 04		1.5713	
4.000E-06	3692.		3.736E 04		1.6175	
1.000E-06	3449.		3.140E 04		1.6862	
4.000E-07	3301.		2.781E 04		1.7309	
1.000E-07	3093.		2.281E 04		1.7970	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.942E-04	4.942E-04				
THROAT	3.449E-04	3.110E-04	26803.	29055.	1.000	1.000
1.000E-01	9.652E-05	1.238E-04	46297.	44810.	2.260	2.094
1.000E-02	1.373E-05	3.107E-05	59154.	53257.	3.513	3.941
1.000E-03	1.801E-06	7.798E-06	67050.	56272.	4.611	6.597
1.000E-04	2.269E-07	1.958E-06	72604.	57428.	5.644	10.668
4.000E-05	9.869E-08		74399.		6.045	
1.000E-05	2.782E-08		76784.		6.644	
4.000E-06	1.200E-08		78178.		7.036	
1.000E-06	3.349E-09		80061.		7.627	
4.000E-07	1.436E-09		81178.		8.016	
1.000E-07	3.980E-10		82703.		8.607	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	833.1	903.1	1472.7	1445.4
1.000E-01	2.069E 00	1.629E 00	1439.0	1392.7	1675.7	1583.4
1.000E-02	1.138E 01	5.462E 00	1838.6	1655.3	1968.9	1719.2
1.000E-03	7.654E 01	2.059E 01	2084.0	1749.0	2171.6	1773.1
1.000E-04	5.612E 02	8.037E 01	2256.6	1784.9	2320.8	1794.3
4.000E-05	1.259E 03		2312.4		2370.0	
1.000E-05	4.327E 03		2386.5		2436.0	
4.000E-06	9.851E 03		2429.8		2474.9	
1.000E-06	3.448E 04		2488.4		2527.8	
4.000E-07	7.928E 04		2523.1		2559.4	
1.000E-07	2.809E 05		2570.5		2602.6	

TABLE 45

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.39 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.75 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 8.712 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 8.805 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5510
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 4.073E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.695E 05	1.695E 05	1.0089	1.0089
THROAT	12668.	12009.	1.528E 05	1.499E 05	1.0104	1.0089
1.000E-01	7929.	6356.	1.219E 05	1.221E 05	1.0582	1.0089
1.000E-02	6094.	2475.	9.363E 04	1.034E 05	1.1794	1.0089
1.000E-03	5106.	947.	7.307E 04	9.620E 04	1.3027	1.0089
1.000E-04	4419.	359.	5.711E 04	9.345E 04	1.4231	1.0089
4.000E-05	4196.		5.169E 04		1.4702	
1.000E-05	3897.		4.429E 04		1.5405	
4.000E-06	3720.		3.986E 04		1.5863	
1.000E-06	3477.		3.374E 04		1.6545	
4.000E-07	3330.		3.004E 04		1.6989	
1.000E-07	3124.		2.491E 04		1.7649	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.319E-04	4.319E-04				
THROAT	3.010E-04	2.805E-04	28942.	31395.	1.000	1.000
1.000E-01	9.141E-05	1.087E-04	48846.	48726.	2.312	2.124
1.000E-02	1.326E-05	2.792E-05	61647.	57534.	3.594	3.988
1.000E-03	1.747E-06	7.296E-06	69496.	60594.	4.705	6.758
1.000E-04	2.206E-07	1.923E-06	75022.	61720.	5.749	11.151
4.000E-05	9.599E-08		76810.		6.153	
1.000E-05	2.707E-08		79185.		6.758	
4.000E-06	1.168E-08		80575.		7.154	
1.000E-06	3.259E-09		82453.		7.749	
4.000E-07	1.398E-09		83567.		8.142	
1.000E-07	3.870E-10		85091.		8.736	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	899.6	975.8	1568.7	1561.5
1.000E-01	1.951E 00	1.662E 00	1518.2	1514.5	1755.1	1714.2
1.000E-02	1.066E 01	5.481E 00	1916.0	1788.2	2045.5	1854.1
1.000E-03	7.174E 01	1.992E 01	2160.0	1883.3	2247.1	1907.2
1.000E-04	5.265E 02	7.420E 01	2331.8	1918.3	2395.7	1927.2
4.000E-05	1.182E 03		2387.3		2444.7	
1.000E-05	4.064E 03		2461.1		2510.5	
4.000E-06	9.255E 03		2504.3		2549.3	
1.000E-06	3.242E 04		2562.7		2602.1	
4.000E-07	7.459E 04		2597.4		2633.6	
1.000E-07	2.646E 05		2644.7		2676.8	

TABLE 46

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 221.16 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.71 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 8.242 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 8.300 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5425
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 4.132E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.795E 05	1.795E 05	1.0084	1.0084
THROAT	14123.	13511.	1.602E 05	1.573E 05	1.0091	1.0084
1.000E-01	8237.	7158.	1.266E 05	1.261E 05	1.0404	1.0084
1.000E-02	6167.	2794.	9.722E 04	1.050E 05	1.1571	1.0084
1.000E-03	5146.	1071.	7.607E 04	9.686E 04	1.2789	1.0084
1.000E-04	4448.	407.	5.971E 04	9.375E 04	1.3981	1.0084
4.000E-05	4223.		5.416E 04		1.4448	
1.000E-05	3921.		4.658E 04		1.5144	
4.000E-06	3744.		4.204E 04		1.5599	
1.000E-06	3500.		3.579E 04		1.6276	
4.000E-07	3354.		3.200E 04		1.6718	
1.000E-07	3148.		2.675E 04		1.7375	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.837E-04	3.837E-04				
THROAT	2.655E-04	2.492E-04	31048.	33304.	1.000	1.000
1.000E-01	8.652E-05	9.650E-05	51451.	51698.	2.360	2.125
1.000E-02	1.285E-05	2.472E-05	64177.	61060.	3.680	3.985
1.000E-03	1.702E-06	6.449E-06	71955.	64319.	4.806	6.747
1.000E-04	2.153E-07	1.698E-06	77437.	65520.	5.861	11.127
4.000E-05	9.374E-08		79211.		6.270	
1.000E-05	2.645E-08		81571.		6.880	
4.000E-06	1.142E-08		82952.		7.280	
1.000E-06	3.185E-09		84820.		7.881	
4.000E-07	1.366E-09		85928.		8.277	
1.000E-07	3.780E-10		87445.		8.875	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	965.0	1035.1	1661.3	1656.5
1.000E-01	1.852E 00	1.664E 00	1599.2	1606.8	1836.8	1818.9
1.000E-02	9.993E 00	5.499E 00	1994.7	1897.8	2123.0	1967.9
1.000E-03	6.729E 01	2.001E 01	2236.4	1999.1	2322.8	2024.6
1.000E-04	4.944E 02	7.460E 01	2406.8	2036.4	2470.3	2045.9
4.000E-05	1.110E 03		2462.0		2519.0	
1.000E-05	3.820E 03		2535.3		2584.3	
4.000E-06	8.704E 03		2578.2		2622.9	
1.000E-06	3.051E 04		2636.3		2675.4	
4.000E-07	7.023E 04		2670.7		2706.8	
1.000E-07	2.494E 05		2717.9		2749.9	

TABLE 47

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 207.03 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 220.63 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 7.320 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 7.800 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5419
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 4.254E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	2.021E 05	2.021E 05	0.9898	0.9898
THROAT	17139.	15014.	1.793E 05	1.770E 05	1.0022	0.9898
1.000E-01	9447.	7961.	1.374E 05	1.416E 05	1.0151	0.9898
1.000E-02	6344.	3117.	1.049E 05	1.177E 05	1.1129	0.9898
1.000E-03	5232.	1198.	8.244E 04	1.084E 05	1.2313	0.9898
1.000E-04	4508.	456.	6.521E 04	1.048E 05	1.3480	0.9898
4.000E-05	4277.		5.938E 04		1.3937	
1.000E-05	3970.		5.143E 04		1.4621	
4.000E-06	3790.		4.667E 04		1.5067	
1.000E-06	3545.		4.011E 04		1.5734	
4.000E-07	3398.		3.615E 04		1.6169	
1.000E-07	3194.		3.064E 04		1.6818	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.390E-04	3.390E-04				
THROAT	2.170E-04	2.201E-04	33728.	35435.	1.000	1.000
1.000E-01	7.360E-05	8.516E-05	56905.	55011.	2.371	2.126
1.000E-02	1.202E-05	2.175E-05	69739.	64991.	3.858	3.983
1.000E-03	1.612E-06	5.657E-06	77380.	68475.	5.024	6.734
1.000E-04	2.048E-07	1.486E-06	82766.	69762.	6.107	11.092
4.000E-05	8.928E-08		84512.		6.525	
1.000E-05	2.522E-08		86835.		7.150	
4.000E-06	1.089E-08		88196.		7.559	
1.000E-06	3.040E-09		90038.		8.173	
4.000E-07	1.304E-09		91133.		8.577	
1.000E-07	3.607E-10		92632.		9.186	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1048.3	1101.4	1831.5	1762.5
1.000E-01	1.748E 00	1.665E 00	1768.7	1709.8	2021.3	1935.6
1.000E-02	8.735E 00	5.519E 00	2167.5	2020.0	2293.8	2094.8
1.000E-03	5.868E 01	2.014E 01	2405.0	2128.3	2489.9	2155.6
1.000E-04	4.318E 02	7.525E 01	2572.5	2168.3	2634.9	2178.5
4.000E-05	9.700E 02		2626.7		2682.8	
1.000E-05	3.342E 03		2698.9		2747.2	
4.000E-06	7.620E 03		2741.2		2785.3	
1.000E-06	2.674E 04		2798.5		2837.1	
4.000E-07	6.161E 04		2832.5		2868.1	
1.000E-07	2.191E 05		2879.1		2910.8	

TABLE 48

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 172.52 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 191.85 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4.980 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 5.538 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5656
THROAT PRESSURE RATIO(FROZEN) = 0.4878
ENTROPY = 5.346E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	4.855E 05	4.855E 05	0.7538	0.7538
THROAT	28030.	22646.	4.426E 05	4.360E 05	0.7776	0.7538
1.000E-01	23118.	12025.	3.347E 05	3.659E 05	0.8493	0.7538
1.000E-02	18062.	4769.	2.295E 05	3.182E 05	0.9384	0.7538
1.000E-03	12659.	1872.	1.562E 05	2.994E 05	1.0033	0.7538
1.000E-04	5639.	730.	1.182E 05	2.920E 05	1.0172	0.7538
4.000E-05	4945.	501.	1.090E 05	2.906E 05	1.0488	0.7538
1.000E-05	4424.	284.	9.703E 04	2.892E 05	1.1041	0.7538
4.000E-06	4176.		9.006E 04		1.1412	
1.000E-06	3869.		8.059E 04		1.1972	
4.000E-07	3697.		7.492E 04		1.2340	
1.000E-07	3468.		6.710E 04		1.2892	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.721E-04	1.721E-04				
THROAT	1.075E-04	1.112E-04	46336.	49792.	1.000	1.000
1.000E-01	2.516E-05	4.294E-05	86902.	77390.	2.186	2.129
1.000E-02	3.559E-06	1.083E-05	113207.	91515.	3.414	3.984
1.000E-03	5.428E-07	2.758E-06	128393.	96525.	4.526	6.684
1.000E-04	1.236E-07	7.072E-07	135599.	98416.	7.659	10.895
4.000E-05	5.810E-08	4.119E-07	137296.	98789.	8.481	13.192
1.000E-05	1.710E-08	1.819E-07	139456.	99143.	9.405	17.590
4.000E-06	7.488E-09		140701.		9.959	
1.000E-06	2.119E-09		142376.		10.761	
4.000E-07	9.144E-10		143368.		11.277	
1.000E-07	2.546E-10		144727.		12.044	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1440.2	1547.6	2641.8	2479.6
1.000E-01	2.277E 00	1.667E 00	2701.0	2405.4	3184.8	2723.8
1.000E-02	1.236E 01	5.589E 00	3518.6	2844.4	3781.2	2951.2
1.000E-03	7.146E 01	2.080E 01	3990.6	3000.1	4142.4	3039.8
1.000E-04	2.973E 02	7.957E 01	4214.6	3058.9	4277.7	3074.1
4.000E-05	6.243E 02	1.361E 02	4267.3	3070.5	4320.3	3080.9
1.000E-05	2.089E 03	3.071E 02	4334.4	3081.5	4378.8	3087.3
4.000E-06	4.727E 03		4373.1		4413.3	
1.000E-06	1.651E 04		4425.2		4460.2	
4.000E-07	3.799E 04		4456.0		4488.3	
1.000E-07	1.352E 05		4498.3		4527.0	

TABLE 49

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATICN PRESSURE OF 5. ATM AND A STAGNATICN TEMPERATURE OF 40C00. DEG R

THROAT FLCW PARAMETER(EQUIL.) = 149.56 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLCW PARAMETER(FROZEN) = 162.90 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.739 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4.073 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5211
THROAT PRESSURE RATIO(FROZEN) = 0.4895
ENTROPY = 6.743E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MCLECLLAR WT. EQUIL.	MCLECLLAR WT. FROZEN
CHAMBER	40C00.	40000.	9.659E 05	9.659E 05	0.539(	0.5390
THROAT	35734.	30133.	8.763E 05	8.738E 05	0.5589	0.5390
1.000E-C1	28617.	15980.	6.973E 05	7.431E 05	0.612(	0.5390
1.000E-C2	22647.	6360.	5.186E 05	6.544E 05	0.692(	0.5390
1.000E-C3	18692.	2528.	3.897E 05	6.192E 05	0.771(	0.5390
1.000E-C4	15768.	1004.	2.925E 05	6.052E 05	0.8483	0.5390
4.000E-C5	14778.	695.	2.603E 05	6.023E 05	0.8781	0.5390
1.000E-C5	13386.	398.	2.172E 05	5.996E 05	0.921	0.5390
4.000E-C6	12490.		1.920E 05		0.949	
1.000E-06	10996.		1.585E 05		0.987	
4.000E-07	9478.		1.410E 05		1.C04	
1.000E-07	5713.		1.204E 05		1.008	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.230E-05	9.230E-05				
THROAT	5.582E-05	5.997E-05	66979.	67907.	1.C00	1.000
1.000E-01	1.467E-05	2.310E-05	115943.	105608.	2.153	2.131
1.000E-C2	2.093E-06	5.805E-06	149636.	124861.	3.431	3.992
1.000E-C3	2.825E-07	1.460E-06	169836.	131741.	4.592	6.677
1.000E-C4	3.685E-08	3.678E-07	183603.	134377.	5.720	10.805
4.000E-05	1.628E-08	2.125E-07	187943.	134904.	6.168	13.037
1.000E-C5	4.717E-09	9.267E-08	193598.	135408.	6.857	17.282
4.000E-C6	2.083E-09		196827.		7.326	
1.000E-06	6.148E-10		201041.		8.071	
4.000E-C7	2.904E-10		203204.		8.424	
1.000E-07	1.209E-10		205736.		11.481	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2081.8	2110.6	3556.4	3382.2
1.000E-C1	2.198E 00	1.669E 00	3603.6	3282.4	4225.6	3716.0
1.000E-C2	1.194E 01	5.619E 00	4650.8	3880.8	4988.7	4026.8
1.000E-03	7.793E 01	2.117E 01	5278.7	4094.6	5459.2	4149.6
1.000E-C4	5.527E 02	8.241E 01	5706.6	4176.6	5863.0	4198.0
4.000E-C5	1.222E 03	1.421E 02	5841.5	4193.C	5979.8	4207.7
1.000E-05	4.094E 03	3.245E 02	6017.2	4208.6	6133.1	4217.1
4.000E-C6	9.122E 03		6117.6		6220.8	
1.000E-C6	3.025E 04		6248.5		6334.1	
4.000E-07	6.337E 04		6315.8		6387.5	
1.000E-07	1.504E 05		6394.5		6437.0	

TABLE 50

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATICN PRESSURE OF
5. ATM AND A STAGNATICN TEMPERATURE OF 50C00. DEG R

THROAT FLCW PARAMETER(EQUIL.) = 151.36 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.17 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.385 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.537 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4866
THROAT PRESSURE RATIO(FROZEN) = 0.4878
ENTROPY = 7.154E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50C00.	50000.	1.147E 06	1.147E 06	0.5095	0.5095
THROAT	40503.	37582.	1.022E 06	1.025E 06	0.5203	0.5095
1.000E-01	30615.	19953.	8.188E 05	8.532E 05	0.563[illegible]	0.5095
1.000E-02	23663.	7948.	6.137E 05	7.361E 05	0.636[illegible]	0.5095
1.000E-03	19433.	3171.	4.681E 05	6.894E 05	0.711[illegible]	0.5095
1.000E-04	16433.	1267.	3.587E 05	6.707E 05	0.785[illegible]	0.5095
4.000E-05	15450.	879.	3.225E 05	6.670E 05	0.815[illegible]	0.5095
1.000E-05	14117.	506.	2.738E 05	6.633E 05	0.858[illegible]	0.5095
4.000E-06	13313.	351.	2.452E 05	6.618E 05	0.886[illegible]	0.5095
1.000E-06	12165.		2.065E 05		0.927[illegible]	
4.000E-07	11414.		1.836E 05		0.953[illegible]	
1.000E-07	10116.		1.544E 05		0.988[illegible]	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.980E-05	6.980E-05				
THROAT	4.282E-05	4.529E-05	79047.	78088.	1.000	1.00C
1.000E-01	1.261E-05	1.749E-05	128191.	121301.	2.118	2.129
1.000E-02	1.843E-06	4.391E-06	163399.	143445.	3.481	3.992
1.000E-03	2.509E-07	1.101E-06	184370.	151372.	4.681	6.673
1.000E-04	3.276E-08	2.755E-07	198661.	154422.	5.827	10.774
4.000E-05	1.445E-08	1.588E-07	203178.	155036.	6.278	12.983
1.000E-05	4.164E-09	6.895E-08	209086.	155624.	6.961	17.177
4.000E-06	1.824E-09	3.973E-08	212485.	155868.	7.417	2C.648
1.000E-06	5.221E-10		216996.		8.120	
4.000E-07	2.288E-10		219614.		8.601	
1.000E-07	6.694E-11		222927.		9.372	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2456.9	2427.1	3978.0	3886.1
1.000E-01	2.094E 00	1.667E 00	3984.3	3770.2	4638.9	4268.9
1.000E-02	1.124E 01	5.615E 00	5078.6	4458.4	5429.9	4626.4
1.000E-03	7.317E 01	2.123E 01	5730.4	4704.8	5959.2	4768.3
1.000E-04	5.201E 02	8.312E 01	6174.6	4799.6	6337.2	4824.5
4.000E-05	1.153E 03	1.437E 02	6315.0	4818.7	6459.1	4835.9
1.000E-05	3.887E 03	3.296E 02	6498.6	4837.0	6620.1	4846.8
4.000E-06	8.733E 03	5.712E 02	6604.3	4844.5	6713.5	4851.4
1.000E-06	2.987E 04		6744.5		6837.8	
4.000E-07	6.735E 04		6825.8		6910.1	
1.000E-07	2.268E 05		6928.8		6999.7	

TABLE 51

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.23 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.53 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.871 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.876 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4872
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 7.582E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.409E 06	1.409E 06	0.5044	0.5044
THROAT	56477.	56279.	1.225E 06	1.225E 06	0.5051	0.5044
1.000E-01	34374.	29875.	9.568E 05	9.646E 05	0.5227	0.5044
1.000E-02	24860.	11894.	7.175E 05	7.875E 05	0.5870	0.5044
1.000E-03	20163.	4736.	5.528E 05	7.170E 05	0.6574	0.5044
1.000E-04	17011.	1886.	4.303E 05	6.889E 05	0.7279	0.5044
4.000E-05	16003.	1307.	3.898E 05	6.832E 05	0.7557	0.5044
1.000E-05	14663.	751.	3.355E 05	6.777E 05	0.7974	0.5044
4.000E-06	13872.	521.	3.034E 05	6.754E 05	0.8247	0.5044
1.000E-06	12786.	299.	2.600E 05	6.732E 05	0.8653	0.5044
4.000E-07	12123.		2.342E 05		0.8916	
1.000E-07	11165.		1.990E 05		0.9303	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.606E-05	4.606E-05				
THROAT	2.984E-05	2.992E-05	96182.	96128.	1.000	1.000
1.000E-01	1.042E-05	1.156E-05	150515.	149215.	2.086	2.130
1.000E-02	1.617E-06	2.905E-06	186098.	176440.	3.632	3.992
1.000E-03	2.233E-07	7.295E-07	207069.	186174.	4.929	6.675
1.000E-04	2.931E-08	1.832E-07	221381.	189912.	6.126	10.791
4.000E-05	1.294E-08	1.057E-07	225915.	190661.	6.592	13.012
1.000E-05	3.725E-09	4.601E-08	231860.	191379.	7.294	17.233
4.000E-06	1.629E-09	2.655E-08	235292.	191676.	7.757	20.730
1.000E-06	4.635E-10	1.155E-08	239869.	191961.	8.463	27.391
4.000E-07	2.015E-10		242547.		8.934	
1.000E-07	5.707E-11		246155.		9.665	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2989.4	2987.8	4785.2	4780.7
1.000E-01	1.831E 00	1.667E 00	4678.2	4637.7	5353.1	5250.9
1.000E-02	9.537E 00	5.612E 00	5784.1	5483.9	6135.6	5690.4
1.000E-03	6.208E 01	2.118E 01	6435.9	5786.5	6664.7	5864.4
1.000E-04	4.424E 02	8.266E 01	6880.7	5902.6	7043.8	5933.0
4.000E-05	9.821E 02	1.427E 02	7021.7	5925.9	7166.4	5946.9
1.000E-05	3.324E 03	3.266E 02	7206.4	5948.3	7328.9	5960.3
4.000E-06	7.491E 03	5.652E 02	7313.1	5957.5	7423.5	5965.8
1.000E-06	2.582E 04	1.297E 03	7455.4	5966.3	7550.5	5971.1
4.000E-07	5.873E 04		7538.6		7625.2	
1.000E-07	2.043E 05		7650.7		7726.0	

TABLE 52

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.48 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.490 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.490 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 7.667E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.657E 06	1.657E 06	0.5041	0.5041
THROAT	75043.	75020.	1.410E 06	1.410E 06	0.5042	0.5041
1.000E-01	40717.	39822.	1.062E 06	1.063E 06	0.5074	0.5041
1.000E-02	25879.	15854.	7.897E 05	8.272E 05	0.5579	0.5041
1.000E-03	20663.	6312.	6.109E 05	7.332E 05	0.6249	0.5041
1.000E-04	17366.	2513.	4.793E 05	6.957E 05	0.6929	0.5041
4.000E-05	16331.	1742.	4.358E 05	6.881E 05	0.7199	0.5041
1.000E-05	14966.	1000.	3.776E 05	6.808E 05	0.7604	0.5041
4.000E-06	14170.	693.	3.433E 05	6.778E 05	0.7869	0.5041
1.000E-06	13090.	398.	2.968E 05	6.749E 05	0.8267	0.5041
4.000E-07	12440.		2.691E 05		0.8526	
1.000E-07	11529.		2.313E 05		0.8911	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.453E-05	3.453E-05				
THROAT	2.243E-05	2.243E-05	111031.	111031.	1.000	1.000
1.000E-01	8.535E-06	8.671E-06	172474.	172328.	2.118	2.130
1.000E-02	1.477E-06	2.178E-06	208328.	203768.	3.763	3.992
1.000E-03	2.071E-07	5.471E-07	228800.	215009.	5.210	6.675
1.000E-04	2.733E-08	1.374E-07	242776.	219324.	6.472	10.792
4.000E-05	1.208E-08	7.929E-08	247211.	220190.	6.957	13.013
1.000E-05	3.480E-09	3.451E-08	253037.	221019.	7.685	17.235
4.000E-06	1.521E-09	1.992E-08	256405.	221361.	8.164	20.734
1.000E-06	4.326E-10	8.668E-09	260907.	221690.	8.889	27.398
4.000E-07	1.878E-10		263549.		9.371	
1.000E-07	5.294E-11		267121.		10.108	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3450.9	3451.0	5521.6	5521.3
1.000E-01	1.692E 00	1.667E 00	5360.7	5356.1	6079.4	6064.2
1.000E-02	8.095E 00	5.611E 00	6475.1	6333.3	6819.0	6571.7
1.000E-03	5.254E 01	2.117E 01	7111.3	6682.7	7334.5	6772.6
1.000E-04	3.753E 02	8.263E 01	7545.7	6816.8	7705.2	6851.9
4.000E-05	8.340E 02	1.426E 02	7683.6	6843.7	7825.3	6868.0
1.000E-05	2.828E 03	3.265E 02	7864.6	6869.5	7984.8	6883.4
4.000E-06	6.383E 03	5.649E 02	7969.3	6880.1	8077.8	6889.7
1.000E-06	2.206E 04	1.296E 03	8109.3	6890.3	8203.0	6895.8
4.000E-07	5.032E 04		8191.4		8276.9	
1.000E-07	1.761E 05		8302.4		8377.2	

TABLE 53

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2.033 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2.033 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.267E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.150E 06	2.150E 06	0.5040	0.5040
THROAT	112516.	112516.	1.780E 06	1.780E 06	0.5040	0.5040
1.000E-01	59756.	59722.	1.260E 06	1.260E 06	0.5042	0.5040
1.000E-02	28273.	23780.	8.973E 05	9.055E 05	0.5232	0.5040
1.000E-03	21454.	9469.	6.951E 05	7.644E 05	0.5839	0.5040
1.000E-04	17855.	3771.	5.497E 05	7.082E 05	0.6483	0.5040
4.000E-05	16766.	2614.	5.020E 05	6.968E 05	0.6740	0.5040
1.000E-05	15352.	1502.	4.383E 05	6.858E 05	0.7128	0.5040
4.000E-06	14537.	1041.	4.008E 05	6.813E 05	0.7382	0.5040
1.000E-06	13443.	598.	3.499E 05	6.769E 05	0.7765	0.5040
4.000E-07	12794.	414.	3.196E 05	6.751E 05	0.8016	0.5040
1.000E-07	11902.		2.782E 05		0.8391	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.302E-05	2.302E-05				
THROAT	1.495E-05	1.495E-05	136002.	136002.	1.000	1.000
1.000E-01	5.779E-06	5.781E-06	211067.	211065.	2.130	2.130
1.000E-02	1.267E-06	1.452E-06	250391.	249571.	3.861	3.992
1.000E-03	1.864E-07	3.646E-07	269851.	263342.	5.722	6.675
1.000E-04	2.487E-08	9.156E-08	283016.	268628.	7.160	10.790
4.000E-05	1.101E-08	5.283E-08	287200.	269689.	7.692	13.011
1.000E-05	3.180E-09	2.299E-08	292704.	270705.	8.480	17.231
4.000E-06	1.391E-09	1.327E-08	295893.	271125.	8.995	20.728
1.000E-06	3.956E-10	5.774E-09	300165.	271527.	9.770	27.389
4.000E-07	1.716E-10	3.332E-09	302679.	271694.	10.283	32.916
1.000E-07	4.829E-11		306088.		11.061	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4227.1	4227.1	6762.5	6762.5
1.000E-01	1.667E 00	1.667E 00	6560.2	6560.1	7427.6	7427.3
1.000E-02	6.408E 00	5.612E 00	7782.4	7756.9	8115.8	8048.9
1.000E-03	4.042E 01	2.118E 01	8387.3	8184.9	8597.6	8295.1
1.000E-04	2.889E 02	8.268E 01	8796.4	8349.2	8946.7	8392.3
4.000E-05	6.428E 02	1.427E 02	8926.5	8382.2	9060.2	8411.9
1.000E-05	2.185E 03	3.267E 02	9097.5	8413.8	9211.2	8430.8
4.000E-06	4.939E 03	5.653E 02	9196.7	8426.8	9299.5	8438.6
1.000E-06	1.712E 04	1.297E 03	9329.4	8439.3	9418.5	8446.1
4.000E-07	3.914E 04	2.246E 03	9407.6	8444.5	9489.0	8449.2
1.000E-07	1.376E 05		9513.5		9585.1	

TABLE 54

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 5. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1.761 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1.761 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.551E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.643E 06	2.643E 06	0.5040	0.5040
THROAT	150017.	150018.	2.150E 06	2.150E 06	0.5040	0.5040
1.000E-01	79628.	79625.	1.456E 06	1.456E 06	0.5040	0.5040
1.000E-02	32640.	31702.	9.826E 05	9.837E 05	0.5076	0.5040
1.000E-03	22157.	12623.	7.569E 05	7.956E 05	0.5577	0.5040
1.000E-04	18216.	5026.	6.008E 05	7.207E 05	0.6196	0.5040
4.000E-05	17074.	3484.	5.500E 05	7.055E 05	0.6444	0.5040
1.000E-05	15610.	2001.	4.822E 05	6.909E 05	0.6819	0.5040
4.000E-06	14775.	1387.	4.423E 05	6.848E 05	0.7066	0.5040
1.000E-06	13663.	797.	3.883E 05	6.790E 05	0.7437	0.5040
4.000E-07	13008.	552.	3.562E 05	6.766E 05	0.7681	0.5040
1.000E-07	12115.	317.	3.122E 05	6.743E 05	0.8047	0.5040

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.726E-05	1.726E-05				
THROAT	1.121E-05	1.121E-05	157046.	157046.	1.000	1.000
1.000E-01	4.335E-06	4.336E-06	243717.	243718.	2.130	2.130
1.000E-02	1.065E-06	1.089E-06	288267.	288179.	3.954	3.992
1.000E-03	1.724E-07	2.735E-07	307247.	304077.	6.096	6.675
1.000E-04	2.330E-08	6.869E-08	319707.	310180.	7.783	10.791
4.000E-05	1.034E-08	3.964E-08	323661.	311405.	8.368	13.012
1.000E-05	2.992E-09	1.725E-08	328865.	312577.	9.222	17.234
4.000E-06	1.310E-09	9.955E-09	331883.	313062.	9.776	20.732
1.000E-06	3.729E-10	4.333E-09	335931.	313527.	10.605	27.395
4.000E-07	1.618E-10	2.500E-09	338315.	313719.	11.150	32.924
1.000E-07	4.550E-11	1.088E-09	341554.	313904.	11.975	43.467

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4881.1	4881.1	7808.7	7808.7
1.000E-01	1.667E 00	1.667E 00	7575.0	7575.0	8576.3	8576.3
1.000E-02	5.736E 00	5.612E 00	8959.6	8956.9	9304.2	9294.0
1.000E-03	3.324E 01	2.117E 01	9549.5	9451.0	9749.3	9578.2
1.000E-04	2.364E 02	8.265E 01	9936.8	9640.7	10078.9	9690.4
4.000E-05	5.262E 02	1.427E 02	10059.7	9678.8	10186.1	9713.1
1.000E-05	1.790E 03	3.266E 02	10221.5	9715.2	10329.0	9734.8
4.000E-06	4.050E 03	5.650E 02	10315.3	9730.3	10412.6	9743.8
1.000E-06	1.406E 04	1.296E 03	10441.1	9744.7	10525.5	9752.5
4.000E-07	3.217E 04	2.245E 03	10515.2	9750.7	10592.5	9756.1
1.000E-07	1.133E 05	5.155E 03	10615.8	9756.4	10683.9	9759.5

TABLE 55

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 282.53 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 288.04 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 39.955 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 40.735 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5550
THROAT PRESSURE RATIO(FROZEN) = 0.5441
ENTROPY = 2.169E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	2.016E 04	2.016E 04	1.9923	1.9923
THROAT	4502.	4340.	1.738E 04	1.733E 04	2.0053	1.9923
1.000E-01	3071.	2862.	1.099E 04	1.131E 04	2.0158	1.9923
1.000E-02	1668.	1523.	5.749E 03	6.406E 03	2.0160	1.9923
1.000E-03	871.	744.	2.962E 03	3.890E 03	2.0160	1.9923
1.000E-04	450.	337.	1.513E 03	2.703E 03	2.0160	1.9923

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.458E-03	5.458E-03				
THROAT	3.386E-03	3.422E-03	11799.	11905.	1.000	1.000
1.000E-01	8.992E-04	9.536E-04	21421.	21044.	2.133	2.147
1.000E-02	1.656E-04	1.792E-04	26860.	26240.	3.560	3.580
1.000E-03	3.170E-05	3.666E-05	29343.	28540.	5.355	5.424
1.000E-04	6.134E-06	8.096E-06	30554.	29563.	7.729	8.172

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	366.7	370.0	660.7	652.6
1.000E-01	2.074E 00	2.030E 00	665.8	654.1	775.7	759.5
1.000E-02	8.982E 00	8.665E 00	834.8	815.6	882.4	860.6
1.000E-03	4.296E 01	3.893E 01	912.0	887.0	934.8	907.3
1.000E-04	2.132E 02	1.702E 02	949.6	918.8	960.9	927.7

TABLE 56

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 270.90 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 281.40 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 34.974 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 36.329 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5692
THROAT PRESSURE RATIO(FROZEN) = 0.5435
ENTROPY = 2.338E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.955E 04	2.955E 04	1.8975	1.8975
THROAT	5603.	5199.	2.615E 04	2.598E 04	1.9274	1.8975
1.000E-01	4395.	3423.	1.735E 04	1.842E 04	1.9968	1.8975
1.000E-02	2648.	1827.	9.350E 03	1.225E 04	2.0160	1.8975
1.000E-03	1417.	898.	4.863E 03	9.079E 03	2.0160	1.8975
1.000E-04	738.	408.	2.500E 03	7.572E 03	2.0160	1.8975
5.000E-05	605.		2.042E 03		2.0160	
1.000E-05	380.		1.274E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.332E-03	4.332E-03				
THROAT	2.682E-03	2.717E-03	13039.	13370.	1.000	1.000
1.000E-01	6.223E-04	7.593E-04	24715.	23598.	2.141	2.148
1.000E-02	1.043E-04	1.423E-04	31797.	29422.	3.389	3.583
1.000E-03	1.950E-05	2.895E-05	35152.	32010.	5.044	5.416
1.000E-04	3.744E-06	6.364E-06	36797.	33167.	7.292	8.138
5.000E-05	2.282E-06		37107.		8.112	
1.000E-05	7.268E-07		37621.		10.347	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	405.3	415.5	749.6	732.1
1.000E-01	2.274E 00	2.027E 00	768.2	733.4	905.7	851.5
1.000E-02	1.055E 01	8.678E 00	988.3	914.5	1052.1	965.0
1.000E-03	5.103E 01	3.920E 01	1092.6	994.9	1123.4	1017.7
1.000E-04	2.539E 02	1.721E 02	1143.7	1030.9	1159.0	1040.9
5.000E-05	4.129E 02		1153.3		1165.8	
1.000E-05	1.279E 03		1169.3		1177.0	

TABLE 57

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 254.11 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 267.25 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 30.371 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 31.943 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5719
THROAT PRESSURE RATIO(FROZEN) = 0.5368
ENTROPY = 2.618E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	4.785E 04	4.785E 04	1.6780	1.6780
THROAT	6606.	5968.	4.339E 04	4.308E 04	1.7159	1.6780
1.000E-01	5563.	3806.	3.153E 04	3.349E 04	1.8285	1.6780
1.000E-02	4405.	1943.	1.949E 04	2.589E 04	1.9550	1.6780
1.000E-03	3021.	919.	1.085E 04	2.213E 04	2.0148	1.6780
1.000E-04	1646.	406.	5.671E 03	2.041E 04	2.0160	1.6780
5.000E-05	1355.		4.649E 03		2.0160	
1.000E-05	860.		2.921E 03		2.0160	
5.000E-06	705.		2.388E 03		2.0160	
1.000E-06	444.		1.492E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.284E-03	3.284E-03				
THROAT	2.035E-03	2.067E-03	14927.	15451.	1.000	1.000
1.000E-01	4.502E-04	6.040E-04	28582.	26809.	2.167	2.147
1.000E-02	6.080E-05	1.183E-04	37677.	33155.	3.307	3.634
1.000E-03	9.136E-06	2.501E-05	43036.	35876.	4.353	5.580
1.000E-04	1.678E-06	5.656E-06	45948.	37058.	6.129	8.504
5.000E-05	1.019E-06		46502.		6.819	
1.000E-05	3.213E-07		47423.		8.713	
5.000E-06	1.958E-07		47703.		9.666	
1.000E-06	6.220E-08		48171.		12.269	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	463.9	480.2	862.4	835.8
1.000E-01	2.360E 00	1.973E 00	888.4	833.3	1052.8	963.9
1.000E-02	1.326E 01	8.144E 00	1171.0	1030.5	1263.4	1084.4
1.000E-03	7.724E 01	3.560E 01	1337.6	1115.1	1391.4	1138.7
1.000E-04	3.939E 02	1.524E 02	1428.1	1151.8	1455.6	1161.9
5.000E-05	6.411E 02		1445.3		1467.7	
1.000E-05	1.993E 03		1473.9		1487.8	
5.000E-06	3.252E 03		1482.7		1494.0	
1.000E-06	1.014E 04		1497.2		1504.3	

TABLE 58

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 232.62 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 248.39 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 26.007 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 27.771 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5692
THROAT PRESSURE RATIO(FROZEN) = 0.5226
ENTROPY = 3.008E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	7.716E 04	7.716E 04	1.390[illegible]	1.3905
THROAT	7527.	6587.	7.099E 04	7.041E 04	1.429[illegible]	1.3905
1.000E-01	6363.	3945.	5.491E 04	5.821E 04	1.547[illegible]	1.3905
1.000E-02	5253.	1843.	3.858E 04	4.907E 04	1.6961	1.3905
1.000E-03	4407.	812.	2.609E 04	4.492E 04	1.8347	1.3905
1.000E-04	3654.	342.	1.635E 04	4.312E 04	1.9549	1.3905
5.000E-05	3402.		1.388E 04		1.9836	
1.000E-05	2564.		9.062E 03		2.0153	
5.000E-06	2141.		7.457E 03		2.0160	
1.000E-06	1373.		4.710E 03		2.0160	
5.000E-07	1129.		3.858E 03		2.0160	
1.000E-07	715.		2.420E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.381E-03	2.381E-03				
THROAT	1.481E-03	1.511E-03	17565.	18375.	1.000	1.000
1.000E-01	3.330E-04	4.828E-04	33368.	30799.	2.174	2.142
1.000E-02	4.423E-05	1.034E-04	43944.	37494.	3.331	3.742
1.000E-03	5.703E-06	2.346E-05	50562.	40174.	4.372	5.931
1.000E-04	7.329E-07	5.567E-06	55172.	41277.	5.378	9.277
5.000E-05	3.994E-07		56281.		5.673	
1.000E-05	1.077E-07		58385.		6.366	
5.000E-06	6.449E-08		59069.		6.953	
1.000E-06	2.012E-08		60222.		8.775	
5.000E-07	1.223E-08		60575.		9.721	
1.000E-07	3.865E-09		61167.		12.315	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	545.9	571.1	1009.1	969.3
1.000E-01	2.340E 00	1.867E 00	1037.1	957.3	1227.5	1099.6
1.000E-02	1.338E 01	7.166E 00	1365.8	1165.4	1474.7	1220.0
1.000E-03	9.020E 01	2.947E 01	1571.5	1248.6	1644.9	1271.1
1.000E-04	6.431E 02	1.209E 02	1714.8	1282.9	1767.1	1292.1
5.000E-05	1.157E 03		1749.3		1796.3	
1.000E-05	4.137E 03		1814.7		1848.3	
5.000E-06	6.828E 03		1835.9		1863.7	
1.000E-06	2.147E 04		1871.8		1889.2	
5.000E-07	3.511E 04		1882.7		1897.0	
1.000E-07	1.100E 05		1901.1		1910.1	

TABLE 59

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 216.44 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 234.05 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 22.815 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 24.672 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5652
THROAT PRESSURE RATIO(FROZEN) = 0.5065
ENTROPY = 3.372E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	9000.	9000.	1.079E 05	1.079E 05	1.1780	1.1780
THROAT	8361.	7111.	9.972E 04	9.874E 04	1.214[illegible]	1.1780
1.000E-01	6938.	4007.	7.909E 04	8.391E 04	1.325[illegible]	1.1780
1.000E-02	5693.	1724.	5.851E 04	7.336E 04	1.470[illegible]	1.1780
1.000E-03	4822.	718.	4.292E 04	6.889E 04	1.6094	1.1780
1.000E-04	4155.	293.	3.069E 04	6.705E 04	1.7421	1.1780
5.000E-05	3980.		2.751E 04		1.780[illegible]	
1.000E-05	3598.		2.086E 04		1.8663	
5.000E-06	3439.		1.829E 04		1.901[illegible]	
1.000E-06	3044.		1.293E 04		1.974[illegible]	
5.000E-07	2828.		1.089E 04		1.9983	
1.000E-07	2014.		6.994E 03		2.016[illegible]	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.793E-03	1.793E-03				
THROAT	1.125E-03	1.149E-03	20286.	21464.	1.000	1.000
1.000E-01	2.617E-04	4.027E-04	38006.	34686.	2.183	2.136
1.000E-02	3.537E-05	9.359E-05	49747.	41607.	3.365	3.859
1.000E-03	4.572E-06	2.247E-05	57052.	44215.	4.425	6.294
1.000E-04	5.744E-07	5.513E-06	62188.	45247.	5.434	10.033
5.000E-05	3.065E-07		63456.		5.733	
1.000E-05	7.105E-08		66024.		6.428	
5.000E-06	3.787E-08		66993.		6.728	
1.000E-06	8.884E-09		68966.		7.426	
5.000E-07	4.840E-09		69702.		7.701	
1.000E-07	1.371E-09		71088.		8.616	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	630.5	667.1	1154.7	1101.5
1.000E-01	2.294E 00	1.766E 00	1181.2	1078.1	1394.0	1229.6
1.000E-02	1.297E 01	6.336E 00	1546.2	1293.2	1666.4	1347.5
1.000E-03	8.747E 01	2.483E 01	1773.2	1374.3	1854.3	1395.5
1.000E-04	6.388E 02	9.891E 01	1932.9	1406.3	1992.1	1414.8
5.000E-05	1.173E 03		1972.3		2026.7	
1.000E-05	4.863E 03		2052.1		2097.2	
5.000E-06	8.994E 03		2082.2		2123.9	
1.000E-06	3.724E 04		2143.5		2178.1	
5.000E-07	6.763E 04		2166.4		2197.8	
1.000E-07	2.341E 05		2209.5		2231.2	

TABLE 60

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 210.35 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 227.27 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 21.035 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 22.727 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5624
THROAT PRESSURE RATIO(FROZEN) = 0.4962
ENTROPY = 3.591E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	10000.	10000.	1.287E 05	1.287E 05	1.0777	1.0777
THROAT	9074.	7688.	1.187E 05	1.173E 05	1.1100	1.0777
1.000E-01	7309.	4189.	9.470E 04	1.003E 05	1.2138	1.0777
1.000E-02	5924.	1725.	7.125E 04	8.845E 04	1.3530	1.0777
1.000E-03	5003.	700.	5.370E 04	8.362E 04	1.4883	1.0777
1.000E-04	4324.	281.	3.999E 04	8.167E 04	1.6189	1.0777
5.000E-05	4150.		3.643E 04		1.6572	
1.000E-05	3785.		2.897E 04		1.7442	
5.000E-06	3641.		2.607E 04		1.7806	
1.000E-06	3324.		1.996E 04		1.8624	
5.000E-07	3192.		1.757E 04		1.8960	
1.000E-07	2864.		1.255E 04		1.9675	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.476E-03	1.476E-03				
THROAT	9.423E-04	9.529E-04	22323.	23850.	1.000	1.000
1.000E-01	2.275E-04	3.524E-04	41230.	37703.	2.198	2.133
1.000E-02	3.129E-05	8.557E-05	53610.	44863.	3.404	3.931
1.000E-03	4.075E-06	2.109E-05	61256.	47481.	4.481	6.503
1.000E-04	5.129E-07	5.247E-06	66623.	48499.	5.503	10.453
5.000E-05	2.735E-07		67948.		5.805	
1.000E-05	6.313E-08		70642.		6.500	
5.000E-06	3.350E-08		71662.		6.798	
1.000E-06	7.674E-09		73767.		7.494	
5.000E-07	4.069E-09		74573.		7.796	
1.000E-07	9.409E-10		76239.		8.503	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	693.8	741.3	1259.5	1203.3
1.000E-01	2.243E 00	1.711E 00	1281.5	1171.8	1507.1	1331.1
1.000E-02	1.254E 01	5.921E 00	1666.3	1394.4	1792.4	1449.5
1.000E-03	8.427E 01	2.269E 01	1903.9	1475.8	1988.7	1496.9
1.000E-04	6.156E 02	8.931E 01	2070.7	1507.4	2132.6	1515.7
5.000E-05	1.132E 03		2111.9		2168.8	
1.000E-05	4.717E 03		2195.6		2243.1	
5.000E-06	8.762E 03		2227.3		2271.4	
1.000E-06	3.716E 04		2292.7		2330.1	
5.000E-07	6.933E 04		2317.8		2352.7	
1.000E-07	2.932E 05		2369.6		2399.1	

TABLE 61

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 201.81 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 213.17 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 18.423 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 19.460 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5290
THROAT PRESSURE RATIO(FROZEN) = 0.4612
ENTROPY = 3.777E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.475E 05	1.475E 05	1.0211	1.0211
THROAT	10115.	8845.	1.353E 05	1.333E 05	1.0433	1.0211
1.000E-01	7708.	4831.	1.086E 05	1.135E 05	1.1311	1.0211
1.000E-02	6123.	1937.	8.245E 04	9.931E 04	1.2645	1.0211
1.000E-03	5143.	774.	6.314E 04	9.363E 04	1.3957	1.0211
1.000E-04	4441.	309.	4.815E 04	9.136E 04	1.5231	1.0211
5.000E-05	4264.		4.426E 04		1.5607	
1.000E-05	3998.		3.612E 04		1.6464	
5.000E-06	3756.		3.296E 04		1.6826	
1.000E-06	3454.		2.627E 04		1.7649	
5.000E-07	3332.		2.365E 04		1.7995	
1.000E-07	3062.		1.809E 04		1.8770	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.166E-03	1.166E-03				
THROAT	7.474E-04	7.293E-04	24650.	26683.	1.000	1.000
1.000E-01	2.010E-04	2.895E-04	44089.	41237.	2.197	2.089
1.000E-02	2.829E-05	7.221E-05	57056.	49103.	3.437	3.924
1.000E-03	3.718E-06	1.807E-05	64977.	51919.	4.535	6.557
1.000E-04	4.698E-07	4.530E-06	70516.	53002.	5.572	10.593
5.000E-05	2.507E-07		71883.		5.878	
1.000E-05	5.785E-08		74662.		6.579	
5.000E-06	3.068E-08		75716.		6.879	
1.000E-06	7.000E-09		77895.		7.574	
5.000E-07	3.699E-09		78733.		7.874	
1.000E-07	8.397E-10		80482.		8.576	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	766.2	829.3	1373.7	1330.8
1.000E-01	2.079E 00	1.630E 00	1370.3	1281.7	1609.1	1458.9
1.000E-02	1.141E 01	5.488E 00	1773.4	1526.2	1904.4	1585.8
1.000E-03	7.626E 01	2.074E 01	2019.5	1613.7	2107.1	1636.2
1.000E-04	5.561E 02	8.105E 01	2191.7	1647.3	2255.6	1656.2
5.000E-05	1.022E 03		2234.2		2292.9	
1.000E-05	4.265E 03		2320.6		2369.6	
5.000E-06	7.930E 03		2353.3		2398.9	
1.000E-06	3.379E 04		2421.1		2459.9	
5.000E-07	6.326E 04		2447.1		2483.4	
1.000E-07	2.726E 05		2501.5		2532.8	

TABLE 62

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG F

THROAT FLOW PARAMETER(EQUIL.) = 217.78 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 213.98 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 18.406 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 18.085 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5571
THROAT PRESSURE RATIO(FROZEN) = 0.4636
ENTROPY = 3.866E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.591E 05	1.591E 05	1.0121	1.0121
THROAT	11364.	10314.	1.446E 05	1.422E 05	1.0196	1.0121
1.000E-01	7966.	5597.	1.157E 05	1.190E 05	1.0954	1.0121
1.000E-02	6225.	2234.	8.797E 04	1.024E 05	1.2252	1.0121
1.000E-03	5208.	890.	6.777E 04	9.583E 04	1.3543	1.0121
1.000E-04	4492.	355.	5.214E 04	9.320E 04	1.4795	1.0121
5.000E-05	4314.		4.810E 04		1.5170	
1.000E-05	3945.		3.963E 04		1.6018	
5.000E-06	3803.		3.634E 04		1.6378	
1.000E-06	3502.		2.938E 04		1.7196	
5.000E-07	3383.		2.665E 04		1.7542	
1.000E-07	3122.		2.085E 04		1.8323	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.903E-04	9.903E-04				
THROAT	6.847E-04	6.232E-04	26882.	29020.	1.000	1.000
1.000E-01	1.884E-04	2.477E-04	46611.	44784.	2.241	2.094
1.000E-02	2.696E-05	6.207E-05	59652.	53238.	3.503	3.940
1.000E-03	3.562E-06	1.557E-05	67600.	56257.	4.615	6.591
1.000E-04	4.513E-07	3.909E-06	73157.	57416.	5.664	10.656
5.000E-05	2.409E-07		74529.		5.972	
1.000E-05	5.562E-08		77319.		6.680	
5.000E-06	2.950E-08		78378.		6.983	
1.000E-06	6.726E-09		80569.		7.683	
5.000E-07	3.552E-09		81413.		7.984	
1.000E-07	8.040E-10		83177.		8.686	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	835.5	902.0	1476.0	1444.4
1.000E-01	2.096E 00	1.630E 00	1448.7	1391.9	1689.7	1582.7
1.000E-02	1.144E 01	5.473E 00	1854.1	1654.7	1985.6	1718.7
1.000E-03	7.644E 01	2.065E 01	2101.1	1748.5	2188.9	1772.7
1.000E-04	5.575E 02	8.059E 01	2273.8	1784.6	2337.9	1794.0
5.000E-05	1.025E 03		2316.4		2375.4	
1.000E-05	4.280E 03		2403.2		2452.4	
5.000E-06	7.961E 03		2436.1		2481.8	
1.000E-06	3.396E 04		2504.2		2543.2	
5.000E-07	6.366E 04		2530.4		2567.0	
1.000E-07	2.752E 05		2585.2		2616.9	

TABLE 63

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.02 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 17.394 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 17.614 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5503
THROAT PRESSURE RATIO(FROZEN) = 0.4876
ENTROPY = 3.935E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	16000.	16000.	1.694E 05	1.694E 05	1.0097	1.0097
THROAT	12715.	12014.	1.526E 05	1.497E 05	1.0126	1.0097
1.000E-01	8224.	6361.	1.212E 05	1.220E 05	1.0701	1.0097
1.000E-02	6310.	2478.	9.230E 04	1.033E 05	1.1963	1.0097
1.000E-03	5259.	948.	7.138E 04	9.606E 04	1.3236	1.0097
1.000E-04	4531.	360.	5.526E 04	9.330E 04	1.4479	1.0097
5.000E-05	4350.		5.108E 04		1.4846	
1.000E-05	3979.		4.237E 04		1.5686	
5.000E-06	3836.		3.897E 04		1.6043	
1.000E-06	3536.		3.181E 04		1.6856	
5.000E-07	3417.		2.900E 04		1.7200	
1.000E-07	3161.		2.302E 04		1.7982	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	8.645E-04	8.645E-04				
THROAT	6.004E-04	5.613E-04	28972.	31379.	1.000	1.000
1.000E-01	1.782E-04	2.175E-04	49094.	48714.	2.287	2.124
1.000E-02	2.597E-05	5.582E-05	62121.	57525.	3.576	3.987
1.000E-03	3.448E-06	1.458E-05	70043.	60587.	4.702	6.755
1.000E-04	4.378E-07	3.844E-06	75586.	61714.	5.762	11.147
5.000E-05	2.338E-07		76955.		6.074	
1.000E-05	5.401E-08		79740.		6.788	
5.000E-06	2.864E-08		80798.		7.093	
1.000E-06	6.531E-09		82987.		7.799	
5.000E-07	3.448E-09		83831.		8.102	
1.000E-07	7.794E-10		85597.		8.807	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	900.5	975.3	1569.9	1561.0
1.000E-01	1.988E 00	1.663E 00	1525.9	1514.1	1767.7	1713.8
1.000E-02	1.078E 01	5.485E 00	1930.8	1787.9	2061.9	1853.8
1.000E-03	7.202E 01	1.993E 01	2177.0	1883.1	2264.6	1907.0
1.000E-04	5.257E 02	7.426E 01	2349.3	1918.1	2413.2	1927.1
5.000E-05	9.669E 02		2391.8		2450.6	
1.000E-05	4.039E 03		2478.4		2527.5	
5.000E-06	7.516E 03		2511.3		2557.0	
1.000E-06	3.209E 04		2579.3		2618.4	
5.000E-07	6.018E 04		2605.6		2642.2	
1.000E-07	2.607E 05		2660.5		2692.2	

TABLE 64

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG F

THROAT FLOW PARAMETER(EQUIL.) = 221.03 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.73 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 16.474 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 16.601 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5422
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 3.595E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.794E 05	1.794E 05	1.0089	1.0089
THROAT	14143.	13513.	1.601E 05	1.573E 05	1.0101	1.0089
1.000E-01	8519.	7161.	1.262E 05	1.260E 05	1.0504	1.0089
1.000E-02	6387.	2796.	9.605E 04	1.050E 05	1.1724	1.0089
1.000E-03	5302.	1072.	7.450E 04	9.679E 04	1.2983	1.0089
1.000E-04	4563.	407.	5.794E 04	9.367E 04	1.4213	1.0089
5.000E-05	4380.		5.366E 04		1.4577	
1.000E-05	4006.		4.473E 04		1.5410	
5.000E-06	3863.		4.125E 04		1.5764	
1.000E-06	3562.		3.391E 04		1.6572	
5.000E-07	3444.		3.103E 04		1.6915	
1.000E-07	3190.		2.490E 04		1.7695	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.678E-04	7.678E-04				
THROAT	5.304E-04	4.986E-04	31058.	33295.	1.000	1.000
1.000E-01	1.689E-04	1.930E-04	51625.	51691.	2.332	2.125
1.000E-02	2.514E-05	4.943E-05	64603.	61055.	3.656	3.985
1.000E-03	3.354E-06	1.289E-05	72471.	64316.	4.796	6.745
1.000E-04	4.267E-07	3.395E-06	77981.	65517.	5.867	11.125
5.000E-05	2.279E-07		79342.		6.182	
1.000E-05	5.269E-08		82114.		6.904	
5.000E-06	2.795E-08		83167.		7.212	
1.000E-06	6.373E-09		85348.		7.923	
5.000E-07	3.364E-09		86189.		8.229	
1.000E-07	7.598E-10		87950.		8.939	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	965.3	1034.8	1661.7	1656.3
1.000E-01	1.885E 00	1.664E 00	1604.5	1606.6	1847.2	1818.7
1.000E-02	1.014E 01	5.501E 00	2007.9	1897.7	2138.2	1967.8
1.000E-03	6.777E 01	2.002E 01	2252.5	1999.0	2339.5	2024.5
1.000E-04	4.951E 02	7.463E 01	2423.7	2036.3	2487.3	2045.8
5.000E-05	9.109E 02		2466.0		2524.5	
1.000E-05	3.808E 03		2552.2		2601.1	
5.000E-06	7.088E 03		2584.9		2630.4	
1.000E-06	3.029E 04		2652.7		2691.6	
5.000E-07	5.683E 04		2678.8		2715.3	
1.000E-07	2.465E 05		2733.6		2765.3	

TABLE 65

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 210.65 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 221.23 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 14.895 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 15.644 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5281
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 4.097E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.983E 05	1.983E 05	0.9954	0.9954
THROAT	16665.	15015.	1.750E 05	1.734E 05	1.0054	0.9954
1.000E-01	9354.	7963.	1.353E 05	1.382E 05	1.0236	0.9954
1.000E-02	6539.	3118.	1.027E 05	1.144E 05	1.1331	0.9954
1.000E-03	5380.	1198.	7.997E 04	1.052E 05	1.2562	0.9954
1.000E-04	4617.	456.	6.264E 04	1.016E 05	1.3770	0.9954
5.000E-05	4431.		5.817E 04		1.4128	
1.000E-05	4052.		4.885E 04		1.4949	
5.000E-06	3907.		4.522E 04		1.5298	
1.000E-06	3605.		3.758E 04		1.6096	
5.000E-07	3487.		3.457E 04		1.6435	
1.000E-07	3235.		2.818E 04		1.7209	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.818E-04	6.818E-04				
THROAT	4.365E-04	4.427E-04	34127.	35335.	1.000	1.000
1.000E-01	1.499E-04	1.712E-04	56174.	54860.	2.366	2.126
1.000E-02	2.374E-05	4.373E-05	69197.	64814.	3.797	3.983
1.000E-03	3.199E-06	1.138E-05	76969.	68288.	4.970	6.734
1.000E-04	4.085E-07	2.990E-06	82411.	69572.	6.064	11.094
5.000E-05	2.184E-07		83757.		6.385	
1.000E-05	5.054E-08		86498.		7.121	
5.000E-06	2.682E-08		87541.		7.435	
1.000E-06	6.116E-09		89701.		8.159	
5.000E-07	3.228E-09		90535.		8.469	
1.000E-07	7.287E-10		92284.		9.189	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1060.7	1098.2	1810.9	1757.7
1.000E-01	1.769E 00	1.665E 00	1745.9	1705.1	1997.2	1930.3
1.000E-02	9.069E 00	5.519E 00	2150.7	2014.5	2279.6	2089.1
1.000E-03	6.050E 01	2.013E 01	2392.3	2122.5	2478.2	2149.7
1.000E-04	4.424E 02	7.519E 01	2561.4	2162.4	2624.3	2172.5
5.000E-05	8.143E 02		2603.3		2661.1	
1.000E-05	3.407E 03		2688.5		2736.9	
5.000E-06	6.345E 03		2720.9		2765.9	
1.000E-06	2.715E 04		2788.0		2826.6	
5.000E-07	5.096E 04		2813.9		2850.1	
1.000E-07	2.215E 05		2868.3		2899.8	

