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EFFECT OF INJECTANT MOLECULAR WEIGHT ON MIXING OF A NORMAL JET IN A MACH 4 AIRSTREAM

by Marvin G. Torrence

Langley Research Center
Hampton, Va. 23365

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16. Abstract

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The decay of the maximum value of concentration with axial position was found to be a strong function of injectant molecular weight and the effect of molecular weight on vertical penetration was small. The rate of decay in the far field (downstream of the potential core) was similar for all injectants.

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SUMMARY

As part of a basic scramjet (supersonic combustion ram jet) research program, experiments have been conducted on mixing and penetration with normal injection in a supersonic airstream without chemical reaction. Molecular weight of the injected gases ranged from 2 (hydrogen) to 40 (argon). Pressure and mole fraction concentration surveys were made downstream of a sonic jet at axial stations as far as 200 jet orifice diameters. Jet—free-stream dynamic-pressure ratio was varied from 0.51 to 3.08. Nominal tunnel stagnation conditions were held constant during the program with a pressure of 17 atmospheres and temperature of 300° K. A nominal value of free-stream Mach number was 4.03 with a corresponding Reynolds number per meter of 7.87×10^{7}. The turbulent boundary layer on the flat-plate model had a thickness of approximately 3 jet orifice diameters.

The decay of the maximum value of concentration with axial position was found to be a strong function of injectant molecular weight and the effect of molecular weight on vertical penetration was small. The rate of decay in the far field (downstream of the potential core) was similar for all injectants and much slower than that for coaxial mixing. Penetration increases substantially at downstream stations because of mixing and increases with dynamic-pressure ratio.

INTRODUCTION

The concept of the scramjet (supersonic combustion ramjet) engine as a propulsion unit for hypersonic vehicles has stimulated considerable research effort in recent years. One of the important areas in the design of the supersonic combustor is the method of fuel injection employed. Some of the analytical and experimental work on tangential, normal, and coaxial injection is reported in references 1 to 9. Although normal injection affords greater penetration, the additional momentum gained by tangential or parallel injection may produce significant increases in engine thrust at hypersonic flight velocities. (See ref. 3.) To obtain uniform fuel distribution and minimum-length combustors, adequate design methods must be developed. Because of the complexity of the flow field downstream of a fuel injector, the form of correlating and design expressions must be highly empirical.

An experimental study has been made to obtain basic mixing and penetration data without chemical reaction by use of a single choked normal injector mounted flush to the surface of a flat plate in a Mach 4.03 airstream. This flow situation is simplified compared with a real supersonic combustor; however, the simplification is justified on the basis that a better understanding of some of the basic phenomena occurring in the complex flow may be obtained. The initial part of the investigation was an extension of work reported in reference 1; however, later experiments were directed at determining the effect of the molecular weight of the injectant on the mixing because a survey of the literature had indicated qualitatively that this parameter was important. A few of the early results of the experiments were reported in reference 10. The information presented in the present paper includes all the results and more detailed data analyses.

One of the important features of the flow conditions for both the present data and that of reference 1 is that the boundary layer is relatively thick compared with the injector diameter ($\delta/D = 3.0$). Most data in the literature correspond to thinner boundary layers; however, a value of approximately 3.0 is considered to be applicable to small-scale engines or to designs where fuel injection from both the wall and points in the stream is used.

In the initial part of the investigation, air-in-air mixing was studied by use of an ethylene tracer in the injected gas flow. A mixture of 3 percent by volume of ethylene in air produced a gas with a molecular weight essentially that of air. The principal variables for this part of the investigation were the downstream axial survey stations of 7, 15, 30, and 60 jet diameters and jet—free-stream dynamic-pressure ratios of 3.08, 1.75, 1.0, and 0.51. In later experiments additional survey data were taken at several axial locations with the use of other injectant gases including hydrogen, helium, and argon. Premixed helium-air and argon-air injectants provided jets with molecular weights of 8.2, 17.6, 22, and 36. With the exception of the air-in-air testing, a jet—free-stream dynamic-pressure ratio of unity was maintained.

Center-line vertical surveys were made to determine concentration, pitot-pressure, and static-pressure distributions at all test conditions and axial-survey stations. Lateral surveys were made at the downstream station of 30 jet diameters for each test condition. The position at which the lateral survey was made coincides with the point of maximum concentration measured by the center-line vertical survey. Nominal tunnel stagnation conditions were held constant during the experimental program, a pressure of 17 atmospheres (1723 kN/m^2) and temperature of 300° K. The free-stream Mach number was approximately 4.03 with a Reynolds number per meter of 7.87×10^7.