TABLE 66

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 179.20 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 198.61 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 10.346 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 11.467 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5660
THROAT PRESSURE RATIO(FROZEN) = 0.4880
ENTROPY = 4.947E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	4.189E 05	4.189E 05	0.8094	0.8094
THROAT	27913.	22679.	3.791E 05	3.728E 05	0.8340	0.8094
1.000E-01	22580.	12044.	2.794E 05	3.073E 05	0.9069	0.8094
1.000E-02	16398.	4773.	1.851E 05	2.629E 05	0.9879	0.8094
1.000E-03	7888.	1868.	1.308E 05	2.454E 05	1.0092	0.8094
1.000E-04	5181.	725.	1.040E 05	2.385E 05	1.0839	0.8094
5.000E-05	4901.	545.	9.770E 04	2.375E 05	1.1143	0.8094
1.000E-05	4403.	280.	8.478E 04	2.359E 05	1.1850	0.8094
5.000E-06	4229.		7.983E 04		1.2153	
1.000E-06	3882.		6.946E 04		1.2852	
5.000E-07	3752.		6.542E 04		1.3150	
1.000E-07	3484.		5.685E 04		1.3836	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.696E-04	3.696E-04				
THROAT	2.317E-04	2.386E-04	44661.	48063.	1.000	1.000
1.000E-01	5.502E-05	9.206E-05	83565.	74731.	2.192	2.128
1.000E-02	8.253E-06	2.323E-05	108177.	88374.	3.443	3.982
1.000E-03	1.753E-06	5.936E-06	120083.	93204.	5.560	6.686
1.000E-04	2.866E-07	1.529E-06	125552.	95020.	7.684	10.918
5.000E-05	1.557E-07	1.018E-06	126804.	95303.	8.119	12.628
1.000E-05	3.687E-08	3.955E-07	129329.	95715.	9.062	17.671
5.000E-06	1.968E-08		130284.		9.453	
1.000E-06	4.535E-09		132260.		10.339	
5.000E-07	2.400E-09		133023.		10.715	
1.000E-07	5.440E-10		134626.		11.578	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1388.1	1493.8	2545.6	2394.4
1.000E-01	2.250E 00	1.667E 00	2597.3	2322.7	3057.5	2630.3
1.000E-02	1.159E 01	5.585E 00	3362.2	2746.7	3599.2	2849.8
1.000E-03	4.916E 01	2.072E 01	3732.3	2896.9	3832.9	2935.1
1.000E-04	2.875E 02	7.890E 01	3902.3	2953.3	3961.1	2967.9
5.000E-05	5.239E 02	1.182E 02	3941.2	2962.1	3994.8	2973.0
1.000E-05	2.170E 03	3.029E 02	4019.7	2974.9	4064.0	2980.5
5.000E-06	4.034E 03		4049.3		4090.6	
1.000E-06	1.725E 04		4110.8		4146.1	
5.000E-07	3.240E 04		4134.5		4167.6	
1.000E-07	1.413E 05		4184.3		4213.2	

TABLE 67

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 152.24 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 166.97 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 7.612 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 8.348 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5349
THROAT PRESSURE RATIO(FROZEN) = 0.4912
ENTROPY = 6.322E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	40000.	40000.	8.971E 05	8.971E 05	0.5662	0.5662
THROAT	36211.	30233.	8.150E 05	8.094E 05	0.5869	0.5662
1.000E-01	29157.	16023.	6.387E 05	6.843E 05	0.6473	0.5662
1.000E-02	22995.	6377.	4.665E 05	5.997E 05	0.7315	0.5662
1.000E-03	18828.	2532.	3.432E 05	5.661E 05	0.8149	0.5662
1.000E-04	15673.	1003.	2.510E 05	5.527E 05	0.8952	0.5662
5.000E-05	14829.	759.	2.278E 05	5.506E 05	0.9182	0.5662
1.000E-05	12883.	397.	1.808E 05	5.474E 05	0.9682	0.5662
5.000E-06	11935.		1.633E 05		0.9869	
1.000E-06	8047.		1.319E 05		1.0080	
5.000E-07	6099.		1.223E 05		1.0080	
1.000E-07	3997.		1.073E 05		1.0322	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.939E-04	1.939E-04				
THROAT	1.188E-04	1.260E-04	64090.	66247.	1.000	1.000
1.000E-01	3.041E-05	4.841E-05	113727.	103202.	2.167	2.131
1.000E-02	4.358E-06	1.216E-05	146810.	122011.	3.438	3.992
1.000E-03	5.929E-07	3.064E-06	166523.	128728.	4.610	6.678
1.000E-04	7.824E-08	7.731E-07	179843.	131297.	5.764	10.815
5.000E-05	4.241E-08	5.109E-07	183039.	131702.	6.116	12.470
1.000E-05	1.030E-08	1.953E-07	189361.	132301.	6.963	17.316
5.000E-06	5.664E-09		191660.		7.344	
1.000E-06	1.716E-09		195724.		8.950	
5.000E-07	1.132E-09		196948.		10.588	
1.000E-07	3.537E-10		198833.		13.701	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	1992.0	2059.0	3478.9	3304.0
1.000E-01	2.201E 00	1.671E 00	3534.8	3207.6	4146.6	3631.2
1.000E-02	1.190E 01	5.625E 00	4563.0	3792.2	4893.8	3934.8
1.000E-03	7.709E 01	2.117E 01	5175.7	4001.0	5350.0	4054.6
1.000E-04	5.410E 02	8.225E 01	5589.7	4080.8	5740.1	4101.7
5.000E-05	9.805E 02	1.241E 02	5689.0	4093.4	5825.3	4109.2
1.000E-05	3.905E 03	3.231E 02	5885.5	4112.0	5994.1	4120.2
5.000E-06	7.012E 03		5957.0		6054.5	
1.000E-06	2.266E 04		6083.3		6146.3	
5.000E-07	3.414E 04		6121.3		6168.8	
1.000E-07	1.082E 05		6179.9		6210.0	

TABLE 68

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 150.43 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 6.728 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 7.102 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4922
THROAT PRESSURE RATIO(FROZEN) = 0.4882
ENTROPY = 6.853E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	1.131E 06	1.131E 06	0.5148	0.5148
THROAT	41566.	37656.	1.008E 06	1.011E 06	0.5289	0.5148
1.000E-01	31775.	19999.	8.003E 05	8.398E 05	0.5763	0.5148
1.000E-02	24464.	7970.	5.927E 05	7.236E 05	0.6530	0.5148
1.000E-03	19963.	3186.	4.464E 05	6.772E 05	0.7311	0.5148
1.000E-04	16767.	1277.	3.374E 05	6.587E 05	0.8082	0.5148
5.000E-05	15962.	970.	3.099E 05	6.557E 05	0.8310	0.5148
1.000E-05	14281.	512.	2.535E 05	6.512E 05	0.8829	0.5148
5.000E-06	13614.	389.	2.320E 05	6.500E 05	0.9049	0.5148
1.000E-06	12112.		1.877E 05		0.9527	
5.000E-07	11433.		1.709E 05		0.9719	
1.000E-07	9097.		1.385E 05		1.0056	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.410E-04	1.410E-04				
THROAT	8.580E-05	9.143E-05	78413.	77674.	1.000	1.000
1.000E-01	2.484E-05	3.526E-05	128684.	120772.	2.131	2.129
1.000E-02	3.656E-06	8.848E-06	164173.	142837.	3.484	3.992
1.000E-03	5.017E-07	2.213E-06	185144.	150743.	4.695	6.670
1.000E-04	6.603E-08	5.524E-07	199330.	153793.	5.862	10.756
5.000E-05	3.566E-08	3.636E-07	202754.	154279.	6.211	12.382
1.000E-05	8.468E-09	1.377E-07	209602.	154999.	7.027	17.120
5.000E-06	4.551E-09	9.065E-08	212154.	155193.	7.383	19.668
1.000E-06	1.077E-09		217320.		8.236	
5.000E-07	5.822E-10		219253.		8.623	
1.000E-07	1.514E-10		222913.		9.308	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2437.2	2414.2	3985.2	3868.9
1.000E-01	2.104E 00	1.668E 00	3999.6	3753.7	4661.5	4250.6
1.000E-02	1.121E 01	5.619E 00	5102.7	4439.5	5455.2	4606.9
1.000E-03	7.243E 01	2.129E 01	5754.5	4685.2	5982.3	4748.7
1.000E-04	5.112E 02	8.360E 01	6195.4	4780.1	6356.2	4805.0
5.000E-05	9.306E 02	1.266E 02	6301.8	4795.1	6448.1	4814.0
1.000E-05	3.790E 03	3.327E 02	6514.6	4817.5	6633.9	4827.4
5.000E-06	6.969E 03	5.048E 02	6594.0	4823.5	6703.5	4831.1
1.000E-06	2.873E 04		6754.5		6844.9	
5.000E-07	5.270E 04		6814.6		6897.5	
1.000E-07	1.993E 05		6928.3		6991.0	

TABLE 69

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 156.98 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.55 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 5.732 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 5.753 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4872
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 7.308E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.408E 06	1.408E 06	0.5048	0.5048
THROAT	56681.	56303.	1.223E 06	1.224E 06	0.5061	0.5048
1.000E-01	35632.	29892.	9.524E 05	9.636E 05	0.5287	0.5048
1.000E-02	25835.	11901.	7.069E 05	7.865E 05	0.5963	0.5048
1.000E-03	20829.	4739.	5.391E 05	7.160E 05	0.6694	0.5048
1.000E-04	17472.	1887.	4.153E 05	6.879E 05	0.7425	0.5048
5.000E-05	16650.	1431.	3.841E 05	6.834E 05	0.7643	0.5048
1.000E-05	14973.	752.	3.201E 05	6.768E 05	0.8145	0.5048
5.000E-06	14329.	570.	2.956E 05	6.750E 05	0.8356	0.5048
1.000E-06	12967.	299.	2.449E 05	6.723E 05	0.8843	0.5048
5.000E-07	12421.		2.254E 05		0.9047	
1.000E-07	11186.		1.846E 05		0.9502	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.220E-05	9.220E-05				
THROAT	5.960E-05	5.988E-05	96182.	96084.	1.000	1.000
1.000E-01	2.033E-05	2.313E-05	151045.	149181.	2.090	2.130
1.000E-02	3.162E-06	5.811E-06	187357.	176406.	3.620	3.991
1.000E-03	4.402E-07	1.459E-06	208578.	186140.	4.924	6.675
1.000E-04	5.822E-08	3.664E-07	222941.	189878.	6.141	10.789
5.000E-05	3.144E-08	2.417E-07	226415.	190470.	6.501	12.432
1.000E-05	7.452E-09	9.198E-08	233384.	191346.	7.334	17.228
5.000E-06	3.995E-09	6.068E-08	235993.	191581.	7.694	19.813
1.000E-06	9.341E-10	2.309E-08	241314.	191928.	8.536	27.380
5.000E-07	4.988E-10		243333.		8.905	
1.000E-07	1.164E-10		247486.		9.789	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2989.4	2986.4	4788.0	4779.5
1.000E-01	1.867E 00	1.667E 00	4694.6	4636.7	5383.8	5249.8
1.000E-02	9.676E 00	5.613E 00	5823.2	5482.9	6180.4	5689.3
1.000E-03	6.243E 01	2.118E 01	6482.8	5785.4	6713.3	5863.3
1.000E-04	4.417E 02	8.269E 01	6929.2	5901.6	7092.3	5932.0
5.000E-05	8.052E 02	1.250E 02	7037.2	5920.0	7185.8	5943.0
1.000E-05	3.296E 03	3.269E 02	7253.8	5947.2	7375.5	5959.3
5.000E-06	6.080E 03	4.949E 02	7334.9	5954.5	7447.1	5963.6
1.000E-06	2.543E 04	1.298E 03	7500.3	5965.3	7594.1	5970.1
5.000E-07	4.722E 04		7563.0		7650.2	
1.000E-07	1.991E 05		7692.1		7765.6	

TABLE 70

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.47 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4.980 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4.981 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4874
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 7.594E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	100000.	100000.	1.656E 06	1.656E 06	0.5042	0.5042
THROAT	75078.	75032.	1.410E 06	1.410E 06	0.5044	0.5042
1.000E-01	41341.	39832.	1.061E 06	1.063E 06	0.5098	0.5042
1.000E-02	26910.	15858.	7.822E 05	8.269E 05	0.5652	0.5042
1.000E-03	21379.	6314.	5.994E 05	7.329E 05	0.6348	0.5042
1.000E-04	17870.	2514.	4.658E 05	6.955E 05	0.7053	0.5042
5.000E-05	17026.	1905.	4.322E 05	6.895E 05	0.7265	0.5042
1.000E-05	15321.	1001.	3.634E 05	6.805E 05	0.7752	0.5042
5.000E-06	14675.	759.	3.371E 05	6.782E 05	0.7959	0.5042
1.000E-06	13328.	399.	2.825E 05	6.746E 05	0.8435	0.5042
5.000E-07	12799.		2.614E 05		0.8637	
1.000E-07	11655.		2.173E 05		0.9096	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	6.907E-05	6.907E-05				
THROAT	4.486E-05	4.487E-05	111011.	111013.	1.000	1.000
1.000E-01	1.689E-05	1.734E-05	172584.	172319.	2.112	2.130
1.000E-02	2.877E-06	4.356E-06	209183.	203762.	3.749	3.991
1.000E-03	4.068E-07	1.094E-06	230022.	215004.	5.186	6.675
1.000E-04	5.407E-08	2.748E-07	244128.	219320.	6.465	10.791
5.000E-05	2.923E-08	1.813E-07	247545.	220003.	6.840	12.434
1.000E-05	6.931E-09	6.901E-08	254411.	221014.	7.702	17.234
5.000E-06	3.715E-09	4.553E-08	256985.	221285.	8.073	19.820
1.000E-06	8.670E-10	1.733E-08	262249.	221686.	8.935	27.395
5.000E-07	4.622E-10		264253.		9.310	
1.000E-07	1.069E-10		268397.		10.193	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	3450.3	3450.4	5521.5	5520.9
1.000E-01	1.708E 00	1.667E 00	5364.1	5355.8	6089.9	6064.0
1.000E-02	8.274E 00	5.612E 00	6501.6	6333.1	6853.2	6571.5
1.000E-03	5.322E 01	2.117E 01	7149.3	6682.5	7375.5	6772.5
1.000E-04	3.772E 02	8.265E 01	7587.7	6816.7	7748.0	6851.8
5.000E-05	6.883E 02	1.249E 02	7694.0	6837.9	7840.2	6864.4
1.000E-05	2.824E 03	3.266E 02	7907.3	6869.3	8027.3	6883.2
5.000E-06	5.216E 03	4.944E 02	7987.3	6877.7	8098.2	6888.2
1.000E-06	2.190E 04	1.296E 03	8151.0	6890.2	8244.0	6895.7
5.000E-07	4.077E 04		8213.2		8299.9	
1.000E-07	1.735E 05		8342.1		8415.8	

TABLE 71

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4.067 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4.067 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 7.994E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.150E 06	2.150E 06	0.5041	0.5041
THROAT	112520.	112520.	1.780E 06	1.780E 06	0.5041	0.5041
1.000E-01	59795.	59728.	1.260E 06	1.260E 06	0.5043	0.5041
1.000E-02	29283.	23787.	8.941E 05	9.054E 05	0.5280	0.5041
1.000E-03	22229.	9474.	6.866E 05	7.643E 05	0.5914	0.5041
1.000E-04	18409.	3774.	5.383E 05	7.081E 05	0.6581	0.5041
5.000E-05	17520.	2860.	5.013E 05	6.990E 05	0.6783	0.5041
1.000E-05	15753.	1503.	4.256E 05	6.857E 05	0.7248	0.5041
5.000E-06	15092.	1139.	3.966E 05	6.821E 05	0.7446	0.5041
1.000E-06	13733.	599.	3.366E 05	6.767E 05	0.7907	0.5041
5.000E-07	13209.	454.	3.135E 05	6.753E 05	0.8103	0.5041
1.000E-07	12100.		2.649E 05		0.8551	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.603E-05	4.603E-05				
THROAT	2.990E-05	2.990E-05	135995.	135995.	1.000	1.000
1.000E-01	1.155E-05	1.156E-05	211066.	211061.	2.130	2.130
1.000E-02	2.470E-06	2.903E-06	250704.	249571.	3.856	3.992
1.000E-03	3.644E-07	7.289E-07	270629.	263345.	5.679	6.674
1.000E-04	4.897E-08	1.830E-07	284007.	268635.	7.123	10.788
5.000E-05	2.652E-08	1.207E-07	287251.	269473.	7.532	12.430
1.000E-05	6.303E-09	4.594E-08	293780.	270713.	8.464	17.225
5.000E-06	3.380E-09	3.030E-08	296232.	271044.	8.862	19.809
1.000E-06	7.887E-10	1.153E-08	301260.	271536.	9.781	27.376
5.000E-07	4.202E-10	7.608E-09	303179.	271668.	10.177	31.460
1.000E-07	9.681E-11		307164.		11.103	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4226.9	4226.9	6762.3	6762.3
1.000E-01	1.668E 00	1.667E 00	6560.1	6560.0	7427.9	7427.2
1.000E-02	6.567E 00	5.613E 00	7792.1	7756.9	8133.8	8049.0
1.000E-03	4.124E 01	2.119E 01	8411.4	8185.0	8626.0	8295.3
1.000E-04	2.924E 02	8.273E 01	8827.2	8349.4	8979.3	8392.5
5.000E-05	5.339E 02	1.250E 02	8928.1	8375.5	9067.0	8408.0
1.000E-05	2.196E 03	3.270E 02	9131.0	8414.0	9245.2	8431.0
5.000E-06	4.062E 03	4.951E 02	9207.2	8424.3	9312.9	8437.2
1.000E-06	1.712E 04	1.299E 03	9363.5	8439.6	9452.5	8446.4
5.000E-07	3.193E 04	1.968E 03	9423.1	8443.7	9506.2	8448.8
1.000E-07	1.368E 05		9547.0		9618.1	

TABLE 72

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 10. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3.522 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3.522 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.277E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	200000.	200000.	2.643E 06	2.643E 06	0.5040	0.5040
THROAT	150018.	150020.	2.150E 06	2.150E 06	0.5040	0.5040
1.000E-01	79634.	79629.	1.456E 06	1.456E 06	0.5041	0.5040
1.000E-02	33212.	31707.	9.818E 05	9.836E 05	0.5098	0.5040
1.000E-03	22968.	12626.	7.506E 05	7.955E 05	0.5638	0.5040
1.000E-04	18800.	5028.	5.911E 05	7.206E 05	0.6278	0.5040
5.000E-05	17868.	3811.	5.515E 05	7.086E 05	0.6472	0.5040
1.000E-05	16039.	2002.	4.706E 05	6.908E 05	0.6923	0.5040
5.000E-06	15361.	1518.	4.398E 05	6.860E 05	0.7116	0.5040
1.000E-06	13979.	797.	3.759E 05	6.789E 05	0.7562	0.5040
5.000E-07	13451.	604.	3.513E 05	6.770E 05	0.7753	0.5040
1.000E-07	12345.	318.	2.996E 05	6.741E 05	0.8191	0.5040

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	3.452E-05	3.452E-05				
THROAT	2.243E-05	2.243E-05	157042.	157042.	1.000	1.000
1.000E-01	8.671E-06	8.671E-06	243714.	243715.	2.130	2.130
1.000E-02	2.103E-06	2.178E-06	288332.	288178.	3.937	3.992
1.000E-03	3.362E-07	5.469E-07	307749.	304078.	6.053	6.675
1.000E-04	4.575E-08	1.373E-07	320461.	310183.	7.725	10.790
5.000E-05	2.481E-08	9.060E-08	323539.	311150.	8.174	12.433
1.000E-05	5.913E-09	3.449E-08	329736.	312581.	9.183	17.231
5.000E-06	3.173E-09	2.275E-08	332066.	312963.	9.609	19.816
1.000E-06	7.410E-10	8.660E-09	336848.	313530.	10.590	27.388
5.000E-07	3.948E-10	5.713E-09	338676.	313682.	11.011	31.474
1.000E-07	9.090E-11	2.175E-09	342477.	313908.	11.991	43.453

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	4881.0	4881.0	7808.6	7808.6
1.000E-01	1.667E 00	1.667E 00	7574.9	7574.9	8576.2	8576.2
1.000E-02	5.809E 00	5.612E 00	8961.7	8956.9	9310.7	9294.0
1.000E-03	3.404E 01	2.118E 01	9565.2	9451.0	9769.6	9578.3
1.000E-04	2.403E 02	8.268E 01	9960.2	9640.8	10104.6	9690.5
5.000E-05	4.388E 02	1.249E 02	10055.9	9670.8	10187.7	9708.4
1.000E-05	1.806E 03	3.267E 02	10248.5	9715.3	10357.1	9734.9
5.000E-06	3.343E 03	4.947E 02	10320.9	9727.2	10421.4	9742.1
1.000E-06	1.411E 04	1.297E 03	10469.6	9744.8	10554.3	9752.6
5.000E-07	2.634E 04	1.965E 03	10526.4	9749.6	10605.5	9755.5
1.000E-07	1.131E 05	5.159E 03	10644.5	9756.6	10712.5	9759.7

TABLE 73

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 284.27 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 288.45 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 80.405 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 81.585 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5521
THROAT PRESSURE RATIO(FROZEN) = 0.5443
ENTROPY = 2.093E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	5000.	5000.	1.982E 04	1.982E 04	1.9997	1.9992
THROAT	4464.	4342.	1.703E 04	1.700E 04	2.0091	1.9992
1.000E-01	3014.	2867.	1.077E 04	1.100E 04	2.0159	1.9992
1.000E-02	1633.	1528.	5.625E 03	6.094E 03	2.0160	1.9992
1.000E-03	853.	748.	2.897E 03	3.577E 03	2.0160	1.9992
1.000E-04	440.	339.	1.479E 03	2.387E 03	2.0160	1.9992

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.095E-02	1.095E-02				
THROAT	6.808E-03	6.866E-03	11811.	11882.	1.000	1.000
1.000E-01	1.833E-03	1.911E-03	21289.	21015.	2.138	2.147
1.000E-02	3.383E-04	3.584E-04	26657.	26213.	3.569	3.579
1.000E-03	6.478E-05	7.321E-05	29106.	28515.	5.369	5.418
1.000E-04	1.254E-05	1.615E-05	30300.	29541.	7.749	8.158

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	367.1	369.3	657.7	651.6
1.000E-01	2.061E 00	2.032E 00	661.7	653.2	770.2	758.6
1.000E-02	8.916E 00	8.685E 00	828.5	814.7	875.4	859.8
1.000E-03	4.264E 01	3.908E 01	904.6	886.3	927.1	906.6
1.000E-04	2.116E 02	1.710E 02	941.8	918.2	952.9	927.0

TABLE 74

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 274.43 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 283.38 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 70.856 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 73.168 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5660
THROAT PRESSURE RATIO(FROZEN) = 0.5446
ENTROPY = 2.237E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.775E 04	2.775E 04	1.9307	1.9307
THROAT	5555.	5213.	2.439E 04	2.425E 04	1.9569	1.9307
1.000E-01	4190.	3452.	1.592E 04	1.678E 04	2.0081	1.9307
1.000E-02	2424.	1859.	8.501E 03	1.064E 04	2.0160	1.9307
1.000E-03	1287.	922.	4.410E 03	7.451E 03	2.0160	1.9307
1.000E-04	669.	422.	2.264E 03	5.926E 03	2.0160	1.9307
5.000E-05	549.		1.849E 03		2.0160	
1.000E-05	344.		1.153E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.816E-03	8.816E-03				
THROAT	5.463E-03	5.526E-03	12970.	13240.	1.000	1.000
1.000E-01	1.313E-03	1.532E-03	24335.	23439.	2.132	2.149
1.000E-02	2.279E-04	2.845E-04	31044.	29270.	3.447	3.574
1.000E-03	4.290E-05	5.740E-05	34184.	31880.	5.141	5.384
1.000E-04	8.251E-06	1.253E-05	35721.	33055.	7.428	8.063
5.000E-05	5.033E-06		36010.		8.262	
1.000E-05	1.605E-06		36491.		10.539	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	403.1	411.5	741.2	726.5
1.000E-01	2.218E 00	2.037E 00	756.3	728.5	868.8	846.3
1.000E-02	1.001E 01	8.786E 00	964.9	909.7	1024.7	960.5
1.000E-03	4.831E 01	3.999E 01	1062.5	990.9	1091.3	1014.0
1.000E-04	2.404E 02	1.766E 02	1110.2	1027.4	1124.6	1037.6
5.000E-05	3.909E 02		1119.2		1130.9	
1.000E-05	1.210E 03		1134.2		1141.4	

TABLE 75

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 260.87 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 272.45 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 62.360 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 65.129 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5706
THROAT PRESSURE RATIO(FROZEN) = 0.5404
ENTROPY = 2.457E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	4.216E 04	4.216E 04	1.7624	1.7624
THROAT	6577.	6020.	3.791E 04	3.765E 04	1.7989	1.7624
1.000E-01	5438.	3907.	2.671E 04	2.833E 04	1.9034	1.7624
1.000E-02	4026.	2048.	1.560E 04	2.082E 04	2.0006	1.7624
1.000E-03	2382.	993.	8.346E 03	1.701E 04	2.0160	1.7624
1.000E-04	1264.	447.	4.328E 03	1.522E 04	2.0160	1.7624
5.000E-05	1039.		3.544E 03		2.0160	
1.000E-05	657.		2.221E 03		2.0160	
5.000E-06	538.		1.814E 03		2.0160	
1.000E-06	338.		1.131E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.898E-03	6.898E-03				
THROAT	4.276E-03	4.334E-03	14585.	15027.	1.000	1.000
1.000E-01	9.590E-04	1.236E-03	27813.	26313.	2.164	2.148
1.000E-02	1.361E-04	2.358E-04	36463.	32690.	3.300	3.606
1.000E-03	2.319E-05	4.864E-05	41146.	35487.	4.606	5.482
1.000E-04	4.371E-06	1.080E-05	43521.	36724.	6.606	8.276
5.000E-05	2.658E-06		43970.		7.354	
1.000E-05	8.408E-07		44716.		9.386	
5.000E-06	5.130E-07		44944.		10.408	
1.000E-06	1.636E-07		45322.		13.214	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	453.3	467.1	840.5	818.2
1.000E-01	2.338E 00	2.003E 00	864.5	817.8	1023.1	948.0
1.000E-02	1.256E 01	8.450E 00	1133.3	1016.0	1218.6	1071.0
1.000E-03	6.536E 01	3.773E 01	1278.8	1103.0	1323.2	1127.5
1.000E-04	3.278E 02	1.642E 02	1352.7	1141.4	1374.9	1152.1
5.000E-05	5.335E 02		1366.6		1384.7	
1.000E-05	1.659E 03		1389.8		1401.1	
5.000E-06	2.705E 03		1396.9		1406.1	
1.000E-06	8.408E 03		1408.7		1414.4	

TABLE 76

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 242.29 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 256.06 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 54.177 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 57.256 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5690
THROAT PRESSURE RATIO(FROZEN) = 0.5299
ENTROPY = 2.772E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	6.584E 04	6.584E 04	1.5095	1.5095
THROAT	7519.	6707.	6.016E 04	5.970E 04	1.5492	1.5095
1.000E-01	6319.	4146.	4.534E 04	4.799E 04	1.6687	1.5095
1.000E-02	5140.	2027.	3.035E 04	3.897E 04	1.8166	1.5095
1.000E-03	4168.	926.	1.904E 04	3.468E 04	1.9443	1.5095
1.000E-04	2971.	400.	1.069E 04	3.278E 04	2.0140	1.5095
5.000E-05	2507.		8.821E 03		2.0159	
1.000E-05	1622.		5.588E 03		2.0160	
5.000E-06	1336.		4.581E 03		2.0160	
1.000E-06	847.		2.878E 03		2.0160	
5.000E-07	695.		2.353E 03		2.0160	
1.000E-07	437.		1.469E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.170E-03	5.170E-03				
THROAT	3.212E-03	3.268E-03	16865.	17523.	1.000	1.000
1.000E-01	7.235E-04	9.976E-04	32030.	29890.	2.172	2.145
1.000E-02	9.682E-05	2.040E-04	42147.	36677.	3.332	3.687
1.000E-03	1.278E-05	4.465E-05	48402.	39492.	4.384	5.747
1.000E-04	1.857E-06	1.035E-05	52542.	40683.	5.388	8.870
5.000E-05	1.102E-06		53425.		5.848	
1.000E-05	3.405E-07		54919.		7.377	
5.000E-06	2.067E-07		55376.		8.178	
1.000E-06	6.521E-08		56141.		10.390	
5.000E-07	3.973E-08		56374.		11.506	
1.000E-07	1.263E-08		56765.		14.564	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	524.2	544.6	968.7	936.3
1.000E-01	2.338E 00	1.920E 00	995.5	929.0	1178.1	1070.9
1.000E-02	1.328E 01	7.652E 00	1310.0	1140.0	1413.7	1196.5
1.000E-03	8.758E 01	3.247E 01	1504.4	1227.5	1572.8	1251.5
1.000E-04	5.552E 02	1.360E 02	1633.0	1264.5	1676.4	1274.5
5.000E-05	9.206E 02		1660.5		1696.5	
1.000E-05	2.897E 03		1706.9		1729.6	
5.000E-06	4.733E 03		1721.2		1739.6	
1.000E-06	1.480E 04		1744.9		1756.5	
5.000E-07	2.419E 04		1752.2		1761.6	
1.000E-07	7.558E 04		1764.3		1770.2	

TABLE 77

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 224.48 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 240.40 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 47.325 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 50.680 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5652
THROAT PRESSURE RATIO(FROZEN) = 0.5151
ENTROPY = 3.117E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	9.512E 04	9.512E 04	1.2743	1.2743
THROAT	8389.	7271.	8.750E 04	8.673E 04	1.3131	1.2743
1.000E-01	6977.	4228.	6.830E 04	7.236E 04	1.4301	1.2743
1.000E-02	5702.	1899.	4.912E 04	6.187E 04	1.5806	1.2743
1.000E-03	4789.	814.	3.463E 04	5.725E 04	1.7240	1.2743
1.000E-04	4063.	337.	2.334E 04	5.530E 04	1.8569	1.2743
5.000E-05	3861.		2.043E 04		1.8940	
1.000E-05	3375.		1.443E 04		1.9709	
5.000E-06	3123.		1.217E 04		1.9958	
1.000E-06	2247.		7.850E 03		2.0159	
5.000E-07	1864.		6.449E 03		2.0160	
1.000E-07	1189.		4.065E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.879E-03	3.879E-03				
THROAT	2.424E-03	2.473E-03	19524.	20490.	1.000	1.000
1.000E-01	5.616E-04	8.257E-04	36638.	33754.	2.179	2.139
1.000E-02	7.596E-05	1.838E-04	47987.	40798.	3.361	3.797
1.000E-03	9.864E-06	4.289E-05	55026.	43537.	4.425	6.100
1.000E-04	1.252E-06	1.035E-05	59944.	44643.	5.448	9.631
5.000E-05	6.719E-07		61147.		5.754	
1.000E-05	1.599E-07		63554.		6.464	
5.000E-06	8.753E-08		64438.		6.753	
1.000E-06	2.458E-08		66095.		7.616	
5.000E-07	1.482E-08		66623.		8.371	
1.000E-07	4.647E-09		67513.		10.562	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	606.8	636.9	1112.3	1067.0
1.000E-01	2.300E 00	1.818E 00	1138.7	1049.1	1344.4	1200.9
1.000E-02	1.298E 01	6.757E 00	1491.5	1268.0	1607.6	1324.5
1.000E-03	8.719E 01	2.714E 01	1710.3	1353.2	1788.2	1375.9
1.000E-04	6.305E 02	1.097E 02	1863.1	1387.5	1919.5	1396.7
5.000E-05	1.152E 03		1900.5		1952.0	
1.000E-05	4.656E 03		1975.3		2017.0	
5.000E-06	8.390E 03		2002.8		2040.3	
1.000E-06	2.913E 04		2054.3		2080.3	
5.000E-07	4.793E 04		2070.7		2092.1	
1.000E-07	1.509E 05		2098.4		2111.9	

TABLE 78

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 214.22 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 230.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 42.845 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 46.160 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5615
THROAT PRESSURE RATIO(FROZEN) = 0.5024
ENTROPY = 3.377E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	1.198E 05	1.198E 05	1.131[illegible]	1.1317
THROAT	9166.	7816.	1.102E 05	1.091E 05	1.167[illegible]	1.1317
1.000E-01	7447.	4344.	8.710E 04	9.231E 04	1.278[illegible]	1.1317
1.000E-02	6024.	1837.	6.442E 04	8.050E 04	1.424[illegible]	1.1317
1.000E-03	5063.	757.	4.749E 04	7.557E 04	1.564[illegible]	1.1317
1.000E-04	4346.	307.	3.433E 04	7.355E 04	1.699[illegible]	1.1317
5.000E-05	4160.		3.092E 04		1.738[illegible]	
1.000E-05	3765.		2.382E 04		1.826[illegible]	
5.000E-06	3604.		2.107E 04		1.863[illegible]	
1.000E-06	3232.		1.532E 04		1.941[illegible]	
5.000E-07	3055.		1.310E 04		1.971[illegible]	
1.000E-07	2438.		8.642E 03		2.014[illegible]	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.101E-03	3.101E-03				
THROAT	1.960E-03	1.993E-03	21863.	23160.	1.000	1.000
1.000E-01	4.702E-04	7.137E-04	40453.	37094.	2.190	2.135
1.000E-02	6.476E-05	1.688E-04	52652.	44350.	3.397	3.888
1.000E-03	8.468E-06	4.096E-05	60161.	47052.	4.480	6.376
1.000E-04	1.072E-06	1.011E-05	65408.	48113.	5.513	10.198
5.000E-05	5.726E-07		66699.		5.819	
1.000E-05	1.329E-07		69314.		6.528	
5.000E-06	7.081E-08		70301.		6.833	
1.000E-06	1.646E-08		72319.		7.550	
5.000E-07	8.839E-09		73081.		7.858	
1.000E-07	2.263E-09		74594.		8.441	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	679.5	719.8	1234.1	1180.4
1.000E-01	2.252E 00	1.743E 00	1257.3	1152.9	1479.8	1312.8
1.000E-02	1.256E 01	6.166E 00	1636.5	1378.4	1760.6	1435.0
1.000E-03	8.410E 01	2.395E 01	1869.9	1462.4	1952.9	1484.4
1.000E-04	6.113E 02	9.494E 01	2033.0	1495.4	2093.3	1504.1
5.000E-05	1.122E 03		2073.1		2128.5	
1.000E-05	4.650E 03		2154.4		2200.3	
5.000E-06	8.607E 03		2185.0		2227.5	
1.000E-06	3.599E 04		2247.7		2283.3	
5.000E-07	6.633E 04		2271.4		2304.2	
1.000E-07	2.538E 05		2318.5		2343.5	

TABLE 79

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG F

THROAT FLOW PARAMETER(EQUIL.) = 200.93 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 214.00 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 36.684 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 39.071 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5267
THROAT PRESSURE RATIO(FROZEN) = 0.4631
ENTROPY = 3.624E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.452E 05	1.452E 05	1.0335	1.0335
THROAT	10336.	8893.	1.329E 05	1.311E 05	1.0626	1.0335
1.000E-01	7980.	4879.	1.061E 05	1.114E 05	1.1568	1.0335
1.000E-02	6314.	1969.	7.960E 04	9.722E 04	1.2955	1.0335
1.000E-03	5276.	790.	6.022E 04	9.150E 04	1.4314	1.0335
1.000E-04	4532.	316.	4.527E 04	8.921E 04	1.5625	1.0335
5.000E-05	4345.		4.140E 04		1.6016	
1.000E-05	3958.		3.334E 04		1.6896	
5.000E-06	3807.		3.021E 04		1.7266	
1.000E-06	3483.		2.362E 04		1.8103	
5.000E-07	3351.		2.104E 04		1.8451	
1.000E-07	3049.		1.561E 04		1.9220	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.360E-03	2.360E-03				
THROAT	1.483E-03	1.475E-03	24729.	26494.	1.000	1.000
1.000E-01	3.971E-04	5.803E-04	44245.	41094.	2.186	2.091
1.000E-02	5.621E-05	1.438E-04	57290.	48990.	3.433	3.913
1.000E-03	7.434E-06	3.584E-05	65208.	51830.	4.543	6.525
1.000E-04	9.447E-07	8.967E-06	70716.	52924.	5.595	10.529
5.000E-05	5.049E-07		72070.		5.906	
1.000E-05	1.170E-07		74819.		6.620	
5.000E-06	6.213E-08		75859.		6.926	
1.000E-06	1.424E-08		78002.		7.636	
5.000E-07	7.543E-09		78824.		7.944	
1.000E-07	1.727E-09		80532.		8.667	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	768.6	823.5	1376.2	1325.1
1.000E-01	2.088E 00	1.638E 00	1375.2	1277.3	1616.0	1454.7
1.000E-02	1.139E 01	5.547E 00	1780.6	1522.7	1912.0	1582.7
1.000E-03	7.568E 01	2.103E 01	2026.7	1610.9	2114.0	1633.7
1.000E-04	5.491E 02	8.233E 01	2197.9	1644.9	2261.3	1653.8
5.000E-05	1.008E 03		2240.0		2298.2	
1.000E-05	4.192E 03		2325.4		2373.8	
5.000E-06	7.783E 03		2357.8		2402.7	
1.000E-06	3.302E 04		2424.4		2462.5	
5.000E-07	6.170E 04		2449.9		2485.5	
1.000E-07	2.638E 05		2503.0		2533.4	

TABLE 80

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 216.56 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 214.24 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 36.604 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 36.213 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5547
THROAT PRESSURE RATIO(FROZEN) = 0.4643
ENTROPY = 3.725E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	14000.	14000.	1.583E 05	1.583E 05	1.0161	1.0161
THROAT	11516.	10333.	1.437E 05	1.415E 05	1.0282	1.0161
1.000E-01	8276.	5616.	1.143E 05	1.183E 05	1.1129	1.0161
1.000E-02	6440.	2247.	8.608E 04	1.017E 05	1.2477	1.0161
1.000E-03	5358.	897.	6.562E 04	9.513E 04	1.3812	1.0161
1.000E-04	4599.	358.	4.990E 04	9.249E 04	1.5108	1.0161
5.000E-05	4410.		4.585E 04		1.5490	
1.000E-05	4020.		3.739E 04		1.6361	
5.000E-06	3869.		3.411E 04		1.6730	
1.000E-06	3550.		2.719E 04		1.7566	
5.000E-07	3422.		2.449E 04		1.7917	
1.000E-07	3140.		1.876E 04		1.8706	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.988E-03	1.988E-03				
THROAT	1.357E-03	1.251E-03	26977.	28951.	1.000	1.000
1.000E-01	3.684E-04	4.957E-04	46920.	44734.	2.224	2.095
1.000E-02	5.308E-05	1.239E-04	60123.	53201.	3.495	3.936
1.000E-03	7.062E-06	3.104E-05	68108.	56229.	4.622	6.580
1.000E-04	9.000E-07	7.787E-06	73658.	57393.	5.687	10.633
5.000E-05	4.812E-07		75023.		6.000	
1.000E-05	1.115E-07		77794.		6.721	
5.000E-06	5.923E-08		78843.		7.030	
1.000E-06	1.356E-08		81009.		7.744	
5.000E-07	7.172E-09		81841.		8.052	
1.000E-07	1.632E-09		83575.		8.773	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	838.5	899.8	1479.8	1442.4
1.000E-01	2.117E 00	1.633E 00	1458.3	1390.4	1703.1	1581.2
1.000E-02	1.147E 01	5.493E 00	1868.7	1653.5	2001.3	1717.7
1.000E-03	7.610E 01	2.075E 01	2116.9	1747.7	2204.8	1771.9
1.000E-04	5.522E 02	8.103E 01	2289.4	1783.8	2353.2	1793.3
5.000E-05	1.014E 03		2331.8		2390.4	
1.000E-05	4.220E 03		2417.9		2466.7	
5.000E-06	7.838E 03		2450.5		2495.8	
1.000E-06	3.333E 04		2517.8		2556.4	
5.000E-07	6.236E 04		2543.7		2579.8	
1.000E-07	2.684E 05		2597.6		2628.6	

TABLE 81

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 219.41 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.90 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 34.691 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 35.243 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5491
THROAT PRESSURE RATIO(FROZEN) = 0.4878
ENTROPY = 3.797E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	16000.	16000.	1.691E 05	1.691E 05	1.0114	1.0114
THROAT	12795.	12023.	1.522E 05	1.494E 05	1.0167	1.0114
1.000E-01	8544.	6371.	1.204E 05	1.217E 05	1.0843	1.0114
1.000E-02	6536.	2484.	9.075E 04	1.030E 05	1.2155	1.0114
1.000E-03	5417.	951.	6.950E 04	9.576E 04	1.3472	1.0114
1.000E-04	4644.	361.	5.323E 04	9.301E 04	1.4754	1.0114
5.000E-05	4453.		4.904E 04		1.5132	
1.000E-05	4060.		4.030E 04		1.5996	
5.000E-06	3909.		3.691E 04		1.6362	
1.000E-06	3591.		2.976E 04		1.7195	
5.000E-07	3465.		2.697E 04		1.7546	
1.000E-07	3191.		2.104E 04		1.8339	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.732E-03	1.732E-03				
THROAT	1.195E-03	1.124E-03	29021.	31346.	1.000	1.000
1.000E-01	3.477E-04	4.350E-04	49375.	48690.	2.265	2.124
1.000E-02	5.095E-05	1.115E-04	62612.	57507.	3.562	3.985
1.000E-03	6.814E-06	2.914E-05	70596.	60573.	4.703	6.750
1.000E-04	8.704E-07	7.680E-06	76146.	61702.	5.780	11.138
5.000E-05	4.655E-07		77512.		6.097	
1.000E-05	1.079E-07		80285.		6.824	
5.000E-06	5.734E-08		81335.		7.135	
1.000E-06	1.312E-08		83505.		7.855	
5.000E-07	6.936E-09		84339.		8.164	
1.000E-07	1.575E-09		86082.		8.887	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	902.0	974.2	1571.9	1560.0
1.000E-01	2.021E 00	1.664E 00	1534.6	1513.3	1781.1	1713.2
1.000E-02	1.087E 01	5.494E 00	1946.0	1787.4	2078.7	1853.4
1.000E-03	7.211E 01	1.997E 01	2194.2	1882.7	2282.2	1906.7
1.000E-04	5.234E 02	7.437E 01	2366.7	1917.8	2430.6	1926.7
5.000E-05	9.614E 02		2409.1		2467.8	
1.000E-05	4.003E 03		2495.3		2544.2	
5.000E-06	7.439E 03		2528.0		2573.4	
1.000E-06	3.167E 04		2595.4		2634.1	
5.000E-07	5.930E 04		2621.4		2657.5	
1.000E-07	2.559E 05		2675.5		2706.7	

TABLE 82

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.78 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.78 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 32.912 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 33.210 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5417
THROAT PRESSURE RATIO(FROZEN) = 0.4877
ENTROPY = 3.857E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.793E 05	1.793E 05	1.0097	1.0097
THROAT	14182.	13518.	1.600E 05	1.571E 05	1.0121	1.0097
1.000E-01	8832.	7167.	1.256E 05	1.259E 05	1.0624	1.0097
1.000E-02	6620.	2800.	9.470E 04	1.048E 05	1.1898	1.0097
1.000E-03	5465.	1074.	7.277E 04	9.664E 04	1.3199	1.0097
1.000E-04	4680.	408.	5.603E 04	9.352E 04	1.4468	1.0097
5.000E-05	4487.		5.173E 04		1.4843	
1.000E-05	4092.		4.275E 04		1.5700	
5.000E-06	3940.		3.927E 04		1.6064	
1.000E-06	3623.		3.193E 04		1.6893	
5.000E-07	3497.		2.906E 04		1.7243	
1.000E-07	3227.		2.296E 04		1.8037	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.537E-03	1.537E-03				
THROAT	1.059E-03	9.980E-04	31076.	33277.	1.000	1.000
1.000E-01	3.296E-04	3.860E-04	51839.	51679.	2.306	2.125
1.000E-02	4.924E-05	9.880E-05	65060.	61047.	3.634	3.984
1.000E-03	6.616E-06	2.577E-05	73011.	64309.	4.790	6.742
1.000E-04	8.469E-07	6.786E-06	78539.	65511.	5.879	11.120
5.000E-05	4.531E-07		79900.		6.199	
1.000E-05	1.051E-07		82664.		6.934	
5.000E-06	5.584E-08		83712.		7.247	
1.000E-06	1.278E-08		85878.		7.973	
5.000E-07	6.754E-09		86711.		8.285	
1.000E-07	1.531E-09		88453.		9.011	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	965.9	1034.3	1662.4	1655.7
1.000E-01	1.927E 00	1.665E 00	1611.2	1606.2	1858.9	1818.4
1.000E-02	1.027E 01	5.506E 00	2022.1	1897.4	2154.3	1967.5
1.000E-03	6.813E 01	2.004E 01	2269.2	1998.8	2356.8	2024.3
1.000E-04	4.948E 02	7.470E 01	2441.1	2036.2	2504.7	2045.7
5.000E-05	9.090E 02		2483.4		2541.8	
1.000E-05	3.787E 03		2569.3		2618.0	
5.000E-06	7.040E 03		2601.9		2647.1	
1.000E-06	3.000E 04		2669.2		2707.7	
5.000E-07	5.620E 04		2695.1		2731.2	
1.000E-07	2.430E 05		2749.2		2780.4	

TABLE 83

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 213.69 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 221.68 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 30.220 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 31.351 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5163
THROAT PRESSURE RATIO(FROZEN) = 0.4876
ENTROPY = 3.945E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.956E 05	1.956E 05	0.9997	0.9997
THROAT	16256.	15019.	1.719E 05	1.708E 05	1.0077	0.9997
1.000E-01	9457.	7967.	1.336E 05	1.357E 05	1.0351	0.9997
1.000E-02	6758.	3120.	1.006E 05	1.120E 05	1.1537	0.9997
1.000E-03	5538.	1199.	7.762E 04	1.028E 05	1.281[illegible]	0.9997
1.000E-04	4733.	456.	6.018E 04	9.930E 04	1.4064	0.9997
5.000E-05	4536.		5.570E 04		1.4434	
1.000E-05	4136.		4.637E 04		1.5281	
5.000E-06	3984.		4.276E 04		1.5640	
1.000E-06	3665.		3.514E 04		1.6461	
5.000E-07	3540.		3.216E 04		1.6809	
1.000E-07	3273.		2.583E 04		1.7601	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.369E-03	1.369E-03				
THROAT	8.770E-04	8.892E-04	34460.	35257.	1.000	1.000
1.000E-01	2.999E-04	3.438E-04	55709.	54748.	2.345	2.126
1.000E-02	4.677E-05	8.778E-05	68966.	64685.	3.748	3.982
1.000E-03	6.339E-06	2.284E-05	76853.	68154.	4.931	6.732
1.000E-04	8.142E-07	6.006E-06	82336.	69434.	6.040	11.094
5.000E-05	4.359E-07		83687.		6.366	
1.000E-05	1.012E-07		86432.		7.112	
5.000E-06	5.378E-08		87473.		7.431	
1.000E-06	1.231E-08		89625.		8.167	
5.000E-07	6.504E-09		90455.		8.483	
1.000E-07	1.473E-09		92190.		9.217	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1071.1	1095.8	1754.1	1754.0
1.000E-01	1.809E 00	1.666E 00	1731.5	1701.6	1984.8	1926.5
1.000E-02	9.368E 00	5.521E 00	2143.5	2010.5	2274.7	2085.0
1.000E-03	6.203E 01	2.014E 01	2388.7	2118.3	2475.5	2145.5
1.000E-04	4.508E 02	7.518E 01	2559.1	2158.1	2622.2	2168.2
5.000E-05	8.284E 02		2601.1		2659.1	
1.000E-05	3.454E 03		2686.4		2734.8	
5.000E-06	6.424E 03		2718.7		2763.7	
1.000E-06	2.740E 04		2785.6		2824.0	
5.000E-07	5.137E 04		2811.4		2847.4	
1.000E-07	2.225E 05		2865.4		2896.5	

TABLE 84

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 185.10 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 204.22 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 21.374 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 23.582 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5654
THROAT PRESSURE RATIO(FROZEN) = 0.4882
ENTROPY = 4.614E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	3.686E 05	3.686E 05	0.8572	0.8572
THROAT	27731.	22709.	3.310E 05	3.250E 05	0.8819	0.8572
1.000E-01	21735.	12062.	2.384E 05	2.631E 05	0.9523	0.8572
1.000E-02	13073.	4777.	1.560E 05	2.211E 05	1.0070	0.8572
1.000E-03	6457.	1864.	1.171E 05	2.046E 05	1.0448	0.8572
1.000E-04	5156.	721.	9.319E 04	1.981E 05	1.1515	0.8572
5.000E-05	4907.	541.	8.726E 04	1.971E 05	1.1843	0.8572
1.000E-05	4433.	277.	7.506E 04	1.957E 05	1.2600	0.8572
5.000E-06	4261.		7.037E 04		1.2923	
1.000E-06	3913.		6.054E 04		1.3665	
5.000E-07	3781.		5.671E 04		1.3981	
1.000E-07	3507.		4.859E 04		1.4709	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.828E-04	7.828E-04				
THROAT	4.927E-04	5.048E-04	43385.	46711.	1.000	1.000
1.000E-01	1.200E-04	1.947E-04	80746.	72657.	2.197	2.128
1.000E-02	2.111E-05	4.916E-05	103173.	85925.	3.326	3.980
1.000E-03	4.433E-06	1.260E-05	112210.	90615.	5.948	6.687
1.000E-04	6.119E-07	3.259E-06	117416.	92373.	7.431	10.937
5.000E-05	3.306E-07	2.171E-06	118674.	92646.	7.830	12.658
1.000E-05	7.787E-08	8.468E-07	121220.	93043.	8.727	17.740
5.000E-06	4.155E-08		122185.		9.104	
1.000E-06	9.567E-09		124182.		9.966	
5.000E-07	5.065E-09		124952.		10.334	
1.000E-07	1.149E-09		126568.		11.179	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1348.4	1451.8	2468.0	2327.9
1.000E-01	2.205E 00	1.667E 00	2509.7	2258.3	2946.3	2557.4
1.000E-02	9.816E 00	5.582E 00	3206.7	2670.6	3401.1	2770.8
1.000E-03	4.296E 01	2.066E 01	3487.6	2816.4	3572.7	2853.5
1.000E-04	2.975E 02	7.834E 01	3649.4	2871.1	3708.3	2885.1
5.000E-05	5.447E 02	1.172E 02	3688.5	2879.5	3742.4	2890.0
1.000E-05	2.264E 03	2.993E 02	3767.7	2891.9	3812.5	2897.2
5.000E-06	4.211E 03		3797.6		3839.3	
1.000E-06	1.799E 04		3859.7		3895.3	
5.000E-07	3.377E 04		3883.6		3917.1	
1.000E-07	1.470E 05		3933.9		3963.0	

TABLE 85

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.13 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 172.86 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 15.713 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 17.286 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5463
THROAT PRESSURE RATIO(FROZEN) = 0.4938
ENTROPY = 5.859E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	40000.	40000.	8.060E 05	8.060E 05	0.6068	0.6068
THROAT	36544.	30383.	7.316E 05	7.242E 05	0.6288	0.6068
1.000E-01	29437.	16089.	5.632E 05	6.065E 05	0.6952	0.6068
1.000E-02	23071.	6402.	4.017E 05	5.273E 05	0.7851	0.6068
1.000E-03	18634.	2538.	2.869E 05	4.958E 05	0.8727	0.6068
1.000E-04	15042.	1003.	2.026E 05	4.833E 05	0.9532	0.6068
5.000E-05	13947.	758.	1.819E 05	4.813E 05	0.9749	0.6068
1.000E-05	10256.	395.	1.435E 05	4.784E 05	1.0068	0.6068
5.000E-06	7899.		1.311E 05		1.0080	
1.000E-06	4660.		1.124E 05		1.0227	
5.000E-07	4316.		1.064E 05		1.0459	
1.000E-07	3865.		9.429E 04		1.1049	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	4.156E-04	4.156E-04				
THROAT	2.575E-04	2.702E-04	61011.	63975.	1.000	1.000
1.000E-01	6.470E-05	1.033E-04	110245.	99926.	2.179	2.132
1.000E-02	9.324E-06	2.597E-05	142263.	118128.	3.448	3.992
1.000E-03	1.283E-06	6.551E-06	161197.	124625.	4.637	6.679
1.000E-04	1.736E-07	1.658E-06	173801.	127104.	5.839	10.829
5.000E-05	9.572E-08	1.097E-06	176761.	127494.	6.218	12.492
1.000E-05	2.690E-08	4.204E-07	182112.	128069.	6.809	17.367
5.000E-06	1.748E-08		183806.		8.499	
1.000E-06	6.013E-09		186343.		11.746	
5.000E-07	3.320E-09		187142.		12.447	
1.000E-07	7.829E-10		188756.		13.709	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	1896.3	1988.4	3367.7	3197.4
1.000E-01	2.203E 00	1.674E 00	3426.5	3105.8	4019.8	3515.7
1.000E-02	1.185E 01	5.636E 00	4421.7	3671.5	4740.7	3809.5
1.000E-03	7.597E 01	2.117E 01	5010.2	3873.5	5214.8	3925.3
1.000E-04	5.207E 02	8.201E 01	5401.9	3950.5	5542.2	3970.6
5.000E-05	9.287E 02	1.236E 02	5493.9	3962.6	5619.0	3977.8
1.000E-05	3.208E 03	3.210E 02	5660.2	3980.5	5746.6	3988.4
5.000E-06	4.890E 03		5712.9		5778.7	
1.000E-06	1.402E 04		5791.7		5829.5	
5.000E-07	2.529E 04		5816.6		5850.6	
1.000E-07	1.063E 05		5866.7		5895.4	

TABLE 86

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 150.43 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 159.98 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 13.455 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 14.309 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5020
THROAT PRESSURE RATIO(FROZEN) = 0.4891
ENTROPY = 6.530E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	1.102E 06	1.102E 06	0.5247	0.5247
THROAT	42653.	37796.	9.835E 05	9.838E 05	0.5419	0.5247
1.000E-01	32874.	20086.	7.719E 05	8.153E 05	0.5938	0.5247
1.000E-02	25216.	8012.	5.639E 05	7.008E 05	0.6744	0.5247
1.000E-03	20434.	3215.	4.184E 05	6.550E 05	0.7562	0.5247
1.000E-04	17021.	1296.	3.111E 05	6.366E 05	0.8364	0.5247
5.000E-05	16156.	986.	2.841E 05	6.336E 05	0.8599	0.5247
1.000E-05	14321.	523.	2.292E 05	6.291E 05	0.9130	0.5247
5.000E-06	13573.	398.	2.084E 05	6.279E 05	0.9349	0.5247
1.000E-06	11746.		1.660E 05		0.9814	
5.000E-07	10718.		1.517E 05		0.9974	
1.000E-07	6448.		1.240E 05		1.0080	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.875E-04	2.875E-04				
THROAT	1.747E-04	1.861E-04	76997.	76910.	1.000	1.000
1.000E-01	4.949E-05	7.157E-05	128547.	119800.	2.144	2.127
1.000E-02	7.327E-06	1.794E-05	164119.	141718.	3.487	3.991
1.000E-03	1.014E-06	4.471E-06	184978.	149587.	4.711	6.664
1.000E-04	1.346E-07	1.109E-06	198978.	152637.	5.901	10.722
5.000E-05	7.291E-08	7.289E-07	202338.	153124.	6.260	12.332
1.000E-05	1.747E-08	2.748E-07	209026.	153850.	7.103	17.015
5.000E-06	9.435E-09	1.805E-07	211501.	154046.	7.476	19.528
1.000E-06	2.289E-09		216454.		8.386	
5.000E-07	1.275E-09		218102.		8.774	
1.000E-07	4.283E-10		221264.		11.522	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2393.1	2390.4	3972.2	3837.1
1.000E-01	2.115E 00	1.669E 00	3995.4	3723.5	4660.6	4217.0
1.000E-02	1.119E 01	5.627E 00	5101.0	4404.7	5452.9	4571.2
1.000E-03	7.175E 01	2.139E 01	5749.3	4649.3	5975.0	4712.6
1.000E-04	5.023E 02	8.450E 01	6184.4	4744.1	6342.4	4769.1
5.000E-05	9.120E 02	1.282E 02	6288.9	4759.3	6432.3	4778.2
1.000E-05	3.685E 03	3.385E 02	6496.7	4781.8	6612.6	4791.8
5.000E-06	6.742E 03	5.147E 02	6573.7	4787.5	6679.7	4795.5
1.000E-06	2.716E 04		6727.6		6813.0	
5.000E-07	4.839E 04		6778.8		6854.9	
1.000E-07	1.420E 05		6877.1		6921.8	

TABLE 87

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 156.58 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.60 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 11.435 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 11.510 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4874
THROAT PRESSURE RATIO(FROZEN) = 0.4877
ENTROPY = 7.032E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	75000.	75000.	1.406E 06	1.406E 06	0.5056	0.5056
THROAT	57048.	56349.	1.221E 06	1.222E 06	0.5080	0.5056
1.000E-01	36960.	29925.	9.466E 05	9.616E 05	0.5355	0.5056
1.000E-02	26862.	11914.	6.946E 05	7.846E 05	0.6069	0.5056
1.000E-03	21518.	4745.	5.238E 05	7.142E 05	0.6828	0.5056
1.000E-04	17935.	1891.	3.990E 05	6.861E 05	0.7587	0.5056
5.000E-05	17059.	1433.	3.677E 05	6.816E 05	0.7814	0.5056
1.000E-05	15269.	754.	3.037E 05	6.749E 05	0.8332	0.5056
5.000E-06	14581.	571.	2.793E 05	6.731E 05	0.8551	0.5056
1.000E-06	13112.	300.	2.290E 05	6.704E 05	0.9048	0.5056
5.000E-07	12513.		2.097E 05		0.9255	
1.000E-07	11096.		1.699E 05		0.9708	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.847E-04	1.847E-04				
THROAT	1.189E-04	1.199E-04	96159.	95995.	1.000	1.000
1.000E-01	3.969E-05	4.629E-05	151623.	149114.	2.096	2.129
1.000E-02	6.190E-06	1.163E-05	188685.	176338.	3.612	3.991
1.000E-03	8.694E-07	2.919E-06	210119.	186073.	4.924	6.674
1.000E-04	1.159E-07	7.326E-07	224505.	189812.	6.162	10.786
5.000E-05	6.274E-08	4.832E-07	227967.	190404.	6.530	12.427
1.000E-05	1.495E-08	1.838E-07	234888.	191281.	7.384	17.220
5.000E-06	8.034E-09	1.212E-07	237468.	191516.	7.753	19.801
1.000E-06	1.891E-09	4.612E-08	242713.	191864.	8.624	27.359
5.000E-07	1.013E-09		244694.		9.009	
1.000E-07	2.397E-10		248738.		9.944	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	2988.7	2983.6	4792.6	4777.0
1.000E-01	1.900E 00	1.668E 00	4712.6	4634.6	5415.8	5247.7
1.000E-02	9.791E 00	5.614E 00	5864.5	5480.8	6226.9	5687.2
1.000E-03	6.260E 01	2.119E 01	6530.7	5783.3	6762.4	5861.2
1.000E-04	4.394E 02	8.277E 01	6977.8	5899.5	7140.5	5930.0
5.000E-05	7.994E 02	1.251E 02	7085.4	5917.9	7233.4	5940.9
1.000E-05	3.256E 03	3.273E 02	7300.5	5945.2	7421.1	5957.2
5.000E-06	5.994E 03	4.957E 02	7380.8	5952.5	7491.7	5961.6
1.000E-06	2.492E 04	1.301E 03	7543.8	5963.3	7636.0	5968.1
5.000E-07	4.612E 04		7605.3		7690.7	
1.000E-07	1.918E 05		7731.0		7802.0	

TABLE 88

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.44 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.52 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 9.958 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 9.962 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4876
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 7.320E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	100000.	100000.	1.656E 06	1.656E 06	0.5045	0.5045
THROAT	75147.	75056.	1.410E 06	1.410E 06	0.5048	0.5045
1.000E-01	42230.	39853.	1.059E 06	1.063E 06	0.5133	0.5045
1.000E-02	28009.	15867.	7.735E 05	8.264E 05	0.5735	0.5045
1.000E-03	22129.	6317.	5.866E 05	7.324E 05	0.6458	0.5045
1.000E-04	18387.	2516.	4.512E 05	6.949E 05	0.7191	0.5045
5.000E-05	17489.	1907.	4.174E 05	6.889E 05	0.7409	0.5045
1.000E-05	15676.	1002.	3.482E 05	6.800E 05	0.7913	0.5045
5.000E-06	14988.	759.	3.219E 05	6.776E 05	0.8128	0.5045
1.000E-06	13551.	399.	2.674E 05	6.741E 05	0.8618	0.5045
5.000E-07	12984.		2.465E 05		0.8825	
1.000E-07	11739.		2.028E 05		0.9292	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.382E-04	1.382E-04				
THROAT	8.973E-05	8.977E-05	110972.	110975.	1.000	1.000
1.000E-01	3.330E-05	3.468E-05	172760.	172302.	2.106	2.130
1.000E-02	5.610E-06	8.711E-06	210149.	203750.	3.735	3.991
1.000E-03	7.996E-07	2.188E-06	231336.	214994.	5.167	6.674
1.000E-04	1.071E-07	5.494E-07	245551.	219310.	6.465	10.790
5.000E-05	5.803E-08	3.625E-07	248977.	219994.	6.846	12.433
1.000E-05	1.387E-08	1.380E-07	255836.	221005.	7.728	17.231
5.000E-06	7.428E-09	9.102E-08	258399.	221276.	8.107	19.816
1.000E-06	1.742E-09	3.464E-08	263624.	221677.	8.994	27.388
5.000E-07	9.311E-10		265606.		9.380	
1.000E-07	2.169E-10		269687.		10.298	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	3449.1	3449.2	5521.4	5520.1
1.000E-01	1.731E 00	1.667E 00	5369.6	5355.3	6105.1	6063.5
1.000E-02	8.447E 00	5.613E 00	6531.6	6332.7	6850.6	6571.2
1.000E-03	5.383E 01	2.118E 01	7190.2	6682.2	7419.0	6772.2
1.000E-04	3.785E 02	8.268E 01	7632.0	6816.4	7792.9	6851.5
5.000E-05	6.892E 02	1.249E 02	7738.5	6837.6	7884.9	6864.2
1.000E-05	2.814E 03	3.267E 02	7951.7	6869.1	8071.3	6882.9
5.000E-06	5.188E 03	4.947E 02	8031.3	6877.5	8141.5	6888.0
1.000E-06	2.168E 04	1.297E 03	8193.7	6889.9	8285.8	6895.4
5.000E-07	4.027E 04		8255.3		8340.9	
1.000E-07	1.703E 05		8382.1		8454.5	

TABLE 89

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.52 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.52 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 8.134 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 8.134 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 7.720E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.149E 06	2.149E 06	0.5042	0.5042
THROAT	112528.	112527.	1.780E 06	1.780E 06	0.5042	0.5042
1.000E-01	59870.	59740.	1.260E 06	1.260E 06	0.5041	0.5042
1.000E-02	30394.	23800.	8.899E 05	9.052E 05	0.5331	0.5042
1.000E-03	23050.	9484.	6.771E 05	7.640E 05	0.5997	0.5042
1.000E-04	18985.	3779.	5.261E 05	7.077E 05	0.6689	0.5042
5.000E-05	18041.	2865.	4.885E 05	6.987E 05	0.6898	0.5042
1.000E-05	16165.	1506.	4.120E 05	6.853E 05	0.7380	0.5042
5.000E-06	15464.	1142.	3.829E 05	6.817E 05	0.7586	0.5042
1.000E-06	14022.	600.	3.226E 05	6.764E 05	0.8061	0.5042
5.000E-07	13466.	455.	2.995E 05	6.749E 05	0.8262	0.5042
1.000E-07	12286.		2.510E 05		0.872	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.208E-05	9.208E-05				
THROAT	5.982E-05	5.982E-05	135981.	135981.	1.000	1.000
1.000E-01	2.309E-05	2.312E-05	211064.	211052.	2.130	2.130
1.000E-02	4.810E-06	5.804E-06	251096.	249570.	3.852	3.991
1.000E-03	7.128E-07	1.456E-06	271489.	263352.	5.638	6.673
1.000E-04	9.653E-08	3.655E-07	285070.	268647.	7.091	10.783
5.000E-05	5.238E-08	2.411E-07	288347.	269486.	7.506	12.423
1.000E-05	1.251E-08	9.171E-08	294916.	270729.	8.455	17.213
5.000E-06	6.721E-09	6.049E-08	297376.	271061.	8.860	19.794
1.000E-06	1.575E-09	2.301E-08	302403.	271554.	9.801	27.350
5.000E-07	8.406E-10	1.518E-08	304317.	271686.	10.207	31.428
1.000E-07	1.946E-10		308278.		11.159	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4226.4	4226.4	6761.9	6761.9
1.000E-01	1.669E 00	1.667E 00	6560.1	6559.7	7428.4	7427.0
1.000E-02	6.734E 00	5.616E 00	7804.3	7756.9	8154.7	8049.1
1.000E-03	4.203E 01	2.121E 01	8438.1	8185.3	8656.8	8295.6
1.000E-04	2.956E 02	8.284E 01	8860.3	8349.8	9014.1	8392.9
5.000E-05	5.386E 02	1.252E 02	8962.1	8375.9	9102.2	8408.5
1.000E-05	2.205E 03	3.276E 02	9166.3	8414.5	9281.0	8431.6
5.000E-06	4.070E 03	4.961E 02	9242.7	8424.8	9348.6	8437.7
1.000E-06	1.708E 04	1.302E 03	9399.0	8440.2	9487.9	8446.9
5.000E-07	3.180E 04	1.973E 03	9458.5	8444.3	9541.2	8449.4
1.000E-07	1.356E 05		9581.6		9652.1	

TABLE 90

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 20. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.51 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 7.044 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 7.044 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 8.004E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	200000.	200000.	2.642E 06	2.642E 06	0.5041	0.5041
THROAT	150021.	150025.	2.150E 06	2.150E 06	0.5041	0.5041
1.000E-01	79646.	79636.	1.456E 06	1.456E 06	0.5041	0.5041
1.000E-02	33978.	31715.	9.805E 05	9.835E 05	0.5128	0.5041
1.000E-03	23831.	12632.	7.435E 05	7.954E 05	0.5705	0.5041
1.000E-04	19413.	5032.	5.805E 05	7.204E 05	0.6369	0.5041
5.000E-05	18423.	3814.	5.402E 05	7.084E 05	0.6570	0.5041
1.000E-05	16482.	2004.	4.583E 05	6.906E 05	0.7036	0.5041
5.000E-06	15764.	1519.	4.272E 05	6.858E 05	0.7236	0.5041
1.000E-06	14301.	798.	3.628E 05	6.787E 05	0.7697	0.5041
5.000E-07	13742.	605.	3.381E 05	6.768E 05	0.7894	0.5041
1.000E-07	12571.	318.	2.863E 05	6.739E 05	0.8346	0.5041

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	6.905E-05	6.905E-05				
THROAT	4.486E-05	4.486E-05	157034.	157033.	1.000	1.000
1.000E-01	1.734E-05	1.734E-05	243707.	243708.	2.130	2.130
1.000E-02	4.135E-06	4.355E-06	288435.	288175.	3.919	3.992
1.000E-03	6.559E-07	1.093E-06	308318.	304079.	6.008	6.674
1.000E-04	8.988E-08	2.745E-07	321278.	310187.	7.671	10.788
5.000E-05	4.885E-08	1.811E-07	324400.	311155.	8.125	12.429
1.000E-05	1.170E-08	6.890E-08	330663.	312587.	9.149	17.225
5.000E-06	6.288E-09	4.545E-08	333010.	312970.	9.583	19.808
1.000E-06	1.475E-09	1.730E-08	337812.	313538.	10.584	27.374
5.000E-07	7.869E-10	1.141E-08	339642.	313690.	11.014	31.457
1.000E-07	1.819E-10	4.342E-09	343438.	313916.	12.017	43.424

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	4880.8	4880.7	7808.3	7808.3
1.000E-01	1.667E 00	1.667E 00	7574.7	7574.7	8576.0	8576.0
1.000E-02	5.906E 00	5.613E 00	8964.9	8956.8	9319.7	9294.0
1.000E-03	3.483E 01	2.119E 01	9582.8	9451.1	9792.1	9578.4
1.000E-04	2.439E 02	8.274E 01	9985.6	9640.9	10132.2	9690.6
5.000E-05	4.445E 02	1.250E 02	10082.7	9671.0	10216.2	9708.6
1.000E-05	1.821E 03	3.270E 02	10277.3	9715.5	10386.8	9735.2
5.000E-06	3.364E 03	4.952E 02	10350.3	9727.4	10451.3	9742.3
1.000E-06	1.414E 04	1.299E 03	10499.5	9745.1	10584.5	9752.9
5.000E-07	2.636E 04	1.968E 03	10556.4	9749.8	10635.6	9755.7
1.000E-07	1.128E 05	5.168E 03	10674.4	9756.8	10742.1	9759.9

TABLE 91

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 286.01 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 288.81 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 202.236 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 204.219 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5494
THROAT PRESSURE RATIO(FROZEN) = 0.5445
ENTROPY = 1.996E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	1.952E 04	1.952E 04	2.0053	2.0053
THROAT	4425.	4344.	1.673E 04	1.671E 04	2.0120	2.0053
1.000E-01	2963.	2871.	1.057E 04	1.072E 04	2.0160	2.0053
1.000E-02	1602.	1533.	5.517E 03	5.818E 03	2.0160	2.0053
1.000E-03	836.	751.	2.841E 03	3.299E 03	2.0160	2.0053
1.000E-04	432.	341.	1.450E 03	2.107E 03	2.0160	2.0053

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.747E-02	2.747E-02				
THROAT	1.711E-02	1.722E-02	11820.	11862.	1.000	1.000
1.000E-01	4.659E-03	4.785E-03	21167.	20990.	2.141	2.147
1.000E-02	8.619E-04	8.960E-04	26473.	26188.	3.577	3.577
1.000E-03	1.651E-04	1.828E-04	28893.	28494.	5.381	5.412
1.000E-04	3.198E-05	4.027E-05	30073.	29522.	7.765	8.145

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	367.4	368.7	654.8	650.8
1.000E-01	2.051E 00	2.034E 00	657.9	652.4	765.2	757.7
1.000E-02	8.864E 00	8.704E 00	822.8	813.9	869.2	859.0
1.000E-03	4.239E 01	3.921E 01	898.0	885.6	920.2	905.9
1.000E-04	2.103E 02	1.718E 02	934.7	917.6	945.7	926.5

TABLE 92

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 278.25 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 285.19 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 179.612 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 184.087 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5616
THROAT PRESSURE RATIO(FROZEN) = 0.5456
ENTROPY = 2.117E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.616E 04	2.616E 04	1.9612	1.9612
THROAT	5488.	5225.	2.282E 04	2.272E 04	1.9819	1.9612
1.000E-01	3963.	3479.	1.472E 04	1.532E 04	2.0135	1.9612
1.000E-02	2237.	1888.	7.807E 03	9.205E 03	2.0160	1.9612
1.000E-03	1182.	943.	4.043E 03	6.005E 03	2.0160	1.9612
1.000E-04	614.	435.	2.073E 03	4.463E 03	2.0160	1.9612
4.000E-05	472.		1.586E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.239E-02	2.239E-02				
THROAT	1.389E-02	1.403E-02	12931.	13125.	1.000	1.000
1.000E-01	3.480E-03	3.861E-03	23931.	23296.	2.131	2.149
1.000E-02	6.173E-04	7.113E-04	30308.	29132.	3.493	3.566
1.000E-03	1.168E-04	1.424E-04	33272.	31762.	5.220	5.356
1.000E-04	2.249E-05	3.089E-05	34723.	32954.	7.536	7.995
4.000E-05	1.171E-05		35072.		8.672	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	401.9	407.9	732.7	721.5
1.000E-01	2.157E 00	2.046E 00	743.8	724.1	870.9	841.7
1.000E-02	9.600E 00	8.884E 00	942.0	905.4	958.6	956.5
1.000E-03	4.621E 01	4.071E 01	1034.1	987.2	1061.4	1010.6
1.000E-04	2.300E 02	1.809E 02	1079.2	1024.3	1092.8	1034.6
4.000E-05	4.372E 02		1090.1		1100.4	

TABLE 93

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 267.94 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 277.58 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 160.125 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 165.883 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5681
THROAT PRESSURE RATIO(FROZEN) = 0.5436
ENTROPY = 2.283E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	3.700E 04	3.700E 04	1.8468	1.8468
THROAT	6526.	6067.	3.292E 04	3.272E 04	1.8795	1.8468
1.000E-01	5214.	4002.	2.241E 04	2.366E 04	1.9662	1.8468
1.000E-02	3427.	2151.	1.246E 04	1.622E 04	2.0148	1.8468
1.000E-03	1892.	1068.	6.551E 03	1.236E 04	2.0160	1.8468
1.000E-04	992.	490.	3.382E 03	1.051E 04	2.0160	1.8468
4.000E-05	765.		2.593E 03		2.0160	
1.000E-05	514.		1.730E 03		2.0160	
4.000E-06	394.		1.322E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.807E-02	1.807E-02				
THROAT	1.121E-02	1.133E-02	14285.	14635.	1.000	1.000
1.000E-01	2.583E-03	3.161E-03	27026.	25844.	2.156	2.150
1.000E-02	4.027E-04	5.880E-04	35048.	32247.	3.333	3.581
1.000E-03	7.298E-05	1.184E-04	39040.	35116.	4.870	5.391
1.000E-04	1.392E-05	2.580E-05	41022.	36410.	7.019	8.063
4.000E-05	7.224E-06		41501.		8.080	
1.000E-05	2.687E-06		42018.		9.957	
4.000E-06	1.401E-06		42260.		11.415	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	444.0	454.9	819.4	801.6
1.000E-01	2.294E 00	2.031E 00	840.0	803.2	991.6	932.8
1.000E-02	1.135E 01	8.749E 00	1089.3	1002.3	1164.3	1058.1
1.000E-03	5.620E 01	3.990E 01	1213.4	1091.4	1250.5	1116.9
1.000E-04	2.805E 02	1.766E 02	1275.0	1131.7	1293.5	1142.9
4.000E-05	5.341E 02		1289.9		1304.0	
1.000E-05	1.418E 03		1305.9		1315.3	
4.000E-06	2.704E 03		1313.5		1320.6	

TABLE 94

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 253.69 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 265.07 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 141.815 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 148.180 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5683
THROAT PRESSURE RATIO(FROZEN) = 0.5372
ENTROPY = 2.514E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	5.438E 04	5.438E 04	1.6528	1.6528
THROAT	7492.	6828.	4.918E 04	4.885E 04	1.6919	1.6528
1.000E-01	6205.	4366.	3.571E 04	3.769E 04	1.8071	1.6528
1.000E-02	4855.	2246.	2.224E 04	2.881E 04	1.9392	1.6528
1.000E-03	3429.	1073.	1.259E 04	2.439E 04	2.0123	1.6528
1.000E-04	1913.	478.	6.628E 03	2.234E 04	2.0160	1.6528
4.000E-05	1484.		5.101E 03		2.0160	
1.000E-05	1004.		3.422E 03		2.0160	
4.000E-06	774.		2.624E 03		2.0160	
1.000E-06	520.		1.751E 03		2.0160	
4.000E-07	399.		1.338E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.415E-02	1.415E-02				
THROAT	8.791E-03	8.907E-03	16132.	16636.	1.000	1.000
1.000E-01	1.995E-03	2.593E-03	30571.	28899.	2.170	2.148
1.000E-02	2.736E-04	5.039E-04	40110.	35773.	3.335	3.630
1.000E-03	4.019E-05	1.055E-04	45737.	38746.	4.396	5.552
1.000E-04	7.217E-06	2.367E-05	48891.	40047.	6.066	8.425
4.000E-05	3.721E-06		49666.		6.966	
1.000E-05	1.376E-06		50506.		8.592	
4.000E-06	7.140E-07		50900.		9.853	
1.000E-06	2.656E-07		51327.		12.093	
4.000E-07	1.385E-07		51528.		13.837	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	501.4	517.1	925.4	900.6
1.000E-01	2.325E 00	1.978E 00	950.2	898.2	1123.7	1039.4
1.000E-02	1.292E 01	8.219E 00	1246.7	1111.9	1343.1	1170.6
1.000E-03	7.714E 01	3.626E 01	1421.6	1204.3	1479.1	1230.2
1.000E-04	4.019E 02	1.563E 02	1519.6	1244.7	1549.6	1255.9
4.000E-05	7.673E 02		1543.7		1566.6	
1.000E-05	2.041E 03		1569.8		1585.0	
4.000E-06	3.902E 03		1582.0		1593.7	
1.000E-06	1.040E 04		1595.3		1603.1	
4.000E-07	1.987E 04		1601.5		1607.5	

TABLE 95

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 237.12 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 250.32 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 124.972 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 131.930 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5654
THROAT PRESSURE RATIO(FROZEN) = 0.5262
ENTROPY = 2.795E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	7.830E 04	7.830E 04	1.4273	1.4273
THROAT	8395.	7478.	7.149E 04	7.095E 04	1.4679	1.4273
1.000E-01	6959.	4550.	5.427E 04	5.730E 04	1.5893	1.4273
1.000E-02	5616.	2180.	3.708E 04	4.692E 04	1.7430	1.4273
1.000E-03	4601.	981.	2.421E 04	4.208E 04	1.8822	1.4273
1.000E-04	3630.	420.	1.446E 04	3.996E 04	1.9905	1.4273
4.000E-05	3118.		1.139E 04		2.0116	
1.000E-05	2220.		7.746E 03		2.0160	
4.000E-06	1730.		5.970E 03		2.0160	
1.000E-06	1173.		4.010E 03		2.0160	
4.000E-07	905.		3.077E 03		2.0160	
1.000E-07	609.		2.056E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.086E-02	1.086E-02				
THROAT	6.771E-03	6.880E-03	18456.	19176.	1.000	1.000
1.000E-01	1.564E-03	2.149E-03	34680.	32422.	2.176	2.144
1.000E-02	2.126E-04	4.485E-04	45424.	39631.	3.358	3.714
1.000E-03	2.802E-05	9.961E-05	52032.	42577.	4.433	5.829
1.000E-04	3.756E-06	2.330E-05	56528.	43810.	5.471	9.043
4.000E-05	1.767E-06		57875.		5.861	
1.000E-05	6.220E-07		59428.		6.876	
4.000E-06	3.193E-07		60172.		7.835	
1.000E-06	1.177E-07		60981.		9.604	
4.000E-07	6.106E-08		61363.		10.592	
1.000E-07	2.268E-08		61778.		13.462	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	573.6	596.0	1052.3	1018.0
1.000E-01	2.304E 00	1.894E 00	1077.9	1007.7	1272.9	1159.6
1.000E-02	1.294E 01	7.423E 00	1411.8	1231.8	1521.4	1291.3
1.000E-03	8.571E 01	3.111E 01	1617.2	1323.3	1689.8	1348.3
1.000E-04	5.886E 02	1.292E 02	1756.9	1361.7	1806.8	1372.0
4.000E-05	1.222E 03		1798.8		1840.2	
1.000E-05	3.381E 03		1847.1		1875.7	
4.000E-06	6.504E 03		1870.2		1892.2	
1.000E-06	1.741E 04		1895.4		1910.1	
4.000E-07	3.335E 04		1907.2		1918.5	
1.000E-07	8.921E 04		1920.1		1927.7	

TABLE 96

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 223.39 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 238.10 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 111.697 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 119.049 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5614
THROAT PRESSURE RATIO(FROZEN) = 0.5134
ENTROPY = 3.064E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	1.039E 05	1.039E 05	1.2439	1.2439
THROAT	9232.	8044.	9.514E 04	9.429E 04	1.2834	1.2439
1.000E-01	7544.	4648.	7.383E 04	7.808E 04	1.4016	1.2439
1.000E-02	6075.	2073.	5.287E 04	6.631E 04	1.5556	1.2439
1.000E-03	5055.	885.	3.728E 04	6.116E 04	1.7021	1.2439
1.000E-04	4266.	366.	2.526E 04	5.899E 04	1.8385	1.2439
4.000E-05	3984.		2.123E 04		1.888[illegible]	
1.000E-05	3552.		1.583E 04		1.957[illegible]	
4.000E-06	3222.		1.270E 04		1.992[illegible]	
1.000E-06	2483.		8.747E 03		2.015[illegible]	
4.000E-07	1948.		6.753E 03		2.0160	
1.000E-07	1325.		4.542E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.520E-03	8.520E-03				
THROAT	5.345E-03	5.438E-03	20897.	21892.	1.000	1.000
1.000E-01	1.272E-03	1.833E-03	38775.	35926.	2.183	2.139
1.000E-02	1.754E-04	4.110E-04	50527.	43360.	3.388	3.809
1.000E-03	2.306E-05	9.626E-05	57733.	46238.	4.478	6.133
1.000E-04	2.952E-06	2.328E-05	62730.	47396.	5.528	9.693
4.000E-05	1.299E-06		64318.		5.943	
1.000E-05	3.773E-07		66387.		6.573	
4.000E-06	1.695E-07		67556.		6.977	
1.000E-06	5.561E-08		69004.		7.627	
4.000E-07	2.836E-08		69724.		8.579	
1.000E-07	1.042E-08		70513.		10.456	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	649.5	680.4	1181.2	1136.7
1.000E-01	2.264E 00	1.808E 00	1205.2	1116.6	1419.6	1277.3
1.000E-02	1.260E 01	6.680E 00	1570.4	1347.7	1689.8	1407.0
1.000E-03	8.389E 01	2.675E 01	1794.4	1437.1	1873.9	1460.9
1.000E-04	6.032E 02	1.079E 02	1949.7	1473.1	2006.8	1482.7
4.000E-05	1.337E 03		1999.1		2049.7	
1.000E-05	4.459E 03		2063.4		2105.6	
4.000E-06	9.756E 03		2099.7		2136.7	
1.000E-06	2.911E 04		2144.7		2172.3	
4.000E-07	5.650E 04		2167.1		2188.5	
1.000E-07	1.520E 05		2191.6		2206.0	

TABLE 97

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 201.90 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 216.29 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 92.155 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 98.720 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5251
THROAT PRESSURE RATIO(FROZEN) = 0.4684
ENTROPY = 3.399E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.391E 05	1.391E 05	1.0674	1.0674
THROAT	10604.	9017.	1.270E 05	1.256E 05	1.1051	1.0674
1.000E-01	8309.	5009.	1.004E 05	1.060E 05	1.2080	1.0674
1.000E-02	6545.	2059.	7.403E 04	9.176E 04	1.3544	1.0674
1.000E-03	5430.	835.	5.488E 04	8.594E 04	1.4965	1.0674
1.000E-04	4629.	335.	4.022E 04	8.359E 04	1.6340	1.0674
4.000E-05	4364.		3.529E 04		1.6868	
1.000E-05	4004.		2.861E 04		1.7646	
4.000E-06	3786.		2.465E 04		1.8143	
1.000E-06	3471.		1.925E 04		1.8861	
4.000E-07	3263.		1.603E 04		1.9303	
1.000E-07	2905.		1.169E 04		1.9881	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.092E-03	6.092E-03				
THROAT	3.748E-03	3.797E-03	24587.	25997.	1.000	1.000
1.000E-01	9.957E-04	1.460E-03	44047.	40712.	2.173	2.094
1.000E-02	1.417E-04	3.551E-04	57079.	48687.	3.426	3.885
1.000E-03	1.888E-05	8.757E-05	64933.	51592.	4.551	6.438
1.000E-04	2.418E-06	2.179E-05	70360.	52719.	5.622	10.355
4.000E-05	1.059E-06		72092.		6.041	
1.000E-05	3.018E-07		74374.		6.670	
4.000E-06	1.313E-07		75696.		7.086	
1.000E-06	3.721E-08		77462.		7.720	
4.000E-07	1.621E-08		78493.		8.144	
1.000E-07	4.687E-09		79867.		8.776	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	764.2	808.0	1367.0	1310.0
1.000E-01	2.101E 00	1.661E 00	1369.0	1265.4	1610.3	1443.4
1.000E-02	1.139E 01	5.711E 00	1774.1	1513.2	1904.8	1574.4
1.000E-03	7.516E 01	2.185E 01	2018.2	1603.5	2104.5	1626.9
1.000E-04	5.417E 02	8.593E 01	2186.8	1638.6	2249.0	1647.8
4.000E-05	1.207E 03		2240.7		2296.1	
1.000E-05	4.105E 03		2311.6		2358.7	
4.000E-06	9.272E 03		2352.7		2395.3	
1.000E-06	3.197E 04		2407.6		2444.3	
4.000E-07	7.245E 04		2439.6		2472.9	
1.000E-07	2.462E 05		2482.4		2510.6	

TABLE 98

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 215.09 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 214.99 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 90.892 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 90.850 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5511
THROAT PRESSURE RATIO(FROZEN) = 0.4663
ENTROPY = 3.531E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.561E 05	1.561E 05	1.0278	1.0278
THROAT	11777.	10388.	1.414E 05	1.396E 05	1.0478	1.0278
1.000E-01	8698.	5672.	1.115E 05	1.164E 05	1.1437	1.0278
1.000E-02	6730.	2285.	8.277E 04	9.977E 04	1.2856	1.0278
1.000E-03	5556.	916.	6.212E 04	9.311E 04	1.4252	1.0278
1.000E-04	4735.	366.	4.639E 04	9.044E 04	1.5602	1.0278
4.000E-05	4467.		4.111E 04		1.6126	
1.000E-05	4108.		3.396E 04		1.6900	
4.000E-06	3894.		2.971E 04		1.7400	
1.000E-06	3595.		2.390E 04		1.8134	
4.000E-07	3408.		2.043E 04		1.8601	
1.000E-07	3128.		1.568E 04		1.9267	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.029E-03	5.029E-03				
THROAT	3.358E-03	3.160E-03	27067.	28752.	1.000	1.000
1.000E-01	9.006E-04	1.241E-03	47220.	44590.	2.204	2.096
1.000E-02	1.308E-04	3.081E-04	60582.	53093.	3.486	3.925
1.000E-03	1.757E-05	7.689E-05	68585.	56148.	4.632	6.546
1.000E-04	2.257E-06	1.925E-05	74105.	57325.	5.719	10.566
4.000E-05	9.889E-07		75867.		6.143	
1.000E-05	2.818E-07		78190.		6.779	
4.000E-06	1.224E-07		79538.		7.198	
1.000E-06	3.455E-08		81344.		7.832	
4.000E-07	1.495E-08		82406.		8.254	
1.000E-07	4.219E-09		83838.		8.901	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	841.3	893.6	1482.7	1436.6
1.000E-01	2.137E 00	1.642E 00	1467.7	1385.9	1716.4	1577.1
1.000E-02	1.147E 01	5.553E 00	1882.9	1650.2	2016.4	1714.9
1.000E-03	7.543E 01	2.104E 01	2131.7	1745.1	2219.5	1769.7
1.000E-04	5.434E 02	8.233E 01	2303.3	1781.7	2366.5	1791.3
4.000E-05	1.211E 03		2358.0		2414.4	
1.000E-05	4.126E 03		2430.2		2478.3	
4.000E-06	9.335E 03		2472.1		2515.6	
1.000E-06	3.234E 04		2528.3		2565.9	
4.000E-07	7.377E 04		2561.3		2595.6	
1.000E-07	2.570E 05		2605.8		2635.7	

TABLE 99

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.23 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.19 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 86.265 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 88.225 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5467
THROAT PRESSURE RATIO(FROZEN) = 0.4886
ENTROPY = 3.612E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.681E 05	1.681E 05	1.0164	1.0164
THROAT	12975.	12049.	1.512E 05	1.486E 05	1.0270	1.0164
1.000E-01	8598.	6400.	1.187E 05	1.209E 05	1.1080	1.0164
1.000E-02	6849.	2503.	8.823E 04	1.022E 05	1.2462	1.0164
1.000E-03	5631.	959.	6.662E 04	9.491E 04	1.3838	1.0164
1.000E-04	4794.	364.	5.022E 04	9.214E 04	1.5174	1.0164
4.000E-05	4524.		4.472E 04		1.5693	
1.000E-05	4163.		3.728E 04		1.6462	
4.000E-06	3950.		3.286E 04		1.6960	
1.000E-06	3655.		2.682E 04		1.7696	
4.000E-07	3474.		2.320E 04		1.8167	
1.000E-07	3211.		1.823E 04		1.8853	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.351E-03	4.351E-03				
THROAT	2.964E-03	2.823E-03	29106.	31248.	1.000	1.000
1.000E-01	8.434E-04	1.088E-03	49754.	48619.	2.238	2.125
1.000E-02	1.246E-04	2.782E-04	63234.	57456.	3.546	3.979
1.000E-03	1.683E-05	7.260E-05	71277.	60533.	4.708	6.734
1.000E-04	2.168E-06	1.915E-05	76821.	61666.	5.809	11.113
4.000E-05	9.503E-07		78591.		6.237	
1.000E-05	2.708E-07		80926.		6.879	
4.000E-06	1.176E-07		82281.		7.301	
1.000E-06	3.316E-08		84099.		7.939	
4.000E-07	1.433E-08		85170.		8.362	
1.000E-07	4.022E-09		86619.		9.009	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	904.6	971.2	1575.2	1557.2
1.000E-01	2.056E 00	1.668E 00	1546.4	1511.1	1798.6	1711.2
1.000E-02	1.095E 01	5.520E 00	1965.4	1785.8	2099.6	1852.0
1.000E-03	7.191E 01	2.007E 01	2215.4	1881.4	2303.6	1905.5
1.000E-04	5.180E 02	7.471E 01	2387.7	1916.6	2451.2	1925.6
4.000E-05	1.155E 03		2442.7		2499.4	
1.000E-05	3.936E 03		2515.2		2563.5	
4.000E-06	8.912E 03		2557.4		2601.1	
1.000E-06	3.093E 04		2613.9		2651.8	
4.000E-07	7.069E 04		2647.2		2681.8	
1.000E-07	2.476E 05		2692.2		2722.6	

TABLE 100

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.19 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.93 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 82.061 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 83.080 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5405
THROAT PRESSURE RATIO(FROZEN) = 0.4881
ENTROPY = 3.674E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.788E 05	1.788E 05	1.0123	1.0123
THROAT	14284.	13534.	1.594E 05	1.567E 05	1.0175	1.0123
1.000E-01	9293.	7184.	1.244E 05	1.255E 05	1.0822	1.0123
1.000E-02	6947.	2811.	9.256E 04	1.044E 05	1.2168	1.0123
1.000E-03	5690.	1078.	7.017E 04	9.620E 04	1.3528	1.0123
1.000E-04	4839.	409.	5.324E 04	9.308E 04	1.4851	1.0123
4.000E-05	4566.		4.758E 04		1.5365	
1.000E-05	4203.		3.991E 04		1.6130	
4.000E-06	3990.		3.536E 04		1.6626	
1.000E-06	3696.		2.913E 04		1.7360	
4.000E-07	3518.		2.540E 04		1.7833	
1.000E-07	3263.		2.026E 04		1.8526	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.852E-03	3.852E-03				
THROAT	2.637E-03	2.501E-03	31117.	33224.	1.000	1.000
1.000E-01	7.977E-04	9.651E-04	52170.	51641.	2.273	2.126
1.000E-02	1.200E-04	2.466E-04	65691.	61020.	3.610	3.980
1.000E-03	1.628E-05	6.429E-05	73730.	64290.	4.788	6.734
1.000E-04	2.102E-06	1.694E-05	79269.	65495.	5.901	11.105
4.000E-05	9.219E-07		81039.		6.333	
1.000E-05	2.628E-07		83373.		6.981	
4.000E-06	1.142E-07		84729.		7.407	
1.000E-06	3.217E-08		86549.		8.050	
4.000E-07	1.389E-08		87622.		8.475	
1.000E-07	3.889E-09		89077.		9.123	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	967.1	1032.6	1664.0	1654.2
1.000E-01	1.972E 00	1.667E 00	1621.5	1605.0	1875.7	1817.3
1.000E-02	1.041E 01	5.520E 00	2041.7	1896.6	2176.0	1966.9
1.000E-03	6.835E 01	2.010E 01	2291.6	1998.2	2379.7	2023.8
1.000E-04	4.925E 02	7.490E 01	2463.8	2035.6	2527.3	2045.2
4.000E-05	1.098E 03		2518.8		2575.4	
1.000E-05	3.745E 03		2591.3		2639.6	
4.000E-06	8.483E 03		2633.5		2677.2	
1.000E-06	2.947E 04		2690.0		2728.0	
4.000E-07	6.743E 04		2723.4		2758.1	
1.000E-07	2.369E 05		2768.6		2799.1	

TABLE 101

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 216.51 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.14 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 76.548 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 78.539 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5074
THROAT PRESSURE RATIO(FROZEN) = 0.4879
ENTROPY = 3.751E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.930E 05	1.930E 05	1.0046	1.0046
THROAT	15910.	15029.	1.690E 05	1.683E 05	1.0115	1.0046
1.000E-01	9772.	7979.	1.317E 05	1.334E 05	1.0543	1.0046
1.000E-02	7076.	3128.	9.791E 04	1.097E 05	1.1826	1.0046
1.000E-03	5762.	1202.	7.454E 04	1.006E 05	1.3165	1.0046
1.000E-04	4892.	457.	5.695E 04	9.705E 04	1.4472	1.0046
4.000E-05	4615.		5.108E 04		1.4981	
1.000E-05	4249.		4.314E 04		1.5739	
4.000E-06	4034.		3.842E 04		1.6231	
1.000E-06	3742.		3.197E 04		1.6961	
4.000E-07	3565.		2.810E 04		1.7434	
1.000E-07	3316.		2.277E 04		1.8130	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.440E-03	3.440E-03				
THROAT	2.210E-03	2.234E-03	34644.	35164.	1.000	1.000
1.000E-01	7.389E-04	8.624E-04	55418.	54632.	2.309	2.127
1.000E-02	1.145E-04	2.200E-04	68996.	64560.	3.698	3.980
1.000E-03	1.565E-05	5.725E-05	77009.	68027.	4.899	6.727
1.000E-04	2.026E-06	1.506E-05	82527.	69307.	6.029	11.087
4.000E-05	8.893E-07		84290.		6.468	
1.000E-05	2.537E-07		86617.		7.125	
4.000E-06	1.102E-07		87970.		7.556	
1.000E-06	3.105E-08		89786.		8.206	
4.000E-07	1.340E-08		90858.		8.635	
1.000E-07	3.745E-09		92314.		9.288	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1076.8	1092.9	1778.1	1750.1
1.000E-01	1.869E 00	1.667E 00	1722.4	1698.0	1980.8	1922.6
1.000E-02	9.692E 00	5.530E 00	2144.5	2006.6	2278.4	2081.1
1.000E-03	6.351E 01	2.017E 01	2393.5	2114.3	2481.3	2141.5
1.000E-04	4.577E 02	7.526E 01	2565.0	2154.1	2628.3	2164.3
4.000E-05	1.021E 03		2619.8		2676.3	
1.000E-05	3.483E 03		2692.1		2740.3	
4.000E-06	7.895E 03		2734.2		2777.8	
1.000E-06	2.746E 04		2790.6		2828.6	
4.000E-07	6.288E 04		2824.0		2858.7	
1.000E-07	2.214E 05		2869.2		2899.8	

TABLE 102

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 191.74 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 209.85 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 55.349 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 60.578 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5632
THROAT PRESSURE RATIO(FROZEN) = 0.4884
ENTROPY = 4.254E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	3.223E 05	3.223E 05	0.9067	0.9067
THROAT	27382.	22743.	2.867E 05	2.811E 05	0.9303	0.9067
1.000E-01	19991.	12084.	2.020E 05	2.225E 05	0.9899	0.9067
1.000E-02	9440.	4784.	1.373E 05	1.827E 05	1.0152	0.9067
1.000E-03	6343.	1862.	1.049E 05	1.670E 05	1.1130	0.9067
1.000E-04	5231.	717.	8.242E 04	1.610E 05	1.2315	0.9067
4.000E-05	4913.	489.	7.506E 04	1.598E 05	1.2783	0.9067
1.000E-05	4507.		6.519E 04		1.3482	
4.000E-06	4277.		5.936E 04		1.3939	
1.000E-06	3970.		5.141E 04		1.4623	
4.000E-07	3790.		4.665E 04		1.5069	
1.000E-07	3545.		4.009E 04		1.5736	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.070E-03	2.070E-03				
THROAT	1.311E-03	1.334E-03	42228.	45423.	1.000	1.000
1.000E-01	3.392E-04	5.139E-04	77614.	70690.	2.189	2.128
1.000E-02	7.366E-05	1.298E-04	96226.	83605.	4.012	3.978
1.000E-03	1.202E-05	3.335E-05	104327.	88165.	5.772	6.686
1.000E-04	1.612E-06	8.665E-06	109581.	89868.	7.116	10.954
4.000E-05	7.128E-07	5.077E-06	111248.	90201.	7.622	13.298
1.000E-05	2.049E-07		113448.		8.371	
4.000E-06	8.930E-08		114727.		8.859	
1.000E-06	2.523E-08		116449.		9.590	
4.000E-07	1.089E-08		117467.		10.068	
1.000E-07	3.040E-09		118856.		10.790	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1312.5	1411.8	2389.1	2264.7
1.000E-01	2.103E 00	1.667E 00	2412.3	2197.1	2814.2	2488.3
1.000E-02	7.809E 00	5.582E 00	2990.8	2598.5	3140.1	2696.0
1.000E-03	4.414E 01	2.060E 01	3242.6	2740.3	3327.0	2776.2
1.000E-04	3.133E 02	7.779E 01	3405.9	2793.2	3465.8	2806.8
4.000E-05	6.980E 02	1.323E 02	3457.7	2803.5	3511.1	2812.8
1.000E-05	2.381E 03		3526.1		3571.6	
4.000E-06	5.402E 03		3565.8		3607.1	
1.000E-06	1.884E 04		3619.3		3655.4	
4.000E-07	4.325E 04		3651.0		3684.1	
1.000E-07	1.532E 05		3694.2		3723.4	

TABLE 103

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 165.81 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 182.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 41.453 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 45.701 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5543
THROAT PRESSURE RATIO(FROZEN) = 0.4987
ENTROPY = 5.240E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	40000.	40000.	6.723E 05	6.723E 05	0.6783	0.6783
THROAT	36701.	30650.	6.071E 05	5.992E 05	0.7018	0.6783
1.000E-01	29374.	16209.	4.542E 05	4.924E 05	0.7755	0.6783
1.000E-02	22577.	6450.	3.105E 05	4.209E 05	0.8718	0.6783
1.000E-03	17381.	2549.	2.108E 05	3.925E 05	0.9587	0.6783
1.000E-04	10702.	1002.	1.452E 05	3.813E 05	1.0076	0.6783
4.000E-05	7479.	690.	1.290E 05	3.791E 05	1.0089	0.6783
1.000E-05	5271.	392.	1.125E 05	3.770E 05	1.0381	0.6783
4.000E-06	4815.		1.038E 05		1.0746	
1.000E-06	4362.		9.239E 04		1.1318	
4.000E-07	4130.		8.567E 04		1.1696	
1.000E-07	3837.		7.652E 04		1.2266	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.161E-03	1.161E-03				
THROAT	7.260E-04	7.559E-04	57096.	60458.	1.000	1.000
1.000E-01	1.808E-04	2.866E-04	104492.	94901.	2.192	2.133
1.000E-02	2.644E-05	7.203E-05	134570.	112179.	3.471	3.991
1.000E-03	3.778E-06	1.822E-05	151994.	118339.	4.710	6.680
1.000E-04	6.449E-07	4.638E-06	162430.	120680.	5.690	10.850
4.000E-05	3.694E-07	2.693E-06	164917.	121145.	7.878	13.119
1.000E-05	1.349E-07	1.184E-06	167400.	121586.	9.926	17.453
4.000E-06	6.115E-08		168690.		10.708	
1.000E-06	1.777E-08		170378.		11.725	
4.000E-07	7.758E-09		171362.		12.354	
1.000E-07	2.190E-09		172694.		13.274	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	1774.6	1879.1	3189.3	3033.7
1.000E-01	2.194E 00	1.680E 00	3247.7	2949.6	3807.6	3338.6
1.000E-02	1.165E 01	5.656E 00	4182.6	3486.6	4479.9	3617.6
1.000E-03	7.219E 01	2.119E 01	4724.1	3678.1	4908.4	3727.1
1.000E-04	3.957E 02	8.165E 01	5048.5	3750.9	5149.5	3769.8
4.000E-05	6.804E 02	1.401E 02	5125.8	3765.3	5195.2	3778.3
1.000E-05	1.836E 03	3.175E 02	5202.9	3779.0	5249.8	3786.4
4.000E-06	4.019E 03		5243.1		5284.1	
1.000E-06	1.369E 04		5295.5		5330.5	
4.000E-07	3.118E 04		5326.1		5357.9	
1.000E-07	1.096E 05		5367.5		5395.5	

TABLE 104

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 152.65 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 162.98 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 34.134 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 36.444 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5203
THROAT PRESSURE RATIO(FROZEN) = 0.4916
ENTROPY = 6.049E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	1.031E 06	1.031E 06	0.5506	0.5506
THROAT	43899.	38153.	9.227E 05	9.188E 05	0.5706	0.5506
1.000E-01	34069.	20314.	7.106E 05	7.559E 05	0.6295	0.5506
1.000E-02	25998.	8121.	5.078E 05	6.455E 05	0.7163	0.5506
1.000E-03	20836.	3291.	3.673E 05	6.011E 05	0.8036	0.5506
1.000E-04	17074.	1346.	2.650E 05	5.830E 05	0.8878	0.5506
4.000E-05	15780.	944.	2.319E 05	5.792E 05	0.9196	0.5506
1.000E-05	13865.	553.	1.885E 05	5.756E 05	0.9643	0.5506
4.000E-06	12437.	388.	1.640E 05	5.741E 05	0.9897	0.5506
1.000E-06	8802.		1.356E 05		1.0080	
4.000E-07	6104.		1.223E 05		1.0081	
1.000E-07	4282.		1.089E 05		1.0315	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.542E-04	7.542E-04				
THROAT	4.632E-04	4.859E-04	73688.	75010.	1.000	1.000
1.000E-01	1.266E-04	1.856E-04	126693.	117400.	2.164	2.124
1.000E-02	1.887E-05	4.643E-05	161870.	138962.	3.494	3.991
1.000E-03	2.642E-06	1.146E-05	182300.	146741.	4.735	6.649
1.000E-04	3.561E-07	2.802E-06	195847.	149791.	5.963	10.637
4.000E-05	1.597E-07	1.598E-06	200032.	150416.	6.461	12.759
1.000E-05	4.764E-08	6.822E-07	205388.	151024.	7.243	16.751
4.000E-06	2.180E-08	3.886E-07	208358.	151279.	7.782	20.027
1.000E-06	7.844E-09		211744.		9.176	
4.000E-07	4.524E-09		213311.		11.463	
1.000E-07	1.650E-09		214877.		14.254	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2290.3	2331.4	3902.9	3758.4
1.000E-01	2.129E 00	1.672E 00	3937.7	3648.9	4597.6	4134.4
1.000E-02	1.117E 01	5.648E 00	5031.1	4319.1	5377.4	4483.0
1.000E-03	7.088E 01	2.167E 01	5666.1	4560.9	5885.8	4623.8
1.000E-04	4.894E 02	8.683E 01	6087.1	4655.7	6238.8	4680.9
4.000E-05	1.069E 03	1.517E 02	6217.2	4675.1	6349.7	4692.7
1.000E-05	3.489E 03	3.537E 02	6383.6	4694.0	6491.8	4704.2
4.000E-06	7.514E 03	6.199E 02	6476.0	4701.9	6569.1	4709.1
1.000E-06	2.055E 04		6581.2		6644.9	
4.000E-07	3.537E 04		6629.9		6673.8	
1.000E-07	9.628E 04		6678.6		6708.4	

TABLE 105

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 155.77 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.76 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 28.439 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 28.802 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4885
THROAT PRESSURE RATIO(FROZEN) = 0.4885
ENTROPY = 6.663E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.399E 06	1.399E 06	0.5079	0.5079
THROAT	57918.	56485.	1.215E 06	1.216E 06	0.5129	0.5079
1.000E-01	38987.	30024.	9.343E 05	9.559E 05	0.5475	0.5079
1.000E-02	28290.	11955.	6.746E 05	7.791E 05	0.623[illegible]	0.5079
1.000E-03	22451.	4764.	5.006E 05	7.087E 05	0.703[illegible]	0.5079
1.000E-04	18537.	1901.	3.748E 05	6.806E 05	0.783[illegible]	0.5079
4.000E-05	17288.	1319.	3.340E 05	6.749E 05	0.8147	0.5079
1.000E-05	15617.	759.	2.799E 05	6.694E 05	0.8611	0.5079
4.000E-06	14619.	526.	2.485E 05	6.671E 05	0.8911	0.5079
1.000E-06	13197.	303.	2.065E 05	6.649E 05	0.9346	0.5079
4.000E-07	12256.		1.821E 05		0.9617	
1.000E-07	10523.		1.513E 05		0.9966	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.639E-04	4.639E-04				
THROAT	2.963E-04	3.009E-04	95983.	95733.	1.000	1.000
1.000E-01	9.618E-05	1.159E-04	152496.	148915.	2.110	2.128
1.000E-02	1.510E-05	2.910E-05	190410.	176138.	3.604	3.989
1.000E-03	2.147E-06	7.302E-06	212056.	185873.	4.931	6.671
1.000E-04	2.895E-07	1.830E-06	226414.	189616.	6.200	10.778
4.000E-05	1.291E-07	1.055E-06	230881.	190367.	6.702	12.991
1.000E-05	3.777E-08	4.586E-07	236670.	191089.	7.465	17.194
4.000E-06	1.670E-08	2.643E-07	239969.	191387.	7.976	20.673
1.000E-06	4.851E-09	1.149E-07	244308.	191673.	8.770	27.296
4.000E-07	2.150E-09		246800.		9.318	
1.000E-07	6.487E-10		249908.		10.180	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2983.3	2975.5	4800.6	4769.7
1.000E-01	1.939E 00	1.669E 00	4739.7	4628.4	5461.1	5241.5
1.000E-02	9.894E 00	5.619E 00	5918.1	5474.5	6286.2	5681.0
1.000E-03	6.248E 01	2.122E 01	6590.9	5777.1	6823.3	5855.1
1.000E-04	4.339E 02	8.299E 01	7037.2	5893.4	7198.6	5923.9
4.000E-05	9.540E 02	1.434E 02	7176.0	5916.8	7318.0	5937.9
1.000E-05	3.182E 03	3.287E 02	7355.9	5939.2	7474.3	5951.3
4.000E-06	7.097E 03	5.693E 02	7458.5	5948.5	7564.1	5956.9
1.000E-06	2.400E 04	1.308E 03	7593.3	5957.4	7682.6	5962.2
4.000E-07	5.360E 04		7670.8		7750.6	
1.000E-07	1.754E 05		7767.4		7832.7	

TABLE 106

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.37 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.55 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 24.883 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 24.911 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4881
THROAT PRESSURE RATIO(FROZEN) = 0.4879
ENTROPY = 6.957E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.654E 06	1.654E 06	0.5052	0.5052
THROAT	75346.	75129.	1.408E 06	1.408E 06	0.5059	0.5052
1.000E-01	43830.	39916.	1.055E 06	1.061E 06	0.5201	0.5052
1.000E-02	29569.	15894.	7.595E 05	8.248E 05	0.5862	0.5052
1.000E-03	23170.	6329.	5.676E 05	7.307E 05	0.6624	0.5052
1.000E-04	19087.	2521.	4.301E 05	6.933E 05	0.7393	0.5052
4.000E-05	17812.	1748.	3.856E 05	6.856E 05	0.7696	0.5052
1.000E-05	16133.	1004.	3.266E 05	6.783E 05	0.8150	0.5052
4.000E-06	15152.	696.	2.923E 05	6.753E 05	0.8446	0.5052
1.000E-06	13804.	400.	2.463E 05	6.724E 05	0.8883	0.5052
4.000E-07	12974.		2.193E 05		0.9163	
1.000E-07	11737.		1.829E 05		0.9567	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.460E-04	3.460E-04				
THROAT	2.245E-04	2.247E-04	110854.	110862.	1.000	1.000
1.000E-01	8.128E-05	8.669E-05	173113.	172250.	2.103	2.129
1.000E-02	1.358E-05	2.177E-05	211580.	203713.	3.717	3.990
1.000E-03	1.959E-06	5.467E-06	233185.	214962.	5.149	6.673
1.000E-04	2.653E-07	1.373E-06	247504.	219281.	6.474	10.786
4.000E-05	1.184E-07	7.919E-07	251965.	220148.	6.993	13.005
1.000E-05	3.460E-08	3.445E-07	257757.	220978.	7.776	17.222
4.000E-06	1.527E-08	1.987E-07	261068.	221321.	8.296	20.714
1.000E-06	4.407E-09	8.647E-08	265444.	221651.	9.093	27.367
4.000E-07	1.935E-09		267979.		9.631	
1.000E-07	5.583E-10		271354.		10.478	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3445.4	3445.7	5520.8	5517.8
1.000E-01	1.768E 00	1.668E 00	5380.5	5353.7	6132.4	6062.2
1.000E-02	8.661E 00	5.617E 00	6576.1	6331.6	6944.4	6570.2
1.000E-03	5.450E 01	2.120E 01	7247.6	6681.2	7479.3	6771.3
1.000E-04	3.790E 02	8.276E 01	7692.7	6815.5	7853.8	6850.6
4.000E-05	8.342E 02	1.429E 02	7831.3	6842.4	7973.2	6866.7
1.000E-05	2.790E 03	3.272E 02	8011.3	6868.2	8130.0	6882.1
4.000E-06	6.241E 03	5.663E 02	8114.3	6878.9	8220.4	6888.5
1.000E-06	2.127E 04	1.300E 03	8250.3	6889.1	8340.7	6894.7
4.000E-07	4.799E 04		8329.1		8410.7	
1.000E-07	1.642E 05		8434.0		8503.8	

TABLE 107

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.54 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.54 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 20.338 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 20.338 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4874
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 7.359E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	150000.	150000.	2.149E 06	2.149E 06	0.5044	0.5044
THROAT	112553.	112551.	1.780E 06	1.780E 06	0.5044	0.5044
1.000E-01	60085.	59776.	1.259E 06	1.259E 06	0.5055	0.5044
1.000E-02	32020.	23840.	8.828E 05	9.046E 05	0.5424	0.5044
1.000E-03	24204.	9512.	6.627E 05	7.631E 05	0.6122	0.5044
1.000E-04	19782.	3796.	5.081E 05	7.067E 05	0.6849	0.5044
4.000E-05	18446.	2634.	4.584E 05	6.952E 05	0.7139	0.5044
1.000E-05	16719.	1515.	3.926E 05	6.842E 05	0.7574	0.5044
4.000E-06	15726.	1051.	3.543E 05	6.796E 05	0.7859	0.5044
1.000E-06	14395.	605.	3.029E 05	6.752E 05	0.8285	0.5044
4.000E-07	13602.	420.	2.727E 05	6.733E 05	0.8562	0.5044
1.000E-07	12497.		2.317E 05		0.8972	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	2.303E-04	2.303E-04				
THROAT	1.496E-04	1.496E-04	135938.	135939.	1.000	1.000
1.000E-01	5.762E-05	5.779E-05	211057.	211026.	2.129	2.131
1.000E-02	1.160E-05	1.449E-05	251750.	249568.	3.847	3.991
1.000E-03	1.732E-06	3.632E-06	272757.	263374.	5.587	6.668
1.000E-04	2.371E-07	9.100E-07	286586.	268685.	7.056	10.769
4.000E-05	1.060E-07	5.246E-07	290898.	269752.	7.616	12.979
1.000E-05	3.103E-08	2.280E-07	296506.	270776.	8.454	17.178
4.000E-06	1.369E-08	1.314E-07	299719.	271199.	9.006	20.655
1.000E-06	3.942E-09	5.712E-08	303979.	271606.	9.843	27.274
4.000E-07	1.724E-09	3.293E-08	306461.	271774.	10.400	32.763
1.000E-07	4.918E-10		309791.		11.257	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	4225.1	4225.1	6760.7	6760.7
1.000E-01	1.672E 00	1.668E 00	6559.9	6558.9	7429.9	7426.4
1.000E-02	6.963E 00	5.624E 00	7824.6	7756.8	8166.9	8049.4
1.000E-03	4.304E 01	2.126E 01	8477.5	8185.9	8701.5	8296.5
1.000E-04	2.992E 02	8.318E 01	8907.4	8351.0	9063.1	8394.3
4.000E-05	6.594E 02	1.437E 02	9041.4	8384.2	9178.6	8414.1
1.000E-05	2.211E 03	3.294E 02	9215.7	8416.0	9330.7	8433.1
4.000E-06	4.956E 03	5.705E 02	9315.6	8429.1	9418.7	8441.0
1.000E-06	1.697E 04	1.311E 03	9448.0	8441.8	9536.3	8448.6
4.000E-07	3.848E 04	2.272E 03	9525.1	8447.0	9605.2	8451.7
1.000E-07	1.335E 05		9628.6		9698.1	