SYMBOLS

A	cross-sectional area, meters^2
B	mole fraction of injected gas
C_D	jet-orifice discharge coefficient
C_p	specific heat at constant pressure
D	jet orifice diameter, 0.123 millimeter
G	mass flow per unit cross-sectional area, kilograms/meter^2-second
h	penetration height, meters
K	mass fraction of injected gas
M	Mach number
$\mathcal{M}$	molecular weight
N	boundary-layer profile exponent; for example, $\frac{V}{V_\infty} = \left(\frac{z}{\delta}\right)^{1/N}$
p	absolute pressure, newtons/meter^2
q	dynamic pressure, newtons/meter^2
R	universal gas constant, joules/$^{\circ}$Kelvin-mole
T	absolute temperature, $^{\circ}$Kelvin
V	velocity, meters/second
x	longitudinal coordinate (origin at center of jet orifice)
x_o/D	correlating length
y	lateral coordinate

z	vertical coordinate
γ	ratio of specific heats
δ	boundary-layer thickness, meters
$\lambda = \frac{(\rho V)_j}{(\rho V)_\infty}$	
ξ	ratio of injected-gas mass flow per unit area at the survey point to jet mass flow per unit area, G_{jx}/G_j
ρ	mass density, kilograms/meter^3

Subscripts:

∞	free-stream conditions
t	stagnation conditions
max	maximum value
w	plate surface conditions
x	survey point
j	injected gas

APPARATUS AND PROCEDURE

Model and Facility

The model used in this investigation consisted of a rectangular flat plate containing a flush-mounted sonic orifice (D = 0.123 mm) normal to the plate surface. A sketch of the model is shown in figure 1(a). The facility used was a continuous-flow supersonic tunnel with the model spanning the 23-cm by 23-cm test section and the flow exhausting to the atmosphere. The schlieren photograph, shown as figure 1(b), indicates the formation of weak shocks from the plate leading edge in the tunnel free-stream flow above the jet bow wave. A nominal Mach number of 4.03 was measured in the flow field between the jet bow wave and the plate leading-edge wave. As used in this paper, this region is referred to as the free-stream flow. All measurements were taken well ahead of the points of reflection of the two waves. A detailed description of the model and facility can be found in reference 1. All test runs were made with dry air at tunnel stagnation conditions of 17 atmospheres and 300° K. The corresponding unit Reynolds number was 7.87×10^{7} per meter. At the jet location, the turbulent boundary-layer thickness was equal to 3 jet orifice diameters; this thickness remained constant throughout the investigation. A typical boundary-layer velocity profile is shown in figure 1(c).

Injectant System

The secondary flow routing for the air-in-air mixing experiments is shown schematically in figure 2. Metered quantities of settling chamber air and ethylene (C_2H_4) were mixed prior to injection in the proportions of a 3-percent ethylene mixture by volume. The flow system was modified for the tests involving the injectants other than air by introducing the injectants directly from high pressure cylinders. Downstream of the jet total-temperature probe, provisions were made for removal of a jet gas sample for a reference chromatograph reading. Jet pitot- and static-pressure measurements were made immediately ahead of the jet nozzle.

Instrumentation

Gas analysis.- A process gas chromatograph was used to obtain the concentration data. The fundamentals of gas chromatography can be found in reference 11. Because of the variety of gases used during this experiment, certain changes in the operation of the chromatograph had to be made. These modifications of the mode of operation or instrument configuration were concerned with carrier gas selection, cycle time, or separation column choice.

The operation of the chromatograph when measuring ethylene concentration is identical to that reported in reference 1. A helium carrier gas was selected primarily for its large thermal conductivity relative to that of ethylene. An inert carrier also reduces the probability of combustion. Activated alumina was used as the column packing to separate the ethylene and air. Calibration of the instrument with premixed ethylene-air mixtures indicated linearity well within the accuracy of 1 percent of full scale on the strip chart readout. Cycle time of analysis from sample introduction to readout was limited to a minimum of 3 minutes because of the requirement of high resolution for the detection of trace quantities of ethylene.

Similarly, the detection and measurement of the hydrogen component of a sample requires separation and a noncombustible carrier gas. Nitrogen was chosen as the carrier for hydrogen measurements because of the relative difference in conductivity and the nonreactive mixture. Helium was rejected as a carrier gas choice because of the small difference in conductivities and an anomalous detector cell response to H_2-He mixtures.

Reference 11 discusses the reversal of chromatograph readout at low hydrogen concentration levels in a helium carrier. The column used for hydrogen separation was a 6-foot (1.83-meter) length packed with molecular sieve No. 5A. Since hydrogen elutes first in any chromatograph column, the cycle time was reduced to 1 minute. This reduction was achieved by purging the column after the H_2 had separated and entered the detector line. The remaining component, oxygen, is removed in the purging process and is not permitted to pass through the detectors.

For the analysis of samples containing helium or argon, the chromatograph column was removed and the instrument was used as a simple thermal conductivity cell. While operating in this manner, the detectors are continuously swept by the sample flow and the magnitude of the signal output is very sensitive to sample mass flow rate. An equivalent length of stainless-steel tubing was installed in place of the column to produce the same pressure drop and approximately the same flow rate. Tunnel air was used to establish the chromatogram reference base line and peak height was an indication of the helium or argon content. The advantage of continuous concentration readout was canceled by the requirement of precise sample-flow-rate regulation and cycle time was approximately the same, 1 minute, as that for the hydrogen measurements.

The gas chromatograph was calibrated with each injectant used during this investigation. Before each test run, the instrument was calibrated and repeatability checked to a variation of less than 1 percent of full scale.

Flow measurements.- Jet gas mass-flow rates were measured with corner-tapped orifice meters. Ethylene tracer gas and sample flow rates were measured by direct-reading mass-flow-rate meters. A description of the mass-flow-rate meter is given in reference 1. Orifice-meter upstream static pressure and pressure drop were measured by a 300 psig (2.07×10^6 N/m^2) transducer and a ± 5 psid (3.45×10^4 N/m^2) differential pressure gage. Average discharge coefficients, based on the orifice flow measurements, for the jet nozzle are given in table I. The diameter of the jet nozzle was 0.123 millimeter.

TABLE I.- TEST CONDITIONS

Injectant	m_j	q_j/q_∞	λ	C_D	T_{tj}, °K
H_2	2.0	1.00	0.58	0.83	288
He	4.0	1.00	.78	.80	299
He-Air	8.2	1.00	1.11	.79	301
He-Air	17.6	1.00	1.66	.80	296
He-Air	22.0	1.00	1.87	.82	299
Air	29	.51	1.11	.82	299
Air	29	1.00	2.17	.85	299
Air	29	1.75	3.77	.95	300
Air	29	3.08	6.66	.96	300
A-Air	36	1.00	2.36	.84	298
A	40	1.00	2.45	.83	298

Pressure measurements.- Survey static and pitot pressures were measured by 5 psia (3.45×10^4 N/m^2) and 50 psia (3.45×10^5 N/m^2) pressure transducers, respectively. Both survey probes are shown in figure 3. Pitot-pressure surveys were made with the gas-sampling probe and were limited by probe geometry to heights of 0.381 millimeter and greater above the plate surface. Tunnel and jet stagnation conditions were measured with total-pressure probes and standard iron-constantan thermocouples. Measurement of the model surface pressures were made with four 12-port rotating scanning valves, each using a 3 psia (2.07×10^4 N/m^2) pressure transducer. Tunnel wall static pressures were measured directly by mercury manometers.

Test Procedure

Before each test run, check calibrations were made to test repeatability of concentration and pressure measuring instrumentation. Readout of pressure transducers was recorded on automatic balance potentiometers and the appropriate reference pressure was set before each run. In the case of pitot pressure, this reference was atmospheric pressure, whereas the survey and wall static cells were absolute pressure transducers. After tunnel run conditions were established, jet gas total pressure was set to provide the desired jet—free-stream dynamic-pressure ratio. A sample of the injectant gas was withdrawn from the jet nozzle supply line and analyzed for chromatograph full-scale readout.

Vertical data surveys were made in steps outward from the plate surface and lateral surveys were made in steps from left to right. This convention of survey direction was maintained throughout the experimental program to eliminate probe position error due to actuator mechanism play. It has been demonstrated in reference 2 that accuracy in gas concentration measurements can depend heavily on sampling technique. In an effort to minimize spillage and obtain a representative gas sample at the probe, samples were withdrawn from the test section by vacuum pump and the quantity in excess of the chromatograph requirements was bypassed to the atmosphere. Pitot pressures were measured with the gas sample probe immediately after concentration sampling and prior to moving the probe to a new position. Static-pressure measurements were made at each pitot survey point.

The concentration contours reported in reference 1 indicate that the flow cross section containing a mixture of combustible proportions is approximately circular. At the 30-diameter axial-survey stations, horizontal surveys were made at the vertical position of maximum concentration. This combination of vertical- and horizontal-survey data permits a good approximation of these contour plots. In the case of hydrogen injection, additional yaw surveys were made at points approximately one-half the distance from the plate surface to maximum concentration and one-half the distance from maximum to zero concentration. These additional surveys were made at $x/D = 30$ and $x/D = 120$.

At the beginning and end of each test run, model surface pressure scans were made and the stagnation temperatures were recorded. Tunnel wall static pressures and mass flow measurements were monitored continuously throughout a run and schlieren pictures taken at the end of each run.