TABLE 108

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 50. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.53 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.53 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 17.612 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 17.612 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4873
THROAT PRESSURE RATIO(FROZEN) = 0.4873
ENTROPY = 7.643E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.642E 06	2.642E 06	0.5042	0.5042
THROAT	150029.	150038.	2.150E 06	2.150E 06	0.5042	0.5042
1.000E-01	79681.	79657.	1.456E 06	1.456E 06	0.5043	0.5042
1.000E-02	35285.	31740.	9.777E 05	9.833E 05	0.5183	0.5042
1.000E-03	25053.	12651.	7.325E 05	7.949E 05	0.5806	0.5042
1.000E-04	20266.	5043.	5.650E 05	7.199E 05	0.6503	0.5042
4.000E-05	18870.	3498.	5.113E 05	7.046E 05	0.6782	0.5042
1.000E-05	17088.	2011.	4.406E 05	6.899E 05	0.7203	0.5042
4.000E-06	16074.	1395.	3.995E 05	6.839E 05	0.7479	0.5042
1.000E-06	14730.	802.	3.443E 05	6.780E 05	0.7894	0.5042
4.000E-07	13939.	556.	3.118E 05	6.756E 05	0.8165	0.5042
1.000E-07	12855.	320.	2.677E 05	6.732E 05	0.8569	0.5042

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.727E-04	1.727E-04				
THROAT	1.122E-04	1.122E-04	157010.	157007.	1.000	1.000
1.000E-01	4.335E-05	4.336E-05	243687.	243688.	2.130	2.130
1.000E-02	1.006E-05	1.088E-05	288647.	288166.	3.900	3.991
1.000E-03	1.587E-06	2.730E-06	309178.	304084.	5.947	6.672
1.000E-04	2.198E-07	6.848E-07	322458.	310201.	7.606	10.780
4.000E-05	9.847E-08	3.949E-07	326593.	311430.	8.213	12.996
1.000E-05	2.887E-08	1.718E-07	331973.	312607.	9.113	17.206
4.000E-06	1.275E-08	9.906E-08	335059.	313093.	9.701	20.692
1.000E-06	3.671E-09	4.308E-08	339155.	313561.	10.588	27.333
4.000E-07	1.605E-09	2.485E-08	341545.	313754.	11.176	32.841
1.000E-07	4.566E-10	1.081E-08	344762.	313940.	12.071	43.340

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4880.0	4879.9	7807.5	7807.5
1.000E-01	1.667E 00	1.667E 00	7574.0	7574.1	8575.6	8575.5
1.000E-02	6.064E 00	5.617E 00	8971.4	8956.5	9335.7	9293.9
1.000E-03	3.589E 01	2.122E 01	9609.6	9451.2	9825.1	9578.7
1.000E-04	2.485E 02	8.291E 01	10022.3	9641.4	10171.6	9691.2
4.000E-05	5.477E 02	1.432E 02	10150.8	9679.5	10282.4	9714.0
1.000E-05	1.838E 03	3.280E 02	10318.1	9716.1	10428.4	9735.8
4.000E-06	4.123E 03	5.679E 02	10414.0	9731.3	10513.0	9744.9
1.000E-06	1.415E 04	1.304E 03	10541.3	9745.8	10626.3	9753.6
4.000E-07	3.213E 04	2.259E 03	10615.6	9751.8	10692.8	9757.2
1.000E-07	1.119E 05	5.192E 03	10715.5	9757.6	10782.8	9760.7

TABLE 109

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 286.95 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 288.98 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 405.806 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 408.684 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5480
THROAT PRESSURE RATIO(FROZEN) = 0.5446
ENTROPY = 1.925E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	1.936E 04	1.936E 04	2.0084	2.0084
THROAT	4404.	4345.	1.657E 04	1.656E 04	2.0133	2.0084
1.000E-01	2938.	2873.	1.047E 04	1.057E 04	2.0160	2.0084
1.000E-02	1587.	1535.	5.464E 03	5.678E 03	2.0160	2.0084
1.000E-03	828.	753.	2.813E 03	3.158E 03	2.0160	2.0084
1.000E-04	428.	342.	1.436E 03	1.965E 03	2.0160	2.0084

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.503E-02	5.503E-02				
THROAT	3.432E-02	3.448E-02	11824.	11851.	1.000	1.000
1.000E-01	9.399E-03	9.577E-03	21103.	20977.	2.143	2.147
1.000E-02	1.740E-03	1.792E-03	26379.	26175.	3.581	3.576
1.000E-03	3.334E-04	3.653E-04	28785.	28483.	5.387	5.410
1.000E-04	6.459E-05	8.044E-05	29958.	29513.	7.773	8.139

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	367.5	368.4	653.3	650.3
1.000E-01	2.046E 00	2.034E 00	655.9	652.0	762.6	757.3
1.000E-02	8.840E 00	8.713E 00	819.9	813.5	866.0	858.7
1.000E-03	4.228E 01	3.928E 01	894.7	885.3	916.7	905.6
1.000E-04	2.097E 02	1.721E 02	931.1	917.3	942.1	926.2

TABLE 110

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 280.61 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 286.11 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 362.261 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 369.372 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5584
THROAT PRESSURE RATIO(FROZEN) = 0.5461
ENTROPY = 2.033E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.535E 04	2.535E 04	1.9769	1.9769
THROAT	5439.	5232.	2.202E 04	2.194E 04	1.9936	1.9769
1.000E-01	3837.	3492.	1.413E 04	1.458E 04	2.0148	1.9769
1.000E-02	2147.	1903.	7.478E 03	8.481E 03	2.0160	1.9769
1.000E-03	1132.	955.	3.869E 03	5.276E 03	2.0160	1.9769
1.000E-04	588.	442.	1.983E 03	3.726E 03	2.0160	1.9769
5.000E-05	481.		1.619E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.513E-02	4.513E-02				
THROAT	2.804E-02	2.827E-02	12922.	13066.	1.000	1.000
1.000E-01	7.192E-03	7.755E-03	23699.	23223.	2.134	2.149
1.000E-02	1.286E-03	1.423E-03	29913.	29061.	3.515	3.562
1.000E-03	2.439E-04	2.836E-04	32794.	31702.	5.256	5.341
1.000E-04	4.700E-05	6.132E-05	34203.	32903.	7.586	7.961
5.000E-05	2.869E-05		34469.		8.437	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	401.6	406.1	727.8	719.0
1.000E-01	2.125E 00	2.051E 00	736.6	721.8	860.7	839.3
1.000E-02	9.416E 00	8.934E 00	929.7	903.2	984.7	954.4
1.000E-03	4.529E 01	4.108E 01	1019.3	985.3	1045.7	1008.9
1.000E-04	2.253E 02	1.831E 02	1063.1	1022.7	1076.2	1033.1
5.000E-05	3.663E 02		1071.3		1082.0	

TABLE 111

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 272.14 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 280.35 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 325.268 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 335.082 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5658
THROAT PRESSURE RATIO(FROZEN) = 0.5453
ENTROPY = 2.171E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	3.436E 04	3.436E 04	1.8931	1.8931
THROAT	6480.	6091.	3.037E 04	3.020E 04	1.9225	1.8931
1.000E-01	5016.	4052.	2.027E 04	2.127E 04	1.9918	1.8931
1.000E-02	3088.	2207.	1.106E 04	1.389E 04	2.0158	1.8931
1.000E-03	1678.	1110.	5.786E 03	1.000E 04	2.0160	1.8931
1.000E-04	877.	515.	2.981E 03	8.119E 03	2.0160	1.8931
5.000E-05	720.	403.	2.437E 03	7.786E 03	2.0160	1.8931
1.000E-05	453.		1.523E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.705E-02	3.705E-02				
THROAT	2.300E-02	2.322E-02	14144.	14433.	1.000	1.000
1.000E-01	5.438E-03	6.400E-03	26560.	25597.	2.149	2.150
1.000E-02	8.942E-04	1.175E-03	34153.	32013.	3.393	3.568
1.000E-03	1.646E-04	2.335E-04	37822.	34920.	4.998	5.345
1.000E-04	3.150E-05	5.034E-05	39635.	36245.	7.210	7.952
5.000E-05	1.919E-05	3.214E-05	39977.	36474.	8.021	8.990
1.000E-05	6.095E-06		40545.		10.224	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	439.6	448.6	807.7	792.9
1.000E-01	2.252E 00	2.045E 00	825.5	795.6	972.0	924.8
1.000E-02	1.065E 01	8.909E 00	1061.5	995.0	1130.8	1051.3
1.000E-03	5.225E 01	4.109E 01	1175.6	1085.3	1209.5	1111.3
1.000E-04	2.605E 02	1.837E 02	1231.9	1126.5	1248.8	1138.1
5.000E-05	4.240E 02	2.859E 02	1242.5	1133.7	1256.3	1142.7
1.000E-05	1.316E 03		1260.2		1268.8	

TABLE 112

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 260.77 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 270.56 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 291.551 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 302.496 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5673
THROAT PRESSURE RATIO(FROZEN) = 0.5411
ENTROPY = 2.355E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	4.819E 04	4.819E 04	1.7420	1.7420
THROAT	7460.	6893.	4.325E 04	4.299E 04	1.7792	1.7420
1.000E-01	6075.	4493.	3.055E 04	3.216E 04	1.8855	1.7420
1.000E-02	4502.	2380.	1.809E 04	2.337E 04	1.9909	1.7420
1.000E-03	2765.	1169.	9.801E 03	1.887E 04	2.0159	1.7420
1.000E-04	1485.	532.	5.105E 03	1.673E 04	2.0160	1.7420
5.000E-05	1222.	415.	4.183E 03	1.636E 04	2.0160	1.7420
1.000E-05	774.		2.626E 03		2.0160	
5.000E-06	635.		2.146E 03		2.0160	
1.000E-06	399.		1.339E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.983E-02	2.983E-02				
THROAT	1.853E-02	1.873E-02	15732.	16147.	1.000	1.000
1.000E-01	4.251E-03	5.311E-03	29716.	28331.	2.167	2.149
1.000E-02	6.058E-04	1.002E-03	38822.	35248.	3.333	3.600
1.000E-03	9.986E-05	2.041E-04	43840.	38314.	4.582	5.445
1.000E-04	1.859E-05	4.482E-05	46444.	39686.	6.512	8.173
5.000E-05	1.130E-05	2.875E-05	46938.	39920.	7.243	9.261
1.000E-05	3.567E-06		47761.		9.242	
5.000E-06	2.174E-06		48012.		10.248	
1.000E-06	6.919E-07		48431.		13.001	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	489.0	501.9	900.7	880.4
1.000E-01	2.308E 00	2.010E 00	923.6	880.6	1091.1	1021.2
1.000E-02	1.240E 01	8.561E 00	1206.6	1095.5	1296.6	1155.4
1.000E-03	6.659E 01	3.868E 01	1362.6	1190.8	1410.9	1217.9
1.000E-04	3.376E 02	1.701E 02	1443.5	1233.5	1468.0	1245.4
5.000E-05	5.498E 02	2.636E 02	1458.9	1240.8	1478.8	1250.0
1.000E-05	1.711E 03		1484.5		1496.9	
5.000E-06	2.793E 03		1492.3		1502.4	
1.000E-06	8.700E 03		1505.3		1511.6	

TABLE 113

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 246.57 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 257.79 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 259.907 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 271.740 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5653
THROAT PRESSURE RATIO(FROZEN) = 0.5332
ENTROPY = 2.583E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	6.763E 04	6.763E 04	1.5450	1.5450
THROAT	8383.	7607.	6.134E 04	6.093E 04	1.5859	1.5450
1.000E-01	6897.	4774.	4.543E 04	4.781E 04	1.7059	1.5450
1.000E-02	5465.	2395.	2.961E 04	3.754E 04	1.8539	1.5450
1.000E-03	4267.	1121.	1.798E 04	3.254E 04	1.9731	1.5450
1.000E-04	2773.	493.	9.839E 03	3.027E 04	2.0157	1.5450
5.000E-05	2317.		8.104E 03		2.0160	
1.000E-05	1491.		5.125E 03		2.0160	
5.000E-06	1227.		4.200E 03		2.0160	
1.000E-06	777.		2.636E 03		2.0160	
5.000E-07	638.		2.154E 03		2.0160	
1.000E-07	401.		1.345E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.352E-02	2.352E-02				
THROAT	1.465E-02	1.483E-02	17745.	18318.	1.000	1.000
1.000E-01	3.388E-03	4.433E-03	33342.	31501.	2.174	2.147
1.000E-02	4.647E-04	8.838E-04	43630.	38811.	3.359	3.662
1.000E-03	6.335E-05	1.888E-04	49857.	41912.	4.442	5.648
1.000E-04	9.959E-06	4.297E-05	53788.	43248.	5.626	8.634
5.000E-05	5.960E-06		54589.		6.191	
1.000E-05	1.852E-06		55938.		7.828	
5.000E-06	1.125E-06		56351.		8.679	
1.000E-06	3.553E-07		57041.		11.016	
5.000E-07	2.166E-07		57252.		12.196	
1.000E-07	6.891E-08		57605.		15.432	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	551.5	569.3	1011.8	984.5
1.000E-01	2.301E 00	1.946E 00	1036.3	979.1	1223.6	1130.6
1.000E-02	1.282E 01	7.922E 00	1356.1	1206.3	1460.4	1268.0
1.000E-03	8.229E 01	3.435E 01	1549.6	1302.7	1616.6	1329.4
1.000E-04	4.852E 02	1.462E 02	1671.8	1344.2	1711.3	1355.6
5.000E-05	7.988E 02		1696.7		1729.2	
1.000E-05	2.509E 03		1738.6		1759.0	
5.000E-06	4.099E 03		1751.4		1768.1	
1.000E-06	1.282E 04		1772.9		1783.3	
5.000E-07	2.096E 04		1779.5		1788.0	
1.000E-07	6.547E 04		1790.4		1795.8	

TABLE 114

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG F

THROAT FLOW PARAMETER(EQUIL.) = 232.54 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 245.23 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 232.542 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 245.233 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5617
THROAT PRESSURE RATIO(FROZEN) = 0.5223
ENTROPY = 2.827E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	9.075E 04	9.075E 04	1.3544	1.3544
THROAT	9250.	8228.	8.273E 04	8.209E 04	1.3953	1.3544
1.000E-01	7555.	4925.	6.304E 04	6.645E 04	1.5173	1.3544
1.000E-02	6038.	2309.	4.365E 04	5.473E 04	1.6743	1.3544
1.000E-03	4952.	1023.	2.931E 04	4.937E 04	1.8203	1.3544
1.000E-04	4039.	433.	1.839E 04	4.704E 04	1.9463	1.3544
5.000E-05	3752.		1.565E 04		1.9767	
1.000E-05	2875.		1.030E 04		2.014	
5.000E-06	2420.		8.493E 03		2.015	
1.000E-06	1562.		5.376E 03		2.016	
5.000E-07	1286.		4.406E 03		2.016	
1.000E-07	815.		2.767E 03		2.016	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.855E-02	1.855E-02				
THROAT	1.161E-02	1.178E-02	20034.	20821.	1.000	1.000
1.000E-01	2.751E-03	3.767E-03	37244.	34878.	2.180	2.143
1.000E-02	3.799E-04	8.036E-04	48555.	42463.	3.384	3.744
1.000E-03	5.035E-05	1.813E-04	55460.	45514.	4.481	5.919
1.000E-04	6.601E-06	4.284E-05	60185.	46776.	5.548	9.232
5.000E-05	3.608E-06		61312.		5.866	
1.000E-05	9.598E-07		63460.		6.599	
5.000E-06	5.706E-07		64169.		7.139	
1.000E-06	1.768E-07		65374.		8.943	
5.000E-07	1.074E-07		65744.		9.893	
1.000E-07	3.388E-08		66365.		12.518	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	622.7	647.1	1133.8	1097.8
1.000E-01	2.269E 00	1.866E 00	1157.6	1084.0	1364.1	1245.1
1.000E-02	1.261E 01	7.187E 00	1509.2	1319.8	1623.9	1381.8
1.000E-03	8.327E 01	2.972E 01	1723.7	1414.6	1799.5	1440.3
1.000E-04	5.854E 02	1.224E 02	1870.6	1453.8	1923.9	1464.4
5.000E-05	1.051E 03		1905.7		1953.5	
1.000E-05	3.818E 03		1972.4		2007.1	
5.000E-06	6.352E 03		1994.4		2023.3	
1.000E-06	2.012E 04		2031.9		2050.2	
5.000E-07	3.294E 04		2043.4		2058.4	
1.000E-07	1.034E 05		2062.7		2072.1	

TABLE 115

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 205.26 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 219.55 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 187.377 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 200.418 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5256
THROAT PRESSURE RATIO(FROZEN) = 0.4753
ENTROPY = 3.207E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.312E 05	1.312E 05	1.1151	1.1151
THROAT	10762.	9178.	1.195E 05	1.184E 05	1.1581	1.1151
1.000E-01	8506.	5186.	9.355E 04	9.894E 04	1.2675	1.1151
1.000E-02	6681.	2187.	6.788E 04	8.466E 04	1.4201	1.1151
1.000E-03	5509.	901.	4.928E 04	7.870E 04	1.5677	1.1151
1.000E-04	4661.	365.	3.511E 04	7.626E 04	1.7084	1.1151
5.000E-05	4445.		3.149E 04		1.7491	
1.000E-05	3986.		2.398E 04		1.8400	
5.000E-06	3799.		2.109E 04		1.8771	
1.000E-06	3362.		1.511E 04		1.9558	
5.000E-07	3147.		1.284E 04		1.9840	
1.000E-07	2380.		8.363E 03		2.0155	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.273E-02	1.273E-02				
THROAT	7.748E-03	7.910E-03	24184.	25339.	1.000	1.000
1.000E-01	2.041E-03	2.945E-03	43420.	40191.	2.166	2.098
1.000E-02	2.912E-04	6.985E-04	56306.	48273.	3.421	3.848
1.000E-03	3.898E-05	1.696E-04	64041.	51270.	4.554	6.322
1.000E-04	5.021E-06	4.185E-05	69359.	52446.	5.638	10.115
5.000E-05	2.696E-06		70655.		5.960	
1.000E-05	6.324E-07		73267.		6.706	
5.000E-06	3.384E-07		74246.		7.029	
1.000E-06	7.970E-08		76235.		7.786	
5.000E-07	4.319E-08		76979.		8.106	
1.000E-07	1.160E-08		78421.		8.845	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	751.7	787.6	1345.2	1289.3
1.000E-01	2.114E 00	1.693E 00	1349.5	1249.2	1588.3	1427.9
1.000E-02	1.143E 01	5.944E 00	1750.0	1500.4	1879.1	1563.1
1.000E-03	7.506E 01	2.305E 01	1990.5	1593.5	2075.2	1617.9
1.000E-04	5.380E 02	9.132E 01	2155.7	1630.1	2216.5	1639.7
5.000E-05	9.838E 02		2196.0		2251.6	
1.000E-05	4.044E 03		2277.2		2322.9	
5.000E-06	7.458E 03		2307.6		2349.7	
1.000E-06	3.084E 04		2369.5		2404.3	
5.000E-07	5.636E 04		2392.6		2424.4	
1.000E-07	2.060E 05		2437.4		2460.7	

TABLE 116

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 214.85 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 216.17 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 181.584 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 182.701 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5486
THROAT PRESSURE RATIO(FROZEN) = 0.4692
ENTROPY = 3.374E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.527E 05	1.527E 05	1.0462	1.0462
THROAT	11993.	10471.	1.382E 05	1.366E 05	1.0727	1.0462
1.000E-01	9008.	5760.	1.082E 05	1.134E 05	1.1767	1.0462
1.000E-02	6942.	2345.	7.926E 04	9.678E 04	1.3242	1.0462
1.000E-03	5696.	946.	5.865E 04	9.003E 04	1.4687	1.0462
1.000E-04	4824.	379.	4.304E 04	8.732E 04	1.6079	1.0462
5.000E-05	4607.		3.905E 04		1.6486	
1.000E-05	4157.		3.079E 04		1.7407	
5.000E-06	3982.		2.761E 04		1.7792	
1.000E-06	3601.		2.095E 04		1.8649	
5.000E-07	3442.		1.838E 04		1.8999	
1.000E-07	3049.		1.301E 04		1.9728	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.024E-02	1.024E-02				
THROAT	6.722E-03	6.422E-03	27013.	28448.	1.000	1.000
1.000E-01	1.789E-03	2.488E-03	47232.	44367.	2.192	2.098
1.000E-02	2.613E-04	6.112E-04	60645.	52925.	3.480	3.908
1.000E-03	3.532E-05	1.515E-04	68628.	56023.	4.639	6.495
1.000E-04	4.566E-06	3.782E-05	74101.	57222.	5.743	10.462
5.000E-05	2.451E-06		75436.		6.069	
1.000E-05	5.736E-07		78130.		6.822	
5.000E-06	3.060E-07		79144.		7.146	
1.000E-06	7.094E-08		81221.		7.902	
5.000E-07	3.781E-08		82011.		8.231	
1.000E-07	8.864E-09		83634.		9.000	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	839.6	884.2	1478.9	1427.7
1.000E-01	2.149E 00	1.655E 00	1468.0	1379.0	1718.4	1570.6
1.000E-02	1.146E 01	5.648E 00	1884.9	1645.0	2018.4	1710.4
1.000E-03	7.491E 01	2.152E 01	2133.0	1741.3	2220.3	1766.2
1.000E-04	5.367E 02	8.443E 01	2303.1	1778.5	2365.7	1788.3
5.000E-05	9.821E 02		2344.6		2401.9	
1.000E-05	4.052E 03		2428.4		2475.6	
5.000E-06	7.497E 03		2459.9		2503.6	
1.000E-06	3.151E 04		2524.4		2561.1	
5.000E-07	5.857E 04		2549.0		2583.1	
1.000E-07	2.449E 05		2599.4		2628.0	

TABLE 117

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 217.33 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.67 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 171.814 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 176.828 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5444
THROAT PRESSURE RATIO(FROZEN) = 0.4899
ENTROPY = 3.467E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.666E 05	1.666E 05	1.0246	1.0246
THROAT	13170.	12091.	1.496E 05	1.473E 05	1.0408	1.0246
1.000E-01	9358.	6447.	1.167E 05	1.196E 05	1.1315	1.0246
1.000E-02	7092.	2533.	8.577E 04	1.008E 05	1.2751	1.0246
1.000E-03	5794.	972.	6.398E 04	9.353E 04	1.4175	1.0246
1.000E-04	4904.	368.	4.755E 04	9.076E 04	1.5552	1.0246
5.000E-05	4685.		4.336E 04		1.5956	
1.000E-05	4234.		3.468E 04		1.6874	
5.000E-06	4060.		3.134E 04		1.7259	
1.000E-06	3690.		2.433E 04		1.8128	
5.000E-07	3540.		2.162E 04		1.8488	
1.000E-07	3197.		1.591E 04		1.9276	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.772E-03	8.772E-03				
THROAT	5.894E-03	5.687E-03	29153.	31092.	1.000	1.000
1.000E-01	1.656E-03	2.177E-03	49979.	48504.	2.220	2.125
1.000E-02	2.463E-04	5.541E-04	63602.	57373.	3.537	3.969
1.000E-03	3.351E-05	1.444E-04	71667.	60469.	4.715	6.709
1.000E-04	4.344E-06	3.813E-05	77190.	61609.	5.833	11.072
5.000E-05	2.333E-06		78537.		6.164	
1.000E-05	5.459E-07		81257.		6.924	
5.000E-06	2.912E-07		82281.		7.251	
1.000E-06	6.730E-08		84384.		8.009	
5.000E-07	3.577E-08		85187.		8.338	
1.000E-07	8.260E-09		86848.		9.112	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	906.1	966.4	1576.6	1552.6
1.000E-01	2.076E 00	1.675E 00	1553.4	1507.6	1809.0	1708.0
1.000E-02	1.097E 01	5.563E 00	1976.8	1783.2	2111.9	1849.8
1.000E-03	7.154E 01	2.025E 01	2227.5	1879.4	2315.6	1903.7
1.000E-04	5.124E 02	7.528E 01	2399.1	1914.9	2462.2	1923.9
5.000E-05	9.377E 02		2441.0		2498.8	
1.000E-05	3.873E 03		2525.5		2573.2	
5.000E-06	7.172E 03		2557.4		2601.5	
1.000E-06	3.025E 04		2622.7		2660.0	
5.000E-07	5.638E 04		2647.7		2682.4	
1.000E-07	2.395E 05		2699.3		2728.8	

TABLE 118

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 219.54 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.17 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 163.636 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 166.342 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5391
THROAT PRESSURE RATIO(FROZEN) = 0.4888
ENTROPY = 3.534E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.780E 05	1.780E 05	1.0165	1.0165
THROAT	14418.	13559.	1.586E 05	1.560E 05	1.0255	1.0165
1.000E-01	9671.	7213.	1.231E 05	1.248E 05	1.1012	1.0165
1.000E-02	7207.	2830.	9.057E 04	1.037E 05	1.2413	1.0165
1.000E-03	5865.	1087.	6.789E 04	9.548E 04	1.3821	1.0165
1.000E-04	4959.	412.	5.087E 04	9.235E 04	1.5185	1.0165
5.000E-05	4737.		4.653E 04		1.5586	
1.000E-05	4284.		3.754E 04		1.6499	
5.000E-06	4110.		3.408E 04		1.6884	
1.000E-06	3744.		2.683E 04		1.7754	
5.000E-07	3598.		2.401E 04		1.8117	
1.000E-07	3272.		1.808E 04		1.8925	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.736E-03	7.736E-03				
THROAT	5.253E-03	5.020E-03	31154.	33137.	1.000	1.000
1.000E-01	1.560E-03	1.931E-03	52426.	51578.	2.251	2.126
1.000E-02	2.360E-04	4.920E-04	66145.	60977.	3.595	3.975
1.000E-03	3.228E-05	1.282E-04	74232.	64259.	4.790	6.719
1.000E-04	4.195E-06	3.377E-05	79767.	65468.	5.922	11.081
5.000E-05	2.254E-06		81117.		6.256	
1.000E-05	5.276E-07		83843.		7.024	
5.000E-06	2.813E-07		84871.		7.353	
1.000E-06	6.496E-08		86982.		8.116	
5.000E-07	3.449E-08		87790.		8.446	
1.000E-07	7.923E-09		89465.		9.221	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	968.3	1029.9	1665.4	1651.7
1.000E-01	2.001E 00	1.671E 00	1629.5	1603.1	1888.2	1815.6
1.000E-02	1.048E 01	5.544E 00	2055.8	1895.2	2191.4	1965.8
1.000E-03	6.828E 01	2.020E 01	2307.2	1997.2	2395.5	2022.9
1.000E-04	4.890E 02	7.524E 01	2479.2	2034.8	2542.5	2044.4
5.000E-05	8.951E 02		2521.2		2579.1	
1.000E-05	3.699E 03		2605.9		2653.8	
5.000E-06	6.853E 03		2637.9		2682.2	
1.000E-06	2.896E 04		2703.5		2740.9	
5.000E-07	5.404E 04		2728.6		2763.5	
1.000E-07	2.309E 05		2780.7		2810.5	

TABLE 119

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 217.75 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.47 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 153.971 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 157.311 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5060
THROAT PRESSURE RATIO(FROZEN) = 0.4883
ENTROPY = 3.606E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.914E 05	1.914E 05	1.0088	1.0088
THROAT	15820.	15047.	1.675E 05	1.668E 05	1.0165	1.0088
1.000E-01	10098.	7998.	1.301E 05	1.319E 05	1.0720	1.0088
1.000E-02	7337.	3140.	9.577E 04	1.083E 05	1.2069	1.0088
1.000E-03	5939.	1207.	7.211E 04	9.914E 04	1.3457	1.0088
1.000E-04	5015.	459.	5.444E 04	9.563E 04	1.4807	1.0088
5.000E-05	4790.		4.994E 04		1.5205	
1.000E-05	4334.		4.063E 04		1.6111	
5.000E-06	4160.		3.704E 04		1.6494	
1.000E-06	3795.		2.953E 04		1.7363	
5.000E-07	3651.		2.661E 04		1.7727	
1.000E-07	3337.		2.045E 04		1.8546	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.910E-03	6.910E-03				
THROAT	4.453E-03	4.484E-03	34574.	35079.	1.000	1.000
1.000E-01	1.454E-03	1.728E-03	55372.	54547.	2.282	2.127
1.000E-02	2.254E-04	4.401E-04	69180.	64479.	3.669	3.977
1.000E-03	3.104E-05	1.145E-04	77267.	67951.	4.885	6.719
1.000E-04	4.045E-06	3.011E-05	82797.	69232.	6.034	11.072
5.000E-05	2.174E-06		84146.		6.372	
1.000E-05	5.093E-07		86871.		7.150	
5.000E-06	2.716E-07		87899.		7.482	
1.000E-06	6.268E-08		90012.		8.253	
5.000E-07	3.326E-08		90821.		8.586	
1.000E-07	7.614E-09		92503.		9.363	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1074.6	1090.3	1770.0	1747.1
1.000E-01	1.912E 00	1.669E 00	1721.0	1695.4	1983.8	1919.9
1.000E-02	9.876E 00	5.544E 00	2150.2	2004.1	2285.9	2078.7
1.000E-03	6.420E 01	2.023E 01	2401.5	2112.0	2489.8	2139.2
1.000E-04	4.598E 02	7.545E 01	2573.4	2151.8	2636.6	2162.0
5.000E-05	8.416E 02		2615.3		2673.2	
1.000E-05	3.480E 03		2700.0		2747.9	
5.000E-06	6.450E 03		2732.0		2776.3	
1.000E-06	2.729E 04		2797.7		2835.2	
5.000E-07	5.098E 04		2822.8		2857.8	
1.000E-07	2.186E 05		2875.1		2905.1	

TABLE 120

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 196.09 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 212.93 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 113.210 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 122.938 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5601
THROAT PRESSURE RATIO(FROZEN) = 0.4886
ENTROPY = 4.025E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	2.985E 05	2.985E 05	0.9348	0.9348
THROAT	27029.	22767.	2.638E 05	2.585E 05	0.9566	0.9348
1.000E-01	18252.	12103.	1.846E 05	2.016E 05	1.0030	0.9348
1.000E-02	8713.	4792.	1.288E 05	1.629E 05	1.0412	0.9348
1.000E-03	6430.	1863.	9.800E 04	1.477E 05	1.1604	0.9348
1.000E-04	5325.	715.	7.612E 04	1.419E 05	1.2855	0.9348
5.000E-05	5074.	535.	7.063E 04	1.409E 05	1.3226	0.9348
1.000E-05	4579.	273.	5.934E 04	1.396E 05	1.4079	0.9348
5.000E-06	4396.		5.500E 04		1.4441	
1.000E-06	4020.		4.595E 04		1.5270	
5.000E-07	3877.		4.243E 04		1.5622	
1.000E-07	3576.		3.500E 04		1.6428	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.269E-03	4.269E-03				
THROAT	2.716E-03	2.748E-03	41687.	44735.	1.000	1.000
1.000E-01	7.528E-04	1.058E-03	75527.	69652.	2.151	2.128
1.000E-02	1.637E-04	2.672E-04	92171.	82387.	4.089	3.976
1.000E-03	2.472E-05	6.874E-05	100188.	86881.	5.618	6.684
1.000E-04	3.307E-06	1.790E-05	105513.	88556.	6.932	10.960
5.000E-05	1.785E-06	1.196E-05	106807.	88815.	7.312	12.697
1.000E-05	4.212E-07	4.690E-06	109422.	89189.	8.178	17.842
5.000E-06	2.250E-07		110409.		8.547	
1.000E-06	5.203E-08		112443.		9.394	
5.000E-07	2.760E-08		113224.		9.757	
1.000E-07	6.294E-09		114855.		10.597	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1295.7	1390.4	2342.6	2231.4
1.000E-01	1.991E 00	1.668E 00	2347.5	2164.8	2719.6	2452.0
1.000E-02	7.502E 00	5.584E 00	2864.8	2560.7	3005.0	2656.8
1.000E-03	4.571E 01	2.058E 01	3113.9	2700.3	3159.4	2735.8
1.000E-04	3.245E 02	7.754E 01	3279.4	2752.4	3340.1	2765.8
5.000E-05	5.937E 02	1.158E 02	3319.7	2760.4	3375.2	2770.4
1.000E-05	2.457E 03	2.939E 02	3401.0	2772.1	3446.9	2777.2
5.000E-06	4.557E 03		3431.6		3474.2	
1.000E-06	1.935E 04		3494.8		3531.0	
5.000E-07	3.622E 04		3519.1		3553.0	
1.000E-07	1.566E 05		3569.8		3599.1	

TABLE 121

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 173.01 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 190.79 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 86.504 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 95.397 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5570
THROAT PRESSURE RATIO(FROZEN) = 0.5030
ENTROPY = 4.815E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	40000.	40000.	5.801E 05	5.801E 05	0.7385	0.7385
THROAT	36671.	30876.	5.207E 05	5.132E 05	0.7627	0.7385
1.000E-01	28989.	16316.	3.798E 05	4.137E 05	0.8398	0.7385
1.000E-02	21548.	6495.	2.502E 05	3.476E 05	0.9358	0.7385
1.000E-03	14348.	2561.	1.647E 05	3.214E 05	1.0032	0.7385
1.000E-04	6543.	1002.	1.214E 05	3.111E 05	1.0237	0.7385
5.000E-05	5873.	754.	1.132E 05	3.095E 05	1.0503	0.7385
1.000E-05	5052.	390.	9.723E 04	3.071E 05	1.1218	0.7385
5.000E-06	4806.		9.127E 04		1.1532	
1.000E-06	4344.		7.899E 04		1.2258	
5.000E-07	4177.		7.426E 04		1.2568	
1.000E-07	3842.		6.435E 04		1.3282	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.529E-03	2.529E-03				
THROAT	1.587E-03	1.648E-03	54511.	57879.	1.000	1.000
1.000E-01	3.968E-04	6.200E-04	100123.	91264.	2.201	2.134
1.000E-02	5.949E-05	1.558E-04	128513.	107879.	3.500	3.990
1.000E-03	9.578E-06	3.950E-05	144205.	113798.	4.712	6.678
1.000E-04	2.143E-06	1.010E-05	151525.	116041.	7.887	10.865
5.000E-05	1.225E-06	6.705E-06	152874.	116392.	8.578	12.553
1.000E-05	3.042E-07	2.592E-06	155470.	116905.	9.820	17.520
5.000E-06	1.644E-07		156427.		10.302	
1.000E-06	3.866E-08		158380.		11.373	
5.000E-07	2.061E-08		159125.		11.820	
1.000E-07	4.736E-09		160677.		12.842	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1694.3	1798.9	3056.7	2914.8
1.000E-01	2.177E 00	1.686E 00	3111.9	2836.6	3644.5	3210.5
1.000E-02	1.131E 01	5.677E 00	3994.3	3353.0	4271.1	3478.9
1.000E-03	6.263E 01	2.122E 01	4482.0	3537.0	4635.2	3584.0
1.000E-04	2.664E 02	8.140E 01	4709.5	3606.7	4774.7	3624.7
5.000E-05	4.620E 02	1.222E 02	4751.5	3617.6	4808.0	3631.1
1.000E-05	1.829E 03	3.148E 02	4832.2	3633.5	4876.9	3640.5
5.000E-06	3.364E 03		4861.9		4903.1	
1.000E-06	1.413E 04		4922.6		4957.2	
5.000E-07	2.638E 04		4945.8		4978.0	
1.000E-07	1.137E 05		4994.0		5021.8	

TABLE 122

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG

THROAT FLOW PARAMETER(EQUIL.) = 156.45 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 166.75 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 69.967 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 74.574 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5336
THROAT PRESSURE RATIO(FROZEN) = 0.4948
ENTROPY = 5.640E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	9.485E 05	9.485E 05	0.5843	0.5843
THROAT	44550.	38607.	8.495E 05	8.430E 05	0.6057	0.5843
1.000E-01	34651.	20616.	6.430E 05	6.866E 05	0.6702	0.5843
1.000E-02	26292.	8266.	4.497E 05	5.809E 05	0.7627	0.5843
1.000E-03	20805.	3390.	3.168E 05	5.381E 05	0.8531	0.5843
1.000E-04	16618.	1412.	2.215E 05	5.205E 05	0.9389	0.5843
5.000E-05	15424.	1086.	1.982E 05	5.175E 05	0.9620	0.5843
1.000E-05	11993.	592.	1.532E 05	5.131E 05	1.0029	0.5843
5.000E-06	9648.	456.	1.397E 05	5.118E 05	1.0080	0.5843
1.000E-06	5286.		1.171E 05		1.0140	
5.000E-07	4724.		1.104E 05		1.0348	
1.000E-07	4147.		9.718E 04		1.0950	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.601E-03	1.601E-03				
THROAT	9.939E-04	1.026E-03	70398.	72696.	1.000	1.000
1.000E-01	2.649E-04	3.882E-04	123662.	114517.	2.178	2.119
1.000E-02	3.972E-05	9.683E-05	158027.	135660.	3.502	3.989
1.000E-03	5.621E-06	2.361E-05	177827.	143334.	4.759	6.629
1.000E-04	7.740E-07	5.669E-06	190779.	146388.	6.033	10.529
5.000E-05	4.272E-07	3.684E-06	193801.	146887.	6.432	12.052
1.000E-05	1.146E-07	1.352E-06	199535.	147645.	7.303	16.424
5.000E-06	7.156E-08	8.771E-07	201215.	147853.	8.246	18.743
1.000E-06	2.628E-08		204014.		11.933	
5.000E-07	1.500E-08		204832.		12.891	
1.000E-07	3.617E-09		206443.		14.366	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2188.0	2259.5	3801.9	3663.5
1.000E-01	2.134E 00	1.677E 00	3843.5	3559.3	4489.4	4035.2
1.000E-02	1.115E 01	5.677E 00	4911.6	4216.4	5248.8	4377.5
1.000E-03	6.999E 01	2.204E 01	5527.0	4455.0	5738.7	4517.5
1.000E-04	4.738E 02	8.986E 01	5929.6	4549.9	6072.9	4575.4
5.000E-05	8.451E 02	1.378E 02	6023.5	4565.4	6151.3	4585.0
1.000E-05	3.061E 03	3.737E 02	6201.7	4589.0	6294.3	4599.6
5.000E-06	4.859E 03	5.750E 02	6254.0	4595.4	6327.4	4603.6
1.000E-06	1.305E 04		6341.0		6380.4	
5.000E-07	2.276E 04		6366.4		6400.8	
1.000E-07	9.370E 04		6416.5		6444.8	

TABLE 123

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 155.10 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.01 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 56.636 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 57.696 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4910
THROAT PRESSURE RATIO(FROZEN) = 0.4896
ENTROPY = 6.378E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.388E 06	1.388E 06	0.5118	0.5118
THROAT	58940.	56704.	1.205E 06	1.206E 06	0.5195	0.5118
1.000E-01	40625.	30185.	9.199E 05	9.466E 05	0.5593	0.5118
1.000E-02	29403.	12022.	6.553E 05	7.702E 05	0.6390	0.5118
1.000E-03	23154.	4796.	4.796E 05	6.999E 05	0.7224	0.5118
1.000E-04	18961.	1917.	3.538E 05	6.718E 05	0.8054	0.5118
5.000E-05	17933.	1455.	3.228E 05	6.673E 05	0.8295	0.5118
1.000E-05	15814.	767.	2.599E 05	6.606E 05	0.8855	0.5118
5.000E-06	14981.	582.	2.363E 05	6.588E 05	0.9086	0.5118
1.000E-06	13101.	307.	1.881E 05	6.561E 05	0.9593	0.5118
5.000E-07	12232.		1.701E 05		0.9789	
1.000E-07	8949.		1.367E 05		1.0074	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.348E-04	9.348E-04				
THROAT	5.928E-04	6.054E-04	95534.	95307.	1.000	1.000
1.000E-01	1.886E-04	2.323E-04	153022.	148592.	2.123	2.127
1.000E-02	2.977E-05	5.832E-05	191473.	175814.	3.601	3.986
1.000E-03	4.274E-06	1.462E-05	213206.	185551.	4.940	6.666
1.000E-04	5.819E-07	3.657E-06	227490.	189299.	6.237	10.763
5.000E-05	3.170E-07	2.409E-06	230884.	189894.	6.627	12.394
1.000E-05	7.670E-08	9.139E-07	237602.	190777.	7.540	17.151
5.000E-06	4.154E-08	6.019E-07	240079.	191014.	7.942	19.711
1.000E-06	1.003E-08	2.283E-07	245044.	191366.	8.910	27.194
5.000E-07	5.482E-09		246877.		9.351	
1.000E-07	1.542E-09		250248.		9.790	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2969.3	2962.2	4803.8	4757.9
1.000E-01	1.963E 00	1.672E 00	4756.1	4618.4	5489.4	5231.5
1.000E-02	9.936E 00	5.627E 00	5951.2	5464.5	6322.4	5670.8
1.000E-03	6.215E 01	2.127E 01	6626.7	5767.1	6858.9	5845.1
1.000E-04	4.279E 02	8.334E 01	7070.6	5883.6	7230.5	5914.2
5.000E-05	7.739E 02	1.261E 02	7176.1	5902.1	7320.7	5925.2
1.000E-05	3.108E 03	3.309E 02	7384.9	5929.5	7501.0	5941.7
5.000E-06	5.679E 03	5.018E 02	7461.9	5936.9	7568.0	5946.1
1.000E-06	2.304E 04	1.321E 03	7616.2	5947.8	7702.3	5952.7
5.000E-07	4.185E 04		7673.2		7751.4	
1.000E-07	1.468E 05		7778.0		7832.8	

TABLE 124

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.28 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.60 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 49.737 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 49.838 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4885
THROAT PRESSURE RATIO(FROZEN) = 0.4885
ENTROPY = 6.682E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.651E 06	1.651E 06	0.5064	0.5064
THROAT	75654.	75248.	1.406E 06	1.406E 06	0.5077	0.5064
1.000E-01	45344.	40019.	1.050E 06	1.059E 06	0.5272	0.5064
1.000E-02	30829.	15939.	7.466E 05	8.222E 05	0.5975	0.5064
1.000E-03	23989.	6348.	5.511E 05	7.280E 05	0.6766	0.5064
1.000E-04	19620.	2530.	4.124E 05	6.905E 05	0.7567	0.5064
5.000E-05	18573.	1918.	3.782E 05	6.845E 05	0.7806	0.5064
1.000E-05	16459.	1009.	3.089E 05	6.756E 05	0.8351	0.5064
5.000E-06	15653.	765.	2.828E 05	6.732E 05	0.8582	0.5064
1.000E-06	13941.	402.	2.293E 05	6.696E 05	0.9102	0.5064
5.000E-07	13243.		2.090E 05		0.9317	
1.000E-07	11559.		1.674E 05		0.9780	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.937E-04	6.937E-04				
THROAT	4.495E-04	4.503E-04	110655.	110676.	1.000	1.000
1.000E-01	1.593E-04	1.733E-04	173459.	172164.	2.105	2.129
1.000E-02	2.655E-05	4.352E-05	212732.	203652.	3.706	3.988
1.000E-03	3.865E-06	1.093E-05	234609.	214910.	5.141	6.670
1.000E-04	5.283E-07	2.742E-06	248970.	219234.	6.490	10.780
5.000E-05	2.879E-07	1.808E-06	252386.	219919.	6.892	12.420
1.000E-05	6.951E-08	6.877E-07	259166.	220934.	7.825	17.206
5.000E-06	3.755E-08	4.535E-07	261677.	221205.	8.230	19.785
1.000E-06	8.944E-09	1.725E-07	266745.	221608.	9.188	27.332
5.000E-07	4.819E-09		268646.		9.614	
1.000E-07	1.159E-09		272495.		10.655	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3439.3	3439.9	5519.4	5514.0
1.000E-01	1.800E 00	1.670E 00	5391.3	5351.0	6157.2	6060.1
1.000E-02	8.806E 00	5.623E 00	6611.9	6329.7	6986.6	6568.4
1.000E-03	5.486E 01	2.122E 01	7291.9	6679.6	7525.3	6769.7
1.000E-04	3.781E 02	8.291E 01	7738.2	6814.0	7899.1	6849.2
5.000E-05	6.846E 02	1.253E 02	7844.4	6835.3	7990.0	6861.9
1.000E-05	2.761E 03	3.280E 02	8055.1	6866.8	8172.6	6880.8
5.000E-06	5.062E 03	4.968E 02	8133.2	6875.3	8240.8	6885.8
1.000E-06	2.085E 04	1.304E 03	8290.7	6887.8	8379.4	6893.3
5.000E-07	3.842E 04		8349.8		8431.5	
1.000E-07	1.575E 05		8469.4		8536.4	

TABLE 125

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.57 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.57 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 40.684 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 40.684 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4876
THROAT PRESSURE RATIO(FROZEN) = 0.4876
ENTROPY = 7.085E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.148E 06	2.148E 06	0.5048	0.5048
THROAT	112594.	112590.	1.779E 06	1.779E 06	0.5048	0.5048
1.000E-01	60416.	59837.	1.258E 06	1.259E 06	0.5068	0.5048
1.000E-02	33373.	23906.	8.757E 05	9.036E 05	0.5502	0.5048
1.000E-03	25133.	9560.	6.502E 05	7.618E 05	0.6229	0.5048
1.000E-04	20408.	3825.	4.932E 05	7.050E 05	0.698[illegible]	0.5048
5.000E-05	19313.	2903.	4.546E 05	6.959E 05	0.721[illegible]	0.5048
1.000E-05	17141.	1530.	3.767E 05	6.823E 05	0.773	0.5048
5.000E-06	16331.	1162.	3.474E 05	6.787E 05	0.796[illegible]	0.5048
1.000E-06	14662.	612.	2.871E 05	6.732E 05	0.847[illegible]	0.5048
5.000E-07	14013.	465.	2.641E 05	6.718E 05	0.868[illegible]	0.5048
1.000E-07	12612.		2.164E 05		0.917[illegible]	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL	MACH NUMBER FROZEN
CHAMBER	4.610E-04	4.610E-04				
THROAT	2.994E-04	2.994E-04	135868.	135868.	1.000	1.000
1.000E-01	1.149E-04	1.156E-04	211042.	210982.	2.128	2.131
1.000E-02	2.259E-05	2.893E-05	252347.	249564.	3.843	3.990
1.000E-03	3.395E-06	7.233E-06	273807.	263409.	5.552	6.661
1.000E-04	4.689E-07	1.808E-06	287802.	268747.	7.037	10.745
5.000E-05	2.558E-07	1.191E-06	291134.	269595.	7.469	12.373
1.000E-05	6.183E-08	4.518E-07	297757.	270854.	8.464	17.120
5.000E-06	3.338E-08	2.976E-07	300215.	271191.	8.892	19.675
1.000E-06	7.915E-09	1.129E-07	305200.	271692.	9.890	27.148
5.000E-07	4.246E-09	7.438E-08	307082.	271826.	10.324	31.176
1.000E-07	9.965E-10		310943.		11.356	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4222.9	4222.9	6758.7	6758.7
1.000E-01	1.678E 00	1.669E 00	6559.4	6557.5	7431.9	7425.4
1.000E-02	7.138E 00	5.636E 00	7843.2	7756.7	8214.5	8049.8
1.000E-03	4.376E 01	2.135E 01	8510.2	8187.0	8737.8	8298.1
1.000E-04	3.015E 02	8.373E 01	8945.2	8352.9	9102.0	8396.5
5.000E-05	5.463E 02	1.267E 02	9048.7	8379.3	9190.8	8412.2
1.000E-05	2.210E 03	3.324E 02	9254.6	8418.4	9369.5	8435.7
5.000E-06	4.059E 03	5.040E 02	9331.0	8428.9	9436.5	8442.0
1.000E-06	1.684E 04	1.326E 03	9485.9	8444.5	9573.5	8451.4
5.000E-07	3.120E 04	2.012E 03	9544.4	8448.6	9625.6	8453.9
1.000E-07	1.313E 05		9664.4		9732.7	

TABLE 126

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 100. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.55 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.55 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 35.229 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 35.229 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4874
THROAT PRESSURE RATIO(FROZEN) = 0.4874
ENTROPY = 7.369E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.641E 06	2.641E 06	0.5044	0.5044
THROAT	150042.	150061.	2.149E 06	2.149E 06	0.5044	0.5044
1.000E-01	79738.	79692.	1.456E 06	1.456E 06	0.5046	0.5044
1.000E-02	36428.	31782.	9.747E 05	9.828E 05	0.5233	0.5044
1.000E-03	26045.	12683.	7.228E 05	7.942E 05	0.5894	0.5044
1.000E-04	20945.	5063.	5.519E 05	7.190E 05	0.6617	0.5044
5.000E-05	19800.	3840.	5.102E 05	7.069E 05	0.6836	0.5044
1.000E-05	17559.	2021.	4.260E 05	6.889E 05	0.7343	0.5044
5.000E-06	16733.	1533.	3.943E 05	6.841E 05	0.7560	0.5044
1.000E-06	15051.	807.	3.293E 05	6.769E 05	0.8058	0.5044
5.000E-07	14408.	612.	3.044E 05	6.750E 05	0.8270	0.5044
1.000E-07	13052.	322.	2.529E 05	6.721E 05	0.8753	0.5044

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.455E-04	3.455E-04				
THROAT	2.244E-04	2.244E-04	156970.	156964.	1.000	1.000
1.000E-01	8.669E-05	8.671E-05	243654.	243653.	2.131	2.131
1.000E-02	1.968E-05	2.174E-05	288855.	288151.	3.890	3.991
1.000E-03	3.100E-06	5.448E-06	309912.	304091.	5.902	6.668
1.000E-04	4.328E-07	1.365E-06	323423.	310225.	7.562	10.768
5.000E-05	2.365E-07	8.997E-07	326635.	311198.	8.029	12.403
1.000E-05	5.728E-08	3.418E-07	333022.	312640.	9.095	17.175
5.000E-06	3.094E-08	2.253E-07	335395.	313025.	9.550	19.744
1.000E-06	7.334E-09	8.562E-08	340215.	313599.	10.604	27.264
5.000E-07	3.931E-09	5.644E-08	342038.	313752.	11.060	31.320
1.000E-07	9.187E-10	2.144E-08	345791.	313981.	12.130	43.200

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4878.8	4878.6	7806.1	7806.1
1.000E-01	1.668E 00	1.667E 00	7573.0	7573.0	8574.8	8574.5
1.000E-02	6.198E 00	5.623E 00	8977.9	8956.0	9350.2	9293.8
1.000E-03	3.667E 01	2.126E 01	9632.4	9451.5	9852.6	9579.2
1.000E-04	2.517E 02	8.321E 01	10052.3	9642.1	10203.5	9692.1
5.000E-05	4.561E 02	1.258E 02	10152.1	9672.3	10289.1	9710.1
1.000E-05	1.847E 03	3.296E 02	10350.7	9717.1	10461.6	9736.9
5.000E-06	3.394E 03	4.994E 02	10424.4	9729.1	10526.4	9744.1
1.000E-06	1.412E 04	1.312E 03	10574.2	9747.0	10659.0	9754.8
5.000E-07	2.620E 04	1.990E 03	10630.9	9751.7	10709.6	9757.7
1.000E-07	1.109E 05	5.233E 03	10747.5	9758.8	10814.1	9762.0

TABLE 127

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 287.65 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 289.12 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 813.589 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 817.748 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5471
THROAT PRESSURE RATIO(FROZEN) = 0.5446
ENTROPY = 1.854E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	5000.	5000.	1.926E 04	1.926E 04	2.0106	2.0106
THROAT	4388.	4346.	1.646E 04	1.645E 04	2.0142	2.0106
1.000E-01	2920.	2874.	1.040E 04	1.047E 04	2.0160	2.0106
1.000E-02	1576.	1537.	5.426E 03	5.579E 03	2.0160	2.0106
1.000E-03	823.	754.	2.793E 03	3.059E 03	2.0160	2.0106
1.000E-04	425.	343.	1.426E 03	1.866E 03	2.0160	2.0106

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.102E-01	1.102E-01				
THROAT	6.880E-02	6.904E-02	11826.	11844.	1.000	1.000
1.000E-01	1.891E-02	1.917E-02	21058.	20968.	2.144	2.147
1.000E-02	3.504E-03	3.584E-03	26312.	26166.	3.584	3.576
1.000E-03	6.715E-04	7.303E-04	28708.	28475.	5.390	5.408
1.000E-04	1.301E-04	1.607E-04	29876.	29506.	7.779	8.134

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	367.6	368.1	652.1	650.0
1.000E-01	2.043E 00	2.035E 00	654.5	651.7	760.8	757.0
1.000E-02	8.825E 00	8.719E 00	817.8	813.3	863.7	858.4
1.000E-03	4.221E 01	3.932E 01	892.3	885.0	914.2	905.4
1.000E-04	2.093E 02	1.724E 02	928.6	917.1	939.5	926.0

TABLE 128

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 282.52 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 286.78 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 729.471 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 740.460 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5556
THROAT PRESSURE RATIO(FROZEN) = 0.5465
ENTROPY = 1.954E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.478E 04	2.478E 04	1.9882	1.9882
THROAT	5395.	5236.	2.145E 04	2.139E 04	2.0012	1.9882
1.000E-01	3746.	3502.	1.373E 04	1.406E 04	2.0154	1.9882
1.000E-02	2086.	1914.	7.253E 03	7.970E 03	2.0160	1.9882
1.000E-03	1098.	963.	3.750E 03	4.760E 03	2.0160	1.9882
1.000E-04	570.	446.	1.921E 03	3.204E 03	2.0160	1.9882
5.000E-05	466.		1.568E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.079E-02	9.079E-02				
THROAT	5.646E-02	5.685E-02	12920.	13025.	1.000	1.000
1.000E-01	1.474E-02	1.556E-02	23521.	23171.	2.138	2.149
1.000E-02	2.648E-03	2.846E-03	29623.	29011.	3.529	3.559
1.000E-03	5.029E-04	5.656E-04	32448.	31659.	5.279	5.331
1.000E-04	9.696E-05	1.220E-04	33830.	32867.	7.619	7.936
5.000E-05	5.921E-05		34090.		8.474	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	401.6	404.8	723.9	717.1
1.000E-01	2.104E 00	2.054E 00	731.1	720.2	853.1	837.6
1.000E-02	9.295E 00	8.970E 00	920.7	901.7	974.7	953.0
1.000E-03	4.470E 01	4.135E 01	1008.5	984.0	1034.5	1007.6
1.000E-04	2.224E 02	1.847E 02	1051.5	1021.5	1064.4	1032.1
5.000E-05	3.614E 02		1059.5		1070.0	

TABLE 129

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 275.57 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 282.39 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 658.726 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 675.046 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5632
THROAT PRESSURE RATIO(FROZEN) = 0.5464
ENTROPY = 2.072E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	3.249E 04	3.249E 04	1.9275	1.9275
THROAT	6429.	6108.	2.854E 04	2.841E 04	1.9526	1.9275
1.000E-01	4822.	4088.	1.880E 04	1.958E 04	2.0043	1.9275
1.000E-02	2858.	2248.	1.016E 04	1.223E 04	2.0160	1.9275
1.000E-03	1539.	1142.	5.295E 03	8.330E 03	2.0160	1.9275
1.000E-04	803.	534.	2.725E 03	6.419E 03	2.0160	1.9275
5.000E-05	659.	419.	2.227E 03	6.080E 03	2.0160	1.9275
1.000E-05	414.		1.391E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.544E-02	7.544E-02				
THROAT	4.686E-02	4.724E-02	14057.	14288.	1.000	1.000
1.000E-01	1.139E-02	1.292E-02	26180.	25419.	2.143	2.151
1.000E-02	1.933E-03	2.349E-03	33437.	31843.	3.440	3.558
1.000E-03	3.588E-04	4.624E-04	36896.	34777.	5.084	5.312
1.000E-04	6.880E-05	9.887E-05	38601.	36126.	7.336	7.872
5.000E-05	4.193E-05	6.300E-05	38922.	36360.	8.159	8.890
1.000E-05	1.333E-05		39457.		10.399	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	436.9	444.1	798.7	786.7
1.000E-01	2.210E 00	2.056E 00	813.7	790.1	955.7	919.0
1.000E-02	1.019E 01	9.026E 00	1039.3	989.7	1104.7	1046.3
1.000E-03	4.976E 01	4.198E 01	1146.8	1080.9	1178.7	1107.2
1.000E-04	2.481E 02	1.890E 02	1199.8	1122.8	1215.7	1134.7
5.000E-05	4.037E 02	2.947E 02	1209.7	1130.1	1222.7	1139.4
1.000E-05	1.252E 03		1226.3		1234.4	

TABLE 130

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 266.54 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 274.88 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 595.999 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 614.655 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5659
THROAT PRESSURE RATIO(FROZEN) = 0.5440
ENTROPY = 2.222E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	4.370E 04	4.370E 04	1.8131	1.8131
THROAT	7421.	6940.	3.894E 04	3.872E 04	1.8472	1.8131
1.000E-01	5912.	4589.	2.685E 04	2.815E 04	1.9402	1.8131
1.000E-02	4068.	2485.	1.530E 04	1.944E 04	2.0104	1.8131
1.000E-03	2327.	1248.	8.143E 03	1.488E 04	2.0160	1.8131
1.000E-04	1233.	578.	4.220E 03	1.267E 04	2.0160	1.8131
5.000E-05	1013.	453.	3.455E 03	1.228E 04	2.0160	1.8131
1.000E-05	641.		2.165E 03		2.0160	
5.000E-06	525.		1.768E 03		2.0160	
1.000E-06	329.		1.102E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.209E-02	6.209E-02				
THROAT	3.859E-02	3.894E-02	15444.	15785.	1.000	1.000
1.000E-01	8.991E-03	1.082E-02	29041.	27902.	2.163	2.150
1.000E-02	1.354E-03	1.999E-03	37706.	34847.	3.339	3.577
1.000E-03	2.373E-04	3.982E-04	42191.	37984.	4.773	5.366
1.000E-04	4.480E-05	8.590E-05	44457.	39413.	6.830	7.985
5.000E-05	2.725E-05	5.486E-05	44886.	39660.	7.600	9.028
1.000E-05	8.621E-06		45599.		9.690	
5.000E-06	5.260E-06		45817.		10.743	
1.000E-06	1.679E-06		46179.		13.634	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	480.0	490.6	881.8	865.2
1.000E-01	2.283E 00	2.035E 00	902.6	867.2	1064.7	1007.3
1.000E-02	1.167E 01	8.825E 00	1171.9	1083.1	1254.8	1143.8
1.000E-03	5.953E 01	4.064E 01	1311.3	1180.6	1353.6	1208.5
1.000E-04	2.993E 02	1.816E 02	1381.8	1225.0	1403.0	1237.5
5.000E-05	4.873E 02	2.825E 02	1395.1	1232.7	1412.4	1242.4
1.000E-05	1.516E 03		1417.3		1428.0	
5.000E-06	2.473E 03		1424.0		1432.8	
1.000E-06	7.688E 03		1435.3		1440.7	

TABLE 131

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 254.97 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 264.44 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 537.527 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 557.480 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5649
THROAT PRESSURE RATIO(FROZEN) = 0.5386
ENTROPY = 2.405E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	5.929E 04	5.929E 04	1.6514	1.6514
THROAT	8359.	7707.	5.340E 04	5.308E 04	1.6905	1.6514
1.000E-01	6798.	4961.	3.854E 04	4.042E 04	1.8052	1.6514
1.000E-02	5220.	2586.	2.391E 04	3.027E 04	1.9377	1.6514
1.000E-03	3664.	1255.	1.358E 04	2.514E 04	2.0114	1.6514
1.000E-04	2066.	566.	7.181E 03	2.273E 04	2.0160	1.6514
5.000E-05	1708.	440.	5.895E 03	2.231E 04	2.0160	1.6514
1.000E-05	1087.		3.712E 03		2.0160	
5.000E-06	893.		3.038E 03		2.0160	
1.000E-06	564.		1.901E 03		2.0160	
5.000E-07	462.		1.552E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.027E-02	5.027E-02				
THROAT	3.130E-02	3.162E-02	17173.	17631.	1.000	1.000
1.000E-01	7.276E-03	9.119E-03	32228.	30733.	2.172	2.149
1.000E-02	1.017E-03	1.749E-03	42084.	38117.	3.360	3.620
1.000E-03	1.504E-04	3.607E-04	47835.	41350.	4.459	5.504
1.000E-04	2.674E-05	7.993E-05	51076.	42784.	6.111	8.298
5.000E-05	1.616E-05	5.137E-05	51702.	43028.	6.773	9.414
1.000E-05	5.080E-06		52748.		8.625	
5.000E-06	3.092E-06		53067.		9.565	
1.000E-06	9.795E-07		53600.		12.132	
5.000E-07	5.981E-07		53763.		13.431	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	533.7	548.0	978.5	956.8
1.000E-01	2.292E 00	1.989E 00	1001.7	955.2	1182.2	1106.2
1.000E-02	1.256E 01	8.360E 00	1308.0	1184.7	1406.9	1248.2
1.000E-03	7.471E 01	3.738E 01	1486.7	1285.2	1545.6	1313.6
1.000E-04	3.936E 02	1.630E 02	1587.5	1329.8	1618.5	1342.1
5.000E-05	6.432E 02	2.522E 02	1607.0	1337.3	1632.3	1346.9
1.000E-05	2.006E 03		1639.5		1655.3	
5.000E-06	3.276E 03		1649.4		1662.3	
1.000E-06	1.024E 04		1666.0		1674.0	
5.000E-07	1.672E 04		1671.0		1677.6	

TABLE 132

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 242.20 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 252.83 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 484.404 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 505.664 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5620
THROAT PRESSURE RATIO(FROZEN) = 0.5303
ENTROPY = 2.610E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	10000.	10000.	7.880E 04	7.880E 04	1.4736	1.4736
THROAT	9248.	8393.	7.143E 04	7.095E 04	1.5146	1.4736
1.000E-01	7518.	5199.	5.327E 04	5.592E 04	1.6366	1.4736
1.000E-02	5928.	2563.	3.542E 04	4.429E 04	1.7913	1.4736
1.000E-03	4720.	1185.	2.235E 04	3.871E 04	1.9261	1.4736
1.000E-04	3448.	516.	1.279E 04	3.621E 04	2.0097	1.4736
5.000E-05	2961.	398.	1.060E 04	3.578E 04	2.0151	1.4736
1.000E-05	1946.		6.746E 03		2.0160	
5.000E-06	1607.		5.535E 03		2.0160	
1.000E-06	1022.		3.484E 03		2.0160	
5.000E-07	839.		2.850E 03		2.0160	
1.000E-07	529.		1.783E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	4.037E-02	4.037E-02				
THROAT	2.522E-02	2.551E-02	19208.	19822.	1.000	1.000
1.000E-01	5.965E-03	7.766E-03	35753.	33846.	2.177	2.146
1.000E-02	8.279E-04	1.575E-03	46604.	41566.	3.382	3.684
1.000E-03	1.118E-04	3.408E-04	53163.	44798.	4.488	5.716
1.000E-04	1.597E-05	7.827E-05	57485.	46178.	5.558	8.777
5.000E-05	9.322E-06	5.071E-05	58432.	46408.	5.953	10.003
1.000E-05	2.838E-06		60060.		7.392	
5.000E-06	1.718E-06		60562.		8.171	
1.000E-06	5.407E-07		61404.		10.355	
5.000E-07	3.292E-07		61662.		11.465	
1.000E-07	1.044E-07		62093.		14.501	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	597.0	616.1	1088.0	1059.9
1.000E-01	2.271E 00	1.924E 00	1111.2	1052.0	1309.7	1213.0
1.000E-02	1.255E 01	7.723E 00	1448.5	1291.9	1558.2	1356.5
1.000E-03	8.149E 01	3.312E 01	1652.3	1392.4	1723.5	1420.1
1.000E-04	5.277E 02	1.399E 02	1786.7	1435.3	1832.8	1447.0
5.000E-05	8.892E 02	2.149E 02	1816.1	1442.4	1855.0	1451.4
1.000E-05	2.842E 03		1866.7		1891.5	
5.000E-06	4.655E 03		1882.3		1902.7	
1.000E-06	1.459E 04		1908.5		1921.2	
5.000E-07	2.387E 04		1916.5		1926.9	
1.000E-07	7.476E 04		1929.9		1936.5	

TABLE 133

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 221.77 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 224.66 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 404.888 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 410.163 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5535
THROAT PRESSURE RATIO(FROZEN) = 0.4850
ENTROPY = 2.996E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.203E 05	1.203E 05	1.1887	1.1887
THROAT	10838.	9399.	1.092E 05	1.084E 05	1.2281	1.1887
1.000E-01	8638.	5447.	8.450E 04	8.923E 04	1.3505	1.1887
1.000E-02	6761.	2387.	6.003E 04	7.491E 04	1.5087	1.1887
1.000E-03	5533.	1009.	4.235E 04	6.873E 04	1.6604	1.1887
1.000E-04	4626.	415.	2.896E 04	6.615E 04	1.8023	1.1887
5.000E-05	4388.		2.555E 04		1.8425	
1.000E-05	3859.		1.856E 04		1.9287	
5.000E-06	3623.		1.591E 04		1.9612	
1.000E-06	2915.		1.060E 04		2.0113	
5.000E-07	2486.		8.754E 03		2.0156	
1.000E-07	1610.		5.545E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.714E-02	2.714E-02				
THROAT	1.718E-02	1.680E-02	23563.	24412.	1.000	1.000
1.000E-01	4.284E-03	5.978E-03	42325.	39427.	2.152	2.105
1.000E-02	6.114E-04	1.364E-03	54921.	47660.	3.415	3.796
1.000E-03	8.222E-05	3.228E-04	62461.	50801.	4.554	6.152
1.000E-04	1.067E-05	7.850E-05	67614.	52056.	5.651	9.760
5.000E-05	5.752E-06		68864.		5.979	
1.000E-05	1.369E-06		71360.		6.745	
5.000E-06	7.414E-07		72284.		7.075	
1.000E-06	1.890E-07		74098.		7.785	
5.000E-07	1.111E-07		74720.		8.238	
1.000E-07	3.431E-08		75787.		10.217	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	732.4	758.7	1310.9	1259.1
1.000E-01	2.233E 00	1.740E 00	1315.5	1225.4	1548.9	1405.0
1.000E-02	1.206E 01	6.309E 00	1707.0	1481.3	1833.0	1546.4
1.000E-03	7.884E 01	2.502E 01	1941.3	1578.9	2023.7	1604.8
1.000E-04	5.610E 02	1.004E 02	2101.5	1617.9	2160.2	1628.3
5.000E-05	1.022E 03		2140.3		2193.8	
1.000E-05	4.144E 03		2218.0		2261.3	
5.000E-06	7.555E 03		2246.7		2286.1	
1.000E-06	2.891E 04		2303.0		2333.3	
5.000E-07	4.879E 04		2322.4		2347.9	
1.000E-07	1.557E 05		2355.5		2371.8	

TABLE 134

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 216.23 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 227.05 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 365.498 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 383.780 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5470
THROAT PRESSURE RATIO(FROZEN) = 0.4975
ENTROPY = 3.203E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.470E 05	1.470E 05	1.0793	1.0793
THROAT	12191.	10798.	1.327E 05	1.311E 05	1.1117	1.0793
1.000E-01	9286.	5889.	1.030E 05	1.072E 05	1.2234	1.0793
1.000E-02	7130.	2371.	7.442E 04	9.071E 04	1.3768	1.0793
1.000E-03	5814.	914.	5.411E 04	8.421E 04	1.5263	1.0793
1.000E-04	4889.	343.	3.883E 04	8.174E 04	1.6692	1.0793
5.000E-05	4657.		3.494E 04		1.7108	
1.000E-05	4173.		2.691E 04		1.8039	
5.000E-06	3981.		2.383E 04		1.8423	
1.000E-06	3549.		1.744E 04		1.9256	
5.000E-07	3354.		1.499E 04		1.9577	
1.000E-07	2754.		1.002E 04		2.0104	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.112E-02	2.112E-02				
THROAT	1.367E-02	1.362E-02	26744.	28168.	1.000	1.000
1.000E-01	3.609E-03	5.021E-03	46900.	44639.	2.181	2.127
1.000E-02	5.290E-04	1.247E-03	60270.	53073.	3.474	3.914
1.000E-03	7.193E-05	3.236E-04	68184.	56054.	4.644	6.575
1.000E-04	9.355E-06	8.611E-05	73581.	57148.	5.762	10.866
5.000E-05	5.032E-06		74892.		6.094	
1.000E-05	1.184E-06		77529.		6.863	
5.000E-06	6.339E-07		78517.		7.195	
1.000E-06	1.487E-07		80529.		7.973	
5.000E-07	7.996E-08		81287.		8.311	
1.000E-07	2.000E-08		82801.		9.007	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	831.2	875.5	1464.6	1424.1
1.000E-01	2.159E 00	1.712E 00	1457.7	1387.4	1707.7	1576.2
1.000E-02	1.146E 01	5.798E 00	1873.3	1649.6	2006.0	1713.5
1.000E-03	7.453E 01	2.116E 01	2119.2	1742.2	2205.5	1765.5
1.000E-04	5.310E 02	7.799E 01	2287.0	1776.2	2348.4	1784.8
5.000E-05	9.698E 02		2327.7		2383.9	
1.000E-05	3.981E 03		2409.7		2455.8	
5.000E-06	7.343E 03		2440.4		2482.9	
1.000E-06	3.053E 04		2502.9		2538.3	
5.000E-07	5.623E 04		2526.5		2559.0	
1.000E-07	2.208E 05		2573.5		2599.1	

TABLE 135

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 216.95 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 224.59 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 343.031 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 355.111 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5422
THROAT PRESSURE RATIO(FROZEN) = 0.4923
ENTROPY = 3.316E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.637E 05	1.637E 05	1.0401	1.0401
THROAT	13399.	12168.	1.468E 05	1.448E 05	1.0629	1.0401
1.000E-01	9716.	6537.	1.137E 05	1.172E 05	1.1626	1.0401
1.000E-02	7332.	2592.	8.254E 04	9.834E 04	1.3119	1.0401
1.000E-03	5951.	997.	6.072E 04	9.098E 04	1.4592	1.0401
1.000E-04	5004.	377.	4.438E 04	8.817E 04	1.6009	1.0401
5.000E-05	4770.		4.023E 04		1.6424	
1.000E-05	4290.		3.166E 04		1.7361	
5.000E-06	4103.		2.837E 04		1.7752	
1.000E-06	3700.		2.151E 04		1.8623	
5.000E-07	3533.		1.886E 04		1.8977	
1.000E-07	3122.		1.335E 04		1.9717	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.781E-02	1.781E-02				
THROAT	1.178E-02	1.153E-02	29110.	30800.	1.000	1.000
1.000E-01	3.278E-03	4.359E-03	50043.	48287.	2.205	2.126
1.000E-02	4.902E-04	1.099E-03	63753.	57216.	3.529	3.951
1.000E-03	6.718E-05	2.859E-04	71812.	60348.	4.721	6.661
1.000E-04	8.765E-06	7.559E-05	77295.	61502.	5.858	10.992
5.000E-05	4.716E-06		78628.		6.194	
1.000E-05	1.109E-06		81310.		6.970	
5.000E-06	5.926E-07		82317.		7.304	
1.000E-06	1.379E-07		84377.		8.083	
5.000E-07	7.359E-08		85159.		8.422	
1.000E-07	1.730E-08		86763.		9.217	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	904.8	957.3	1573.7	1544.0
1.000E-01	2.091E 00	1.687E 00	1555.4	1500.8	1813.4	1701.9
1.000E-02	1.098E 01	5.645E 00	1981.5	1778.3	2116.9	1845.6
1.000E-03	7.111E 01	2.058E 01	2232.0	1875.7	2319.7	1900.2
1.000E-04	5.063E 02	7.639E 01	2402.4	1911.5	2464.9	1920.6
5.000E-05	9.251E 02		2443.8		2500.9	
1.000E-05	3.805E 03		2527.2		2574.1	
5.000E-06	7.031E 03		2558.5		2601.9	
1.000E-06	2.948E 04		2622.5		2658.9	
5.000E-07	5.474E 04		2646.8		2680.6	
1.000E-07	2.285E 05		2696.7		2724.9	

TABLE 136

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.89 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.65 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 326.306 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 333.394 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5373
THROAT PRESSURE RATIO(FROZEN) = 0.4901
ENTROPY = 3.391E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.764E 05	1.764E 05	1.0248	1.0248
THROAT	14608.	13608.	1.570E 05	1.547E 05	1.0391	1.0248
1.000E-01	10067.	7269.	1.211E 05	1.235E 05	1.1254	1.0248
1.000E-02	7472.	2867.	8.808E 04	1.024E 05	1.2712	1.0248
1.000E-03	6039.	1103.	6.521E 04	9.410E 04	1.4166	1.0248
1.000E-04	5075.	418.	4.816E 04	9.095E 04	1.5572	1.0248
5.000E-05	4839.		4.383E 04		1.5984	
1.000E-05	4357.		3.490E 04		1.6919	
5.000E-06	4172.		3.147E 04		1.7312	
1.000E-06	3777.		2.431E 04		1.8193	
5.000E-07	3618.		2.154E 04		1.8551	
1.000E-07	3251.		1.574E 04		1.9349	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.560E-02	1.560E-02				
THROAT	1.047E-02	1.011E-02	31166.	32969.	1.000	1.000
1.000E-01	3.063E-03	3.863E-03	52625.	51457.	2.231	2.127
1.000E-02	4.661E-04	9.793E-04	66504.	60893.	3.583	3.965
1.000E-03	6.426E-05	2.546E-04	74618.	64198.	4.794	6.691
1.000E-04	8.407E-06	6.715E-05	80133.	65416.	5.946	11.034
5.000E-05	4.525E-06		81473.		6.286	
1.000E-05	1.064E-06		84172.		7.070	
5.000E-06	5.685E-07		85187.		7.406	
1.000E-06	1.320E-07		87264.		8.189	
5.000E-07	7.026E-08		88056.		8.529	
1.000E-07	1.631E-08		89689.		9.329	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	968.7	1024.7	1665.5	1646.9
1.000E-01	2.024E 00	1.677E 00	1635.6	1599.3	1898.2	1812.3
1.000E-02	1.053E 01	5.591E 00	2067.0	1892.6	2203.5	1963.6
1.000E-03	6.805E 01	2.039E 01	2319.2	1995.3	2407.5	2021.2
1.000E-04	4.844E 02	7.590E 01	2490.6	2033.2	2553.4	2042.8
5.000E-05	8.851E 02		2532.3		2589.7	
1.000E-05	3.644E 03		2616.2		2663.4	
5.000E-06	6.738E 03		2647.7		2691.4	
1.000E-06	2.834E 04		2712.3		2749.0	
5.000E-07	5.274E 04		2736.9		2771.1	
1.000E-07	2.231E 05		2787.6		2816.5	

TABLE 137

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.35 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 222.88 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 308.794 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 315.201 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5081
THROAT PRESSURE RATIO(FROZEN) = 0.4891
ENTROPY = 3.461E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.896E 05	1.896E 05	1.0149	1.0149
THROAT	15877.	15080.	1.661E 05	1.652E 05	1.0251	1.0149
1.000E-01	10474.	8036.	1.283E 05	1.304E 05	1.0934	1.0149
1.000E-02	7611.	3166.	9.338E 04	1.068E 05	1.2347	1.0149
1.000E-03	6122.	1219.	6.948E 04	9.761E 04	1.3784	1.0149
1.000E-04	5138.	463.	5.175E 04	9.409E 04	1.5177	1.0149
5.000E-05	4899.		4.726E 04		1.5586	
1.000E-05	4414.		3.799E 04		1.6517	
5.000E-06	4229.		3.442E 04		1.6908	
1.000E-06	3839.		2.699E 04		1.7793	
5.000E-07	3684.		2.411E 04		1.8162	
1.000E-07	3339.		1.806E 04		1.8979	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.390E-02	1.390E-02				
THROAT	8.989E-03	9.018E-03	34351.	34951.	1.000	1.000
1.000E-01	2.860E-03	3.460E-03	55405.	54439.	2.257	2.127
1.000E-02	4.445E-04	8.783E-04	69418.	64391.	3.646	3.971
1.000E-03	6.169E-05	2.282E-04	77559.	67876.	4.878	6.701
1.000E-04	8.093E-06	6.007E-05	83085.	69163.	6.046	11.042
5.000E-05	4.358E-06		84428.		6.391	
1.000E-05	1.025E-06		87133.		7.184	
5.000E-06	5.477E-07		88150.		7.524	
1.000E-06	1.270E-07		90236.		8.312	
5.000E-07	6.753E-08		91032.		8.654	
1.000E-07	1.557E-08		92680.		9.456	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1067.7	1086.3	1764.1	1743.0
1.000E-01	1.949E 00	1.673E 00	1722.1	1692.0	1989.1	1916.7
1.000E-02	1.001E 01	5.573E 00	2157.6	2001.3	2294.7	2076.2
1.000E-03	6.454E 01	2.035E 01	2410.6	2109.7	2499.1	2137.0
1.000E-04	4.592E 02	7.587E 01	2582.4	2149.6	2645.3	2159.8
5.000E-05	8.392E 02		2624.1		2681.6	
1.000E-05	3.457E 03		2708.2		2755.6	
5.000E-06	6.396E 03		2739.8		2783.6	
1.000E-06	2.695E 04		2804.6		2841.6	
5.000E-07	5.023E 04		2829.4		2863.8	
1.000E-07	2.139E 05		2880.6		2909.9	

TABLE 138

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 200.06 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 215.25 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 231.015 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 248.549 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5555
THROAT PRESSURE RATIO(FROZEN) = 0.4889
ENTROPY = 3.823E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	2.815E 05	2.815E 05	0.9566	0.9566
THROAT	26604.	22796.	2.473E 05	2.425E 05	0.9756	0.9566
1.000E-01	16591.	12127.	1.732E 05	1.867E 05	1.0091	0.9566
1.000E-02	8659.	4806.	1.226E 05	1.488E 05	1.0746	0.9566
1.000E-03	6571.	1867.	9.244E 04	1.340E 05	1.2043	0.9566
1.000E-04	5438.	715.	7.090E 04	1.282E 05	1.3354	0.9566
5.000E-05	5176.	535.	6.551E 04	1.273E 05	1.3742	0.9566
1.000E-05	4660.	273.	5.443E 04	1.260E 05	1.4630	0.9566
5.000E-06	4468.		5.019E 04		1.500[illegible]	
1.000E-06	4074.		4.135E 04		1.5861	
5.000E-07	3923.		3.792E 04		1.6233	
1.000E-07	3605.		3.069E 04		1.7064	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.736E-03	8.736E-03				
THROAT	5.582E-03	5.621E-03	41383.	44216.	1.000	1.000
1.000E-01	1.666E-03	2.161E-03	73651.	68891.	2.106	2.128
1.000E-02	3.400E-04	5.454E-04	89205.	81503.	4.040	3.973
1.000E-03	5.021E-05	1.404E-04	97295.	85954.	5.492	6.678
1.000E-04	6.728E-06	3.663E-05	102686.	87612.	6.796	10.958
5.000E-05	3.637E-06	2.448E-05	103993.	87867.	7.176	12.699
1.000E-05	8.602E-07	9.618E-06	106625.	88237.	8.045	17.857
5.000E-06	4.601E-07		107616.		8.414	
1.000E-06	1.067E-07		109654.		9.267	
5.000E-07	5.669E-08		110434.		9.633	
1.000E-07	1.297E-08		112060.		10.481	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1286.2	1374.3	2303.9	2206.8
1.000E-01	1.882E 00	1.669E 00	2289.2	2141.2	2634.0	2425.5
1.000E-02	7.616E 00	5.592E 00	2772.6	2533.2	2912.1	2628.4
1.000E-03	4.729E 01	2.060E 01	3024.0	2671.5	3110.7	2706.6
1.000E-04	3.344E 02	7.745E 01	3191.6	2723.1	3252.8	2736.2
5.000E-05	6.109E 02	1.155E 02	3232.2	2731.0	3288.2	2740.8
1.000E-05	2.519E 03	2.929E 02	3314.0	2742.5	3360.2	2747.5
5.000E-06	4.665E 03		3344.8		3387.6	
1.000E-06	1.974E 04		3408.1		3444.3	
5.000E-07	3.690E 04		3432.4		3466.2	
1.000E-07	1.590E 05		3482.9		3512.1	

TABLE 139

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 179.86 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 198.21 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 179.858 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 198.213 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5581
THROAT PRESSURE RATIO(FROZEN) = 0.5075
ENTROPY = 4.447E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	40000.	40000.	5.048E 05	5.048E 05	0.7967	0.7967
THROAT	36548.	31100.	4.500E 05	4.430E 05	0.8207	0.7967
1.000E-01	28295.	16432.	3.199E 05	3.496E 05	0.8979	0.7967
1.000E-02	19565.	6547.	2.037E 05	2.878E 05	0.9842	0.7967
1.000E-03	9523.	2577.	1.386E 05	2.634E 05	1.0106	0.7967
1.000E-04	6081.	1003.	1.066E 05	2.538E 05	1.0944	0.7967
5.000E-05	5699.	755.	9.934E 04	2.523E 05	1.1283	0.7967
1.000E-05	5035.	389.	8.468E 04	2.500E 05	1.2074	0.7967
5.000E-06	4806.		7.915E 04		1.2413	
1.000E-06	4360.		6.771E 04		1.3193	
5.000E-07	4195.		6.330E 04		1.3525	
1.000E-07	3858.		5.405E 04		1.4288	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.457E-03	5.457E-03				
THROAT	3.433E-03	3.562E-03	52387.	55648.	1.000	1.000
1.000E-01	8.694E-04	1.328E-03	96232.	88165.	2.209	2.135
1.000E-02	1.378E-04	3.334E-04	122774.	104227.	3.532	3.988
1.000E-03	2.908E-05	8.471E-05	135401.	109948.	5.601	6.673
1.000E-04	4.931E-06	2.175E-05	141188.	112110.	7.933	10.873
5.000E-05	2.712E-06	1.446E-05	142475.	112446.	8.436	12.570
1.000E-05	6.571E-07	5.616E-06	145028.	112938.	9.526	17.576
5.000E-06	3.538E-07		145980.		9.976	
1.000E-06	8.290E-08		147928.		10.997	
5.000E-07	4.417E-08		148672.		11.430	
1.000E-07	1.015E-08		150222.		12.422	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1628.2	1729.6	2941.4	2813.1
1.000E-01	2.150E 00	1.692E 00	2991.0	2740.3	3496.8	3101.6
1.000E-02	1.063E 01	5.704E 00	3815.9	3239.5	4066.0	3361.3
1.000E-03	4.568E 01	2.128E 01	4208.4	3417.3	4315.9	3462.7
1.000E-04	2.583E 02	8.128E 01	4388.3	3484.5	4449.1	3501.8
5.000E-05	4.654E 02	1.219E 02	4428.3	3494.9	4483.0	3508.0
1.000E-05	1.887E 03	3.125E 02	4507.6	3510.2	4552.0	3516.9
5.000E-06	3.483E 03		4537.2		4578.2	
1.000E-06	1.467E 04		4597.7		4632.3	
5.000E-07	2.739E 04		4620.9		4653.1	
1.000E-07	1.180E 05		4669.0		4696.8	

TABLE 140

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 162.05 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 171.83 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 144.935 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 153.692 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5432
THROAT PRESSURE RATIO(FROZEN) = 0.4996
ENTROPY = 5.211E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	50000.	50000.	8.475E 05	8.475E 05	0.6317	0.6317
THROAT	44924.	39221.	7.581E 05	7.505E 05	0.6539	0.6317
1.000E-01	34891.	21051.	5.627E 05	6.020E 05	0.7233	0.6317
1.000E-02	26199.	8475.	3.827E 05	5.022E 05	0.8204	0.6317
1.000E-03	20249.	3532.	2.606E 05	4.614E 05	0.9140	0.6317
1.000E-04	14960.	1506.	1.758E 05	4.442E 05	0.9910	0.6317
5.000E-05	12824.	1169.	1.565E 05	4.413E 05	1.0041	0.6317
1.000E-05	7072.	650.	1.269E 05	4.368E 05	1.0050	0.6317
5.000E-06	5767.	505.	1.182E 05	4.355E 05	1.0202	0.6317
1.000E-06	4786.	282.	1.024E 05	4.336E 05	1.0820	0.6317
5.000E-07	4548.		9.656E 04		1.1107	
1.000E-07	4119.		8.447E 04		1.1777	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	3.462E-03	3.462E-03				
THROAT	2.166E-03	2.205E-03	66911.	69714.	1.000	1.000
1.000E-01	5.679E-04	8.222E-04	119420.	110860.	2.189	2.112
1.000E-02	8.579E-05	2.042E-04	152540.	131492.	3.514	3.984
1.000E-03	1.237E-05	4.901E-05	171407.	139041.	4.799	6.599
1.000E-04	1.815E-06	1.149E-05	183380.	142102.	6.138	10.383
5.000E-05	1.073E-06	7.405E-06	185989.	142612.	6.445	11.842
1.000E-05	3.909E-07	2.664E-06	189942.	143395.	9.379	15.994
5.000E-06	2.424E-07	1.714E-06	191072.	143614.	10.673	18.177
1.000E-06	6.193E-08	6.147E-07	193134.	143951.	12.343	24.415
5.000E-07	3.346E-08		193892.		12.917	
1.000E-07	7.834E-09		195447.		14.161	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	2079.7	2166.8	3665.7	3542.4
1.000E-01	2.137E 00	1.686E 00	3711.7	3445.7	4335.7	3909.9
1.000E-02	1.108E 01	5.723E 00	4741.1	4086.9	5064.5	4244.5
1.000E-03	6.837E 01	2.256E 01	5327.5	4321.5	5527.2	4383.6
1.000E-04	4.355E 02	9.414E 01	5699.6	4416.7	5826.8	4442.6
5.000E-05	7.266E 02	1.455E 02	5780.7	4432.5	5886.8	4452.6
1.000E-05	1.952E 03	4.023E 02	5903.6	4456.9	5960.6	4467.9
5.000E-06	3.130E 03	6.244E 02	5938.7	4463.7	5984.4	4472.3
1.000E-06	1.212E 04	1.737E 03	6002.8	4474.1	6038.2	4478.9
5.000E-07	2.234E 04		6026.4		6059.0	
1.000E-07	9.467E 04		6074.7		6102.3	

TABLE 141

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 154.77 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.50 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 113.029 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 115.751 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4963
THROAT PRESSURE RATIO(FROZEN) = 0.4919
ENTROPY = 6.083E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.367E 06	1.367E 06	0.5192	0.5192
THROAT	60246.	57116.	1.188E 06	1.188E 06	0.5299	0.5192
1.000E-01	42789.	30496.	8.981E 05	9.292E 05	0.5747	0.5192
1.000E-02	30504.	12152.	6.304E 05	7.534E 05	0.6583	0.5192
1.000E-03	23819.	4857.	4.543E 05	6.834E 05	0.7454	0.5192
1.000E-04	19319.	1949.	3.295E 05	6.553E 05	0.8315	0.5192
5.000E-05	18209.	1481.	2.989E 05	6.508E 05	0.8568	0.5192
1.000E-05	15891.	784.	2.373E 05	6.440E 05	0.9135	0.5192
5.000E-06	14955.	596.	2.144E 05	6.422E 05	0.9367	0.5192
1.000E-06	12664.	315.	1.683E 05	6.395E 05	0.9850	0.5192
5.000E-07	11352.		1.516E 05		1.0005	
1.000E-07	6540.		1.244E 05		1.0080	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.897E-03	1.897E-03				
THROAT	1.196E-03	1.225E-03	94499.	94496.	1.000	1.000
1.000E-01	3.723E-04	4.664E-04	153135.	147977.	2.138	2.124
1.000E-02	5.912E-05	1.171E-04	191973.	175198.	3.600	3.980
1.000E-03	8.573E-06	2.929E-05	213706.	184939.	4.953	6.657
1.000E-04	1.179E-06	7.299E-06	227853.	188698.	6.279	10.735
5.000E-05	6.446E-07	4.802E-06	231191.	189297.	6.680	12.355
1.000E-05	1.575E-07	1.815E-06	237763.	190188.	7.629	17.071
5.000E-06	8.580E-08	1.194E-06	240168.	190427.	8.050	19.604
1.000E-06	2.131E-08	4.510E-07	244924.	190783.	9.082	26.998
5.000E-07	1.207E-08		246625.		9.487	
1.000E-07	4.223E-09		249365.		12.879	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2937.1	2937.0	4755.4	4735.3
1.000E-01	1.983E 00	1.677E 00	4759.6	4599.3	5501.9	5212.4
1.000E-02	9.959E 00	5.644E 00	5966.7	5445.3	6339.6	5651.7
1.000E-03	6.169E 01	2.137E 01	6642.2	5748.1	6873.2	5826.2
1.000E-04	4.207E 02	8.405E 01	7081.9	5864.9	7239.4	5895.7
5.000E-05	7.585E 02	1.274E 02	7185.6	5883.5	7327.6	5906.8
1.000E-05	3.018E 03	3.353E 02	7389.9	5911.2	7502.9	5923.5
5.000E-06	5.485E 03	5.092E 02	7464.7	5918.7	7567.4	5928.0
1.000E-06	2.166E 04	1.345E 03	7612.5	5929.7	7693.6	5934.7
5.000E-07	3.796E 04		7665.4		7736.4	
1.000E-07	1.073E 05		7750.5		7790.7	

TABLE 142

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.16 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.71 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 99.398 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 99.745 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4906
THROAT PRESSURE RATIO(FROZEN) = 0.4897
ENTROPY = 6.404E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.644E 06	1.644E 06	0.5087	0.5087
THROAT	76199.	75480.	1.402E 06	1.401E 06	0.5111	0.5087
1.000E-01	47087.	40222.	1.041E 06	1.054E 06	0.5363	0.5087
1.000E-02	32150.	16027.	7.310E 05	8.170E 05	0.6107	0.5087
1.000E-03	24827.	6385.	5.325E 05	7.228E 05	0.6933	0.5087
1.000E-04	20143.	2547.	3.929E 05	6.852E 05	0.7764	0.5087
5.000E-05	19021.	1932.	3.588E 05	6.792E 05	0.8011	0.5087
1.000E-05	16748.	1017.	2.898E 05	6.702E 05	0.8574	0.5087
5.000E-06	15876.	772.	2.640E 05	6.678E 05	0.8810	0.5087
1.000E-06	13990.	406.	2.114E 05	6.642E 05	0.9338	0.5087
5.000E-07	13192.		1.916E 05		0.9552	
1.000E-07	10991.		1.517E 05		0.9975	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.394E-03	1.394E-03				
THROAT	9.015E-04	9.042E-04	110257.	110312.	1.000	1.000
1.000E-01	3.121E-04	3.465E-04	173804.	171993.	2.113	2.128
1.000E-02	5.204E-05	8.696E-05	213841.	203531.	3.697	3.984
1.000E-03	7.650E-06	2.183E-05	235940.	214806.	5.137	6.664
1.000E-04	1.056E-06	5.471E-06	250304.	219139.	6.513	10.768
5.000E-05	5.769E-07	3.606E-06	253700.	219827.	6.925	12.404
1.000E-05	1.403E-07	1.370E-06	260410.	220845.	7.886	17.177
5.000E-06	7.602E-08	9.031E-07	262882.	221118.	8.306	19.746
1.000E-06	1.829E-08	3.430E-07	267846.	221523.	9.307	27.263
5.000E-07	9.918E-09		269692.		9.757	
1.000E-07	2.486E-09		273365.		10.837	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3426.9	3428.6	5515.7	5506.3
1.000E-01	1.833E 00	1.674E 00	5402.0	5345.7	6182.3	6055.8
1.000E-02	8.932E 00	5.636E 00	6646.4	6325.9	7026.7	6565.0
1.000E-03	5.507E 01	2.127E 01	7333.3	6676.4	7567.7	6766.7
1.000E-04	3.761E 02	8.320E 01	7779.7	6811.1	7939.8	6846.4
5.000E-05	6.791E 02	1.258E 02	7885.2	6832.4	8029.8	6859.1
1.000E-05	2.721E 03	3.296E 02	8093.8	6864.1	8209.7	6878.1
5.000E-06	4.974E 03	4.995E 02	8170.6	6872.6	8276.5	6883.2
1.000E-06	2.029E 04	1.313E 03	8324.9	6885.2	8411.3	6890.7
5.000E-07	3.716E 04		8382.3		8461.4	
1.000E-07	1.462E 05		8496.5		8558.7	

TABLE 143

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.63 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.64 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 81.402 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 81.403 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4879
THROAT PRESSURE RATIO(FROZEN) = 0.4879
ENTROPY = 6.811E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.146E 06	2.146E 06	0.5056	0.5056
THROAT	112675.	112668.	1.778E 06	1.778E 06	0.5056	0.5056
1.000E-01	60993.	59956.	1.256E 06	1.257E 06	0.5092	0.5056
1.000E-02	34833.	24037.	8.670E 05	9.017E 05	0.5593	0.5056
1.000E-03	26107.	9655.	6.361E 05	7.590E 05	0.6351	0.5056
1.000E-04	21051.	3881.	4.768E 05	7.017E 05	0.7137	0.5056
5.000E-05	19880.	2950.	4.380E 05	6.924E 05	0.7373	0.5056
1.000E-05	17560.	1561.	3.597E 05	6.786E 05	0.7916	0.5056
5.000E-06	16694.	1186.	3.304E 05	6.749E 05	0.8147	0.5056
1.000E-06	14903.	628.	2.703E 05	6.693E 05	0.8674	0.5056
5.000E-07	14203.	477.	2.475E 05	6.679E 05	0.8895	0.5056
1.000E-07	12662.		2.005E 05		0.9390	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.234E-04	9.234E-04				
THROAT	5.997E-04	5.997E-04	135728.	135729.	1.000	1.000
1.000E-01	2.287E-04	2.310E-04	211007.	210895.	2.128	2.132
1.000E-02	4.399E-05	5.762E-05	253015.	249555.	3.838	3.988
1.000E-03	6.665E-06	1.435E-05	274908.	263479.	5.521	6.646
1.000E-04	9.288E-07	3.569E-06	289047.	268870.	7.024	10.699
5.000E-05	5.080E-07	2.347E-06	292392.	269730.	7.465	12.311
1.000E-05	1.235E-07	8.875E-07	299014.	271008.	8.483	17.006
5.000E-06	6.685E-08	5.837E-07	301462.	271351.	8.923	19.530
1.000E-06	1.594E-08	2.206E-07	306406.	271863.	9.952	26.901
5.000E-07	8.579E-09	1.451E-07	308265.	272001.	10.402	30.869
1.000E-07	2.032E-09		312057.		11.481	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4218.5	4218.6	6754.9	6754.9
1.000E-01	1.687E 00	1.671E 00	6558.3	6554.8	7435.1	7423.4
1.000E-02	7.313E 00	5.661E 00	7864.0	7756.4	8244.2	8050.7
1.000E-03	4.443E 01	2.154E 01	8544.4	8189.2	8775.4	8301.1
1.000E-04	3.032E 02	8.483E 01	8983.9	8356.8	9141.5	8400.9
5.000E-05	5.480E 02	1.286E 02	9087.8	8383.5	9230.3	8416.9
1.000E-05	2.204E 03	3.385E 02	9293.6	8423.2	9408.2	8440.8
5.000E-06	4.039E 03	5.139E 02	9369.7	8433.9	9474.7	8447.2
1.000E-06	1.666E 04	1.357E 03	9523.4	8449.8	9610.0	8456.8
5.000E-07	3.078E 04	2.062E 03	9581.2	8454.1	9661.2	8459.4
1.000E-07	1.284E 05		9699.0		9765.8	

TABLE 144

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 200. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.59 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.59 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 70.477 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 70.478 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4875
THROAT PRESSURE RATIO(FROZEN) = 0.4875
ENTROPY = 7.096E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.640E 06	2.640E 06	0.5049	0.5049
THROAT	150068.	150106.	2.149E 06	2.149E 06	0.5048	0.5049
1.000E-01	79851.	79762.	1.455E 06	1.455E 06	0.5052	0.5049
1.000E-02	37797.	31866.	9.703E 05	9.819E 05	0.5296	0.5049
1.000E-03	27095.	12747.	7.117E 05	7.928E 05	0.5592	0.5049
1.000E-04	21652.	5102.	5.376E 05	7.172E 05	0.6744	0.5049
5.000E-05	20428.	3873.	4.953E 05	7.050E 05	0.6971	0.5049
1.000E-05	18038.	2043.	4.104E 05	6.869E 05	0.7497	0.5049
5.000E-06	17157.	1551.	3.785E 05	6.820E 05	0.7722	0.5049
1.000E-06	15365.	818.	3.134E 05	6.747E 05	0.8237	0.5049
5.000E-07	14677.	621.	2.886E 05	6.728E 05	0.8455	0.5049
1.000E-07	13219.	328.	2.374E 05	6.699E 05	0.8952	0.5049

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.916E-04	6.916E-04				
THROAT	4.492E-04	4.492E-04	156889.	156879.	1.000	1.000
1.000E-01	1.733E-04	1.734E-04	243587.	243585.	2.131	2.131
1.000E-02	3.839E-05	4.341E-05	289130.	288121.	3.886	3.990
1.000E-03	6.059E-06	1.085E-05	310707.	304105.	5.859	6.661
1.000E-04	8.533E-07	2.711E-06	324436.	310270.	7.524	10.744
5.000E-05	4.675E-07	1.786E-06	327679.	311250.	7.998	12.370
1.000E-05	1.139E-07	6.771E-07	334103.	312704.	9.085	17.113
5.000E-06	6.165E-08	4.460E-07	336481.	313094.	9.550	19.665
1.000E-06	1.469E-08	1.691E-07	341291.	313674.	10.632	27.128
5.000E-07	7.891E-09	1.114E-07	343104.	313829.	11.102	31.151
1.000E-07	1.855E-09	4.223E-08	346822.	314061.	12.209	42.923

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4876.3	4876.0	7803.4	7803.4
1.000E-01	1.669E 00	1.668E 00	7570.9	7570.9	8573.3	8572.7
1.000E-02	6.349E 00	5.635E 00	8986.5	8955.1	9367.7	9293.5
1.000E-03	3.744E 01	2.136E 01	9657.1	9451.9	9881.9	9580.1
1.000E-04	2.546E 02	8.379E 01	10083.8	9643.5	10236.7	9693.8
5.000E-05	4.601E 02	1.268E 02	10184.6	9674.0	10322.7	9712.0
1.000E-05	1.853E 03	3.329E 02	10384.3	9719.2	10495.5	9739.2
5.000E-06	3.398E 03	5.048E 02	10458.2	9731.3	10560.2	9746.4
1.000E-06	1.406E 04	1.329E 03	10607.7	9749.3	10692.1	9757.3
5.000E-07	2.603E 04	2.017E 03	10664.0	9754.1	10742.2	9760.2
1.000E-07	1.095E 05	5.314E 03	10779.6	9761.3	10845.4	9764.5

TABLE 145

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 288.29 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 289.24 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2038.507 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2045.210 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5462
THROAT PRESSURE RATIO(FROZEN) = 0.5447
ENTROPY = 1.761E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	5000.	5000.	1.916E 04	1.916E 04	2.0126	2.0126
THROAT	4373.	4346.	1.637E 04	1.636E 04	2.0149	2.0126
1.000E-01	2905.	2876.	1.034E 04	1.039E 04	2.0160	2.0126
1.000E-02	1567.	1538.	5.393E 03	5.492E 03	2.0160	2.0126
1.000E-03	818.	755.	2.776E 03	2.971E 03	2.0160	2.0126
1.000E-04	422.	343.	1.417E 03	1.777E 03	2.0160	2.0126

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	2.757E-01	2.757E-01				
THROAT	1.724E-01	1.728E-01	11827.	11838.	1.000	1.000
1.000E-01	4.754E-02	4.794E-02	21017.	20960.	2.146	2.147
1.000E-02	8.812E-03	8.961E-03	26253.	26158.	3.586	3.575
1.000E-03	1.689E-03	1.825E-03	28640.	28468.	5.394	5.406
1.000E-04	3.272E-04	4.016E-04	29804.	29500.	7.784	8.130

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	367.6	367.9	651.1	649.7
1.000E-01	2.040E 00	2.036E 00	653.2	651.4	759.1	756.7
1.000E-02	8.812E 00	8.725E 00	816.0	813.0	861.7	858.2
1.000E-03	4.214E 01	3.937E 01	890.1	884.8	912.0	905.2
1.000E-04	2.090E 02	1.727E 02	926.3	916.9	937.2	925.8

TABLE 146

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 284.45 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 287.37 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1836.126 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1854.989 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5528
THROAT PRESSURE RATIO(FROZEN) = 0.5468
ENTROPY = 1.854E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.428E 04	2.428E 04	1.9983	1.9983
THROAT	5349.	5240.	2.094E 04	2.091E 04	2.0073	1.9983
1.000E-01	3665.	3510.	1.338E 04	1.359E 04	2.0157	1.9983
1.000E-02	2032.	1924.	7.058E 03	7.516E 03	2.0160	1.9983
1.000E-03	1069.	970.	3.648E 03	4.303E 03	2.0160	1.9983
1.000E-04	554.	451.	1.868E 03	2.741E 03	2.0160	1.9983
4.000E-05	425.		1.428E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.281E-01	2.281E-01				
THROAT	1.421E-01	1.428E-01	12922.	12988.	1.000	1.000
1.000E-01	3.767E-02	3.899E-02	23354.	23125.	2.142	2.150
1.000E-02	6.795E-03	7.114E-03	29359.	28966.	3.540	3.557
1.000E-03	1.292E-03	1.410E-03	32135.	31621.	5.299	5.322
1.000E-04	2.492E-04	3.036E-04	33493.	32834.	7.647	7.915
4.000E-05	1.299E-04		33820.		8.799	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	401.6	403.7	720.1	715.5
1.000E-01	2.087E 00	2.057E 00	725.9	718.7	846.1	836.1
1.000E-02	9.204E 00	9.002E 00	912.5	900.3	965.6	951.6
1.000E-03	4.423E 01	4.159E 01	998.8	982.8	1024.3	1006.5
1.000E-04	2.200E 02	1.861E 02	1041.0	1020.5	1053.7	1031.1
4.000E-05	4.180E 02		1051.2		1060.8	

TABLE 147

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 279.13 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 284.26 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1668.109 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1698.774 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5597
THROAT PRESSURE RATIO(FROZEN) = 0.5475
ENTROPY = 1.955E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	3.082E 04	3.082E 04	1.9590	1.9590
THROAT	6363.	6123.	2.691E 04	2.682E 04	1.9784	1.9590
1.000E-01	4608.	4121.	1.753E 04	1.808E 04	2.0114	1.9590
1.000E-02	2663.	2286.	9.407E 03	1.076E 04	2.0160	1.9590
1.000E-03	1425.	1171.	4.894E 03	6.843E 03	2.0160	1.9590
1.000E-04	742.	552.	2.515E 03	4.908E 03	2.0160	1.9590
4.000E-05	571.	401.	1.926E 03	4.469E 03	2.0160	1.9590
1.000E-05	382.		1.283E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.917E-01	1.917E-01				
THROAT	1.192E-01	1.200E-01	13994.	14159.	1.000	1.000
1.000E-01	2.989E-02	3.256E-02	25793.	25259.	2.141	2.151
1.000E-02	5.184E-03	5.870E-03	32743.	31689.	3.480	3.550
1.000E-03	9.689E-04	1.146E-03	36029.	34648.	5.155	5.282
1.000E-04	1.860E-04	2.431E-04	37645.	36019.	7.438	7.801
4.000E-05	9.674E-05	1.338E-04	38035.	36323.	8.556	9.153
1.000E-05	3.611E-05		38456.		10.543	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	434.9	440.1	789.9	781.0
1.000E-01	2.163E 00	2.066E 00	801.7	785.1	938.9	913.7
1.000E-02	9.827E 00	9.132E 00	1017.7	984.9	1080.0	1041.8
1.000E-03	4.779E 01	4.280E 01	1119.8	1076.9	1150.1	1103.5
1.000E-04	2.382E 02	1.940E 02	1170.0	1119.5	1185.1	1131.6
4.000E-05	4.534E 02	3.495E 02	1182.2	1129.0	1193.7	1137.7
1.000E-05	1.201E 03		1195.2		1202.9	

TABLE 148

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 272.44 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 279.03 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1523.006 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1559.840 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5635
THROAT PRESSURE RATIO(FROZEN) = 0.5465
ENTROPY = 2.073E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	3.966E 04	3.966E 04	1.8823	1.8823
THROAT	7359.	6981.	3.504E 04	3.488E 04	1.9111	1.8823
1.000E-01	5665.	4678.	2.359E 04	2.454E 04	1.9821	1.8823
1.000E-02	3581.	2586.	1.306E 04	1.592E 04	2.0153	1.8823
1.000E-03	1983.	1325.	6.880E 03	1.130E 04	2.0160	1.8823
1.000E-04	1042.	625.	3.554E 03	9.024E 03	2.0160	1.8823
4.000E-05	803.	455.	2.726E 03	8.506E 03	2.0160	1.8823
1.000E-05	540.		1.819E 03		2.0160	
4.000E-06	414.		1.391E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.612E-01	1.612E-01				
THROAT	1.002E-01	1.009E-01	15196.	15456.	1.000	1.000
1.000E-01	2.397E-02	2.756E-02	28359.	27503.	2.156	2.151
1.000E-02	3.859E-03	4.986E-03	36489.	34471.	3.390	3.557
1.000E-03	6.963E-04	9.730E-04	40506.	37673.	4.941	5.295
1.000E-04	1.325E-04	2.062E-04	42511.	39159.	7.099	7.813
4.000E-05	6.878E-05	1.135E-04	42997.	39488.	8.170	9.165
1.000E-05	2.557E-05		43521.		10.064	
4.000E-06	1.333E-05		43767.		11.534	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	472.3	480.4	863.7	851.1
1.000E-01	2.241E 00	2.058E 00	881.4	854.8	1037.1	994.4
1.000E-02	1.083E 01	9.075E 00	1134.1	1071.4	1209.3	1132.9
1.000E-03	5.400E 01	4.256E 01	1259.0	1170.9	1296.5	1199.8
1.000E-04	2.703E 02	1.932E 02	1321.3	1217.1	1340.1	1230.2
4.000E-05	5.150E 02	3.481E 02	1336.4	1227.3	1350.7	1236.8
1.000E-05	1.368E 03		1352.7		1362.2	
4.000E-06	2.610E 03		1360.3		1367.6	

TABLE 149

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 263.97 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 271.43 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1391.231 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1430.586 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5639
THROAT PRESSURE RATIO(FROZEN) = 0.5435
ENTROPY = 2.211E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	9000.	9000.	5.145E 04	5.145E 04	1.7658	1.7658
THROAT	8314.	7799.	4.593E 04	4.570E 04	1.8011	1.7658
1.000E-01	6613.	5147.	3.213E 04	3.351E 04	1.9012	1.7658
1.000E-02	4743.	2787.	1.885E 04	2.349E 04	1.9964	1.7658
1.000E-03	2872.	1403.	1.021E 04	1.823E 04	2.0159	1.7658
1.000E-04	1548.	653.	5.327E 03	1.568E 04	2.0160	1.7658
4.000E-05	1197.	473.	4.094E 03	1.510E 04	2.0160	1.7658
1.000E-05	808.		2.741E 03		2.0160	
4.000E-06	622.		2.099E 03		2.0160	
1.000E-06	417.		1.399E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	1.344E-01	1.344E-01				
THROAT	8.367E-02	8.429E-02	16628.	16973.	1.000	1.000
1.000E-01	1.969E-02	2.350E-02	31099.	29968.	2.168	2.151
1.000E-02	2.883E-03	4.340E-03	40403.	37413.	3.359	3.581
1.000E-03	4.807E-04	8.619E-04	45437.	40781.	4.665	5.367
1.000E-04	8.919E-05	1.852E-04	48053.	42321.	6.602	7.972
4.000E-05	4.615E-05	1.024E-04	48692.	42660.	7.592	9.372
1.000E-05	1.710E-05		49382.		9.357	
4.000E-06	8.886E-06		49706.		10.722	
1.000E-06	3.314E-06		50058.		13.154	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	516.8	527.5	945.6	929.5
1.000E-01	2.272E 00	2.032E 00	966.6	931.4	1139.4	1081.7
1.000E-02	1.194E 01	8.811E 00	1255.8	1162.8	1346.6	1228.0
1.000E-03	6.369E 01	4.070E 01	1412.2	1267.5	1460.7	1297.6
1.000E-04	3.246E 02	1.825E 02	1493.5	1315.4	1518.2	1328.9
4.000E-05	6.191E 02	3.275E 02	1513.4	1325.9	1532.2	1335.6
1.000E-05	1.648E 03		1534.8		1547.4	
4.000E-06	3.150E 03		1544.9		1554.5	
1.000E-06	8.387E 03		1555.8		1562.2	

TABLE 150

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 253.90 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 262.11 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1269.495 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1310.560 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5621
THROAT PRESSURE RATIO(FROZEN) = 0.5384
ENTROPY = 2.368E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	6.638E 04	6.638E 04	1.6220	1.6220
THROAT	9224.	8560.	5.968E 04	5.936E 04	1.6610	1.6220
1.000E-01	7406.	5507.	4.317E 04	4.505E 04	1.7764	1.6220
1.000E-02	5653.	2874.	2.707E 04	3.357E 04	1.9145	1.6220
1.000E-03	4088.	1400.	1.568E 04	2.775E 04	2.0043	1.6220
1.000E-04	2390.	634.	8.378E 03	2.501E 04	2.0160	1.6220
4.000E-05	1867.	455.	6.463E 03	2.440E 04	2.0160	1.6220
1.000E-05	1269.		4.345E 03		2.0160	
4.000E-06	979.		3.335E 03		2.0160	
1.000E-06	659.		2.230E 03		2.0160	
4.000E-07	507.		1.706E 03		2.0160	
1.000E-07	339.		1.136E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.111E-01	1.111E-01				
THROAT	6.932E-02	6.988E-02	18313.	18755.	1.000	1.000
1.000E-01	1.643E-02	2.017E-02	34090.	32680.	2.175	2.149
1.000E-02	2.320E-03	3.866E-03	44364.	40529.	3.382	3.622
1.000E-03	3.358E-04	7.937E-04	50379.	43975.	4.500	5.500
1.000E-04	5.777E-05	1.752E-04	53886.	45510.	6.022	8.274
4.000E-05	2.958E-05	9.763E-05	54768.	45842.	6.875	9.772
1.000E-05	1.088E-05		55728.		8.443	
4.000E-06	5.642E-06		56180.		9.677	
1.000E-06	2.094E-06		56670.		11.872	
4.000E-07	1.090E-06		56901.		13.576	
1.000E-07	4.075E-07		57151.		16.630	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	569.2	582.9	1037.6	1017.6
1.000E-01	2.267E 00	1.988E 00	1059.6	1015.7	1248.5	1176.2
1.000E-02	1.234E 01	8.365E 00	1378.9	1259.7	1481.7	1327.2
1.000E-03	7.504E 01	3.755E 01	1565.8	1366.8	1628.4	1397.1
1.000E-04	4.078E 02	1.644E 02	1674.8	1414.5	1708.8	1427.8
4.000E-05	7.837E 02	2.928E 02	1702.3	1424.8	1728.4	1434.3
1.000E-05	2.093E 03		1732.1		1749.5	
4.000E-06	4.005E 03		1746.1		1759.5	
1.000E-06	1.070E 04		1761.4		1770.3	
4.000E-07	2.047E 04		1768.5		1775.4	
1.000E-07	5.451E 04		1776.3		1780.9	

TABLE 151

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 232.78 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 234.23 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1062.497 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1069.105 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5545
THROAT PRESSURE RATIO(FROZEN) = 0.5004
ENTROPY = 2.710E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	1.033E 05	1.033E 05	1.3240	1.3240
THROAT	10900.	9736.	9.338E 04	9.284E 04	1.3651	1.3240
1.000E-01	8706.	5891.	7.077E 04	7.431E 04	1.4923	1.3240
1.000E-02	6755.	2761.	4.844E 04	5.997E 04	1.6538	1.3240
1.000E-03	5435.	1228.	3.238E 04	5.341E 04	1.8047	1.3240
1.000E-04	4381.	521.	2.039E 04	5.055E 04	1.9356	1.3240
4.000E-05	3960.	367.	1.651E 04	4.994E 04	1.9768	1.3240
1.000E-05	3171.		1.156E 04		2.0123	
4.000E-06	2548.		8.974E 03		2.0159	
1.000E-06	1755.		6.062E 03		2.0160	
4.000E-07	1359.		4.663E 03		2.0160	
1.000E-07	918.		3.125E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.557E-02	7.557E-02				
THROAT	4.756E-02	4.661E-02	22338.	22936.	1.000	1.000
1.000E-01	1.174E-02	1.539E-02	40384.	38128.	2.161	2.116
1.000E-02	1.677E-03	3.284E-03	52428.	46597.	3.410	3.717
1.000E-03	2.275E-04	7.386E-04	59604.	50000.	4.556	5.876
1.000E-04	3.026E-05	1.741E-04	64442.	51411.	5.676	9.153
4.000E-05	1.368E-05	9.882E-05	65933.	51705.	6.119	10.928
1.000E-05	4.346E-06		67786.		6.781	
4.000E-06	2.168E-06		68733.		7.468	
1.000E-06	7.866E-07		69786.		9.023	
4.000E-07	4.063E-07		70286.		10.292	
1.000E-07	1.503E-07		70831.		12.592	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	694.3	712.9	1246.4	1208.1
1.000E-01	2.241E 00	1.821E 00	1255.2	1185.1	1478.3	1365.3
1.000E-02	1.209E 01	6.986E 00	1629.5	1448.3	1749.9	1517.4
1.000E-03	7.837E 01	2.895E 01	1852.6	1554.1	1930.6	1582.7
1.000E-04	5.448E 02	1.195E 02	2002.9	1597.9	2057.2	1609.7
4.000E-05	1.178E 03	2.092E 02	2049.3	1607.0	2096.2	1615.3
1.000E-05	3.606E 03		2106.9		2142.8	
4.000E-06	7.131E 03		2136.3		2164.7	
1.000E-06	1.936E 04		2169.0		2188.3	
4.000E-07	3.721E 04		2184.6		2199.4	
1.000E-07	9.977E 04		2201.5		2211.4	