Data Processing

Pressure and gas concentration survey data were reduced to determine local Mach number, mass flow per unit area, and mass fraction concentration. Since the evaluation of local Mach number requires the value of specific heat ratio for the sample mixture, mixture molecular weight, gas constant, and constant-pressure specific heat were computed from the following equations. The molecular weight of the mixture is given by

$$\mathcal{M}_x = B_x \mathcal{M}_j + (1 - B_x)\mathcal{M}_\infty \tag{1}$$

The mass fraction is given by

$$K_x = B_x \frac{\mathcal{M}_j}{\mathcal{M}_x} \tag{2}$$

and the mixture gas constant by

$$R_x = \frac{R}{\mathcal{M}_x} \tag{3}$$

The ratio of specific heats can be obtained from

$$\gamma_x = \frac{C_{px}}{C_{px} - R_x} \tag{4}$$

where

$$C_{px} = K_x C_{pj} + (1 - K_x) C_{p\infty}$$

Finally, the sample total temperature was assumed to be given by a mass-weighted average of the component gases since the two temperatures were approximately equal; as a result,

$$T_{tx} = K_x \frac{C_{pj}}{C_{px}} T_{tj} + (1 - K_x)\frac{C_{p\infty}}{C_{px}} T_{t\infty} \tag{5}$$

RESULTS AND DISCUSSION

The large range of variables and the detail in which they were studied necessitated the recording of extensive data in this experiment. Although it is not feasible to present the entire detailed analysis of these data, selected data plots are shown to illustrate important features. All the reduced data are given in the appendix.

Plate static-pressure distributions.- The model plate surface-pressure distributions along the axial center line are presented in figure 4. The wall pressures have been normalized by free-stream stagnation pressure, and the solid horizontal line represents a free-stream static pressure corresponding to $M_\infty = 4.03$. The data presented in figure 4(a) are for air injection and four different dynamic-pressure ratios. The axial-pressure distribution appears to be nearly constant with dynamic-pressure ratio at all axial stations except the region immediately downstream of the jet orifice. Only for the case of a q_j/q_∞ of 3.08 is there significant expansion of the flow below free-stream pressures at $x/D = 5.9$. A slight pressure buildup is noted forward of the jet for this same run condition.

Plate surface-pressure distribution is presented in figure 4(b) for injectant gases with different molecular weights and a dynamic-pressure ratio of unity. The values of pressure at the -31-, -20-, and -5.9-diameter stations were identical for each gas. Again the axial-distribution variation is slight for each gas with the exception of the downstream station at 5.9 nozzle diameters. At this station, the lighter injectants (H_2 and He) cause pressures slightly higher than the free-stream static pressure. This type of pressure distribution was reported in reference 7 and was believed to have been caused by reattachment of the jet to the wall. The data of figure 4(b) are interpreted as the reattachment of the separated jet, but the length of the separation region is shorter in the case of the lighter gases. Since the geometry of the test model prohibited the installation of pressure taps closer than 5.9 diameters, the low-pressure region downstream of the jet is not apparent in figure 4(b).

Concentration distributions.- Injectant-gas mass fraction concentration distributions are presented in figures 5 to 7. Figures 5(a) to 5(d) present vertical center-line profiles for air injectant with varying pressure ratio at axial stations of 7, 15, 30, and 60 jet-orifice diameters. The vertical penetration height h is defined as the position above the plate surface at which the injected gas mole fraction is equal to 0.005. The similarity between profiles for the far-field downstream stations of 30 and 60 diameters is apparent for each of the four pressure ratios. The distortion of the flow field near the jet ($x/D = 7$ and $x/D = 15$) is most evident for the higher pressure ratios (q_j/q_∞ of 3.08 and 1.75) and the least for a q_j/q_∞ of 0.51, which has relatively smooth profiles at all four survey stations. Figures 5(e), 5(f), and 5(g) present vertical center-line profiles for injectants of hydrogen, helium, and argon. In general, no significant difference can be seen in the shape of the profiles, but higher concentrations of argon were measured at each survey station. The same distorted flow field near the jet exit ($x/D = 7$) as that noted in figure 4(b) can be seen in the concentration profiles of the lighter gas injectants.

Several vertical profiles were chosen for comparison and are shown in figures 5(h), 5(i), and 5(j). In these figures, vertical height has been nondimensionalized by the distances to the points of maximum and zero concentrations. Concentration has also been divided by its maximum value. Air injectant profiles are shown in figure 5(h) where axial position has been varied. Above the height at which K is maximum, the profile shapes are similar and the profiles become fuller as the axial station is increased. Figure 5(i) shows the effect of varying dynamic-pressure ratio on air injectant profiles at the 30-diameter station. Here again, above the K_{max} position, there appears to be a slight systematic variation with pressure ratio. In the case of figure 5(j), there is significant systematic variation with molecular weight, the heavier gases producing the fullest profiles. All these plots exhibit a random variation and no similarity below the height of maximum K.