TABLE 152

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 221.74 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 231.90 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 937.031 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 979.967 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5467
THROAT PRESSURE RATIO(FROZEN) = 0.5072
ENTROPY = 2.552E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.347E 05	1.347E 05	1.1577	1.1577
THROAT	12387.	11074.	1.212E 05	1.201E 05	1.1956	1.1577
1.000E-01	9560.	6246.	9.289E 04	9.658E 04	1.3160	1.1577
1.000E-02	7306.	2625.	6.550E 04	7.997E 04	1.4764	1.1577
1.000E-03	5899.	1027.	4.614E 04	7.320E 04	1.6313	1.1577
1.000E-04	4894.	383.	3.170E 04	7.062E 04	1.7769	1.1577
4.000E-05	4556.		2.693E 04		1.8313	
1.000E-05	4077.		2.057E 04		1.9080	
4.000E-06	3759.		1.687E 04		1.9531	
1.000E-06	3184.		1.202E 04		2.0038	
4.000E-07	2644.		9.373E 03		2.0151	
1.000E-07	1833.		6.338E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.664E-02	5.664E-02				
THROAT	3.614E-02	3.632E-02	25926.	26982.	1.000	1.000
1.000E-01	9.428E-03	1.269E-02	45732.	43665.	2.172	2.132
1.000E-02	1.384E-03	3.021E-03	58846.	52329.	3.463	3.840
1.000E-03	1.894E-04	7.722E-04	66570.	55470.	4.643	6.361
1.000E-04	2.487E-05	2.069E-04	71797.	56626.	5.781	10.498
4.000E-05	1.101E-05		73441.		6.230	
1.000E-05	3.206E-06		75577.		6.914	
4.000E-06	1.424E-06		76791.		7.369	
1.000E-06	4.311E-07		78357.		8.027	
4.000E-07	2.088E-07		79198.		8.523	
1.000E-07	7.534E-08		80151.		10.151	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	805.8	838.6	1423.1	1386.2
1.000E-01	2.173E 00	1.768E 00	1421.4	1357.2	1666.8	1548.0
1.000E-02	1.150E 01	6.199E 00	1829.0	1626.4	1958.9	1693.4
1.000E-03	7.432E 01	2.288E 01	2069.1	1724.1	2153.0	1748.8
1.000E-04	5.248E 02	8.363E 01	2231.5	1760.0	2250.8	1769.0
4.000E-05	1.159E 03		2282.6		2334.9	
1.000E-05	3.868E 03		2349.0		2392.7	
4.000E-06	8.571E 03		2386.7		2425.4	
1.000E-06	2.774E 04		2435.4		2466.7	
4.000E-07	5.666E 04		2461.6		2487.1	
1.000E-07	1.552E 05		2491.2		2508.7	

TABLE 153

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATICN PRESSURE CF 500. ATM AND A STAGNATICN TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.56 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 227.08 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 863.927 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 897.617 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5404
THROAT PRESSURE RATIO(FROZEN) = 0.4983
ENTROPY = 3.099E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.565E 05	1.565E 05	1.0816	1.0816
THROAT	13698.	12362.	1.400E 05	1.385E 05	1.1126	1.0816
1.000E-01	10147.	6771.	1.073E 05	1.110E 05	1.2231	1.0816
1.000E-02	7617.	2751.	7.643E 04	9.207E 04	1.3796	1.0816
1.000E-03	6126.	1067.	5.496E 04	8.453E 04	1.5332	1.0816
1.000E-04	5099.	402.	3.902E 04	8.164E 04	1.6796	1.0816
4.000E-05	4766.		3.377E 04		1.7357	
1.000E-05	4314.		2.673E 04		1.8170	
4.000E-06	4037.		2.260E 04		1.8680	
1.000E-06	3625.		1.706E 04		1.9389	
4.000E-07	3328.		1.382E 04		1.9788	
1.000E-07	2693.		9.635E 03		2.0136	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.630E-02	4.630E-02				
THROAT	3.006E-02	2.986E-02	28738.	30060.	1.000	1.000
1.000E-01	8.256E-03	1.094E-02	49632.	47720.	2.189	2.129
1.000E-02	1.241E-03	2.692E-03	63322.	56803.	3.517	3.905
1.000E-03	1.714E-04	6.944E-04	71306.	60036.	4.726	6.534
1.000E-04	2.256E-05	1.843E-04	76696.	61228.	5.884	10.776
4.000E-05	9.977E-06		78393.		6.339	
1.000E-05	2.885E-06		80608.		7.027	
4.000E-06	1.268E-06		81879.		7.483	
1.000E-06	3.663E-07		83558.		8.182	
4.000E-07	1.629E-07		84521.		8.643	
1.000E-07	5.121E-08		85753.		9.265	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	893.2	934.3	1555.0	1521.6
1.000E-01	2.108E 00	1.719E 00	1542.6	1483.2	1800.8	1685.8
1.000E-02	1.100E 01	5.869E 00	1968.1	1765.5	2102.8	1834.7
1.000E-03	7.067E 01	2.153E 01	2216.3	1866.0	2302.8	1891.4
1.000E-04	4.992E 02	7.955E 01	2383.8	1903.0	2444.9	1912.4
4.000E-05	1.105E 03		2436.5		2490.6	
1.000E-05	3.715E 03		2505.4		2550.9	
4.000E-06	8.323E 03		2544.9		2585.7	
1.000E-06	2.822E 04		2597.1		2631.6	
4.000E-07	6.275E 04		2627.0		2657.7	
1.000E-07	1.967E 05		2665.3		2689.4	

TABLE 154

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.86 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 225.00 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 815.645 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 838.529 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5351
THROAT PRESSURE RATIO(FROZEN) = 0.4937
ENTROPY = 3.191E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.722E 05	1.722E 05	1.0480	1.0480
THROAT	14925.	13739.	1.530E 05	1.511E 05	1.0707	1.0480
1.000E-01	10588.	7423.	1.169E 05	1.200E 05	1.1699	1.0480
1.000E-02	7817.	2972.	8.359E 04	9.874E 04	1.3231	1.0480
1.000E-03	6259.	1149.	6.070E 04	9.034E 04	1.4748	1.0480
1.000E-04	5210.	435.	4.381E 04	8.713E 04	1.6207	1.0480
4.000E-05	4875.		3.824E 04		1.6767	
1.000E-05	4427.		3.079E 04		1.7589	
4.000E-06	4159.		2.641E 04		1.8113	
1.000E-06	3778.		2.050E 04		1.8864	
4.000E-07	3528.		1.701E 04		1.9322	
1.000E-07	3101.		1.234E 04		1.9904	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.988E-02	3.988E-02				
THROAT	2.629E-02	2.579E-02	31021.	32510.	1.000	1.000
1.000E-01	7.568E-03	9.669E-03	52618.	51119.	2.209	2.129
1.000E-02	1.159E-03	2.415E-03	66617.	60659.	3.569	3.937
1.000E-03	1.614E-04	6.248E-04	74722.	64029.	4.800	6.614
1.000E-04	2.130E-05	1.650E-04	80183.	65273.	5.977	10.901
4.000E-05	9.422E-06		81902.		6.437	
1.000E-05	2.721E-06		84150.		7.131	
4.000E-06	1.193E-06		85442.		7.590	
1.000E-06	3.420E-07		87157.		8.291	
4.000E-07	1.500E-07		88152.		8.760	
1.000E-07	4.396E-08		89467.		9.459	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	964.2	1010.4	1658.2	1633.4
1.000E-01	2.048E 00	1.696E 00	1635.4	1588.8	1901.1	1802.9
1.000E-02	1.056E 01	5.724E 00	2070.5	1885.3	2207.5	1957.5
1.000E-03	6.763E 01	2.096E 01	2322.4	1990.1	2410.2	2016.5
1.000E-04	4.775E 02	7.784E 01	2492.2	2028.7	2554.1	2038.6
4.000E-05	1.057E 03		2545.6		2600.4	
1.000E-05	3.562E 03		2615.5		2661.7	
4.000E-06	8.001E 03		2655.6		2697.1	
1.000E-06	2.736E 04		2708.9		2744.4	
4.000E-07	6.167E 04		2739.8		2771.8	
1.000E-07	2.074E 05		2780.7		2807.6	

TABLE 155

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 218.76 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 223.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 773.449 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 791.245 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5139
THROAT PRESSURE RATIO(FROZEN) = 0.4914
ENTROPY = 3.266E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.863E 05	1.863E 05	1.0302	1.0302
THROAT	16131.	15174.	1.634E 05	1.624E 05	1.0463	1.0302
1.000E-01	10908.	8145.	1.239E 05	1.277E 05	1.1272	1.0302
1.000E-02	7984.	3240.	8.950E 04	1.040E 05	1.2798	1.0302
1.000E-03	6362.	1252.	6.542E 04	9.467E 04	1.4299	1.0302
1.000E-04	5293.	475.	4.773E 04	9.110E 04	1.5748	1.0302
4.000E-05	4955.		4.192E 04		1.6307	
1.000E-05	4506.		3.413E 04		1.7130	
4.000E-06	4241.		2.955E 04		1.7658	
1.000E-06	3872.		2.336E 04		1.8425	
4.000E-07	3640.		1.969E 04		1.8906	
1.000E-07	3280.		1.474E 04		1.9568	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.528E-02	3.528E-02				
THROAT	2.283E-02	2.285E-02	33874.	34631.	1.000	1.000
1.000E-01	7.078E-03	8.663E-03	55908.	54195.	2.256	2.129
1.000E-02	1.098E-03	2.178E-03	69627.	64213.	3.623	3.953
1.000E-03	1.539E-04	5.638E-04	77802.	67743.	4.876	6.651
1.000E-04	2.038E-05	1.485E-04	83298.	69047.	6.070	10.955
4.000E-05	9.017E-06		85029.		6.537	
1.000E-05	2.604E-06		87292.		7.238	
4.000E-06	1.141E-06		88594.		7.701	
1.000E-06	3.259E-07		90327.		8.405	
4.000E-07	1.423E-07		91337.		8.875	
1.000E-07	4.087E-08		92685.		9.596	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1052.8	1076.4	1755.8	1733.4
1.000E-01	1.955E 00	1.685E 00	1737.7	1684.4	2005.0	1909.8
1.000E-02	1.012E 01	5.658E 00	2164.1	1995.8	2302.5	2071.5
1.000E-03	6.458E 01	2.072E 01	2418.2	2105.5	2506.5	2133.2
1.000E-04	4.557E 02	7.715E 01	2589.0	2146.1	2651.3	2156.4
4.000E-05	1.009E 03		2642.8		2658.0	
1.000E-05	3.403E 03		2713.1		2759.7	
4.000E-06	7.653E 03		2753.6		2795.5	
1.000E-06	2.627E 04		2807.4		2843.4	
4.000E-07	5.951E 04		2838.8		2871.4	
1.000E-07	2.042E 05		2880.8		2908.7	

TABLE 156

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 204.93 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 217.46 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 591.592 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 627.756 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5468
THROAT PRESSURE RATIO(FROZEN) = 0.4897
ENTROPY = 3.584E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	2.662E 05	2.662E 05	0.9792	0.9792
THROAT	25972.	22854.	2.322E 05	2.281E 05	0.9941	0.9792
1.000E-01	15186.	12184.	1.637E 05	1.734E 05	1.0192	0.9792
1.000E-02	8887.	4842.	1.162E 05	1.361E 05	1.1200	0.9792
1.000E-03	6807.	1882.	8.633E 04	1.215E 05	1.2595	0.9792
1.000E-04	5605.	720.	6.506E 04	1.158E 05	1.3979	0.9792
4.000E-05	5243.	490.	5.813E 04	1.147E 05	1.4518	0.9792
1.000E-05	4774.		4.889E 04		1.5320	
4.000E-06	4505.		4.347E 04		1.5840	
1.000E-06	4145.		3.613E 04		1.6612	
4.000E-07	3931.		3.177E 04		1.7111	
1.000E-07	3635.		2.581E 04		1.7846	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.236E-02	2.236E-02				
THROAT	1.434E-02	1.437E-02	41269.	43683.	1.000	1.000
1.000E-01	4.597E-03	5.505E-03	71615.	68172.	2.115	2.128
1.000E-02	8.632E-04	1.385E-03	86662.	80695.	3.950	3.968
1.000E-03	1.267E-04	3.564E-04	94889.	85121.	5.369	6.663
1.000E-04	1.708E-05	9.315E-05	100345.	86768.	6.679	10.936
4.000E-05	7.587E-06	5.474E-05	102058.	87088.	7.186	13.293
1.000E-05	2.198E-06		104300.		7.942	
4.000E-06	9.633E-07		105593.		8.438	
1.000E-06	2.745E-07		107318.		9.184	
4.000E-07	1.192E-07		108330.		9.677	
1.000E-07	3.362E-08		109699.		10.425	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1282.7	1357.7	2260.6	2183.0
1.000E-01	1.797E 00	1.673E 00	2225.9	2118.8	2547.3	2400.8
1.000E-02	7.908E 00	5.616E 00	2693.5	2508.1	2835.0	2602.7
1.000E-03	4.919E 01	2.069E 01	2949.3	2645.6	3037.2	2680.5
1.000E-04	3.452E 02	7.767E 01	3118.8	2696.8	3180.5	2709.9
4.000E-05	7.640E 02	1.317E 02	3172.1	2706.8	3226.7	2715.7
1.000E-05	2.581E 03		3241.7		3287.9	
4.000E-06	5.816E 03		3281.9		3323.5	
1.000E-06	2.008E 04		3335.6		3371.5	
4.000E-07	4.580E 04		3367.0		3359.8	
1.000E-07	1.604E 05		3409.6		3438.2	

TABLE 157

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 187.68 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 206.36 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 469.192 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 515.888 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5580
THROAT PRESSURE RATIO(FROZEN) = 0.5130
ENTROPY = 4.047E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	40000.	40000.	4.325E 05	4.325E 05	0.8639	0.8639
THROAT	36273.	31378.	3.819E 05	3.756E 05	0.8855	0.8639
1.000E-01	26855.	16599.	2.634E 05	2.880E 05	0.9556	0.8639
1.000E-02	15036.	6634.	1.655E 05	2.304E 05	1.0081	0.8639
1.000E-03	7821.	2608.	1.199E 05	2.076E 05	1.0667	0.8639
1.000E-04	6064.	1011.	9.207E 04	1.986E 05	1.1895	0.8639
4.000E-05	5626.	692.	8.331E 04	1.969E 05	1.2391	0.8639
1.000E-05	5089.	389.	7.176E 04	1.952E 05	1.3133	0.8639
4.000E-06	4792.		6.503E 04		1.3615	
1.000E-06	4407.		5.598E 04		1.4343	
4.000E-07	4184.		5.061E 04		1.4816	
1.000E-07	3886.		4.329E 04		1.5521	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.479E-02	1.479E-02				
THROAT	9.329E-03	9.674E-03	50292.	53327.	1.000	1.000
1.000E-01	2.438E-03	3.565E-03	91993.	85030.	2.215	2.137
1.000E-02	4.592E-04	8.920E-04	115610.	100564.	3.449	3.982
1.000E-03	9.341E-05	2.269E-04	125094.	106105.	5.994	6.657
1.000E-04	1.343E-05	5.854E-05	130537.	108192.	7.664	10.862
4.000E-05	6.034E-06	3.422E-05	132206.	108601.	8.267	13.170
1.000E-05	1.768E-06	1.521E-05	134374.	108987.	9.152	17.609
4.000E-06	7.786E-07		135621.		9.724	
1.000E-06	2.229E-07		137282.		10.577	
4.000E-07	9.701E-08		138257.		11.135	
1.000E-07	2.736E-08		139577.		11.974	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1563.1	1657.5	2821.3	2709.5
1.000E-01	2.092E 00	1.702E 00	2859.2	2642.8	3331.0	2991.9
1.000E-02	8.837E 00	5.751E 00	3593.3	3125.6	3792.6	3243.6
1.000E-03	4.015E 01	2.143E 01	3888.1	3297.8	3978.6	3341.8
1.000E-04	2.675E 02	8.146E 01	4057.2	3362.7	4117.5	3379.4
4.000E-05	5.882E 02	1.388E 02	4109.1	3375.4	4162.1	3386.8
1.000E-05	1.975E 03	3.111E 02	4176.5	3387.4	4221.0	3393.8
4.000E-06	4.443E 03		4215.2		4255.3	
1.000E-06	1.533E 04		4266.9		4301.4	
4.000E-07	3.498E 04		4297.2		4328.7	
1.000E-07	1.229E 05		4338.2		4365.9	

TABLE 158

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 171.13 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 179.75 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 382.660 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 401.924 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5503
THROAT PRESSURE RATIO(FROZEN) = 0.5075
ENTROPY = 4.668E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	7.122E 05	7.122E 05	0.7101	0.7101
THROAT	45099.	40158.	6.340E 05	6.268E 05	0.7317	0.7101
1.000E-01	34688.	21799.	4.567E 05	4.892E 05	0.8044	0.7101
1.000E-02	25284.	8839.	2.971E 05	3.970E 05	0.9039	0.7101
1.000E-03	17840.	3775.	1.928E 05	3.588E 05	0.9874	0.7101
1.000E-04	8553.	1669.	1.339E 05	3.422E 05	1.0102	0.7101
4.000E-05	6665.	1213.	1.206E 05	3.385E 05	1.0313	0.7101
1.000E-05	5618.	750.	1.048E 05	3.348E 05	1.0919	0.7101
4.000E-06	5200.	547.	9.597E 04	3.331E 05	1.1346	0.7101
1.000E-06	4717.	340.	8.428E 04	3.314E 05	1.1994	0.7101
4.000E-07	4457.		7.744E 04		1.2419	
1.000E-07	4123.		6.817E 04		1.3057	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.728E-03	9.728E-03				
THROAT	6.116E-03	6.147E-03	62569.	65386.	1.000	1.000
1.000E-01	1.588E-03	2.231E-03	113087.	105660.	2.199	2.101
1.000E-02	2.449E-04	5.503E-04	144153.	125617.	3.539	3.973
1.000E-03	3.791E-05	1.289E-04	161253.	133011.	4.885	6.544
1.000E-04	8.090E-06	2.914E-05	170141.	136098.	7.510	10.151
4.000E-05	4.239E-06	1.604E-05	172091.	136770.	8.896	11.990
1.000E-05	1.331E-06	6.481E-06	174372.	137452.	10.236	15.346
4.000E-06	5.978E-07	3.555E-06	175635.	137752.	10.979	18.023
1.000E-06	1.741E-07	1.431E-06	177293.	138059.	12.032	22.938
4.000E-07	7.633E-08		178256.		12.702	
1.000E-07	2.169E-08		179553.		13.693	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1944.7	2032.3	3466.3	3368.2
1.000E-01	2.130E 00	1.705E 00	3514.9	3284.0	4103.9	3732.8
1.000E-02	1.084E 01	5.815E 00	4480.4	3904.3	4780.1	4057.4
1.000E-03	6.260E 01	2.345E 01	5011.9	4134.1	5185.0	4195.9
1.000E-04	2.780E 02	1.013E 02	5288.1	4230.1	5365.0	4256.7
4.000E-05	5.245E 02	1.832E 02	5348.8	4250.9	5406.8	4270.2
1.000E-05	1.648E 03	4.512E 02	5419.6	4272.1	5465.2	4284.0
4.000E-06	3.645E 03	8.208E 02	5458.9	4281.5	5499.2	4290.1
1.000E-06	1.239E 04	2.035E 03	5510.4	4291.0	5544.7	4296.4
4.000E-07	2.812E 04		5540.4		5571.5	
1.000E-07	9.824E 04		5580.7		5607.9	

TABLE 159

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 155.73 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 159.89 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 284.321 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 291.915 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5087
THROAT PRESSURE RATIO(FROZEN) = 0.4978
ENTROPY = 5.666E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.312E 06	1.312E 06	0.5393	0.5393
THROAT	62167.	58171.	1.145E 06	1.142E 06	0.5534	0.5393
1.000E-01	44352.	31343.	8.514E 05	8.846E 05	0.6040	0.5393
1.000E-02	31825.	12510.	5.845E 05	7.106E 05	0.6930	0.5393
1.000E-03	24535.	5025.	4.110E 05	6.410E 05	0.7852	0.5393
1.000E-04	19561.	2037.	2.899E 05	6.130E 05	0.8753	0.5393
4.000E-05	17918.	1424.	2.516E 05	6.072E 05	0.9094	0.5393
1.000E-05	15566.	830.	2.022E 05	6.016E 05	0.9575	0.5393
4.000E-06	13904.	581.	1.746E 05	5.992E 05	0.9849	0.5393
1.000E-06	10084.	339.	1.423E 05	5.969E 05	1.0074	0.5393
4.000E-07	7049.		1.269E 05		1.0081	
1.000E-07	4776.		1.116E 05		1.0296	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.925E-03	4.925E-03				
THROAT	3.101E-03	3.161E-03	91675.	92350.	1.000	1.000
1.000E-01	9.327E-04	1.179E-03	151911.	146338.	2.158	2.116
1.000E-02	1.491E-04	2.953E-04	190898.	173575.	3.601	3.964
1.000E-03	2.192E-05	7.350E-05	212430.	183332.	4.972	6.632
1.000E-04	3.065E-06	1.813E-05	226250.	187124.	6.342	10.657
4.000E-05	1.391E-06	1.037E-05	230440.	187896.	6.900	12.804
1.000E-05	4.213E-07	4.452E-06	235747.	188643.	7.777	16.852
4.000E-06	1.941E-07	2.544E-06	238666.	188956.	8.387	20.181
1.000E-06	6.842E-08	1.091E-06	242030.	189259.	8.844	26.477
4.000E-07	3.918E-08		243612.		12.045	
1.000E-07	1.477E-08		245177.		15.298	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2849.4	2870.3	4742.1	4674.5
1.000E-01	2.007E 00	1.693E 00	4721.5	4548.3	5468.3	5161.8
1.000E-02	9.986E 00	5.696E 00	5933.3	5394.9	6304.9	5601.3
1.000E-03	6.106E 01	2.166E 01	6602.5	5698.1	6829.7	5776.7
1.000E-04	4.100E 02	8.604E 01	7032.1	5816.0	7184.7	5847.2
4.000E-05	8.873E 02	1.498E 02	7162.3	5840.0	7294.4	5861.7
1.000E-05	2.863E 03	3.476E 02	7327.2	5863.2	7433.8	5875.8
4.000E-06	6.138E 03	6.073E 02	7418.0	5872.9	7509.3	5881.7
1.000E-06	1.717E 04	1.414E 03	7522.5	5882.4	7586.4	5887.5
4.000E-07	2.979E 04		7571.7		7616.0	
1.000E-07	7.853E 04		7620.4		7649.6	

TABLE 160

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.12 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.05 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 248.436 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 249.896 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4952
THROAT PRESSURE RATIO(FROZEN) = 0.4931
ENTROPY = 6.031E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.627E 06	1.627E 06	0.5155	0.5155
THROAT	77455.	76131.	1.389E 06	1.388E 06	0.5200	0.5155
1.000E-01	49657.	40813.	1.022E 06	1.039E 06	0.5527	0.5155
1.000E-02	33957.	16285.	7.044E 05	8.022E 05	0.6323	0.5155
1.000E-03	25932.	6495.	5.031E 05	7.077E 05	0.7194	0.5155
1.000E-04	20783.	2599.	3.636E 05	6.700E 05	0.8068	0.5155
4.000E-05	19170.	1807.	3.195E 05	6.623E 05	0.8409	0.5155
1.000E-05	17019.	1042.	2.619E 05	6.549E 05	0.8910	0.5155
4.000E-06	15719.	725.	2.291E 05	6.518E 05	0.9228	0.5155
1.000E-06	13781.	418.	1.861E 05	6.488E 05	0.9673	0.5155
4.000E-07	12304.		1.618E 05		0.9921	
1.000E-07	8486.		1.340E 05		1.0080	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.531E-03	3.531E-03				
THROAT	2.277E-03	2.287E-03	109098.	109268.	1.000	1.000
1.000E-01	7.624E-04	8.651E-04	173975.	171491.	2.131	2.124
1.000E-02	1.275E-04	2.168E-04	214886.	203176.	3.689	3.971
1.000E-03	1.900E-05	5.436E-05	237180.	214503.	5.139	6.647
1.000E-04	2.659E-06	1.358E-05	251474.	218864.	6.554	10.732
4.000E-05	1.202E-06	7.817E-06	255829.	219742.	7.119	12.928
1.000E-05	3.586E-07	3.387E-06	261396.	220587.	7.986	17.089
4.000E-06	1.609E-07	1.949E-06	264524.	220937.	8.574	20.529
1.000E-06	4.809E-08	8.440E-07	268565.	221274.	9.508	27.065
4.000E-07	2.209E-08		270819.		10.152	
1.000E-07	8.136E-09		273371.		12.110	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3390.9	3396.2	5499.9	5483.9
1.000E-01	1.873E 00	1.684E 00	5407.3	5330.1	6205.0	6043.3
1.000E-02	9.065E 00	5.673E 00	6678.9	6314.9	7064.9	6555.1
1.000E-03	5.513E 01	2.143E 01	7371.8	6667.0	7606.6	6757.7
1.000E-04	3.715E 02	8.406E 01	7816.1	6802.5	7974.3	6838.1
4.000E-05	8.080E 02	1.455E 02	7951.4	6829.8	8089.1	6854.4
1.000E-05	2.650E 03	3.344E 02	8124.5	6856.0	8237.3	6870.2
4.000E-06	5.840E 03	5.804E 02	8221.7	6866.9	8321.1	6876.8
1.000E-06	1.924E 04	1.338E 03	8347.3	6877.4	8429.2	6883.1
4.000E-07	4.153E 04		8417.3		8488.1	
1.000E-07	1.117E 05		8496.6		8544.2	

TABLE 161

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.83 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.83 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 203.759 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 203.762 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4887
THROAT PRESSURE RATIO(FROZEN) = 0.4887
ENTROPY = 6.448E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	150000.	150000.	2.140E 06	2.140E 06	0.5079	0.5079
THROAT	112908.	112897.	1.774E 06	1.774E 06	0.5079	0.5079
1.000E-01	62310.	60307.	1.252E 06	1.254E 06	0.5151	0.5079
1.000E-02	36851.	24423.	8.526E 05	8.960E 05	0.5729	0.5079
1.000E-03	27459.	9935.	6.145E 05	7.510E 05	0.6537	0.5079
1.000E-04	21914.	4050.	4.527E 05	6.919E 05	0.7365	0.5079
4.000E-05	20245.	2835.	4.017E 05	6.797E 05	0.7693	0.5079
1.000E-05	18089.	1652.	3.353E 05	6.678E 05	0.8183	0.5079
4.000E-06	16846.	1157.	2.972E 05	6.628E 05	0.8500	0.5079
1.000E-06	15154.	674.	2.467E 05	6.580E 05	0.8968	0.5079
4.000E-07	14112.	472.	2.175E 05	6.559E 05	0.9266	0.5079
1.000E-07	12530.		1.787E 05		0.9686	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.319E-03	2.319E-03				
THROAT	1.506E-03	1.506E-03	135315.	135318.	1.000	1.000
1.000E-01	5.662E-04	5.768E-04	210864.	210636.	2.129	2.134
1.000E-02	1.065E-04	1.424E-04	253845.	249525.	3.828	3.981
1.000E-03	1.631E-05	3.501E-05	276332.	263677.	5.487	6.603
1.000E-04	2.302E-06	8.589E-06	290615.	269227.	7.019	10.565
4.000E-05	1.041E-06	4.909E-06	294971.	270360.	7.618	12.683
1.000E-05	3.098E-07	2.105E-06	300558.	271458.	8.526	16.680
4.000E-06	1.382E-07	1.203E-06	303716.	271917.	9.130	19.971
1.000E-06	4.054E-08	5.158E-07	307844.	272363.	10.061	26.198
4.000E-07	1.799E-08	2.947E-07	310211.	272550.	10.694	31.333
1.000E-07	5.294E-09		313323.		11.703	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4205.7	4205.8	6743.4	6743.3
1.000E-01	1.707E 00	1.677E 00	6553.9	6546.8	7440.0	7417.6
1.000E-02	7.539E 00	5.733E 00	7889.8	7755.5	8281.2	8053.2
1.000E-03	4.522E 01	2.207E 01	8588.7	8195.4	8823.5	8310.0
1.000E-04	3.046E 02	8.811E 01	9032.6	8367.9	9190.7	8413.6
4.000E-05	6.635E 02	1.535E 02	9168.0	8403.1	9305.8	8435.0
1.000E-05	2.188E 03	3.566E 02	9341.6	8437.2	9455.2	8455.7
4.000E-06	4.853E 03	6.230E 02	9439.8	8451.5	9540.6	8464.4
1.000E-06	1.633E 04	1.450E 03	9568.1	8465.3	9652.9	8472.8
4.000E-07	3.651E 04	2.537E 03	9641.7	8471.1	9717.5	8476.4
1.000E-07	1.228E 05		9738.4		9802.2	

TABLE 162

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 500. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.72 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.72 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 176.337 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 176.341 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4878
THROAT PRESSURE RATIO(FROZEN) = 0.4879
ENTROPY = 6.734E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.637E 06	2.637E 06	0.5062	0.5062
THROAT	150146.	150241.	2.146E 06	2.146E 06	0.5059	0.5062
1.000E-01	80171.	79971.	1.453E 06	1.453E 06	0.5069	0.5062
1.000E-02	39866.	32114.	9.619E 05	9.793E 05	0.5400	0.5062
1.000E-03	28576.	12937.	6.945E 05	7.887E 05	0.6142	0.5062
1.000E-04	22622.	5219.	5.164E 05	7.118E 05	0.6934	0.5062
4.000E-05	20884.	3638.	4.605E 05	6.961E 05	0.7250	0.5062
1.000E-05	18673.	2107.	3.878E 05	6.808E 05	0.7725	0.5062
4.000E-06	17419.	1469.	3.462E 05	6.744E 05	0.8036	0.5062
1.000E-06	15750.	851.	2.909E 05	6.683E 05	0.8499	0.5062
4.000E-07	14759.	593.	2.588E 05	6.657E 05	0.8797	0.5062
1.000E-07	13364.	344.	2.159E 05	6.632E 05	0.9235	0.5062

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.734E-03	1.734E-03				
THROAT	1.126E-03	1.126E-03	156650.	156626.	1.000	1.000
1.000E-01	4.330E-04	4.335E-04	243388.	243382.	2.133	2.132
1.000E-02	9.279E-05	1.080E-04	289536.	288031.	3.885	3.988
1.000E-03	1.472E-05	2.680E-05	311797.	304145.	5.805	6.640
1.000E-04	2.099E-06	6.643E-06	325785.	310405.	7.483	10.672
4.000E-05	9.511E-07	3.812E-06	330046.	311673.	8.124	12.836
1.000E-05	2.834E-07	1.645E-06	335514.	312896.	9.087	16.933
4.000E-06	1.264E-07	9.441E-07	338609.	313404.	9.722	20.315
1.000E-06	3.696E-08	4.074E-07	342668.	313896.	10.691	26.733
4.000E-07	1.633E-08	2.338E-07	345006.	314101.	11.341	32.039
1.000E-07	4.733E-09	1.009E-07	348108.	314299.	12.350	42.120

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4868.8	4868.1	7755.4	7795.2
1.000E-01	1.673E 00	1.671E 00	7564.7	7564.5	8568.6	8567.2
1.000E-02	6.564E 00	5.671E 00	8999.1	8952.3	9352.9	9292.5
1.000E-03	3.842E 01	2.163E 01	9691.0	9453.1	9921.4	9582.9
1.000E-04	2.578E 02	8.552E 01	10125.7	9647.7	10280.4	9699.0
4.000E-05	5.617E 02	1.484E 02	10258.2	9687.1	10393.0	9722.7
1.000E-05	1.855E 03	3.425E 02	10428.1	9725.1	10539.4	9745.7
4.000E-06	4.120E 03	5.960E 02	10524.3	9740.9	10623.2	9755.2
1.000E-06	1.392E 04	1.379E 03	10650.5	9756.2	10734.0	9764.5
4.000E-07	3.130E 04	2.402E 03	10723.1	9762.6	10798.2	9768.3
1.000E-07	1.070E 05	5.562E 03	10819.6	9768.7	10883.8	9772.1

TABLE 163

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 288.62 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 289.29 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4081.690 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4091.241 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5458
THROAT PRESSURE RATIO(FROZEN) = 0.5447
ENTROPY = 1.692E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	1.911E 04	1.911E 04	2.0136	2.0136
THROAT	4366.	4346.	1.632E 04	1.631E 04	2.0152	2.0136
1.000E-01	2897.	2876.	1.031E 04	1.034E 04	2.0160	2.0136
1.000E-02	1562.	1539.	5.376E 03	5.448E 03	2.0160	2.0136
1.000E-03	815.	756.	2.767E 03	2.927E 03	2.0160	2.0136
1.000E-04	421.	344.	1.412E 03	1.732E 03	2.0160	2.0136

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	5.517E-01	5.517E-01				
THROAT	3.451E-01	3.457E-01	11827.	11834.	1.000	1.000
1.000E-01	9.533E-02	9.590E-02	20996.	20955.	2.146	2.147
1.000E-02	1.768E-02	1.792E-02	26223.	26154.	3.587	3.575
1.000E-03	3.388E-03	3.649E-03	28605.	28465.	5.396	5.405
1.000E-04	6.565E-04	8.028E-04	29767.	29497.	7.786	8.128

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	367.6	367.8	650.5	649.6
1.000E-01	2.039E 00	2.036E 00	652.6	651.3	758.3	756.6
1.000E-02	8.806E 00	8.728E 00	815.0	812.9	860.7	858.0
1.000E-03	4.211E 01	3.939E 01	889.1	884.7	910.9	905.1
1.000E-04	2.089E 02	1.728E 02	925.2	916.8	936.0	925.7

TABLE 164

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 285.52 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 287.68 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3686.044 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3713.882 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5512
THROAT PRESSURE RATIO(FROZEN) = 0.5469
ENTROPY = 1.781E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.402E 04	2.402E 04	2.0035	2.0035
THROAT	5322.	5242.	2.069E 04	2.066E 04	2.0101	2.0035
1.000E-01	3624.	3514.	1.321E 04	1.336E 04	2.0158	2.0035
1.000E-02	2006.	1929.	6.962E 03	7.288E 03	2.0160	2.0035
1.000E-03	1054.	974.	3.597E 03	4.072E 03	2.0160	2.0035
1.000E-04	547.	453.	1.842E 03	2.508E 03	2.0160	2.0035
5.000E-05	447.		1.503E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.574E-01	4.574E-01				
THROAT	2.852E-01	2.864E-01	12923.	12969.	1.000	1.000
1.000E-01	7.620E-02	7.809E-02	23267.	23101.	2.144	2.150
1.000E-02	1.377E-02	1.423E-02	29224.	28944.	3.546	3.555
1.000E-03	2.619E-03	2.817E-03	31976.	31602.	5.309	5.317
1.000E-04	5.053E-04	6.057E-04	33322.	32818.	7.660	7.904
5.000E-05	3.086E-04		33575.		8.519	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	401.7	403.1	718.1	714.7
1.000E-01	2.079E 00	2.059E 00	723.1	718.0	842.5	835.3
1.000E-02	9.161E 00	9.018E 00	908.3	899.6	960.9	951.0
1.000E-03	4.401E 01	4.172E 01	993.8	982.2	1019.1	1006.0
1.000E-04	2.189E 02	1.868E 02	1035.7	1020.0	1048.2	1030.6
5.000E-05	3.557E 02		1043.5		1053.8	

TABLE 165

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 281.22 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 285.22 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3361.164 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3409.035 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5573
THROAT PRESSURE RATIO(FROZEN) = 0.5480
ENTROPY = 1.873E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	7000.	7000.	2.998E 04	2.998E 04	1.9754	1.9754
THROAT	6317.	6130.	2.609E 04	2.602E 04	1.9907	1.9754
1.000E-01	4488.	4138.	1.692E 04	1.732E 04	2.0136	1.9754
1.000E-02	2569.	2305.	9.049E 03	1.002E 04	2.0160	1.9754
1.000E-03	1371.	1186.	4.702E 03	6.094E 03	2.0160	1.9754
1.000E-04	713.	561.	2.416E 03	4.147E 03	2.0160	1.9754
5.000E-05	585.	442.	1.974E 03	3.799E 03	2.0160	1.9754
1.000E-05	367.		1.231E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	3.866E-01	3.866E-01				
THROAT	2.406E-01	2.419E-01	13970.	14093.	1.000	1.000
1.000E-01	6.146E-02	6.540E-02	25575.	25177.	2.142	2.151
1.000E-02	1.075E-02	1.174E-02	32373.	31610.	3.498	3.546
1.000E-03	2.015E-03	2.281E-03	35575.	34582.	5.188	5.267
1.000E-04	3.871E-04	4.821E-04	37149.	35964.	7.485	7.764
5.000E-05	2.361E-04	3.063E-04	37446.	36205.	8.323	8.756
1.000E-05	7.521E-05		37939.		10.611	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	434.2	438.0	765.1	778.2
1.000E-01	2.138E 00	2.070E 00	794.9	782.5	929.5	911.0
1.000E-02	9.660E 00	9.187E 00	1006.2	982.5	1067.0	1039.5
1.000E-03	4.689E 01	4.322E 01	1105.7	1074.8	1135.2	1101.7
1.000E-04	2.337E 02	1.966E 02	1154.6	1117.8	1169.3	1130.0
5.000E-05	3.803E 02	3.074E 02	1163.9	1125.3	1175.8	1134.8
1.000E-05	1.178E 03		1179.2		1186.6	

TABLE 166

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 275.87 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 281.24 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3084.288 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3144.358 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5614
THROAT PRESSURE RATIO(FROZEN) = 0.5478
ENTROPY = 1.974E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	3.760E 04	3.760E 04	1.9194	1.9194
THROAT	7310.	7003.	3.306E 04	3.293E 04	1.9438	1.9194
1.000E-01	5480.	4724.	2.198E 04	2.272E 04	1.9980	1.9194
1.000E-02	3332.	2639.	1.203E 04	1.414E 04	2.0158	1.9194
1.000E-03	1826.	1367.	6.313E 03	9.495E 03	2.0160	1.9194
1.000E-04	956.	651.	3.257E 03	7.178E 03	2.0160	1.9194
5.000E-05	785.	513.	2.664E 03	6.761E 03	2.0160	1.9194
1.000E-05	495.	289.	1.665E 03	6.109E 03	2.0160	1.9194

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.287E-01	3.287E-01				
THROAT	2.045E-01	2.057E-01	15081.	15287.	1.000	1.000
1.000E-01	4.995E-02	5.566E-02	27966.	27296.	2.151	2.152
1.000E-02	8.288E-03	9.965E-03	35779.	34273.	3.430	3.547
1.000E-03	1.513E-03	1.923E-03	39576.	37510.	5.022	5.259
1.000E-04	2.888E-04	4.036E-04	41464.	39026.	7.225	7.725
5.000E-05	1.759E-04	2.560E-04	41821.	39292.	8.036	8.702
1.000E-05	5.580E-05	9.083E-05	42414.	39705.	10.239	11.567

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	468.7	475.1	853.9	843.8
1.000E-01	2.208E 00	2.070E 00	869.2	848.4	1020.7	987.6
1.000E-02	1.040E 01	9.207E 00	1112.1	1065.3	1183.4	1127.2
1.000E-03	5.152E 01	4.359E 01	1230.1	1165.5	1265.4	1195.2
1.000E-04	2.576E 02	1.996E 02	1288.8	1213.0	1306.4	1226.4
5.000E-05	4.194E 02	3.125E 02	1299.8	1221.2	1314.2	1231.7
1.000E-05	1.303E 03	8.718E 02	1318.3	1234.1	1327.2	1240.0

TABLE 167

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 269.24 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 275.40 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2838.018 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2903.008 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5627
THROAT PRESSURE RATIO(FROZEN) = 0.5461
ENTROPY = 2.089E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	9000.	9000.	4.739E 04	4.739E 04	1.8315	1.8315
THROAT	8271.	7847.	4.205E 04	4.187E 04	1.8629	1.8315
1.000E-01	6443.	5247.	2.886E 04	2.994E 04	1.9478	1.8315
1.000E-02	4341.	2900.	1.643E 04	2.000E 04	2.0107	1.8315
1.000E-03	2499.	1491.	8.783E 03	1.468E 04	2.0160	1.8315
1.000E-04	1330.	706.	4.560E 03	1.204E 04	2.0160	1.8315
5.000E-05	1094.	556.	3.735E 03	1.156E 04	2.0160	1.8315
1.000E-05	692.	313.	2.342E 03	1.082E 04	2.0160	1.8315
5.000E-06	567.		1.913E 03		2.0160	
1.000E-06	356.		1.193E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.788E-01	2.788E-01				
THROAT	1.736E-01	1.746E-01	16348.	16626.	1.000	1.000
1.000E-01	4.141E-02	4.781E-02	30460.	29553.	2.164	2.152
1.000E-02	6.345E-03	8.653E-03	39365.	37026.	3.371	3.561
1.000E-03	1.109E-03	1.683E-03	43962.	40467.	4.811	5.296
1.000E-04	2.076E-04	3.551E-04	46303.	42069.	6.853	7.799
5.000E-05	1.262E-04	2.256E-04	46747.	42349.	7.621	8.791
1.000E-05	3.991E-05	8.025E-05	47487.	42784.	9.714	11.701
5.000E-06	2.434E-05		47713.		10.768	
1.000E-06	7.759E-06		48089.		13.658	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	508.1	516.7	927.6	914.8
1.000E-01	2.250E 00	2.054E 00	946.7	918.5	1114.5	1068.3
1.000E-02	1.136E 01	9.061E 00	1223.5	1150.8	1308.2	1216.9
1.000E-03	5.841E 01	4.263E 01	1366.4	1257.7	1409.9	1288.8
1.000E-04	2.952E 02	1.943E 02	1439.2	1307.5	1461.2	1321.7
5.000E-05	4.809E 02	3.039E 02	1453.0	1316.2	1470.9	1327.3
1.000E-05	1.497E 03	8.455E 02	1476.0	1329.8	1487.1	1335.9
5.000E-06	2.444E 03		1483.0		1492.1	
1.000E-06	7.606E 03		1494.7		1500.3	

TABLE 168

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 261.23 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 267.93 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2612.334 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2679.330 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5617
THROAT PRESSURE RATIO(FROZEN) = 0.5428
ENTROPY = 2.218E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	5.958E 04	5.958E 04	1.7167	1.7167
THROAT	9194.	8650.	5.325E 04	5.300E 04	1.7526	1.7167
1.000E-01	7280.	5687.	3.768E 04	3.913E 04	1.8575	1.7167
1.000E-02	5340.	3067.	2.268E 04	2.777E 04	1.9718	1.7167
1.000E-03	3460.	1543.	1.258E 04	2.182E 04	2.0151	1.7167
1.000E-04	1910.	718.	6.618E 03	1.892E 04	2.0160	1.7167
5.000E-05	1577.	563.	5.429E 03	1.841E 04	2.0160	1.7167
1.000E-05	1002.	314.	3.416E 03	1.762E 04	2.0160	1.7167
5.000E-06	823.		2.795E 03		2.0160	
1.000E-06	519.		1.748E 03		2.0160	
5.000E-07	425.		1.427E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.352E-01	2.352E-01				
THROAT	1.467E-01	1.476E-01	17810.	18157.	1.000	1.000
1.000E-01	3.495E-02	4.135E-02	33115.	31996.	2.172	2.151
1.000E-02	5.058E-03	7.667E-03	42983.	39909.	3.382	3.588
1.000E-03	7.978E-04	1.524E-03	48507.	43481.	4.587	5.381
1.000E-04	1.446E-04	3.273E-04	51492.	45116.	6.394	7.990
5.000E-05	8.755E-05	2.088E-04	52067.	45399.	7.089	9.026
1.000E-05	2.755E-05	7.490E-05	53026.	45836.	9.027	12.068
5.000E-06	1.678E-05		53318.		10.009	
1.000E-06	5.320E-06		53807.		12.687	
5.000E-07	3.250E-06		53957.		14.045	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	553.6	564.4	1008.5	993.0
1.000E-01	2.257E 00	2.025E 00	1029.2	994.5	1212.0	1154.4
1.000E-02	1.202E 01	8.756E 00	1336.0	1240.4	1433.3	1309.6
1.000E-03	6.750E 01	4.043E 01	1507.6	1351.4	1562.3	1383.4
1.000E-04	3.510E 02	1.814E 02	1600.4	1402.2	1628.9	1416.6
5.000E-05	5.731E 02	2.826E 02	1618.3	1411.0	1641.5	1422.2
1.000E-05	1.788E 03	7.804E 02	1648.1	1424.6	1662.6	1430.8
5.000E-06	2.920E 03		1657.2		1669.0	
1.000E-06	9.126E 03		1672.4		1679.8	
5.000E-07	1.490E 04		1677.0		1683.1	

TABLE 169

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 242.25 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 242.71 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2211.408 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2215.641 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5555
THROAT PRESSURE RATIO(FROZEN) = 0.5120
ENTROPY = 2.508E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	9.114E 04	9.114E 04	1.4423	1.4423
THROAT	10914.	9973.	8.200E 04	8.161E 04	1.4826	1.4423
1.000E-01	8686.	6241.	6.098E 04	6.366E 04	1.6088	1.4423
1.000E-02	6860.	3087.	4.032E 04	4.938E 04	1.7665	1.4423
1.000E-03	5222.	1437.	2.558E 04	4.250E 04	1.9086	1.4423
1.000E-04	3878.	630.	1.490E 04	3.938E 04	2.0023	1.4423
5.000E-05	3391.	487.	1.241E 04	3.885E 04	2.0129	1.4423
1.000E-05	2274.		7.945E 03		2.0160	
5.000E-06	1885.		6.528E 03		2.0160	
1.000E-06	1203.		4.116E 03		2.0160	
5.000E-07	989.		3.369E 03		2.0160	
1.000E-07	625.		2.111E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.646E-01	1.646E-01				
THROAT	1.034E-01	1.014E-01	21394.	21841.	1.000	1.000
1.000E-01	2.537E-02	3.166E-02	38858.	37091.	2.161	2.124
1.000E-02	3.634E-03	6.400E-03	50437.	45723.	3.408	3.660
1.000E-03	5.002E-04	1.375E-03	57288.	49347.	4.562	5.670
1.000E-04	7.073E-05	3.136E-04	61777.	50904.	5.692	8.677
5.000E-05	4.066E-05	2.029E-04	62780.	51165.	6.056	9.880
1.000E-05	1.214E-05		64535.		7.382	
5.000E-06	7.324E-06		65083.		8.132	
1.000E-06	2.296E-06		66004.		10.265	
5.000E-07	1.397E-06		66286.		11.361	
1.000E-07	4.420E-07		66760.		14.363	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	664.9	678.8	1156.4	1167.9
1.000E-01	2.243E 00	1.887E 00	1207.8	1152.8	1422.4	1333.1
1.000E-02	1.207E 01	7.572E 00	1567.6	1421.1	1683.1	1493.4
1.000E-03	7.718E 01	3.266E 01	1780.6	1533.8	1854.4	1565.0
1.000E-04	5.061E 02	1.388E 02	1920.1	1582.2	1968.5	1595.4
5.000E-05	8.664E 02	2.134E 02	1951.3	1590.2	1992.7	1600.4
1.000E-05	2.822E 03		2005.8		2032.8	
5.000E-06	4.640E 03		2022.8		2045.0	
1.000E-06	1.459E 04		2051.5		2065.4	
5.000E-07	2.389E 04		2060.2		2071.7	
1.000E-07	7.495E 04		2075.0		2082.1	

TABLE 170

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 228.87 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 237.57 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1934.341 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2007.794 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5476
THROAT PRESSURE RATIO(FROZEN) = 0.5165
ENTROPY = 2.750E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.224E 05	1.224E 05	1.2478	1.2478
THROAT	12478.	11339.	1.099E 05	1.091E 05	1.2875	1.2478
1.000E-01	9678.	6629.	8.316E 04	8.615E 04	1.4118	1.2478
1.000E-02	7359.	2928.	5.729E 04	6.941E 04	1.5751	1.2478
1.000E-03	5880.	1174.	3.905E 04	6.232E 04	1.7310	1.2478
1.000E-04	4788.	436.	2.555E 04	5.957E 04	1.8728	1.2478
5.000E-05	4492.		2.217E 04		1.9111	
1.000E-05	3783.		1.537E 04		1.9849	
5.000E-06	3414.		1.288E 04		2.0051	
1.000E-06	2364.		8.282E 03		2.0160	
5.000E-07	1963.		6.807E 03		2.0160	
1.000E-07	1254.		4.294E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.221E-01	1.221E-01				
THROAT	7.740E-02	7.786E-02	24990.	25786.	1.000	1.000
1.000E-01	1.998E-02	2.578E-02	44335.	42614.	2.168	2.137
1.000E-02	2.932E-03	5.837E-03	57104.	51516.	3.456	3.767
1.000E-03	4.033E-04	1.456E-03	64603.	54853.	4.640	6.129
1.000E-04	5.359E-05	3.917E-04	69639.	56092.	5.793	10.062
5.000E-05	2.914E-05		70843.		6.141	
1.000E-05	7.189E-06		73207.		6.947	
5.000E-06	4.022E-06		74053.		7.280	
1.000E-06	1.168E-06		75591.		8.495	
5.000E-07	7.034E-07		76078.		9.326	
1.000E-07	2.202E-07		76900.		11.716	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	776.7	801.5	1375.8	1345.8
1.000E-01	2.183E 00	1.827E 00	1378.0	1324.5	1616.8	1517.1
1.000E-02	1.155E 01	6.677E 00	1774.8	1601.2	1901.2	1671.5
1.000E-03	7.425E 01	2.513E 01	2007.9	1704.9	2089.1	1731.4
1.000E-04	5.183E 02	9.138E 01	2164.5	1743.4	2221.2	1753.0
5.000E-05	9.371E 02		2201.9		2253.1	
1.000E-05	3.676E 03		2275.4		2315.6	
5.000E-06	6.494E 03		2301.6		2337.2	
1.000E-06	2.191E 04		2349.4		2373.4	
5.000E-07	3.615E 04		2364.6		2384.3	
1.000E-07	1.142E 05		2390.1		2402.6	

TABLE 171

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 222.36 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 230.53 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1757.901 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1822.535 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5404
THROAT PRESSURE RATIO(FROZEN) = 0.5055
ENTROPY = 2.518E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.476E 05	1.476E 05	1.1379	1.1379
THROAT	13883.	12596.	1.318E 05	1.306E 05	1.1734	1.1379
1.000E-01	10402.	7076.	1.001E 05	1.035E 05	1.2903	1.1379
1.000E-02	7780.	2975.	7.004E 04	8.436E 04	1.4518	1.1379
1.000E-03	6208.	1170.	4.925E 04	7.655E 04	1.6090	1.1379
1.000E-04	5115.	439.	3.391E 04	7.354E 04	1.7573	1.1379
5.000E-05	4839.		3.005E 04		1.7996	
1.000E-05	4751.		2.218E 04		1.8919	
5.000E-06	4006.		1.921E 04		1.9280	
1.000E-06	3373.		1.317E 04		1.9956	
5.000E-07	3007.		1.098E 04		2.0110	
1.000E-07	2017.		7.004E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.742E-02	9.742E-02				
THROAT	6.257E-02	6.256E-02	28096.	29134.	1.000	1.000
1.000E-01	1.699E-02	2.203E-02	48771.	46975.	2.181	2.134
1.000E-02	2.556E-03	5.240E-03	62302.	56256.	3.507	3.849
1.000E-03	3.550E-04	1.333E-03	70162.	59632.	4.724	6.367
1.000E-04	4.706E-05	3.548E-04	75436.	60881.	5.898	10.477
5.000E-05	2.547E-05		76704.		6.248	
1.000E-05	6.097E-06		79231.		7.065	
5.000E-06	3.297E-06		80166.		7.421	
1.000E-06	8.105E-07		82028.		8.234	
5.000E-07	4.580E-07		82696.		8.556	
1.000E-07	1.369E-07		83889.		10.152	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	873.2	905.5	1523.8	1492.4
1.000E-01	2.121E 00	1.761E 00	1515.9	1460.0	1771.2	1664.5
1.000E-02	1.104E 01	6.183E 00	1936.4	1748.5	2069.3	1820.3
1.000E-03	7.057E 01	2.294E 01	2180.7	1853.4	2265.6	1880.0
1.000E-04	4.951E 02	8.438E 01	2344.6	1892.2	2404.2	1902.0
5.000E-05	8.998E 02		2384.0		2438.2	
1.000E-05	3.639E 03		2462.6		2506.4	
5.000E-06	6.651E 03		2491.6		2531.7	
1.000E-06	2.644E 04		2549.5		2581.3	
5.000E-07	4.641E 04		2570.3		2598.2	
1.000E-07	1.531E 05		2607.4		2625.8	

TABLE 172

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 220.43 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 227.04 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1642.963 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1692.257 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5343
THROAT PRESSURE RATIO(FROZEN) = 0.4987
ENTROPY = 3.029E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.664E 05	1.664E 05	1.0824	1.0824
THROAT	15171.	13921.	1.476E 05	1.461E 05	1.1111	1.0824
1.000E-01	10833.	7646.	1.110E 05	1.152E 05	1.2145	1.0824
1.000E-02	8051.	3131.	7.882E 04	9.368E 04	1.3769	1.0824
1.000E-03	6398.	1221.	5.624E 04	8.508E 04	1.5331	1.0824
1.000E-04	5282.	461.	3.967E 04	8.177E 04	1.6822	1.0824
5.000E-05	5007.		3.551E 04		1.7253	
1.000E-05	4438.		2.700E 04		1.8214	
5.000E-06	4213.		2.377E 04		1.8606	
1.000E-06	3701.		1.711E 04		1.9438	
5.000E-07	3463.		1.459E 04		1.9743	
1.000E-07	2694.		9.606E 03		2.0143	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	8.237E-02	8.237E-02				
THROAT	5.361E-02	5.311E-02	30648.	31863.	1.000	1.000
1.000E-01	1.536E-02	1.939E-02	52657.	50628.	2.222	2.132
1.000E-02	2.343E-03	4.736E-03	66197.	60315.	3.558	3.899
1.000E-03	3.283E-04	1.214E-03	74246.	63785.	4.801	6.502
1.000E-04	4.363E-05	3.214E-04	79635.	65070.	5.995	10.701
5.000E-05	2.360E-05		80931.		6.350	
1.000E-05	5.622E-06		83522.		7.174	
5.000E-06	3.025E-06		84486.		7.530	
1.000E-06	7.195E-07		86435.		8.368	
5.000E-07	3.905E-07		87162.		8.729	
1.000E-07	1.024E-07		88582.		9.517	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	952.6	990.3	1640.7	1613.9
1.000E-01	2.032E 00	1.724E 00	1636.6	1573.6	1898.3	1789.1
1.000E-02	1.059E 01	5.924E 00	2057.5	1874.6	2193.9	1948.7
1.000E-03	6.741E 01	2.185E 01	2307.6	1982.5	2394.5	2009.8
1.000E-04	4.729E 02	8.092E 01	2475.1	2022.4	2536.0	2032.5
5.000E-05	8.602E 02		2515.4		2570.8	
1.000E-05	3.499E 03		2595.9		2641.0	
5.000E-06	6.429E 03		2625.9		2667.3	
1.000E-06	2.642E 04		2686.5		2720.5	
5.000E-07	4.828E 04		2709.1		2740.2	
1.000E-07	1.811E 05		2753.2		2776.5	

TABLE 173

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 20000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 219.61 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 225.11 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1552.895 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1591.762 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5187
THROAT PRESSURE RATIO(FROZEN) = 0.4947
ENTROPY = 3.113E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.821E 05	1.821E 05	1.0526	1.0526
THROAT	16401.	15314.	1.599E 05	1.588E 05	1.0742	1.0526
1.000E-01	11316.	8310.	1.202E 05	1.242E 05	1.1654	1.0526
1.000E-02	8259.	3356.	8.562E 04	1.004E 05	1.3240	1.0526
1.000E-03	6533.	1304.	6.163E 04	9.089E 04	1.4787	1.0526
1.000E-04	5393.	495.	4.413E 04	8.725E 04	1.6274	1.0526
5.000E-05	5117.		3.974E 04		1.6707	
1.000E-05	4551.		3.076E 04		1.7679	
5.000E-06	4332.		2.734E 04		1.8082	
1.000E-06	3855.		2.027E 04		1.8964	
5.000E-07	3652.		1.757E 04		1.9312	
1.000E-07	3109.		1.204E 04		1.9972	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.210E-02	7.210E-02				
THROAT	4.654E-02	4.658E-02	33365.	34170.	1.000	1.000
1.000E-01	1.411E-02	1.735E-02	55672.	53851.	2.237	2.131
1.000E-02	2.196E-03	4.296E-03	69500.	63976.	3.608	3.927
1.000E-03	3.101E-04	1.105E-03	77661.	67577.	4.876	6.573
1.000E-04	4.133E-05	2.915E-04	83111.	68911.	6.089	10.817
5.000E-05	2.236E-05		84423.		6.449	
1.000E-05	5.321E-06		87045.		7.281	
5.000E-06	2.859E-06		88023.		7.640	
1.000E-06	6.739E-07		90010.		8.481	
5.000E-07	3.622E-07		90758.		8.848	
1.000E-07	8.801E-08		92269.		9.679	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1037.0	1062.0	1743.8	1719.7
1.000E-01	1.977E 00	1.704E 00	1730.3	1673.7	1959.7	1900.2
1.000E-02	1.017E 01	5.792E 00	2160.1	1988.4	2298.8	2065.4
1.000E-03	6.449E 01	2.131E 01	2413.8	2100.4	2501.7	2128.7
1.000E-04	4.520E 02	7.924E 01	2583.2	2141.8	2644.8	2152.3
5.000E-05	8.225E 02		2623.9		2680.0	
1.000E-05	3.353E 03		2705.5		2751.1	
5.000E-06	6.171E 03		2735.9		2777.9	
1.000E-06	2.560E 04		2797.6		2832.5	
5.000E-07	4.724E 04		2820.9		2853.0	
1.000E-07	1.912E 05		2867.8		2893.9	

TABLE 174

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 208.33 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 218.74 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1202.786 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1262.897 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5390
THROAT PRESSURE RATIO(FROZEN) = 0.4909
ENTROPY = 3.417E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	2.580E 05	2.580E 05	0.9945	0.9945
THROAT	25503.	22934.	2.239E 05	2.205E 05	1.0060	0.9945
1.000E-01	14816.	12265.	1.589E 05	1.663E 05	1.0345	0.9945
1.000E-02	9160.	4897.	1.120E 05	1.293E 05	1.1554	0.9945
1.000E-03	7010.	1907.	8.224E 04	1.147E 05	1.3013	0.9945
1.000E-04	5742.	729.	6.109E 04	1.091E 05	1.4448	0.9945
5.000E-05	5447.	545.	5.584E 04	1.082E 05	1.4871	0.9945
1.000E-05	4862.	276.	4.511E 04	1.069E 05	1.5834	0.9945
5.000E-06	4644.		4.103E 04		1.6239	
1.000E-06	4194.		3.257E 04		1.7159	
5.000E-07	4019.		2.931E 04		1.7545	
1.000E-07	3644.		2.250E 04		1.8409	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.541E-02	4.541E-02				
THROAT	2.913E-02	2.916E-02	41297.	43309.	1.000	1.000
1.000E-01	9.565E-03	1.111E-02	70447.	67750.	2.234	2.129
1.000E-02	1.728E-03	2.782E-03	85482.	80261.	3.889	3.960
1.000E-03	2.543E-04	7.145E-04	93805.	84696.	5.306	6.638
1.000E-04	3.447E-05	1.869E-04	99288.	86347.	6.628	10.893
5.000E-05	1.870E-05	1.250E-04	100604.	86601.	7.016	12.628
1.000E-05	4.461E-06	4.929E-05	103238.	86968.	7.908	17.783
5.000E-06	2.395E-06		104223.		8.289	
1.000E-06	5.605E-07		106234.		9.172	
5.000E-07	2.990E-07		106999.		9.552	
1.000E-07	6.920E-08		108582.		10.442	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1283.6	1346.1	2231.8	2168.6
1.000E-01	1.785E 00	1.678E 00	2189.6	2105.7	2503.6	2386.9
1.000E-02	8.144E 00	5.656E 00	2656.9	2494.6	2800.1	2589.4
1.000E-03	5.043E 01	2.087E 01	2915.5	2632.4	3004.3	2667.4
1.000E-04	3.514E 02	7.827E 01	3086.0	2683.8	3147.8	2696.9
5.000E-05	6.393E 02	1.166E 02	3126.9	2691.6	3183.1	2701.4
1.000E-05	2.612E 03	2.946E 02	3208.7	2703.0	3254.7	2708.0
5.000E-06	4.818E 03		3239.3		3281.7	
1.000E-06	2.020E 04		3301.9		3337.4	
5.000E-07	3.760E 04		3325.6		3358.7	
1.000E-07	1.601E 05		3374.8		3403.0	

TABLE 175

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 192.56 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 211.15 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 962.789 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1055.741 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5569
THROAT PRESSURE RATIO(FROZEN) = 0.5169
ENTROPY = 3.797E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	40000.	40000.	3.947E 05	3.947E 05	0.9063	0.9063
THROAT	36004.	31587.	3.464E 05	3.407E 05	0.9243	0.9063
1.000E-01	25395.	16757.	2.351E 05	2.561E 05	0.9837	0.9063
1.000E-02	12387.	6727.	1.499E 05	2.005E 05	1.0182	0.9063
1.000E-03	7761.	2648.	1.102E 05	1.784E 05	1.1228	0.9063
1.000E-04	6145.	1023.	8.369E 04	1.698E 05	1.2555	0.9063
5.000E-05	5806.	767.	7.723E 04	1.684E 05	1.2952	0.9063
1.000E-05	5158.	392.	6.418E 04	1.664E 05	1.3862	0.9063
5.000E-06	4923.		5.924E 04		1.4248	
1.000E-06	4453.		4.904E 04		1.5132	
5.000E-07	4276.		4.512E 04		1.5507	
1.000E-07	3909.		3.691E 04		1.6362	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.104E-02	3.104E-02				
THROAT	1.959E-02	2.032E-02	49157.	51965.	1.000	1.000
1.000E-01	5.306E-03	7.409E-03	89378.	83291.	2.209	2.137
1.000E-02	1.126E-03	1.846E-03	110683.	98578.	3.897	3.975
1.000E-03	1.982E-04	4.689E-04	119329.	104045.	5.900	6.634
1.000E-04	2.799E-05	1.213E-04	124769.	106103.	7.472	10.827
5.000E-05	1.528E-05	8.091E-05	126056.	106421.	7.919	12.532
1.000E-05	3.682E-06	3.167E-05	128623.	106884.	8.932	17.584
5.000E-06	1.982E-06		129580.		9.361	
1.000E-06	4.655E-07		131535.		10.345	
5.000E-07	2.484E-07		132279.		10.766	
1.000E-07	5.733E-08		133824.		11.740	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1527.8	1615.1	2751.9	2651.2
1.000E-01	2.030E 00	1.711E 00	2778.0	2588.8	3224.1	2931.7
1.000E-02	7.725E 00	5.803E 00	3440.1	3063.9	3609.9	3180.2
1.000E-03	4.071E 01	2.164E 01	3708.9	3233.8	3798.3	3277.2
1.000E-04	2.757E 02	8.203E 01	3877.9	3297.8	3938.5	3314.2
5.000E-05	4.999E 02	1.226E 02	3918.0	3307.7	3972.9	3320.0
1.000E-05	2.033E 03	3.119E 02	3997.7	3322.1	4042.4	3328.3
5.000E-06	3.748E 03		4027.5		4068.7	
1.000E-06	1.572E 04		4088.2		4122.8	
5.000E-07	2.930E 04		4111.4		4143.6	
1.000E-07	1.255E 05		4159.4		4186.9	

TABLE 176

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 178.13 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 185.80 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 796.600 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 830.935 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5532
THROAT PRESSURE RATIO(FROZEN) = 0.5138
ENTROPY = 4.309E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	6.254E 05	6.254E 05	0.7735	0.7735
THROAT	45082.	40841.	5.540E 05	5.478E 05	0.7929	0.7735
1.000E-01	34177.	22442.	3.898E 05	4.173E 05	0.8637	0.7735
1.000E-02	23785.	9166.	2.450E 05	3.300E 05	0.9579	0.7735
1.000E-03	13455.	3988.	1.575E 05	2.933E 05	1.0078	0.7735
1.000E-04	7009.	1811.	1.169E 05	2.771E 05	1.0606	0.7735
5.000E-05	6439.	1434.	1.084E 05	2.742E 05	1.0944	0.7735
1.000E-05	5557.	839.	9.154E 04	2.696E 05	1.1760	0.7735
5.000E-06	5272.	667.	8.529E 04	2.683E 05	1.2112	0.7735
1.000E-06	4730.	393.	7.254E 04	2.661E 05	1.2923	0.7735
5.000E-07	4534.		6.766E 04		1.3268	
1.000E-07	4140.		5.752E 04		1.4061	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.119E-02	2.119E-02				
THROAT	1.333E-02	1.333E-02	59762.	62333.	1.000	1.000
1.000E-01	3.462E-03	4.722E-03	108607.	102058.	2.204	2.094
1.000E-02	5.517E-04	1.156E-03	137999.	121612.	3.565	3.960
1.000E-03	1.026E-04	2.657E-04	153044.	128931.	4.782	6.492
1.000E-04	2.073E-05	5.853E-05	159539.	132052.	8.128	9.964
5.000E-05	1.164E-05	3.694E-05	160880.	132596.	8.748	11.261
1.000E-05	2.899E-06	1.263E-05	163477.	133459.	10.026	14.860
5.000E-06	1.574E-06	7.943E-06	164430.	133709.	10.543	16.710
1.000E-06	3.743E-07	2.700E-06	166361.	134109.	11.704	21.876
5.000E-07	2.004E-07		167092.		12.192	
1.000E-07	4.653E-08		168605.		13.311	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1857.5	1937.4	3327.1	3245.8
1.000E-01	2.119E 00	1.724E 00	3375.6	3172.1	3938.4	3611.2
1.000E-02	1.046E 01	5.911E 00	4289.1	3779.8	4567.1	3930.3
1.000E-03	5.073E 01	2.425E 01	4756.8	4007.3	4851.5	4069.1
1.000E-04	2.409E 02	1.075E 02	4958.6	4104.3	5022.6	4131.7
5.000E-05	4.253E 02	1.696E 02	5000.3	4121.2	5056.8	4142.8
1.000E-05	1.681E 03	4.930E 02	5081.0	4148.0	5125.7	4160.6
5.000E-06	3.079E 03	7.824E 02	5110.7	4155.8	5151.5	4165.8
1.000E-06	1.279E 04	2.295E 03	5170.7	4168.2	5204.7	4174.1
5.000E-07	2.378E 04		5193.4		5225.0	
1.000E-07	1.015E 05		5240.4		5267.4	

TABLE 177

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 158.21 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 161.97 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 577.687 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 591.414 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5207
THROAT PRESSURE RATIO(FROZEN) = 0.5056
ENTROPY = 5.324E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	75000.	75000.	1.243E 06	1.243E 06	0.5676	0.5676
THROAT	63502.	59490.	1.088E 06	1.083E 06	0.5826	0.5676
1.000E-01	45643.	32530.	7.978E 05	8.285E 05	0.6362	0.5676
1.000E-02	32584.	13028.	5.369E 05	6.565E 05	0.7293	0.5676
1.000E-03	24813.	5269.	3.689E 05	5.875E 05	0.8254	0.5676
1.000E-04	19371.	2166.	2.533E 05	5.594E 05	0.9172	0.5676
5.000E-05	17934.	1660.	2.256E 05	5.547E 05	0.9426	0.5676
1.000E-05	14395.	898.	1.720E 05	5.478E 05	0.9924	0.5676
5.000E-06	12304.	689.	1.535E 05	5.458E 05	1.0048	0.5676
1.000E-06	6745.	373.	1.252E 05	5.429E 05	1.0090	0.5676
5.000E-07	5533.		1.170E 05		1.0208	
1.000E-07	4633.		1.018E 05		1.0815	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.037E-02	1.037E-02				
THROAT	6.545E-03	6.608E-03	88267.	89504.	1.000	1.000
1.000E-01	1.909E-03	2.390E-03	149348.	144116.	2.171	2.107
1.000E-02	3.066E-04	5.968E-04	188061.	171407.	3.600	3.939
1.000E-03	4.557E-05	1.476E-04	209225.	181201.	4.586	6.592
1.000E-04	6.486E-06	3.590E-05	222631.	185044.	6.401	10.546
5.000E-05	3.600E-06	2.341E-05	225716.	185667.	6.844	12.094
1.000E-05	9.444E-07	8.661E-06	231586.	186606.	7.914	16.551
5.000E-06	5.593E-07	5.640E-06	233575.	186863.	8.223	18.921
1.000E-06	2.049E-07	2.082E-06	236587.	187251.	12.009	25.769
5.000E-07	1.264E-07		237455.		13.582	
1.000E-07	3.198E-08		239058.		15.553	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	2743.4	2781.9	4650.9	4590.8
1.000E-01	2.026E 00	1.717E 00	4641.9	4479.3	5383.9	5093.6
1.000E-02	1.002E 01	5.782E 00	5845.1	5327.5	6212.1	5534.4
1.000E-03	6.059E 01	2.212E 01	6502.9	5631.9	6724.9	5711.1
1.000E-04	4.000E 02	8.902E 01	6919.6	5751.3	7066.1	5783.2
5.000E-05	7.109E 02	1.360E 02	7015.5	5770.7	7145.7	5795.0
1.000E-05	2.641E 03	3.659E 02	7197.9	5799.9	7294.7	5813.0
5.000E-06	4.422E 03	5.611E 02	7259.7	5807.9	7340.7	5817.9
1.000E-06	1.191E 04	1.517E 03	7353.4	5820.0	7397.0	5825.4
5.000E-07	1.925E 04		7380.4		7415.6	
1.000E-07	7.556E 04		7430.2		7457.9	

TABLE 178

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.54 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.64 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 498.185 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 501.667 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5017
THROAT PRESSURE RATIO(FROZEN) = 0.4982
ENTROPY = 5.739E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.600E 06	1.600E 06	0.5262	0.5262
THROAT	78851.	77080.	1.370E 06	1.368E 06	0.5324	0.5262
1.000E-01	51698.	41738.	9.989E 05	1.018E 06	0.5700	0.5262
1.000E-02	35317.	16699.	6.777E 05	7.800E 05	0.6532	0.5262
1.000E-03	26720.	6671.	4.759E 05	6.850E 05	0.7438	0.5262
1.000E-04	21176.	2682.	3.376E 05	6.470E 05	0.8345	0.5262
5.000E-05	19835.	2041.	3.043E 05	6.408E 05	0.8611	0.5262
1.000E-05	17055.	1083.	2.382E 05	6.317E 05	0.9204	0.5262
5.000E-06	15932.	824.	2.138E 05	6.292E 05	0.9443	0.5262
1.000E-06	13094.	438.	1.657E 05	6.255E 05	0.9922	0.5262
5.000E-07	11330.		1.488E 05		1.0047	
1.000E-07	6211.		1.227E 05		1.0084	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.208E-03	7.208E-03				
THROAT	4.641E-03	4.659E-03	107346.	107684.	1.000	1.000
1.000E-01	1.510E-03	1.727E-03	173472.	170690.	2.147	2.119
1.000E-02	2.533E-04	4.317E-04	214875.	202608.	3.683	3.952
1.000E-03	3.813E-05	1.080E-04	237217.	214021.	5.143	6.620
1.000E-04	5.398E-06	2.687E-05	251387.	218426.	6.590	10.675
5.000E-05	2.974E-06	1.766E-05	254682.	219129.	7.030	12.282
1.000E-05	7.393E-07	6.657E-06	261104.	220176.	8.077	16.952
5.000E-06	4.060E-07	4.372E-06	263430.	220457.	8.546	19.456
1.000E-06	1.038E-07	1.646E-06	267963.	220879.	9.686	26.755
5.000E-07	6.074E-08		269539.		9.994	
1.000E-07	2.224E-08		271944.		14.472	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3336.4	3346.9	5467.5	5448.2
1.000E-01	1.902E 00	1.702E 00	5391.7	5305.2	6199.4	6023.0
1.000E-02	9.152E 00	5.736E 00	6678.5	6297.3	7067.2	6539.2
1.000E-03	5.508E 01	2.169E 01	7373.0	6652.0	7606.9	6743.5
1.000E-04	3.671E 02	8.547E 01	7813.4	6788.9	7969.3	6824.9
5.000E-05	6.578E 02	1.296E 02	7915.8	6810.7	8055.5	6838.1
1.000E-05	2.581E 03	3.423E 02	8115.4	6843.3	8225.0	6857.7
5.000E-06	4.658E 03	5.205E 02	8187.7	6852.0	8286.6	6863.0
1.000E-06	1.791E 04	1.380E 03	8328.6	6865.1	8404.6	6870.9
5.000E-07	3.043E 04		8377.5		8442.2	
1.000E-07	8.237E 04		8452.3		8487.3	

TABLE 179

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 158.16 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.16 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 408.358 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 408.362 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4901
THROAT PRESSURE RATIO(FROZEN) = 0.4901
ENTROPY = 6.171E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	150000.	150000.	2.130E 06	2.130E 06	0.5116	0.5116
THROAT	113270.	113261.	1.768E 06	1.768E 06	0.5117	0.5116
1.000E-01	63808.	60869.	1.245E 06	1.247E 06	0.5226	0.5116
1.000E-02	38540.	25044.	8.379E 05	8.871E 05	0.5860	0.5116
1.000E-03	28519.	10391.	5.953E 05	7.382E 05	0.6703	0.5116
1.000E-04	22563.	4328.	4.322E 05	6.763E 05	0.7564	0.5116
5.000E-05	21184.	3327.	3.930E 05	6.660E 05	0.7822	0.5116
1.000E-05	18449.	1806.	3.151E 05	6.505E 05	0.8411	0.5116
5.000E-06	17421.	1389.	2.861E 05	6.462E 05	0.8658	0.5116
1.000E-06	15248.	754.	2.277E 05	6.397E 05	0.9213	0.5116
5.000E-07	14356.	580.	2.058E 05	6.379E 05	0.9439	0.5116
1.000E-07	12091.	315.	1.619E 05	6.352E 05	0.9902	0.5116

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	4.673E-03	4.673E-03				
THROAT	3.033E-03	3.033E-03	134654.	134656.	1.000	1.000
1.000E-01	1.122E-03	1.151E-03	210555.	210211.	2.134	2.138
1.000E-02	2.083E-04	2.799E-04	254344.	249461.	3.820	3.971
1.000E-03	3.220E-05	6.745E-05	277199.	263978.	5.465	6.536
1.000E-04	4.592E-06	1.619E-05	291550.	269783.	7.022	10.359
5.000E-05	2.529E-06	1.053E-05	294892.	270732.	7.486	11.860
1.000E-05	6.245E-07	3.880E-06	301440.	272167.	8.571	16.184
5.000E-06	3.404E-07	2.524E-06	303833.	272560.	9.043	18.486
1.000E-06	8.277E-08	9.292E-07	308610.	273156.	10.168	25.140
5.000E-07	4.503E-08	6.042E-07	310378.	273319.	10.672	28.688
1.000E-07	1.122E-08	2.224E-07	313897.	273568.	11.911	38.958

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	4185.2	4185.2	6724.6	6724.6
1.000E-01	1.729E 00	1.687E 00	6544.3	6533.6	7440.0	7407.7
1.000E-02	7.708E 00	5.849E 00	7905.3	7753.5	8304.7	8056.6
1.000E-03	4.576E 01	2.293E 01	8615.6	8204.7	8852.7	8323.5
1.000E-04	3.050E 02	9.348E 01	9061.7	8385.1	9219.7	8433.6
5.000E-05	5.476E 02	1.432E 02	9165.5	8414.6	9307.4	8451.7
1.000E-05	2.169E 03	3.867E 02	9369.0	8459.2	9481.4	8479.2
5.000E-06	3.948E 03	5.937E 02	9443.4	8471.4	9545.7	8486.8
1.000E-06	1.599E 04	1.609E 03	9591.9	8489.9	9674.7	8498.3
5.000E-07	2.922E 04	2.473E 03	9646.8	8495.0	9722.5	8501.4
1.000E-07	1.160E 05	6.711E 03	9756.2	8502.8	9816.3	8506.2

TABLE 180

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 1000. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 157.94 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 157.94 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 353.155 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 353.172 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4883
THROAT PRESSURE RATIO(FROZEN) = 0.4885
ENTROPY = 6.459E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.631E 06	2.631E 06	0.5084	0.5084
THROAT	150274.	150461.	2.143E 06	2.143E 06	0.5078	0.5084
1.000E-01	80654.	80311.	1.450E 06	1.451E 06	0.5095	0.5084
1.000E-02	41620.	32518.	9.531E 05	9.750E 05	0.5498	0.5084
1.000E-03	29762.	13247.	6.792E 05	7.819E 05	0.6275	0.5084
1.000E-04	23378.	5413.	4.984E 05	7.032E 05	0.7098	0.5084
5.000E-05	21943.	4136.	4.552E 05	6.903E 05	0.7347	0.5084
1.000E-05	19145.	2215.	3.692E 05	6.710E 05	0.7920	0.5084
5.000E-06	18114.	1693.	3.373E 05	6.657E 05	0.8164	0.5084
1.000E-06	16002.	907.	2.727E 05	6.578E 05	0.8718	0.5084
5.000E-07	15180.	693.	2.484E 05	6.556E 05	0.8950	0.5084
1.000E-07	13369.	371.	1.988E 05	6.524E 05	0.9463	0.5084

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.482E-03	3.482E-03				
THROAT	2.260E-03	2.261E-03	156260.	156211.	1.000	1.000
1.000E-01	8.654E-04	8.671E-04	243059.	243048.	2.136	2.134
1.000E-02	1.810E-04	2.142E-04	289784.	287880.	3.886	3.983
1.000E-03	2.888E-05	5.257E-05	312548.	304205.	5.766	6.605
1.000E-04	4.159E-06	1.287E-05	326706.	310619.	7.459	10.558
5.000E-05	2.293E-06	8.419E-06	329999.	311654.	7.954	12.121
1.000E-05	5.667E-07	3.144E-06	336455.	313204.	9.099	16.649
5.000E-06	3.087E-07	2.057E-06	338820.	313624.	9.593	19.071
1.000E-06	7.463E-08	7.681E-07	343557.	314256.	10.754	26.112
5.000E-07	4.038E-08	5.025E-07	345324.	314427.	11.264	29.885
1.000E-07	9.697E-09	1.876E-07	348900.	314685.	12.493	40.864

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4856.7	4855.2	7782.3	7781.9
1.000E-01	1.679E 00	1.676E 00	7554.5	7554.2	8560.5	8558.2
1.000E-02	6.735E 00	5.729E 00	9006.8	8947.6	9410.3	9290.8
1.000E-03	3.912E 01	2.208E 01	9714.3	9455.0	9948.7	9587.3
1.000E-04	2.599E 02	8.838E 01	10154.3	9654.4	10310.1	9707.3
5.000E-05	4.666E 02	1.346E 02	10256.7	9686.5	10396.5	9726.8
1.000E-05	1.852E 03	3.586E 02	10457.4	9734.7	10568.3	9756.2
5.000E-06	3.376E 03	5.474E 02	10530.9	9747.7	10632.0	9764.1
1.000E-06	1.377E 04	1.463E 03	10678.1	9767.4	10760.6	9776.1
5.000E-07	2.533E 04	2.235E 03	10733.0	9772.7	10808.9	9779.4
1.000E-07	1.044E 05	5.983E 03	10844.2	9780.7	10906.7	9784.3

TABLE 181

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 5000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 288.86 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 289.34 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 8170.081 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 8183.700 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5455
THROAT PRESSURE RATIO(FROZEN) = 0.5448
ENTROPY = 1.623E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	5000.	5000.	1.908E 04	1.908E 04	2.0143	2.0143
THROAT	4361.	4347.	1.628E 04	1.628E 04	2.0155	2.0143
1.000E-01	2891.	2877.	1.028E 04	1.031E 04	2.0160	2.0143
1.000E-02	1559.	1540.	5.365E 03	5.417E 03	2.0160	2.0143
1.000E-03	813.	756.	2.761E 03	2.896E 03	2.0160	2.0143
1.000E-04	420.	344.	1.409E 03	1.701E 03	2.0160	2.0143

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.104E 00	1.104E 00				
THROAT	6.908E-01	6.917E-01	11827.	11832.	1.000	1.000
1.000E-01	1.910E-01	1.918E-01	20982.	20953.	2.146	2.147
1.000E-02	3.543E-02	3.584E-02	26201.	26152.	3.588	3.575
1.000E-03	6.791E-03	7.297E-03	28580.	28462.	5.397	5.404
1.000E-04	1.316E-03	1.605E-03	29741.	29495.	7.788	8.127

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	367.6	367.8	650.2	649.5
1.000E-01	2.038E 00	2.036E 00	652.1	651.2	757.7	756.5
1.000E-02	8.801E 00	8.730E 00	814.4	812.8	859.9	858.0
1.000E-03	4.209E 01	3.940E 01	888.3	884.6	910.1	905.0
1.000E-04	2.087E 02	1.729E 02	924.4	916.7	935.2	925.7

TABLE 182

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 6000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 286.32 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 287.88 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 7392.672 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 7432.915 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5501
THROAT PRESSURE RATIO(FROZEN) = 0.5470
ENTROPY = 1.710E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	6000.	6000.	2.384E 04	2.384E 04	2.0071	2.0071
THROAT	5301.	5243.	2.051E 04	2.049E 04	2.0120	2.0071
1.000E-01	3595.	3517.	1.309E 04	1.320E 04	2.0159	2.0071
1.000E-02	1987.	1932.	6.895E 03	7.126E 03	2.0160	2.0071
1.000E-03	1044.	977.	3.562E 03	3.909E 03	2.0160	2.0071
1.000E-04	541.	455.	1.824E 03	2.343E 03	2.0160	2.0071
5.000E-05	443.		1.488E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.165E-01	9.165E-01				
THROAT	5.720E-01	5.737E-01	12924.	12956.	1.000	1.000
1.000E-01	1.536E-01	1.563E-01	23203.	23085.	2.146	2.150
1.000E-02	2.779E-02	2.846E-02	29127.	28927.	3.549	3.554
1.000E-03	5.290E-03	5.629E-03	31862.	31588.	5.315	5.314
1.000E-04	1.021E-03	1.209E-03	33200.	32806.	7.669	7.896
5.000E-05	6.234E-04		33452.		8.529	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	401.7	402.7	716.6	714.1
1.000E-01	2.074E 00	2.060E 00	721.2	717.5	839.9	834.8
1.000E-02	9.132E 00	9.029E 00	905.3	899.1	957.6	950.5
1.000E-03	4.386E 01	4.180E 01	990.3	981.8	1015.4	1005.6
1.000E-04	2.182E 02	1.873E 02	1031.9	1019.6	1044.4	1030.3
5.000E-05	3.545E 02		1039.7		1049.9	

TABLE 183

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 7000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 282.86 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 285.91 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 6761.559 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 6834.520 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5553
THROAT PRESSURE RATIO(FROZEN) = 0.5484
ENTROPY = 1.795E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	7000.	7000.	2.939E 04	2.939E 04	1.9871	1.9871
THROAT	6277.	6136.	2.550E 04	2.545E 04	1.9985	1.9871
1.000E-01	4399.	4150.	1.649E 04	1.679E 04	2.0146	1.9871
1.000E-02	2504.	2319.	8.804E 03	9.500E 03	2.0160	1.9871
1.000E-03	1333.	1197.	4.571E 03	5.565E 03	2.0160	1.9871
1.000E-04	694.	568.	2.348E 03	3.608E 03	2.0160	1.9871
5.000E-05	569.	447.	1.918E 03	3.258E 03	2.0160	1.9871
1.000E-05	357.		1.196E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.777E-01	7.777E-01				
THROAT	4.845E-01	4.866E-01	13956.	14047.	1.000	1.000
1.000E-01	1.255E-01	1.312E-01	25411.	25119.	2.144	2.151
1.000E-02	2.206E-02	2.348E-02	32101.	31554.	3.509	3.543
1.000E-03	4.142E-03	4.547E-03	35247.	34535.	5.210	5.257
1.000E-04	7.962E-04	9.584E-04	36793.	35925.	7.517	7.739
5.000E-05	4.856E-04	6.086E-04	37084.	36168.	8.359	8.723
1.000E-05	1.548E-04		37568.		10.657	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	433.8	436.6	781.4	776.1
1.000E-01	2.121E 00	2.074E 00	789.8	780.7	922.6	909.1
1.000E-02	9.550E 00	9.225E 00	997.7	980.7	1057.5	1037.9
1.000E-03	4.631E 01	4.353E 01	1095.5	1073.4	1124.5	1100.3
1.000E-04	2.308E 02	1.985E 02	1143.6	1116.6	1158.0	1128.9
5.000E-05	3.755E 02	3.105E 02	1152.6	1124.1	1164.4	1133.8
1.000E-05	1.163E 03		1167.6		1174.9	

TABLE 184

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 8000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 278.57 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 282.85 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 6229.110 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 6324.744 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5594
THROAT PRESSURE RATIO(FROZEN) = 0.5487
ENTROPY = 1.885E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	8000.	8000.	3.614E 04	3.614E 04	1.9467	1.9467
THROAT	7261.	7018.	3.165E 04	3.155E 04	1.9665	1.9467
1.000E-01	5319.	4757.	2.086E 04	2.142E 04	2.0063	1.9467
1.000E-02	3161.	2677.	1.134E 04	1.287E 04	2.0159	1.9467
1.000E-03	1721.	1398.	5.939E 03	8.214E 03	2.0160	1.9467
1.000E-04	900.	671.	3.061E 03	5.870E 03	2.0160	1.9467
5.000E-05	739.	530.	2.503E 03	5.447E 03	2.0160	1.9467
1.000E-05	465.	300.	1.564E 03	4.782E 03	2.0160	1.9467

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	6.667E-01	6.667E-01				
THROAT	4.151E-01	4.170E-01	15007.	15167.	1.000	1.000
1.000E-01	1.033E-01	1.121E-01	27660.	27147.	2.148	2.152
1.000E-02	1.747E-02	1.992E-02	35235.	34131.	3.460	3.540
1.000E-03	3.210E-03	3.815E-03	38886.	37393.	5.076	5.233
1.000E-04	6.138E-04	7.949E-04	40696.	38930.	7.309	7.663
5.000E-05	3.739E-04	5.033E-04	41038.	39201.	8.128	8.624
1.000E-05	1.187E-04	1.779E-04	41607.	39624.	10.355	11.440

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	466.4	471.4	846.5	838.5
1.000E-01	2.179E 00	2.078E 00	859.7	843.7	1007.8	982.8
1.000E-02	1.012E 01	9.302E 00	1095.2	1060.8	1163.9	1123.1
1.000E-03	4.991E 01	4.434E 01	1208.6	1162.2	1242.5	1191.9
1.000E-04	2.494E 02	2.044E 02	1264.9	1210.0	1281.8	1223.7
5.000E-05	4.060E 02	3.206E 02	1275.5	1218.4	1289.3	1229.1
1.000E-05	1.261E 03	8.970E 02	1293.2	1231.5	1301.7	1237.5

TABLE 185

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 9000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 273.39 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 278.40 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 5763.526 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 5869.114 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5612
THROAT PRESSURE RATIO(FROZEN) = 0.5479
ENTROPY = 1.983E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	9000.	9000.	4.448E 04	4.448E 04	1.8817	1.8817
THROAT	8225.	7881.	3.927E 04	3.913E 04	1.9084	1.8817
1.000E-01	6264.	5321.	2.655E 04	2.739E 04	1.9768	1.8817
1.000E-02	4007.	2984.	1.485E 04	1.752E 04	2.0145	1.8817
1.000E-03	2256.	1558.	7.877E 03	1.215E 04	2.0160	1.8817
1.000E-04	1193.	749.	4.080E 03	9.442E 03	2.0160	1.8817
5.000E-05	980.	592.	3.340E 03	8.953E 03	2.0160	1.8817
1.000E-05	619.	335.	2.092E 03	8.185E 03	2.0160	1.8817
5.000E-06	507.		1.708E 03		2.0160	
1.000E-06	318.		1.065E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	5.728E-01	5.728E-01				
THROAT	3.568E-01	3.584E-01	16154.	16375.	1.000	1.000
1.000E-01	8.646E-02	9.689E-02	29963.	29248.	2.160	2.152
1.000E-02	1.378E-02	1.728E-02	38517.	36739.	3.400	3.547
1.000E-03	2.449E-03	3.308E-03	42807.	40233.	4.915	5.245
1.000E-04	4.631E-04	6.884E-04	44973.	41882.	7.024	7.675
5.000E-05	2.817E-04	4.357E-04	45383.	42173.	7.812	8.635
1.000E-05	8.917E-05	1.539E-04	46065.	42627.	9.954	11.449
5.000E-06	5.442E-05		46273.		11.033	
1.000E-06	1.738E-05		46620.		14.000	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	502.1	508.9	914.2	904.0
1.000E-01	2.225E 00	2.071E 00	931.3	909.1	1094.6	1058.4
1.000E-02	1.086E 01	9.247E 00	1197.1	1141.9	1276.9	1208.6
1.000E-03	5.499E 01	4.409E 01	1330.5	1250.5	1370.9	1282.3
1.000E-04	2.767E 02	2.036E 02	1397.8	1301.7	1418.1	1316.4
5.000E-05	4.508E 02	3.194E 02	1410.5	1310.8	1427.1	1322.3
1.000E-05	1.403E 03	8.944E 02	1431.8	1324.9	1442.1	1331.3
5.000E-06	2.289E 03		1438.2		1446.6	
1.000E-06	7.115E 03		1449.0		1454.2	

TABLE 186

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 10000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 267.15 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 272.57 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 5343.089 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 5451.437 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5611
THROAT PRESSURE RATIO(FROZEN) = 0.5459
ENTROPY = 2.090E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	10000.	10000.	5.461E 04	5.461E 04	1.7932	1.7932
THROAT	9157.	8716.	4.854E 04	4.834E 04	1.8251	1.7932
1.000E-01	7127.	5823.	3.370E 04	3.482E 04	1.9160	1.7932
1.000E-02	4969.	3219.	1.964E 04	2.356E 04	2.0002	1.7932
1.000E-03	2986.	1662.	1.066E 04	1.751E 04	2.0159	1.7932
1.000E-04	1616.	791.	5.565E 03	1.450E 04	2.0160	1.7932
5.000E-05	1331.	624.	4.562E 03	1.396E 04	2.0160	1.7932
1.000E-05	844.	351.	2.866E 03	1.311E 04	2.0160	1.7932
5.000E-06	692.		2.343E 03		2.0160	
1.000E-06	436.		1.463E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.913E-01	4.913E-01				
THROAT	3.064E-01	3.078E-01	17440.	17714.	1.000	1.000
1.000E-01	7.365E-02	8.437E-02	32357.	31474.	2.169	2.152
1.000E-02	1.103E-02	1.526E-02	41844.	39427.	3.384	3.563
1.000E-03	1.850E-03	2.957E-03	46909.	43096.	4.730	5.295
1.000E-04	3.419E-04	6.208E-04	49551.	44812.	6.668	7.779
5.000E-05	2.076E-04	3.938E-04	50055.	45113.	7.407	8.762
1.000E-05	6.548E-05	1.398E-04	50896.	45582.	9.438	11.644
5.000E-06	3.990E-05		51153.		10.462	
1.000E-06	1.268E-05		51581.		13.262	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	542.1	550.6	986.4	974.4
1.000E-01	2.242E 00	2.053E 00	1005.7	978.2	1183.3	1137.6
1.000E-02	1.158E 01	9.060E 00	1300.6	1225.4	1392.3	1295.8
1.000E-03	6.157E 01	4.278E 01	1458.0	1339.5	1506.8	1372.7
1.000E-04	3.154E 02	1.959E 02	1540.1	1392.8	1565.1	1408.0
5.000E-05	5.143E 02	3.068E 02	1555.8	1402.2	1576.1	1414.1
1.000E-05	1.603E 03	8.556E 02	1581.9	1416.7	1594.6	1423.4
5.000E-06	2.618E 03		1589.9		1600.2	
1.000E-06	8.169E 03		1603.2		1609.7	

TABLE 187

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 12000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 251.31 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 251.13 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4588.239 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4584.953 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5563
THROAT PRESSURE RATIO(FROZEN) = 0.5222
ENTROPY = 2.331E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	12000.	12000.	8.092E 04	8.092E 04	1.5591	1.5591
THROAT	10910.	10167.	7.247E 04	7.219E 04	1.5968	1.5591
1.000E-01	8619.	6556.	5.282E 04	5.481E 04	1.7171	1.5591
1.000E-02	6483.	3403.	3.367E 04	4.064E 04	1.8633	1.5591
1.000E-03	4844.	1657.	2.021E 04	3.347E 04	1.9777	1.5591
1.000E-04	3096.	752.	1.110E 04	3.009E 04	2.0156	1.5591
5.000E-05	2598.	586.	9.160E 03	2.950E 04	2.0160	1.5591
1.000E-05	1684.	323.	5.808E 03	2.860E 04	2.0160	1.5591
5.000E-06	1388.		4.762E 03		2.0160	
1.000E-06	880.		2.992E 03		2.0160	
5.000E-07	722.		2.447E 03		2.0160	
1.000E-07	455.		1.529E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	3.559E-01	3.559E-01				
THROAT	2.231E-01	2.194E-01	20568.	20900.	1.000	1.000
1.000E-01	5.458E-02	6.516E-02	37501.	36147.	2.162	2.131
1.000E-02	7.874E-03	1.255E-02	48635.	44903.	3.407	3.613
1.000E-03	1.119E-03	2.577E-03	55125.	48733.	4.571	5.495
1.000E-04	1.784E-04	5.676E-04	59117.	50440.	5.876	8.259
5.000E-05	1.063E-04	3.643E-04	59934.	50731.	6.444	9.361
1.000E-05	3.280E-05	1.321E-04	61318.	51177.	8.088	12.595
5.000E-06	1.990E-05		61744.		8.950	
1.000E-06	6.275E-06		62457.		11.341	
5.000E-07	3.823E-06		62675.		12.551	
1.000E-07	1.214E-06		63040.		15.866	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	639.3	649.6	1152.4	1131.6
1.000E-01	2.242E 00	1.947E 00	1165.6	1123.5	1372.3	1303.2
1.000E-02	1.198E 01	8.135E 00	1511.6	1395.6	1622.1	1470.7
1.000E-03	7.441E 01	3.651E 01	1713.3	1514.7	1782.0	1548.4
1.000E-04	4.351E 02	1.601E 02	1837.4	1567.7	1877.6	1582.5
5.000E-05	7.203E 02	2.481E 02	1862.8	1576.8	1896.0	1588.2
1.000E-05	2.282E 03	6.781E 02	1905.8	1590.6	1926.9	1596.9
5.000E-06	3.734E 03		1919.1		1936.3	
1.000E-06	1.171E 04		1941.2		1952.0	
5.000E-07	1.915E 04		1948.0		1956.8	
1.000E-07	5.994E 04		1959.4		1964.9	

TABLE 188

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 14000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 237.71 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 244.58 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 4018.004 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 4134.147 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5492
THROAT PRESSURE RATIO(FROZEN) = 0.5259
ENTROPY = 2.552E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	14000.	14000.	1.096E 05	1.096E 05	1.3589	1.3589
THROAT	12531.	11607.	9.812E 04	9.756E 04	1.3981	1.3589
1.000E-01	9722.	7062.	7.309E 04	7.531E 04	1.5223	1.3589
1.000E-02	7331.	3312.	4.897E 04	5.849E 04	1.6841	1.3589
1.000E-03	5761.	1380.	3.203E 04	5.099E 04	1.8350	1.3589
1.000E-04	4508.	515.	1.967E 04	4.801E 04	1.9600	1.3589
5.000E-05	4121.	377.	1.666E 04	4.756E 04	1.9873	1.3589
1.000E-05	3040.		1.091E 04		2.0151	
5.000E-06	2556.		9.001E 03		2.0159	
1.000E-06	1655.		5.705E 03		2.0160	
5.000E-07	1363.		4.677E 03		2.0160	
1.000E-07	865.		2.939E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.659E-01	2.659E-01				
THROAT	1.679E-01	1.687E-01	23934.	24509.	1.000	1.000
1.000E-01	4.290E-02	5.272E-02	42730.	41407.	2.167	2.142
1.000E-02	6.293E-03	1.124E-02	55077.	50562.	3.449	3.694
1.000E-03	8.726E-04	2.699E-03	62300.	54151.	4.638	5.870
1.000E-04	1.191E-04	7.230E-04	67082.	55510.	5.809	9.522
5.000E-05	6.605E-05	4.937E-04	68197.	55712.	6.161	11.092
1.000E-05	1.816E-05		70275.		7.073	
5.000E-06	1.081E-05		70952.		7.691	
1.000E-06	3.337E-06		72105.		9.591	
5.000E-07	2.026E-06		72461.		10.595	
1.000E-07	6.388E-07		73059.		13.384	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	743.9	761.8	1322.3	1300.1
1.000E-01	2.192E 00	1.894E 00	1328.1	1287.0	1558.9	1480.8
1.000E-02	1.159E 01	7.274E 00	1711.8	1571.5	1833.9	1646.0
1.000E-03	7.391E 01	2.829E 01	1936.3	1683.1	2014.2	1712.0
1.000E-04	5.029E 02	1.030E 02	2085.0	1725.3	2138.0	1735.8
5.000E-05	8.920E 02	1.503E 02	2119.6	1731.6	2166.6	1739.3
1.000E-05	3.149E 03		2184.2		2217.4	
5.000E-06	5.241E 03		2205.3		2232.9	
1.000E-06	1.670E 04		2241.1		2258.7	
5.000E-07	2.738E 04		2252.2		2266.6	
1.000E-07	8.609E 04		2270.8		2279.8	

TABLE 189

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 16000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 228.71 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 235.70 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3616.192 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3726.783 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5417
THROAT PRESSURE RATIO(FROZEN) = 0.5146
ENTROPY = 2.728E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	16000.	16000.	1.359E 05	1.359E 05	1.2210	1.2210
THROAT	14018.	12892.	1.212E 05	1.203E 05	1.2584	1.2210
1.000E-01	10577.	7498.	9.097E 04	9.376E 04	1.3790	1.2210
1.000E-02	7874.	3314.	6.237E 04	7.443E 04	1.5430	1.2210
1.000E-03	6222.	1338.	4.261E 04	6.620E 04	1.7015	1.2210
1.000E-04	5044.	502.	2.813E 04	6.299E 04	1.8472	1.2210
5.000E-05	4735.	371.	2.452E 04	6.250E 04	1.8872	1.2210
1.000E-05	4029.		1.725E 04		1.9678	
5.000E-06	3690.		1.456E 04		1.9935	
1.000E-06	2673.		9.459E 03		2.0157	
5.000E-07	2231.		7.787E 03		2.0160	
1.000E-07	1433.		4.922E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	2.091E-01	2.091E-01				
THROAT	1.332E-01	1.335E-01	27142.	27913.	1.000	1.000
1.000E-01	3.572E-02	4.461E-02	47429.	45929.	2.175	2.139
1.000E-02	5.369E-03	1.009E-02	60671.	55475.	3.497	3.779
1.000E-03	7.492E-04	2.500E-03	68340.	59069.	4.718	6.136
1.000E-04	1.003E-04	6.658E-04	73452.	60415.	5.907	10.031
5.000E-05	5.459E-05	4.511E-04	74670.	60617.	6.265	11.670
1.000E-05	1.338E-05		77070.		7.101	
5.000E-06	7.401E-06		77938.		7.456	
1.000E-06	2.066E-06		79560.		8.471	
5.000E-07	1.238E-06		80084.		9.244	
1.000E-07	3.854E-07		80974.		11.553	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	843.6	867.6	1477.6	1451.9
1.000E-01	2.134E 00	1.819E 00	1474.1	1427.5	1723.9	1634.1
1.000E-02	1.110E 01	6.655E 00	1885.7	1724.2	2015.6	1799.8
1.000E-03	7.062E 01	2.524E 01	2124.1	1835.9	2206.7	1864.6
1.000E-04	4.907E 02	9.264E 01	2282.9	1877.8	2340.4	1888.3
5.000E-05	8.871E 02	1.363E 02	2320.8	1884.0	2372.7	1891.8
1.000E-05	3.506E 03		2395.4		2436.4	
5.000E-06	6.269E 03		2422.4		2459.1	
1.000E-06	2.200E 04		2472.8		2498.5	
5.000E-07	3.648E 04		2489.1		2510.4	
1.000E-07	1.159E 05		2516.8		2530.3	

TABLE 190

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 18000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 224.20 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 230.47 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3342.227 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3435.663 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5349
THROAT PRESSURE RATIO(FROZEN) = 0.5060
ENTROPY = 2.855E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	18000.	18000.	1.574E 05	1.574E 05	1.1397	1.1392
THROAT	15386.	14190.	1.395E 05	1.384E 05	1.1721	1.1392
1.000E-01	11126.	8000.	1.040E 05	1.078E 05	1.2809	1.1392
1.000E-02	8236.	3399.	7.260E 04	8.608E 04	1.4480	1.1392
1.000E-03	6492.	1349.	5.068E 04	7.712E 04	1.6074	1.1392
1.000E-04	5302.	509.	3.470E 04	7.365E 04	1.7579	1.1392
5.000E-05	5005.	378.	3.071E 04	7.312E 04	1.8008	1.1392
1.000E-05	4375.		2.260E 04		1.8939	
5.000E-06	4113.		1.954E 04		1.9301	
1.000E-06	3439.		1.337E 04		1.9969	
5.000E-07	3055.		1.114E 04		2.0119	
1.000E-07	2046.		7.110E 03		2.0160	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.734E-01	1.734E-01				
THROAT	1.116E-01	1.113E-01	29938.	30875.	1.000	1.000
1.000E-01	3.154E-02	3.901E-02	51710.	49841.	2.210	2.136
1.000E-02	4.816E-03	9.183E-03	65159.	59756.	3.545	3.842
1.000E-03	6.784E-04	2.313E-03	73096.	63397.	4.797	6.324
1.000E-04	9.083E-05	6.128E-04	78376.	64754.	6.006	10.369
5.000E-05	4.928E-05	4.133E-04	79640.	64959.	6.368	12.050
1.000E-05	1.186E-05		82150.		7.211	
5.000E-06	6.429E-06		83076.		7.578	
1.000E-06	1.591E-06		84915.		8.420	
5.000E-07	9.021E-07		85571.		8.764	
1.000E-07	2.699E-07		86742.		10.426	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	930.5	959.6	1607.8	1582.8
1.000E-01	2.049E 00	1.767E 00	1607.2	1549.1	1866.7	1766.8
1.000E-02	1.065E 01	6.261E 00	2025.2	1857.3	2160.1	1934.4
1.000E-03	6.740E 01	2.343E 01	2271.9	1970.4	2357.2	1999.3
1.000E-04	4.695E 02	8.658E 01	2436.0	2012.6	2495.4	2023.3
5.000E-05	8.516E 02	1.280E 02	2475.3	2019.0	2529.2	2026.9
1.000E-05	3.430E 03		2553.3		2596.7	
5.000E-06	6.258E 03		2582.1		2621.7	
1.000E-06	2.474E 04		2639.2		2670.6	
5.000E-07	4.330E 04		2659.6		2687.0	
1.000E-07	1.428E 05		2696.0		2714.1	

TABLE 191

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATICN PRESSURE OF 2C00. ATM AND A STAGNATICN TEMPERATURE OF 20C00. CEG R

THROAT FLOW PARAMETER(EQUIL.) = 221.86 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 227.40 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 3137.588 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 3215.979 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5229
THROAT PRESSURE RATIO(FROZEN) = 0.5C03
ENTROPY = 2.950E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	20000.	20000.	1.754E 05	1.754E 05	1.0917	1.0917
THROAT	16677.	15542.	1.541E 05	1.531E C5	1.1183	1.0917
1.000E-C1	11692.	8594.	1.148E 05	1.187E 05	1.2173	1.0917
1.000E-C2	8506.	3566.	8.056E 04	9.466E 04	1.3813	1.0917
1.000E-03	6676.	1403.	5.694E 04	8.490E 04	1.5401	1.0917
1.000E-04	5462.	532.	3.983E 04	8.113E C4	1.6917	1.0917
5.000E-C5	5166.	395.	3.556E 04	8.055E 04	1.7354	1.0917
1.000E-C5	4553.		2.685E 04		1.8324	
5.000E-06	4311.		2.356E 04		1.8717	
1.000E-C6	3754.		1.681E 04		1.954C	
5.000E-C7	3490.		1.427E 04		1.9829	
1.000E-07	2633.		9.328E 03		2.0152	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.495E-01	1.495E-01				
THROAT	9.606E-02	9.627E-02	32662.	33406.	1.000	1.000
1.000E-C1	2.853E-02	3.480E-02	55058.	53270.	2.221	2.134
1.000E-C2	4.449E-03	8.388E-03	68903.	63578.	3.593	3.884
1.000E-03	6.321E-04	2.132E-03	77006.	67310.	4.872	6.441
1.000E-04	8.485E-05	5.625E-04	82383.	68698.	6.102	10.572
5.000E-05	4.602E-05	3.783E-04	83670.	68909.	6.469	12.277
1.000E-C5	1.103E-05		86235.		7.320	
5.000E-06	5.948E-06		87186.		7.689	
1.000E-06	1.426E-06		89102.		8.555	
5.000E-C7	7.782E-07		89811.		8.926	
1.000E-07	2.097E-07		91179.		9.826	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1015.2	1038.3	1720.4	1696.6
1.000E-01	1.998E 00	1.735E 00	1711.3	1655.7	1980.7	1884.0
1.000E-02	1.024E 01	6.030E 00	2141.6	1976.1	2279.6	2055.4
1.000E-03	6.446E 01	2.241E 01	2393.4	2092.1	2480.4	2121.5
1.000E-04	4.489E 02	8.322E 01	2560.5	2135.2	2621.1	2146.2
5.000E-05	8.149E 02	1.234E 02	2600.6	2141.8	2655.5	2149.9
1.000E-C5	3.300E 03		2680.3		2724.8	
5.000E-C6	6.050E 03		2709.8		2750.6	
1.000E-C6	2.47CE 04		2769.4		28C2.7	
5.000E-07	4.489E 04		2791.4		2821.7	
1.000E-C7	1.641E 05		2833.9		2856.1	

TABLE 192

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 30000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 211.45 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 219.90 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2441.648 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2539.232 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5318
THROAT PRESSURE RATIO(FROZEN) = 0.4930
ENTROPY = 3.257E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	30000.	30000.	2.514E 05	2.514E 05	1.0119	1.0119
THROAT	25128.	23075.	2.173E 05	2.147E 05	1.0202	1.0119
1.000E-01	14837.	12412.	1.548E 05	1.607E 05	1.0581	1.0119
1.000E-02	9483.	5000.	1.081E 05	1.238E 05	1.1934	1.0119
1.000E-03	7227.	1956.	7.830E 04	1.091E 05	1.3450	1.0119
1.000E-04	5881.	748.	5.727E 04	1.034E 05	1.4934	1.0119
5.000E-05	5567.	558.	5.207E 04	1.025E 05	1.5370	1.0119
1.000E-05	4946.	283.	4.149E 04	1.013E 05	1.6359	1.0119
5.000E-06	4713.		3.747E 04		1.6774	
1.000E-06	4232.		2.918E 04		1.7710	
5.000E-07	4043.		2.600E 04		1.8098	
1.000E-07	3628.		1.938E 04		1.8955	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	9.241E-02	9.241E-02				
THROAT	5.916E-02	5.923E-02	41275.	42870.	1.000	1.000
1.000E-01	1.954E-02	2.233E-02	69540.	67356.	2.234	2.130
1.000E-02	3.448E-03	5.544E-03	84684.	79913.	3.839	3.945
1.000E-03	5.099E-04	1.418E-03	93081.	84392.	5.261	6.593
1.000E-04	6.958E-05	3.707E-04	98574.	86063.	6.599	10.808
5.000E-05	3.782E-05	2.482E-04	99886.	86319.	6.994	12.530
1.000E-05	9.062E-06	9.803E-05	102503.	86690.	7.900	17.656
5.000E-06	4.875E-06		103479.		8.288	
1.000E-06	1.146E-06		105465.		9.190	
5.000E-07	6.132E-07		106218.		9.581	
1.000E-07	1.431E-07		107767.		10.498	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1282.9	1332.4	2204.7	2154.1
1.000E-01	1.797E 00	1.688E 00	2161.4	2093.5	2472.9	2374.8
1.000E-02	8.362E 00	5.731E 00	2632.1	2483.8	2777.0	2579.3
1.000E-03	5.145E 01	2.122E 01	2893.0	2623.0	2982.2	2658.4
1.000E-04	3.560E 02	7.959E 01	3063.8	2674.9	3125.5	2688.2
5.000E-05	6.464E 02	1.185E 02	3104.5	2682.9	3160.6	2692.8
1.000E-05	2.629E 03	2.988E 02	3185.9	2694.4	3231.5	2699.4
5.000E-06	4.840E 03		3216.2		3258.2	
1.000E-06	2.019E 04		3278.0		3313.0	
5.000E-07	3.749E 04		3301.4		3333.9	
1.000E-07	1.583E 05		3349.5		3376.9	

TABLE 193

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 40000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 203.86 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 214.93 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 2038.647 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 2149.304 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5738
THROAT PRESSURE RATIO(FROZEN) = 0.5211
ENTROPY = 3.581E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	40000.	40000.	3.677E 05	3.677E 05	0.9430	0.9430
THROAT	35653.	31827.	3.212E 05	3.161E 05	0.9581	0.9430
1.000E-01	23805.	16977.	2.159E 05	2.335E 05	1.0009	0.9430
1.000E-02	11431.	6867.	1.402E 05	1.792E 05	1.0455	0.9430
1.000E-03	7874.	2713.	1.027E 05	1.575E 05	1.1764	0.9430
1.000E-04	6263.	1047.	7.691E 04	1.490E 05	1.3165	0.9430
5.000E-05	5913.	784.	7.064E 04	1.477E 05	1.3582	0.9430
1.000E-05	5240.	399.	5.798E 04	1.457E 05	1.4533	0.9430
5.000E-06	4996.		5.319E 04		1.4937	
1.000E-06	4503.		4.334E 04		1.5856	
5.000E-07	4317.		3.955E 04		1.6244	
1.000E-07	3929.		3.165E 04		1.7127	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	6.459E-02	6.459E-02				
THROAT	4.225E-02	4.230E-02	48255.	50811.	1.000	1.000
1.000E-01	1.152E-02	1.522E-02	87155.	81959.	2.187	2.138
1.000E-02	2.506E-03	3.762E-03	106722.	97126.	4.012	3.963
1.000E-03	4.093E-04	9.524E-04	115180.	102579.	5.785	6.593
1.000E-04	5.759E-05	2.467E-04	120648.	104633.	7.321	10.755
5.000E-05	3.146E-05	1.647E-04	121942.	104951.	7.764	12.452
1.000E-05	7.598E-06	6.467E-05	124515.	105411.	8.774	17.491
5.000E-06	4.096E-06		125473.		9.202	
1.000E-06	9.647E-07		127424.		10.190	
5.000E-07	5.155E-07		128165.		10.613	
1.000E-07	1.194E-07		129698.		11.594	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	1499.8	1579.2	2691.0	2605.3
1.000E-01	2.031E 00	1.723E 00	2708.9	2547.4	3130.4	2886.7
1.000E-02	7.623E 00	5.882E 00	3317.0	3018.8	3475.3	3134.6
1.000E-03	4.324E 01	2.200E 01	3579.9	3188.3	3669.7	3231.6
1.000E-04	2.934E 02	8.327E 01	3749.9	3252.1	3810.8	3268.5
5.000E-05	5.314E 02	1.243E 02	3790.1	3262.0	3845.2	3274.2
1.000E-05	2.155E 03	3.153E 02	3870.0	3276.3	3914.8	3282.5
5.000E-06	3.967E 03		3899.8		3941.0	
1.000E-06	1.658E 04		3960.4		3994.9	
5.000E-07	3.086E 04		3983.5		4015.5	
1.000E-07	1.316E 05		4031.1		4058.5	