The concentration and mass-flow contours reported in reference 1 indicate that the flow cross section containing a mixture of combustible proportions is approximately circular. At an axial station of 30 diameters, lateral surveys were made at the vertical position of maximum concentration for each test case and were used with the vertical surveys to approximate these contours and to obtain total integrated injectant flow. Plots of these lateral concentration distributions are shown in figure 6. The concentration K and lateral position y/D have been normalized by their respective maximum values for a given test configuration. Like the definition of penetration h, the value of $(y/D)_{max}$ corresponds to the point at which the mole fraction of injectant gas is 1/2 percent. The air injection data in figure 6(a) can be represented by a single curve fairing without excessive scatter. As would be expected, the lateral spreading and maximum concentration increases with increasing jet pressure. For a fixed dynamic-pressure ratio of unity, the lateral concentration distribution with varying molecular weight is presented in figure 6(b). Although there is some similarity between the profiles of the different gases, the detailed profile shape appears to be a function of molecular weight. Lateral profiles at 30 and 120 diameters are shown in figure 6(c) for hydrogen injection. The data show that the normalized profiles become fuller with increasing downstream distance. The decrease in $(y/D)_{max}$ with axial position is due to the shift away from the plate of the maximum concentration position rather than a reduction in the total spreading of the injectant. This shift can be seen in the mass-fraction contour plots of figure 7.

As previously stated, lateral surveys were made at the vertical position of maximum concentration for each injected gas at the station of $x/D = 30$. Since hydrogen is a fuel used in scramjet operation, additional lateral surveys were made in this case at the midpoints between the plate and maximum concentration and between the penetration height and maximum concentration position. The contours presented in figure 7 were generated from these horizontal and vertical survey data and represent lines of constant mass fraction of hydrogen concentration with the nominal zero concentration contour corresponding to a mole fraction of 0.005. At the 30-diameter station, lateral surveys were made at z/D positions of 1.01, 1.85, and 3.90. Lateral surveys were made at vertical positons of 2.25, 3.90, and 6.37 diameters at the 120-diameter axial station and the resulting contour fairings are shown in figure 7(b). It should be noted that the center portion of this contour plot contains a region of near stoichiometric fuel mixture. In general, the contours of figure 7 have roughly a semicircular shape above the maximum concentration point. At the 120-diameter station the contours extend to greater heights on the vertical center line without much change in width, in comparison with the 30-diameter station. Additional significant changes are in the shape of the zero contour and in the location and value of maximum concentration.

Contours of fuel mass flow per unit area are presented in figure 8. This type of plot was made for each injectant used, and the integrated mass flow was compared with the metered jet flow. Values of this ratio of integrated mass flow to metered mass flow are presented in figure 9 with a maximum mass-flow deficiency of 20 percent of the measured value in the case of a helium-air mixture with molecular weight of 8.2. In general, the larger errors occur when the injectant used was helium or helium-air mixtures. Experience gained from the investigations of references 1 and 2 indicates that accuracies within 10 percent to 15 percent represent a high order of agreement for work of this type.

Airflow mixing.- The data taken in the present mixing investigation cannot be expected to apply directly to the design of a supersonic combustor because a number of parameters were not simulated, such as pressure gradients, chemical reaction, density and velocity ratios. Nevertheless, qualitative comparisons are of interest, and, in this regard, the airflow quantities which actually mixed with the injectant have been determined by plotting and integrating contours similar to those of figure 10. The results of the integrations are given in figure 11 in terms of A_∞/A_j as a function of molecular weight of the injectant. The parameter A_∞ represents the area of the undisturbed free-stream stream tube at the injector station which would contain the mixed air. The results show a significant effect of molecular weight, H_2 providing the highest mixing rate; moving from station 30 to station 120 approximately doubled the amount of air mixed with H_2. The square root of the ratio A_∞/A_j provides a rough indication of the width and height of A_∞. For H_2 at the 120-diameter station (maximum concentration approximately stoichiometric), the dimensions of the free-stream stream tube would be on the order of 9 diameters. In actual combustors the wall injectors have been designed to provide smaller values of penetrations and lateral spacing than 9 diameters, which qualitatively appears to be the correct trend because overlapping mixing patterns are desired to provide more uniform fuel-air distributions.