TABLE 194

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 50000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 184.48 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 191.43 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1650.063 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1712.209 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5551
THROAT PRESSURE RATIO(FROZEN) = 0.5197
ENTROPY = 4.002E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	50000.	50000.	5.577E 05	5.577E 05	0.8349	0.8349
THROAT	44996.	41441.	4.917E 05	4.865E 05	0.8499	0.8349
1.000E-01	33412.	23121.	3.384E 05	3.619E 05	0.9136	0.8349
1.000E-02	21378.	9538.	2.073E 05	2.782E 05	0.9926	0.8349
1.000E-03	10086.	4223.	1.391E 05	2.426E 05	1.0223	0.8349
1.000E-04	6857.	1963.	1.044E 05	2.265E 05	1.1316	0.8349
5.000E-05	6397.	1567.	9.651E 04	2.236E 05	1.1695	0.8349
1.000E-05	5586.	934.	8.076E 04	2.189E 05	1.2576	0.8349
5.000E-06	5308.	749.	7.489E 04	2.175E 05	1.2952	0.8349
1.000E-06	4766.	449.	6.287E 04	2.153E 05	1.3814	0.8349
5.000E-07	4567.		5.828E 04		1.4181	
1.000E-07	4163.		4.872E 04		1.5020	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	4.575E-02	4.575E-02				
THROAT	2.873E-02	2.869E-02	57437.	59688.	1.000	1.000
1.000E-01	7.492E-03	9.893E-03	104772.	98988.	2.205	2.088
1.000E-02	1.272E-03	2.398E-03	132431.	118283.	3.574	3.940
1.000E-03	2.777E-04	5.417E-04	144746.	125582.	5.817	6.429
1.000E-04	4.521E-05	1.165E-04	150625.	128755.	8.036	9.774
5.000E-05	2.504E-05	7.300E-05	151936.	129317.	8.579	11.009
1.000E-05	6.168E-06	2.450E-05	154509.	130220.	9.773	14.404
5.000E-06	3.343E-06	1.528E-05	155458.	130486.	10.270	16.136
1.000E-06	7.941E-07	5.092E-06	157382.	130916.	11.399	20.928
5.000E-07	4.254E-07		158110.		11.878	
1.000E-07	9.884E-08		159615.		12.978	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	1785.2	1855.1	3209.0	3139.7
1.000E-01	2.102E 00	1.748E 00	3256.4	3076.6	3795.6	3508.8
1.000E-02	9.794E 00	6.036E 00	4116.1	3676.4	4367.3	3825.5
1.000E-03	4.105E 01	2.517E 01	4498.9	3903.2	4604.1	3965.4
1.000E-04	2.423E 02	1.141E 02	4681.6	4001.8	4743.7	4030.0
5.000E-05	4.337E 02	1.814E 02	4722.3	4019.3	4777.9	4041.7
1.000E-05	1.731E 03	5.368E 02	4802.3	4047.4	4846.7	4060.8
5.000E-06	3.175E 03	8.588E 02	4831.8	4055.6	4872.5	4066.2
1.000E-06	1.320E 04	2.568E 03	4891.6	4069.0	4925.4	4075.3
5.000E-07	2.453E 04		4914.2		4945.7	
1.000E-07	1.046E 05		4961.0		4987.8	

TABLE 195

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 75000. DEG F

THROAT FLOW PARAMETER(EQUIL.) = 162.52 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 165.42 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1186.891 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1208.045 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5324
THROAT PRESSURE RATIO(FROZEN) = 0.5162
ENTROPY = 4.966E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	75000.	75000.	1.150E 06	1.150E 06	0.6111	0.6111
THROAT	64558.	61178.	1.009E 06	1.004E 06	0.6251	0.6111
1.000E-01	46593.	34329.	7.293E 05	7.542E 05	0.6791	0.6111
1.000E-02	33009.	13855.	4.794E 05	5.849E 05	0.7753	0.6111
1.000E-03	24692.	5661.	3.203E 05	5.165E 05	0.8742	0.6111
1.000E-04	18491.	2374.	2.130E 05	4.882E 05	0.9635	0.6111
5.000E-05	16617.	1834.	1.882E 05	4.835E 05	0.9851	0.6111
1.000E-05	10749.	1010.	1.452E 05	4.763E 05	1.0081	0.6111
5.000E-06	8172.	782.	1.323E 05	4.743E 05	1.0088	0.6111
1.000E-06	5579.	432.	1.119E 05	4.712E 05	1.0495	0.6111
5.000E-07	5203.		1.050E 05		1.0789	
1.000E-07	4609.		9.093E 04		1.1492	

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	2.232E-02	2.232E-02				
THROAT	1.412E-02	1.413E-02	84044.	85517.	1.000	1.000
1.000E-01	3.993E-03	4.877E-03	145205.	140835.	2.179	2.097
1.000E-02	6.435E-04	1.209E-03	183278.	168268.	3.597	3.897
1.000E-03	9.700E-05	2.958E-04	203855.	178147.	5.003	6.525
1.000E-04	1.428E-05	7.052E-05	216629.	182076.	6.481	10.369
5.000E-05	8.121E-06	4.566E-05	219480.	182723.	6.950	11.856
1.000E-05	2.569E-06	1.658E-05	224333.	183710.	8.600	16.094
5.000E-06	1.691E-06	1.071E-05	225761.	183983.	10.233	18.328
1.000E-06	5.154E-07	3.874E-06	228010.	184403.	13.167	24.728
5.000E-07	2.841E-07		228774.		13.936	
1.000E-07	6.831E-08		230304.		15.495	

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	2612.2	2658.0	4510.4	4466.1
1.000E-01	2.047E 00	1.759E 00	4513.1	4377.3	5242.9	4993.4
1.000E-02	1.006E 01	5.941E 00	5696.5	5229.9	6055.3	5438.0
1.000E-03	6.002E 01	2.293E 01	6336.0	5537.0	6550.0	5617.3
1.000E-04	3.838E 02	9.408E 01	6733.1	5659.1	6869.9	5692.1
5.000E-05	6.659E 02	1.448E 02	6821.7	5679.2	6940.4	5704.6
1.000E-05	2.059E 03	3.966E 02	6972.5	5709.9	7045.9	5723.8
5.000E-06	3.109E 03	6.131E 02	7016.9	5718.4	7072.3	5729.1
1.000E-06	1.010E 04	1.691E 03	7086.8	5731.4	7122.8	5737.3
5.000E-07	1.826E 04		7110.5		7143.1	
1.000E-07	7.544E 04		7158.1		7185.0	

TABLE 196

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 100000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 158.87 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 159.88 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 1004.787 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 1011.158 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.5111
THROAT PRESSURE RATIO(FROZEN) = 0.5063
ENTROPY = 5.436E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	100000.	100000.	1.554E 06	1.554E 06	0.5456	0.5456
THROAT	80509.	78591.	1.336E 06	1.334E 06	0.5529	0.5456
1.000E-01	53690.	43387.	9.639E 05	9.822E 05	0.5933	0.5456
1.000E-02	36541.	17465.	6.444E 05	7.426E 05	0.6771	0.5456
1.000E-03	27396.	6998.	4.430E 05	6.467E 05	0.7738	0.5456
1.000E-04	21405.	2838.	3.075E 05	6.081E 05	0.8675	0.5456
5.000E-05	19934.	2166.	2.752E 05	6.018E 05	0.8946	0.5456
1.000E-05	16781.	1159.	2.117E 05	5.924E 05	0.9532	0.5456
5.000E-06	15404.	886.	1.887E 05	5.898E 05	0.9755	0.5456
1.000E-06	10953.	475.	1.455E 05	5.859E 05	1.0070	0.5456
5.000E-07	8412.		1.336E 05		1.0081	
1.000E-07	5127.		1.135E 05		1.0289	

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	1.495E-02	1.495E-02				
THROAT	9.617E-03	9.631E-03	104476.	104994.	1.000	1.000
1.000E-01	3.028E-03	3.445E-03	171888.	169205.	2.162	2.113
1.000E-02	5.081E-04	8.559E-04	213405.	201557.	3.671	3.915
1.000E-03	7.739E-05	2.136E-04	235847.	213132.	5.144	6.568
1.000E-04	1.110E-05	5.268E-05	249811.	217620.	6.628	10.569
5.000E-05	6.147E-06	3.451E-05	253028.	218341.	7.085	12.146
1.000E-05	1.556E-06	1.290E-05	259236.	219420.	8.187	16.704
5.000E-06	8.675E-07	8.439E-06	261447.	219712.	8.688	19.138
1.000E-06	2.519E-07	3.148E-06	265552.	220152.	9.457	26.201
5.000E-07	1.641E-07		266662.		11.875	
1.000E-07	5.498E-08		268547.		16.099	

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	3247.2	3263.3	5400.1	5382.5
1.000E-01	1.931E 00	1.734E 00	5342.5	5259.1	6155.6	5985.0
1.000E-02	9.266E 00	5.861E 00	6632.8	6264.6	7023.1	6509.9
1.000E-03	5.505E 01	2.221E 01	7330.3	6624.3	7562.2	6717.3
1.000E-04	3.622E 02	8.820E 01	7764.4	6763.8	7917.0	6800.8
5.000E-05	6.460E 02	1.342E 02	7864.4	6786.2	8000.4	6814.3
1.000E-05	2.491E 03	3.573E 02	8057.3	6819.8	8162.2	6834.7
5.000E-06	4.430E 03	5.454E 02	8126.0	6828.9	8219.3	6840.3
1.000E-06	1.502E 04	1.459E 03	8253.6	6842.5	8316.9	6848.6
5.000E-07	2.295E 04		8288.1		8336.5	
1.000E-07	6.805E 04		8346.7		8375.4	

TABLE 197

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 150000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 158.80 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.79 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 820.020 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 820.002 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4925
THROAT PRESSURE RATIO(FROZEN) = 0.4926
ENTROPY = 5.891E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R		ENTHALPY-BTU/LB		MOLECULAR WT.	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	150000.	150000.	2.112E 06	2.112E 06	0.5189	0.5189
THROAT	113910.	113935.	1.756E 06	1.756E 06	0.5188	0.5189
1.000E-01	65727.	61916.	1.232E 06	1.236E 06	0.5338	0.5189
1.000E-02	40305.	26205.	8.192E 05	8.706E 05	0.6019	0.5189
1.000E-03	29592.	11260.	5.729E 05	7.147E 05	0.6896	0.5189
1.000E-04	23184.	4874.	4.093E 05	6.475E 05	0.7791	0.5189
5.000E-05	21699.	3790.	3.703E 05	6.361E 05	0.8059	0.5189
1.000E-05	18742.	2116.	2.931E 05	6.184E 05	0.8666	0.5189
5.000E-06	17620.	1647.	2.646E 05	6.134E 05	0.8919	0.5189
1.000E-06	15187.	920.	2.075E 05	6.057E 05	0.9479	0.5189
5.000E-07	14129.	716.	1.865E 05	6.036E 05	0.9693	0.5189
1.000E-07	10778.	400.	1.470E 05	6.002E 05	1.0054	0.5189

PRESSURE RATIO	DENSITY-LB/FT3		VELOCITY-FT/SEC		MACH NUMBER	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
CHAMBER	9.478E-03	9.478E-03				
THROAT	6.146E-03	6.146E-03	133421.	133415.	1.000	1.000
1.000E-01	2.225E-03	2.296E-03	209833.	209387.	2.144	2.144
1.000E-02	4.091E-04	5.425E-04	254403.	249288.	3.809	3.951
1.000E-03	6.385E-05	1.263E-04	277577.	264476.	5.446	6.417
1.000E-04	9.208E-06	2.917E-05	291957.	270763.	7.029	10.002
5.000E-05	5.087E-06	1.875E-05	295281.	271819.	7.506	11.389
1.000E-05	1.267E-06	6.718E-06	301757.	273444.	8.625	15.340
5.000E-06	6.934E-07	4.316E-06	304110.	273898.	9.116	17.420
1.000E-06	1.709E-07	1.545E-06	308769.	274601.	10.300	23.367
5.000E-07	9.397E-08	9.922E-07	310473.	274798.	10.840	26.506
1.000E-07	2.556E-08	3.550E-07	313642.	275102.	11.842	35.493

PRESSURE RATIO	NOZZLE AREA RATIO		IDEAL ISP-SEC		VAC ISP-SEC	
	EQUIL.	FROZEN	EQUIL.	FROZEN	EQUIL.	FROZEN
THROAT	1.000E 00	1.000E 00	4146.9	4146.7	6688.7	6688.8
1.000E-01	1.756E 00	1.706E 00	6521.8	6507.9	7428.2	7388.2
1.000E-02	7.879E 00	6.063E 00	7907.1	7748.1	8313.7	8061.0
1.000E-03	4.627E 01	2.456E 01	8627.4	8220.2	8866.2	8346.9
1.000E-04	3.050E 02	1.038E 02	9074.3	8415.6	9231.7	8469.2
5.000E-05	5.459E 02	1.609E 02	9177.6	8448.4	9318.5	8489.9
1.000E-05	2.145E 03	4.464E 02	9378.9	8498.9	9469.6	8521.9
5.000E-06	3.889E 03	6.936E 02	9452.0	8513.0	9552.4	8530.9
1.000E-06	1.554E 04	1.933E 03	9596.8	8534.9	9677.0	8544.8
5.000E-07	2.811E 04	3.007E 03	9649.8	8541.0	9722.3	8548.7
1.000E-07	1.023E 05	8.397E 03	9748.3	8550.5	9801.1	8554.8

TABLE 198

PERFORMANCE PARAMETERS FOR HYDROGEN AT A STAGNATION PRESSURE OF 2000. ATM AND A STAGNATION TEMPERATURE OF 200000. DEG R

THROAT FLOW PARAMETER(EQUIL.) = 158.35 LB-SQRT(DEG R)/SEC-FT2-ATM
THROAT FLOW PARAMETER(FROZEN) = 158.37 LB-SQRT(DEG R)/SEC-FT2-ATM
MAX WT FLOW PER UNIT AREA(EQUIL.) = 708.180 LB/SEC-FT2
MAX WT FLOW PER UNIT AREA(FROZEN) = 708.261 LB/SEC-FT2
THROAT PRESSURE RATIO(EQUIL.) = 0.4892
THROAT PRESSURE RATIO(FROZEN) = 0.4896
ENTROPY = 6.183E 01 BTU/LB-DEG R

PRESSURE RATIO	TEMPERATURE-DEG R EQUIL.	TEMPERATURE-DEG R FROZEN	ENTHALPY-BTU/LB EQUIL.	ENTHALPY-BTU/LB FROZEN	MOLECULAR WT. EQUIL.	MOLECULAR WT. FROZEN
CHAMBER	200000.	200000.	2.619E 06	2.619E 06	0.5126	0.5126
THROAT	150523.	150882.	2.136E 06	2.136E 06	0.5114	0.5126
1.000E-01	81483.	80965.	1.445E 06	1.445E 06	0.5144	0.5126
1.000E-02	43525.	33296.	9.412E 05	9.670E 05	0.5614	0.5126
1.000E-03	30997.	13851.	6.613E 05	7.692E 05	0.6427	0.5126
1.000E-04	24140.	5794.	4.784E 05	6.867E 05	0.7285	0.5126
5.000E-05	22599.	4460.	4.350E 05	6.730E 05	0.7543	0.5126
1.000E-05	19592.	2430.	3.490E 05	6.521E 05	0.8137	0.5126
5.000E-06	18481.	1871.	3.173E 05	6.464E 05	0.8389	0.5126
1.000E-06	16191.	1020.	2.534E 05	6.376E 05	0.8957	0.5126
5.000E-07	15286.	786.	2.296E 05	6.352E 05	0.9192	0.5126
1.000E-07	13198.	429.	1.813E 05	6.316E 05	0.9698	0.5126

PRESSURE RATIO	DENSITY-LB/FT3 EQUIL.	DENSITY-LB/FT3 FROZEN	VELOCITY-FT/SEC EQUIL.	VELOCITY-FT/SEC FROZEN	MACH NUMBER EQUIL.	MACH NUMBER FROZEN
CHAMBER	7.022E-03	7.022E-03				
THROAT	4.554E-03	4.557E-03	155507.	155412.	1.000	1.000
1.000E-01	1.729E-03	1.735E-03	242413.	242396.	2.142	2.137
1.000E-02	3.535E-04	4.218E-04	289805.	287574.	3.885	3.975
1.000E-03	5.681E-05	1.014E-04	313051.	304301.	5.730	6.540
1.000E-04	8.268E-06	2.424E-05	327349.	311012.	7.440	10.349
5.000E-05	4.572E-06	1.574E-05	330651.	312113.	7.945	11.840
1.000E-05	1.138E-06	5.779E-06	337093.	313781.	9.120	16.131
5.000E-06	6.218E-07	3.752E-06	339441.	314239.	9.630	18.411
1.000E-06	1.516E-07	1.376E-06	344119.	314936.	10.834	24.991
5.000E-07	8.237E-08	8.935E-07	345852.	315127.	11.369	28.496
1.000E-07	2.013E-08	3.276E-07	349328.	315419.	12.676	38.623

PRESSURE RATIO	NOZZLE AREA RATIO EQUIL.	NOZZLE AREA RATIO FROZEN	IDEAL ISP-SEC EQUIL.	IDEAL ISP-SEC FROZEN	VAC ISP-SEC EQUIL.	VAC ISP-SEC FROZEN
THROAT	1.000E 00	1.000E 00	4833.3	4830.3	7756.8	7756.0
1.000E-01	1.689E 00	1.685E 00	7534.4	7533.9	8543.8	8540.5
1.000E-02	6.913E 00	5.839E 00	9007.4	8938.1	9420.5	9287.0
1.000E-03	3.982E 01	2.295E 01	9729.9	9458.0	9967.9	9595.1
1.000E-04	2.617E 02	9.396E 01	10174.3	9666.6	10330.7	9722.7
5.000E-05	4.684E 02	1.441E 02	10277.0	9700.8	10416.9	9743.8
1.000E-05	1.846E 03	3.906E 02	10477.2	9752.6	10567.5	9776.0
5.000E-06	3.355E 03	6.007E 02	10550.2	9766.9	10650.4	9784.8
1.000E-06	1.358E 04	1.634E 03	10695.6	9788.5	10776.7	9798.3
5.000E-07	2.486E 04	2.515E 03	10749.4	9794.5	10823.7	9802.0
1.000E-07	1.007E 05	6.854E 03	10857.5	9803.5	10917.6	9807.6

FIG. 1

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON EQUILIBRIUM STAGNATION COMPOSITION OF HYDROGEN

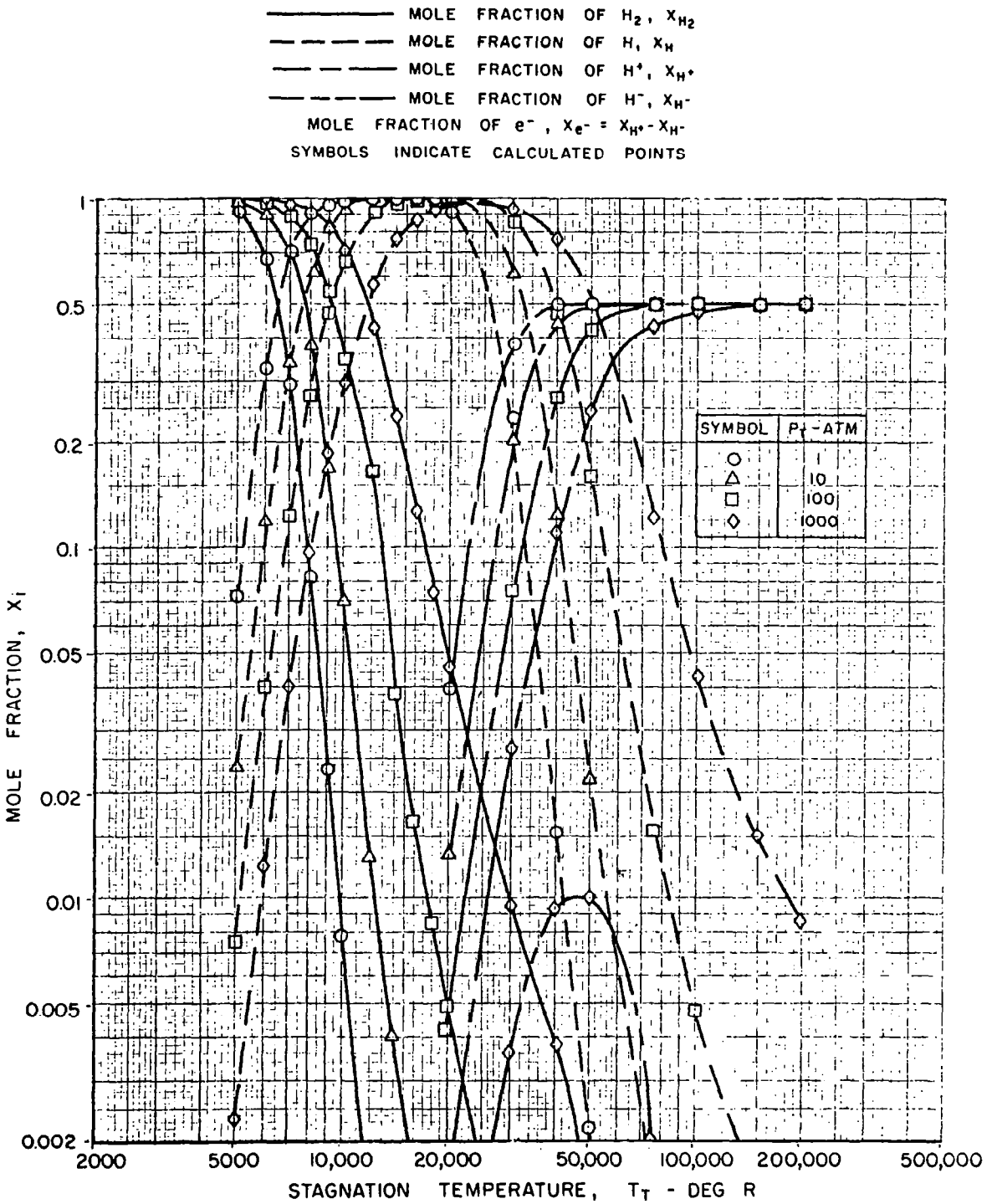


FIG. 2

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON STAGNATION MOLECULAR WEIGHT OF HYDROGEN

SYMBOLS INDICATE CALCULATED POINTS

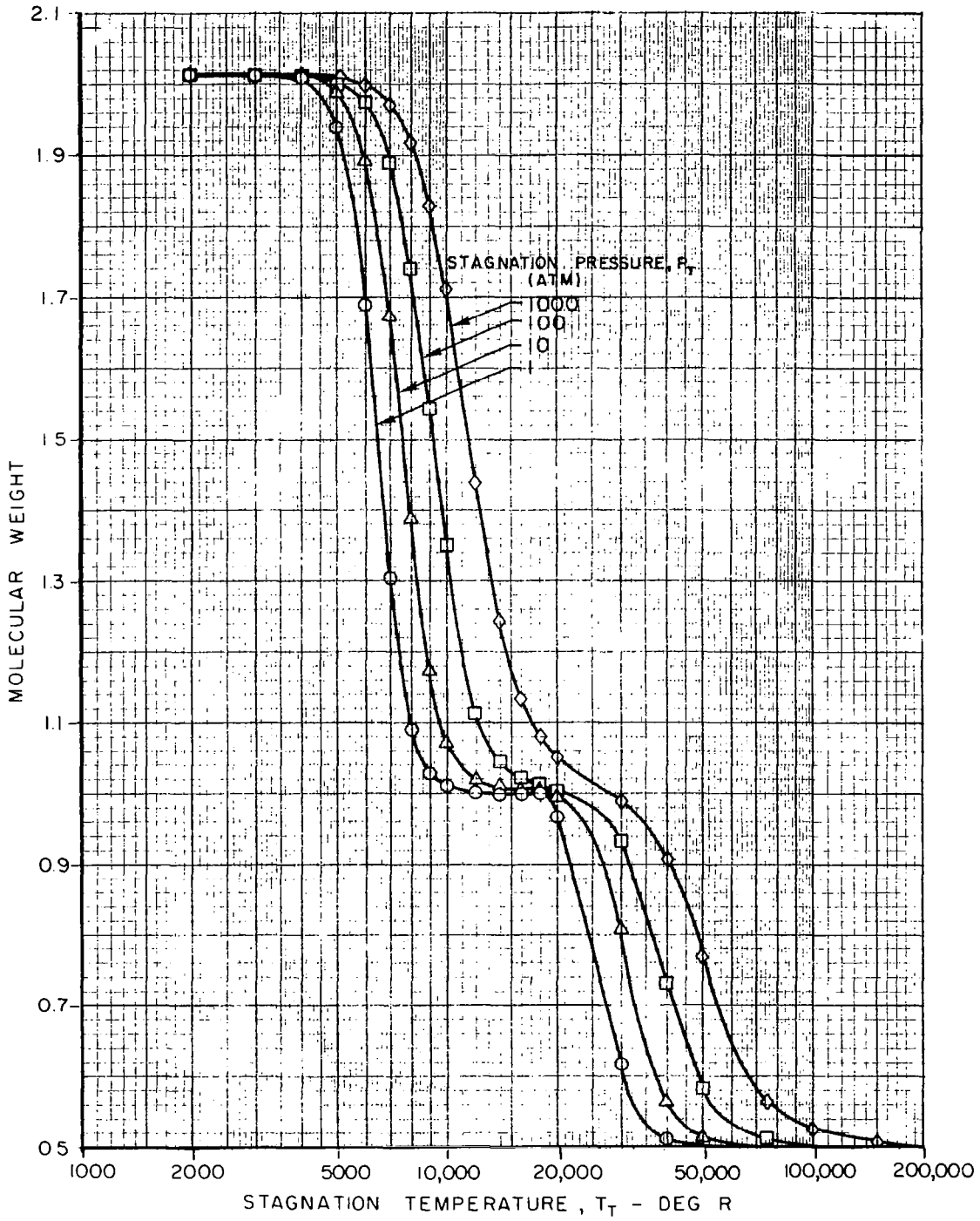


FIG. 3

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON STAGNATION ENTHALPY OF HYDROGEN

SYMBOLS INDICATE CALCULATED POINTS

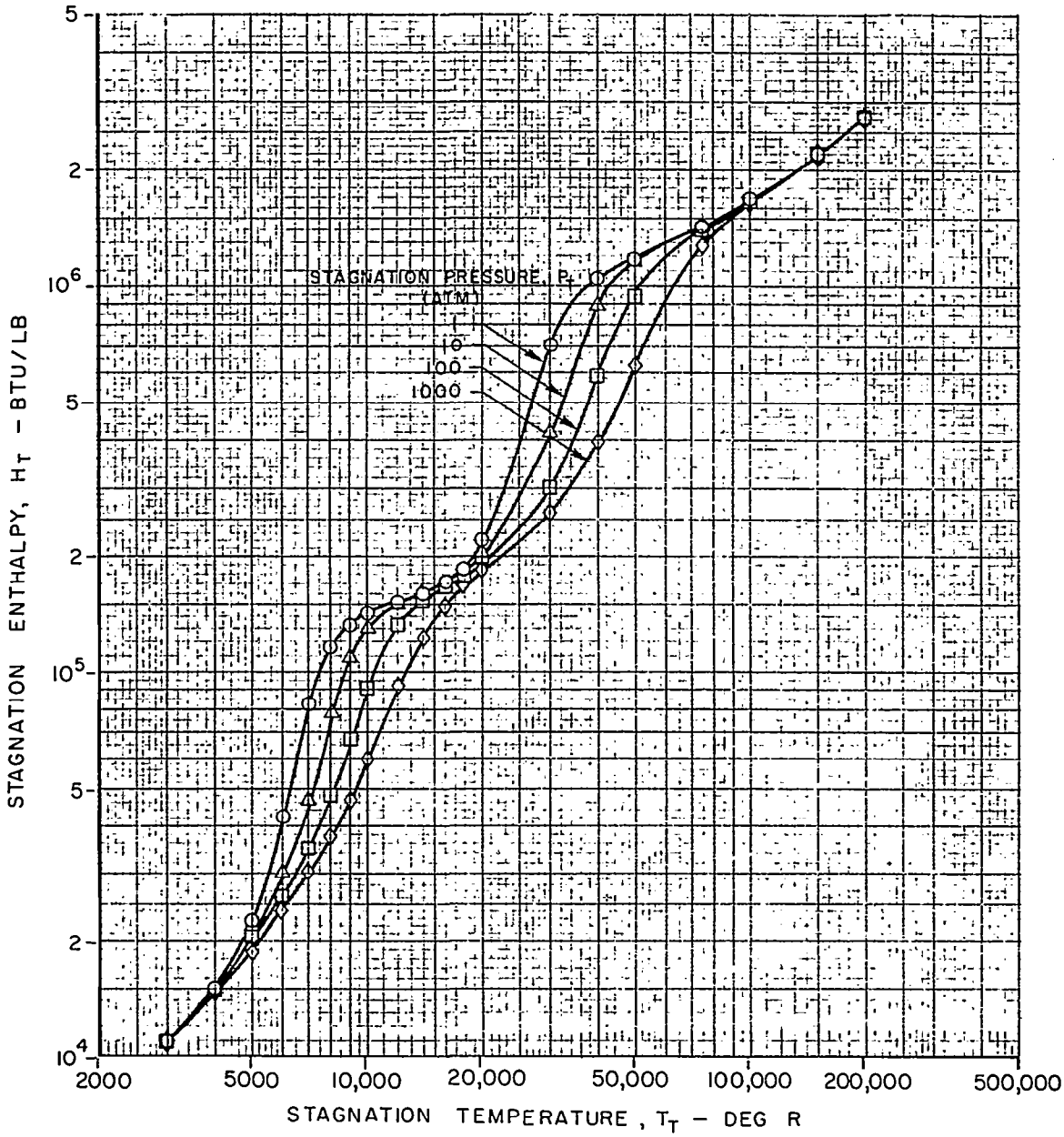


FIG. 4

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON THROAT FLOW PARAMETER

EQUILIBRIUM EXPANSION THROUGH EXHAUST NOZZLE
SYMBOLS INDICATE CALCULATED POINTS

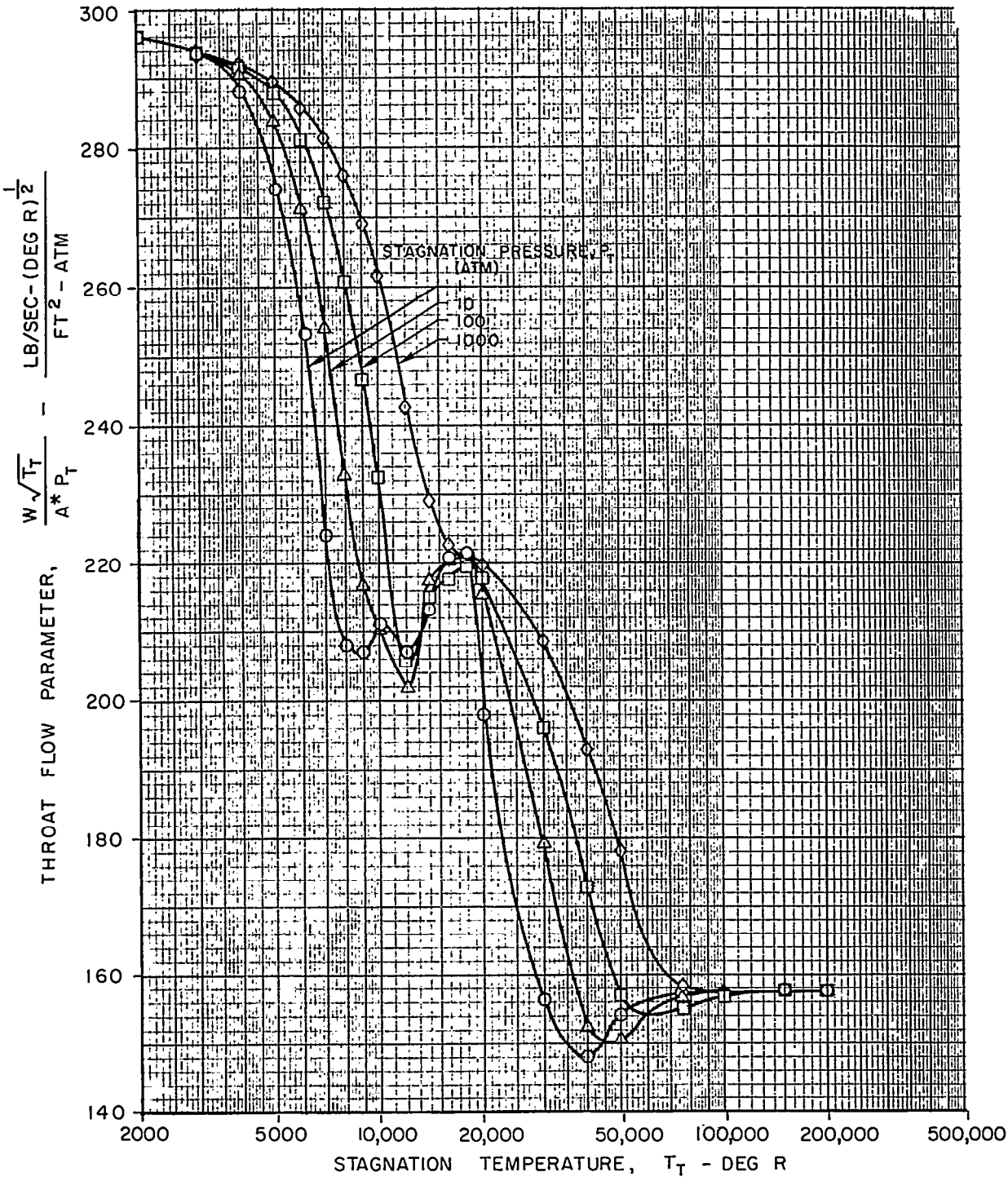


FIG. 5

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON EQUILIBRIUM EXHAUST COMPOSITION OF HYDROGEN

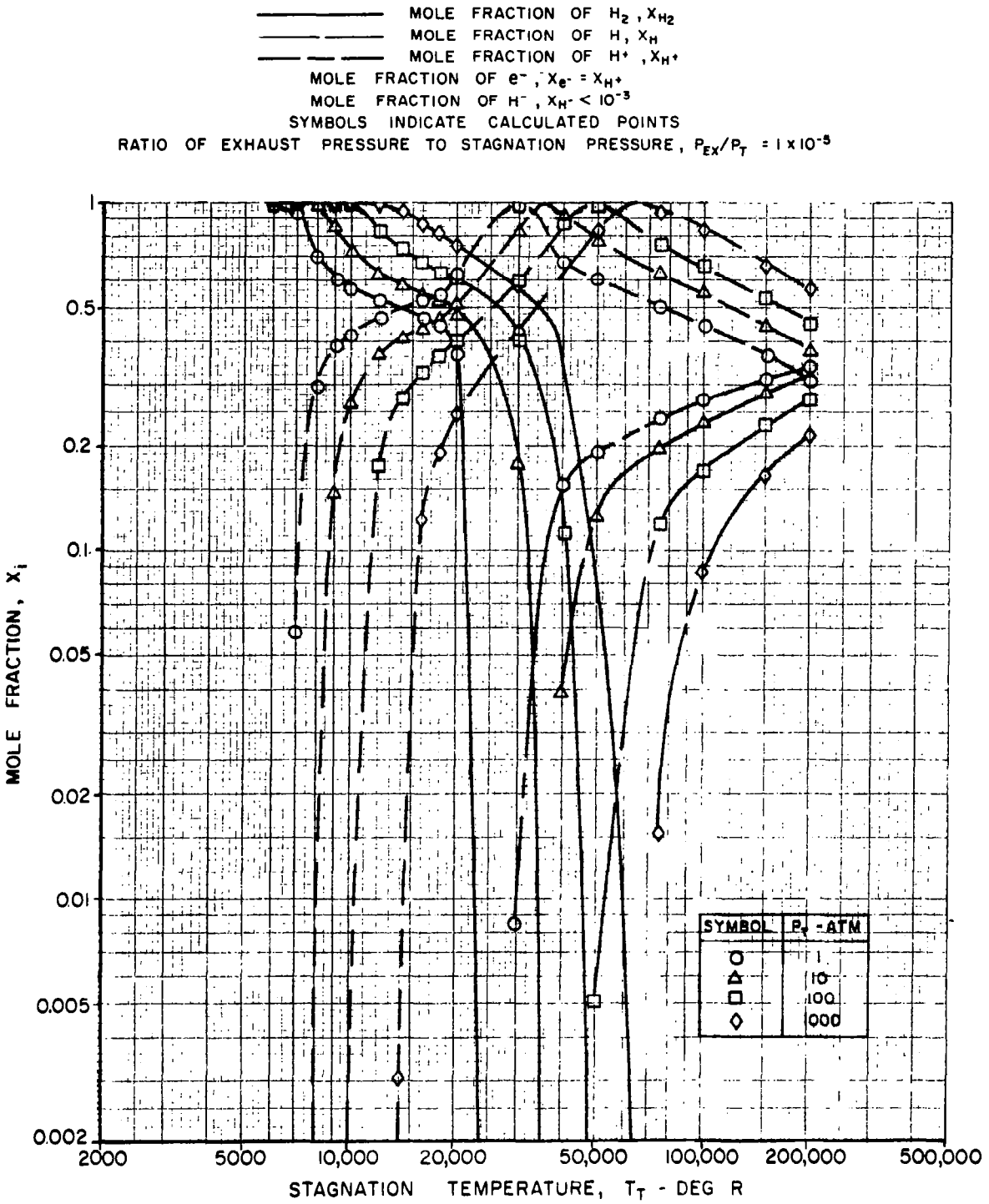


FIG. 6

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON RATIO OF EXHAUST ENTHALPY TO STAGNATION ENTHALPY

RATIO OF EXHAUST PRESSURE TO STAGNATION PRESSURE, $P_{EX}/P_T = 1 \times 10^{-5}$

EQUILIBRIUM EXPANSION THROUGH EXHAUST NOZZLE

SYMBOLS INDICATE CALCULATED POINTS

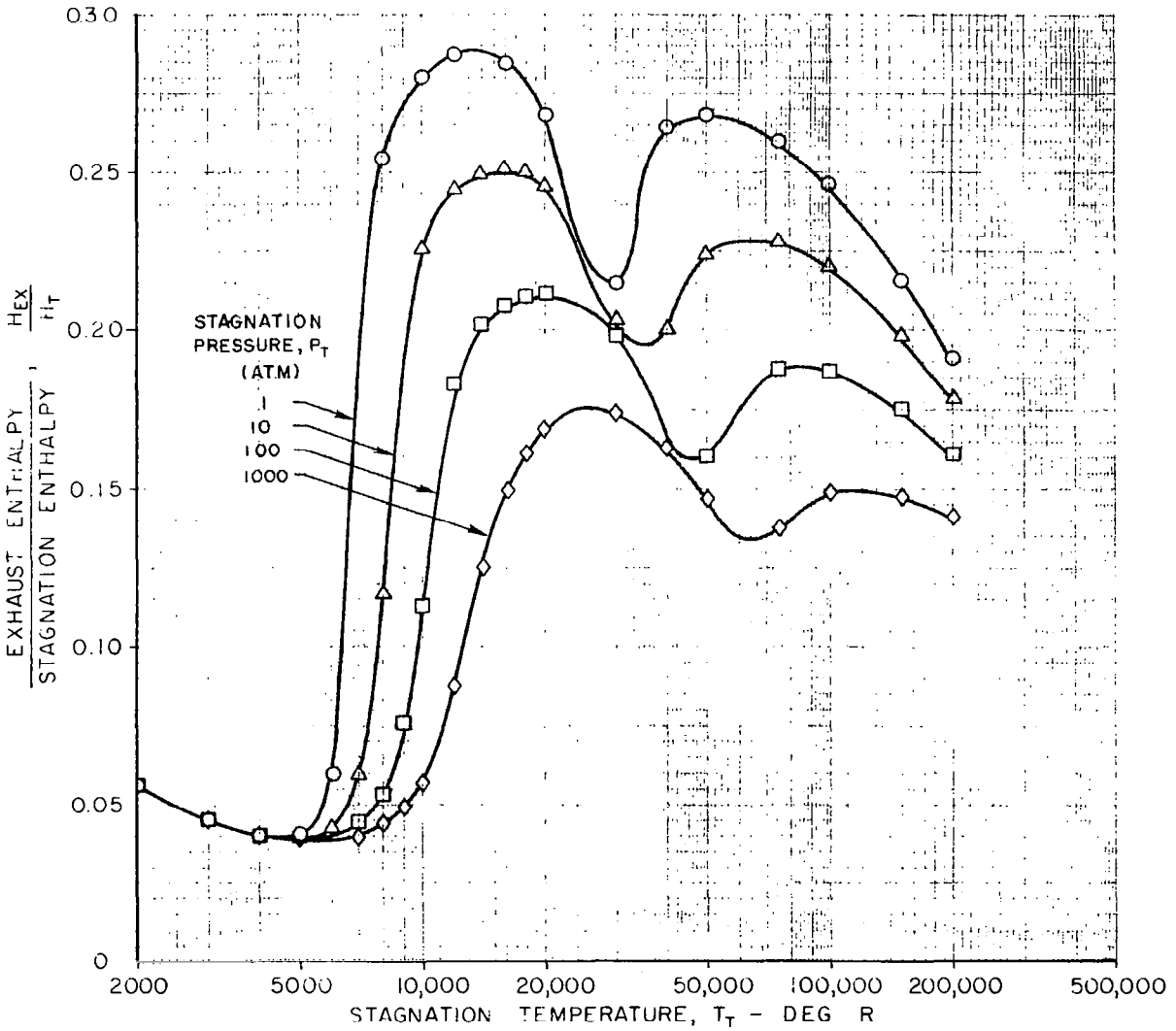


FIG. 7

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON RATIO OF NOZZLE EXHAUST AREA TO THROAT AREA

RATIO OF EXHAUST PRESSURE TO STAGNATION PRESSURE, $P_{EX}/P_T = 1 \times 10^{-5}$

EQUILIBRIUM EXPANSION THROUGH EXHAUST NOZZLE

SYMBOLS INDICATE CALCULATED POINTS

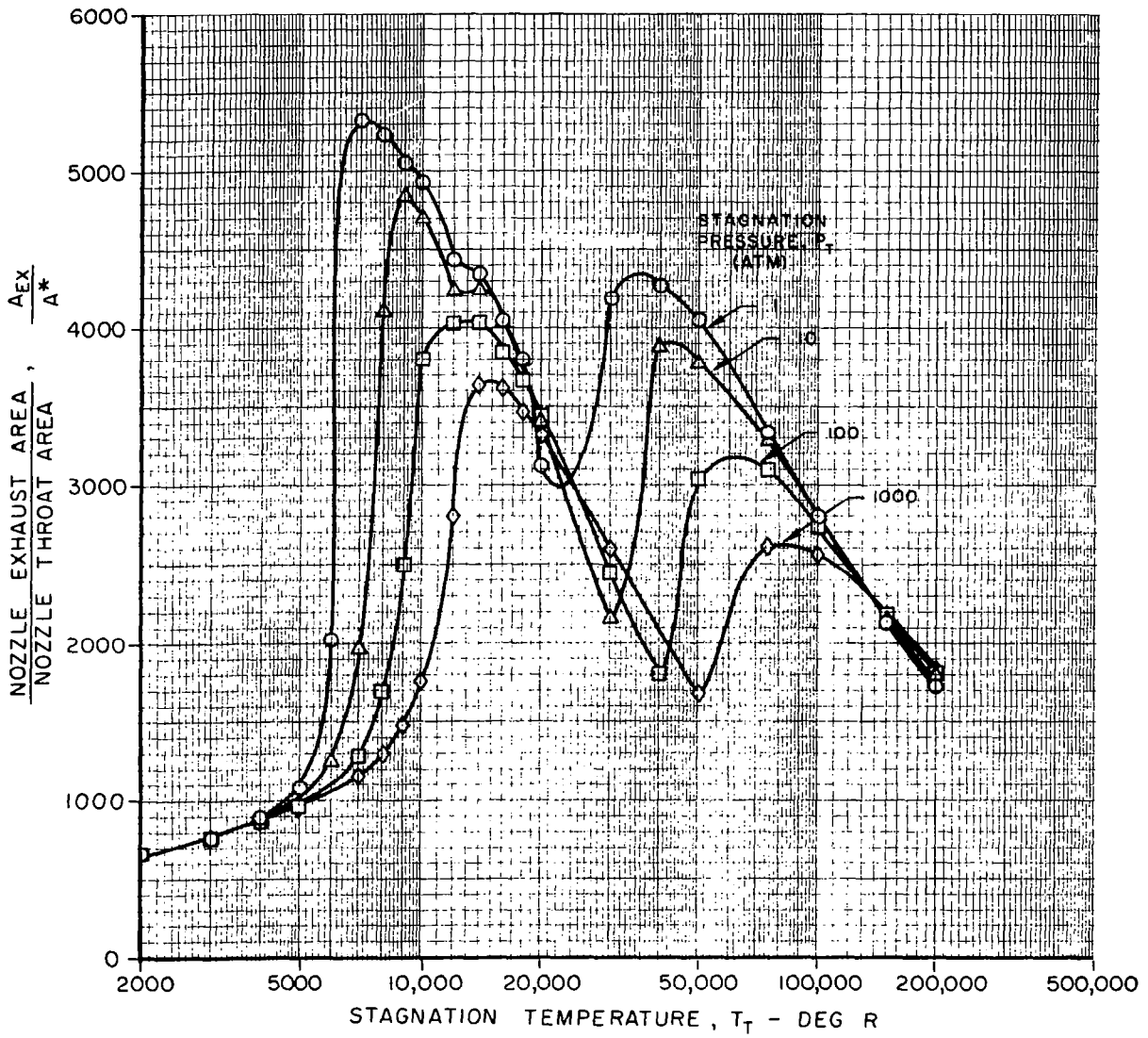


FIG. 8

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON VACUUM SPECIFIC IMPULSES BELOW 4000 SEC

RATIO OF EXHAUST PRESSURE TO STAGNATION PRESSURE, $P_{EX}/P_T = 1 \times 10^{-5}$
EQUILIBRIUM EXPANSION THROUGH EXHAUST NOZZLE
SYMBOLS INDICATE CALCULATED POINTS

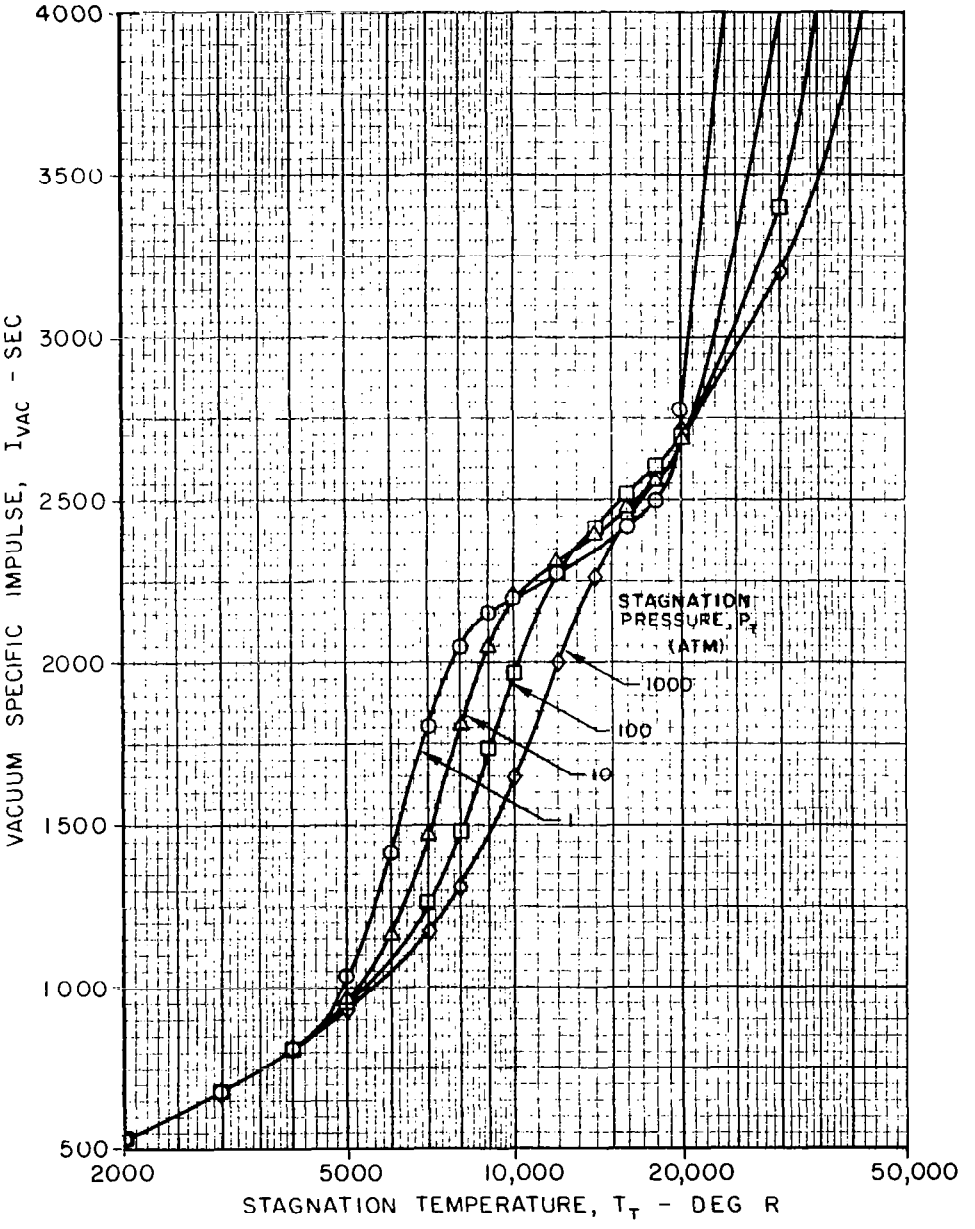


FIG. 9

EFFECT OF STAGNATION TEMPERATURE AND PRESSURE ON VACUUM SPECIFIC IMPULSES ABOVE 4000 SEC

RATIO OF EXHAUST PRESSURE TO STAGNATION PRESSURE, $P_{EX}/P_T = 1 \times 10^{-5}$

EQUILIBRIUM EXPANSION THROUGH EXHAUST NOZZLE

SYMBOLS INDICATE CALCULATED POINTS

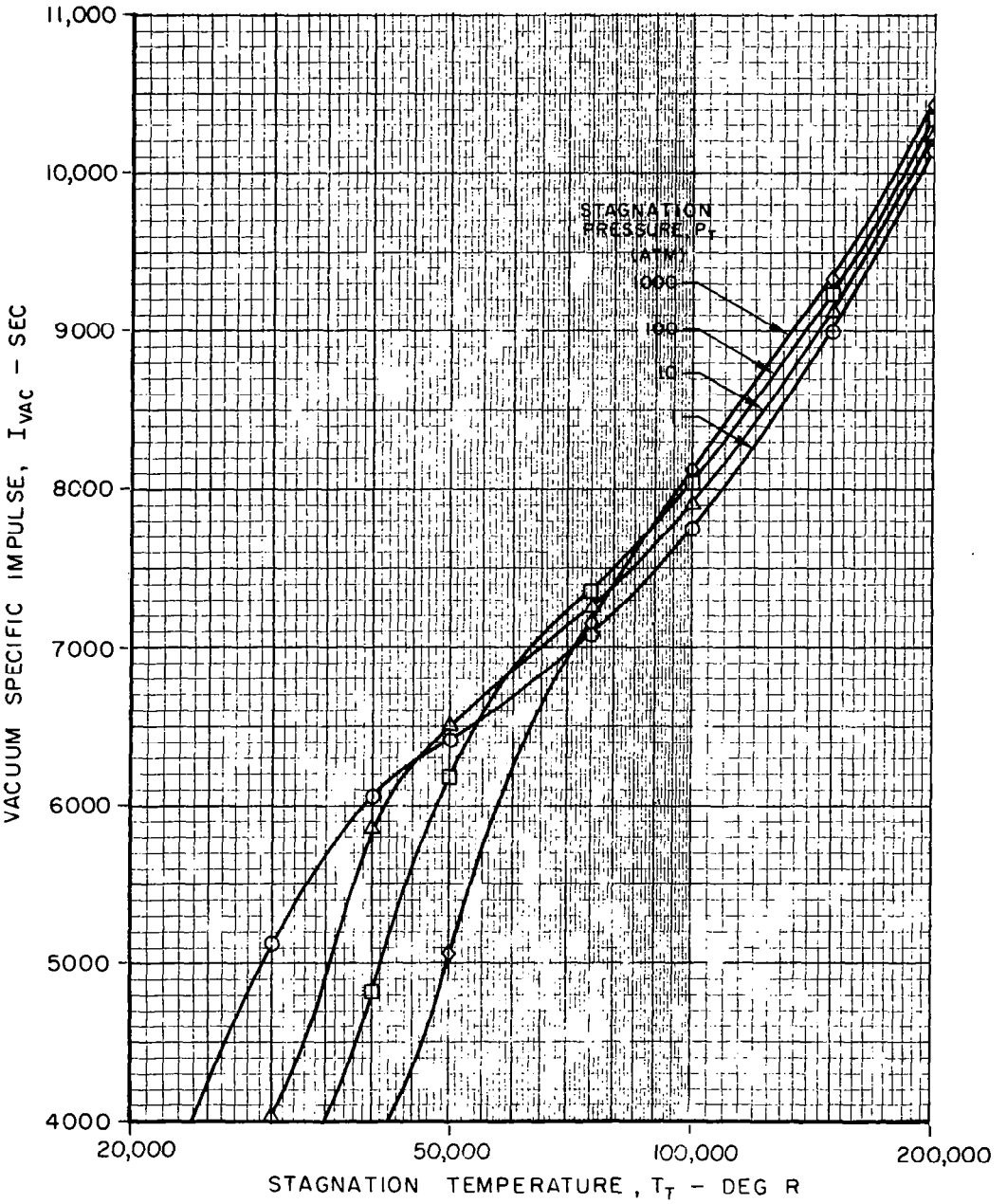
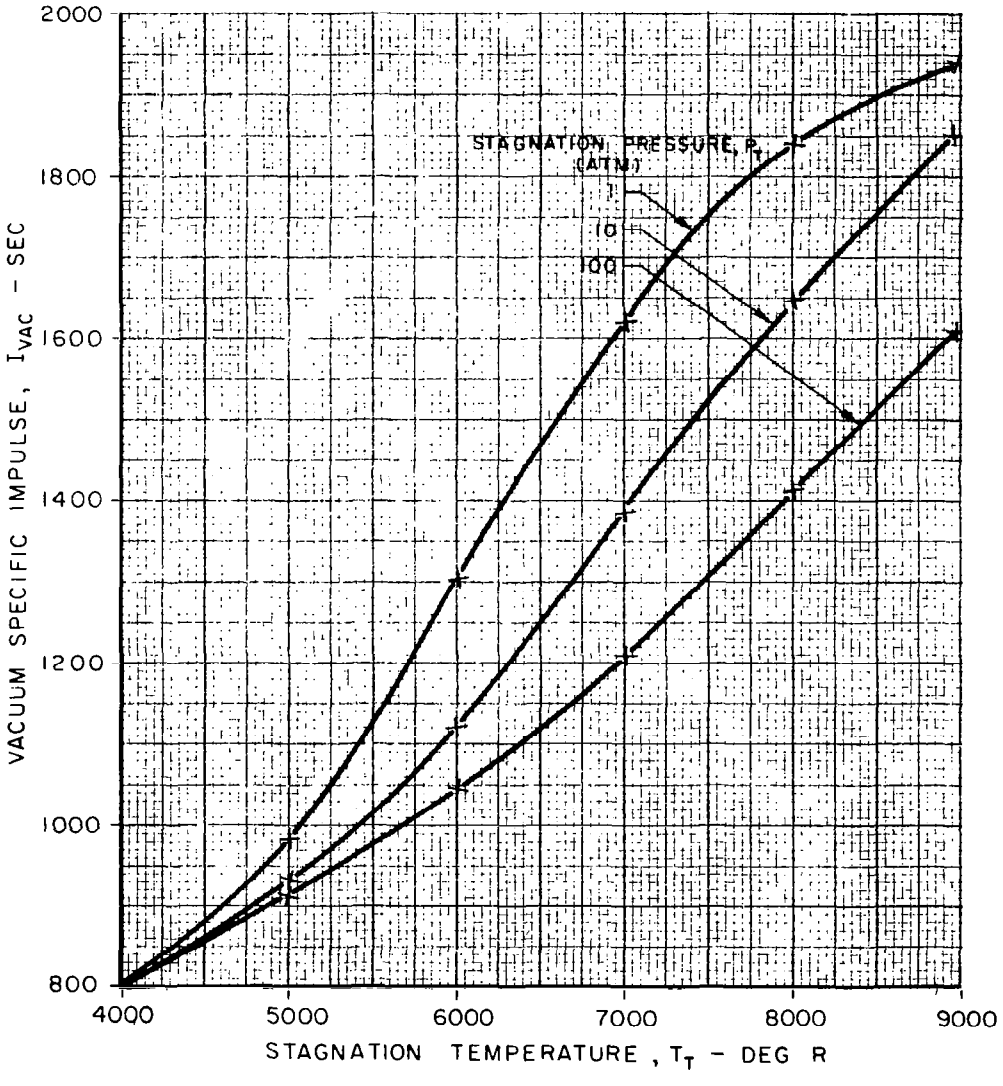


FIG. 10

COMPARISON OF CALCULATED SPECIFIC IMPULSE DATA WITH NASA DATA FROM REF. 4

RATIO OF EXHAUST PRESSURE TO STAGNATION PRESSURE, $P_{EX}/P_T = 1 \times 10^{-3}$
EQUILIBRIUM EXPANSION THROUGH EXHAUST NOZZLE
X INDICATES DATA CALCULATED IN THIS STUDY
——— INDICATES DATA FROM REF. 4