Penetration.- Injectant penetration h is shown in figure 12 for the range of variables used in this investigation. The air-injection data of figure 12(a) show an expected higher penetration for the larger q_j/q_∞ and a stronger dependence on axial position for the lower pressure ratios. Examination of figure 12(b) indicates a small variation in penetration due to the molecular weight of the injected gas for a fixed axial position and pressure ratio. The lateral spreading or penetration parameter shown in figure 12(b) is significantly larger than the vertical penetration and also is a stronger function of molecular weight. Its value ranges from 2.9 times the vertical penetration for H_2 to a factor of 1.2 for argon. For the case of a fixed pressure ratio and variation of axial station (fig. 12(c)) a small effect of molecular weight again can be seen in the data spread at stations of 7, 30, and 60 diameters. It is evident from this figure that penetration increases substantially at the downstream stations because of mixing.

Vertical position for maximum concentration.- The vertical position of the point of maximum injectant mass fraction is presented in figure 13. Some investigators define this point as the jet penetration height in developing analytical and empirical flow models and correlations. There is apparently considerable scatter in the air injection data for a variation in dynamic pressure as shown in figure 13(a), the most extreme case being the pressure ratio of 0.51 and the downstream station of 60 diameters. The data scatter may be associated with the fact that this parameter has values close to the undisturbed boundary-layer thickness. Figure 13(b) does not indicate any systematic molecular weight effect at x/D of 30. Although hydrogen and air $(\mathcal{M} = 2$ and $\mathcal{M} = 29)$ have the same specific heat ratio ($\gamma = 1.4$) and these points are lower than all others, this result does not appear to be significant because the higher points include a variation of γ from 1.45 to 1.67. Variation of $(z/D)_{K=max}$ with axial position for a constant dynamic-pressure ratio is shown in figure 13(c). Examination of the profiles of figure 5 will explain the multiple maximum concentration positions as seen in figure 13(c) at downstream stations of 30 and 60 diameters. The data for H_2 and air suggest that the point of maximum concentration initially moves toward the plate and produces a minimum value of $(z/D)_{K=max}$. The curve fairings also indicate a trend which, in general, is a large increase in $(z/D)_{K=max}$ for the lighter gases at the far downstream stations.

Decay of maximum values of mass concentration.- An important quantity needed for the proper design of the supersonic combustor is the mixing length required for the injected fuel mass fraction to decay to a desired combustible value. An index to this parameter sometimes is taken to be the length required to reach the design fuel-air ratio as determined from maximum concentrations in single injector tests. The data presented in figure 14(a) are relevant to this consideration; the decay of maximum concentration is given as a function of x/D and molecular weight. In the case of coaxial mixing (ref. 4), investigators have used the concept of a potential core length to nondimensionalize the axial coordinate when correlating data. This length is defined as the distance from the jet exit to the point on the axial center line where the concentration first decreases from 100-percent injectant. A correlating parameter of this type for the present normal injection data has been obtained by extrapolating the curves of figure 14(a) to a concentration of 100 percent and defining the intercept as the correlating length x_o/D.

This correlating length should not be interpreted literally as being the same as the length of the potential core, particularly for the lighter injectants, since the end of the potential core apparently is a considerable distance upstream from the first survey station. Curves representing rate of decay for coaxial mixing (from refs. 2 and 4) are shown on the figure. The correlation of reference 4 is for hydrogen injectant and the data of reference 2 are for air-in-air mixing. A comparison of slopes indicates a much higher rate of decay for coaxial mixing than for the normal injection at axial positions downstream of the 100-percent concentration intercept. Examination of figure 14(a) shows this intercept for coaxial mixing at a much greater downstream distance than that for the normal injection. A comparison of the hydrogen curve faired through the present data with the curve from reference 4 indicates that at $x/D > 30$, the overall concentration decay is greater for coaxial injection.

In performing the extrapolation, a study of the data indicated that all the points could be represented well by the same curve, which is a straight line on log-log coordinates with a slope of -0.5 between concentration values of 1.0 and 0.10 and a curved line below 0.10 determined from a fairing of the H_2 and helium data. This same curve is shown in the correlation of figure 14(b). In general, the data deviations from the correlation line are on the order of 10 percent with a maximum of 20 percent.

The correlation parameter x_o/D_j is presented as a function of λ in figure 15 with the values of molecular weight and specific heat ratio noted. An empirical interpolation formula which fits the data also is given on the figure and the dashed line was calculated for air injectant. From the data and the formula, x_o/D_j clearly is seen to be a function not only of λ but also of molecular weight and γ for the present data. The correlation parameter x_o/D_j is much smaller for normal injection $\left(0.316\lambda^{0.543}\right.$ for hydrogen$\left.\right)$ than the coaxial value $\left(11.1\lambda^{0.5}\right)$. It should be noted that the empirical representations presented here apply only to the present data and may change with changes in flow conditions.

CONCLUDING REMARKS

The results of experiments on mixing without reaction have been presented for sonic normal injection of gases from a circular injector in a flat plate mounted in a Mach 4 airstream. The principal variable in the experiments was the molecular weight of the injectant; for an injectant molecular weight of 29, the dynamic-pressure ratio between the jet and free stream also was varied. One of the important features of the flow conditions was a relatively thick turbulent boundary layer which corresponded to a ratio of boundary-layer thickness to injector diameter of 3. Surveys were made at several downstream stations to obtain distributions of injectant concentrations and other parameters. The following summarizes some of the main features of the data.

When nondimensionalized by the distances to the points of maximum and zero concentrations the shape of concentration profiles measured at downstream stations varied significantly with changes in molecular weight and station location but exhibited only a small effect of changes in injection-pressure ratio. At a given station, between the flat plate and the point of maximum concentration, the effect of various variables on concentration distribution had a random character whereas above the maximum concentration point, the data were systematic. The upper parts of contours on concentration maps were roughly semicircular; this shape suggests the possibility of basing an analytical representation on modified coaxial mixing theory for the purpose of estimating some features of the mixing, that is, concentration decay and distribution of flow parameters.

The vertical penetration of the injectant to the point of zero concentration increased by substantial amounts with increasing distance downstream as a result of mixing; the effect of molecular weight on penetration was small. For both hydrogen and air injection, the trajectory of the point of maximum concentration initially approached the flat plate and then turned away from the plate; for helium and argon, this effect was not noted. For hydrogen and helium, the trajectory moved rapidly away from the plate after reaching a point some 30 or 40 injector diameters downstream.

The decay of the maximum value of concentration with downstream distance was a strong function of injectant molecular weight primarily as a result of large changes in the distance to the point where the value initially became smaller than 1.0, a distance analogous to potential core length in coaxial mixing. The rate of decay downstream of the potential core was similar for all injectants and much slower than that for coaxial mixing.

Langley Research Center,
National Aeronautics and Space Administration,
Hampton, Va., September 22, 1970.

APPENDIX

REDUCED DATA

The reduced data obtained from this experiment are presented in this section in their entirety. The format used for data tabulations is that of computer program output. In numbering the sequence of runs, run 30 was omitted. For the purpose of clarity the original units of the parameters (U.S. Customary Units) have been retained and the following key defines the computer readout symbols:

X	longitudinal coordinate
Y	lateral coordinate
Z	vertical coordinate
D	jet orifice diameter
QJ/QI	jet to free-stream dynamic-pressure ratio
LAMDA	jet to free-stream mass flux ratio
GAMMA	ratio of specific heats
RHOVJ	jet mass flow per unit area
K	mole fraction of injected gas
PT2X	survey pitot pressure
P1X	static pressure
MWX	molecular weight of survey gas sample
MX	Mach number
TTX	total temperature
TX	static temperature

VX	velocity
RHOVX	mass flow per unit area
XI	ratio of injected gas mass flow per unit area at survey point to jet mass flow per unit area (see ξ in "Symbols")
GX	mass fraction of injected gas
RHOVX*(1-GX)	survey-point air mass flow per unit area
XIM	maximum XI
GXM	maximum GX
AIRMFM	maximum RHOVX*(1-GX)
AKXM	maximum K

RUN NO. 1 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 7

QJ/QI = 3.0822 LAMDA = 6.6712

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	544	149.78
TUNNEL GAS	29.000	.2400	1.399	556	249.78

RHOVJ = 1.5293E+01

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.0932	2.900	1.525	29.00	1.004	555	462	1056.58	.2931	1.7858E-03	9.3182E-02	2.6577E-01
0.00	.3918	.0932	2.600	1.525	29.00	.908	555	477	970.17	.2609	1.5896E-03	9.3182E-02	2.3657E-01
0.00	.5979	.0705	2.100	1.550	29.00	.673	555	509	743.99	.1903	8.7691E-04	7.0455E-02	1.7693E-01
0.00	1.0103	.1364	3.950	1.490	29.00	1.280	554	418	1281.44	.3841	3.4252E-03	1.3636E-01	3.3174E-01
0.00	1.8351	.2591	4.700	1.280	29.00	1.567	553	371	1478.05	.4285	7.2590E-03	2.5909E-01	3.1745E-01
0.00	2.2474	.2614	3.350	1.270	29.00	1.276	553	417	1276.54	.3265	5.5803E-03	2.6136E-01	2.4117E-01
0.00	2.6598	.4648	3.150	1.285	29.00	1.215	550	425	1226.79	.3116	9.4693E-03	4.6477E-01	1.6676E-01
0.00	3.0722	.8364	4.000	1.295	29.00	1.411	546	391	1366.06	.3805	2.0812E-02	8.3636E-01	6.2270E-02
0.00	3.4845	.9000	7.050	1.315	29.00	1.945	545	311	1678.65	.5971	3.5142E-02	9.0000E-01	5.9713E-02
0.00	3.8969	.7114	9.650	1.335	29.00	2.289	547	268	1833.69	.7688	3.5763E-02	7.1136E-01	2.2191E-01
0.00	4.3093	.5489	11.500	1.355	29.00	2.494	549	245	1912.09	.8884	3.1885E-02	5.4886E-01	4.0079E-01
0.00	5.1340	.3364	15.300	1.310	29.00	2.951	552	202	2051.53	1.1202	2.4639E-02	3.3636E-01	7.4342E-01
0.00	5.9588	.1795	21.300	1.215	29.00	3.641	554	152	2197.36	1.4770	1.7341E-02	1.7955E-01	1.2118E+00
0.00	6.7835	.0636	30.500	1.055	29.00	4.701	555	103	2331.78	2.0148	8.3842E-03	6.3636E-02	1.8866E+00
0.00	7.6082	.0136	42.200	1.060	29.00	5.529	556	78	2395.15	2.7262	2.4309E-03	1.3636E-02	2.6890E+00
0.00	8.0206	.0045	43.550	1.090	29.00	5.539	556	78	2396.00	2.8125	8.3597E-04	4.5455E-03	2.7997E+00
0.00	8.2268	.0023	43.550	1.160	29.00	5.367	556	82	2385.20	2.8231	4.1956E-04	2.2727E-03	2.8167E+00

XIM = 3.5763E-02 GXM = 9.0000E-01 AIRMFM = 2.8167E+00 AKXM = 9.0000E-01

RUN NO. 2 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 7

QJ/QI = 1.7446 LAMDA = 3.7658

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	545	84.78
TUNNEL GAS	29.000	.2400	1.399	554	249.78

RHOVJ = 8.6481E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1417	4.800	1.525	29.00	1.428	553	393	1385.95	.4521	7.4065E-03	1.4168E-01	3.8805E-01
0.00	.3918	.1417	4.800	1.525	29.00	1.428	553	393	1385.95	.4521	7.4065E-03	1.4168E-01	3.8805E-01
0.00	.5979	.1370	4.350	1.530	29.00	1.340	553	407	1323.52	.4181	6.6214E-03	1.3695E-01	3.6085E-01
0.00	1.0103	.1771	5.400	1.500	29.00	1.549	552	374	1465.77	.4946	1.0128E-02	1.7710E-01	4.0698E-01
0.00	1.8351	.2597	4.900	1.340	29.00	1.563	552	371	1473.98	.4476	1.3443E-02	2.5974E-01	3.3133E-01
0.00	2.2474	.3164	3.850	1.330	29.00	1.355	551	403	1332.73	.3693	1.3512E-02	3.1641E-01	2.5245E-01
0.00	2.6598	.6682	4.300	1.335	29.00	1.448	548	386	1393.90	.4048	3.1281E-02	6.6824E-01	1.3430E-01
0.00	3.0722	.6257	8.200	1.355	29.00	2.079	548	294	1746.80	.6757	4.8887E-02	6.2574E-01	2.5287E-01
0.00	3.4845	.4675	10.500	1.380	29.00	2.353	550	261	1862.10	.8269	4.4702E-02	4.6753E-01	4.4028E-01
0.00	4.3093	.2645	12.700	1.415	29.00	2.569	552	238	1941.01	.9698	2.9656E-02	2.6446E-01	7.1330E-01
0.00	5.1340	.1133	20.200	1.325	29.00	3.388	553	168	2150.47	1.4252	1.8679E-02	1.1334E-01	1.2637E+00
0.00	5.9588	.0283	30.600	1.215	29.00	4.382	554	115	2296.88	2.0471	6.7073E-03	2.8335E-02	1.9891E+00
0.00	6.7835	C.0000	42.200	1.030	29.00	5.610	554	76	2396.03	2.7261	0.	0.	2.7261E+00

XIM = 4.8887E-02 GXM = 6.6824E-01 AIRMFM = 2.7261E+C0 AKXM = 6.6824E-01

RUN NO. 3 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 7

QJ/QI = 1.0038 LAMDA = 2.1667

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	546	48.78
TUNNEL GAS	29.000	.2400	1.399	555	249.78

RHOVJ = 4.9713E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2091	5.700	1.550	29.00	1.568	553	371	1479.23	.5193	2.1848E-02	2.0913E-01	4.1073E-01
0.00	.3918	.2212	5.700	1.550	29.00	1.568	553	371	1479.09	.5194	2.3106E-02	2.2115E-01	4.0453E-01
0.00	.5979	.2139	5.300	1.550	29.00	1.502	553	381	1436.22	.4905	2.1108E-02	2.1394E-01	3.8555E-01
0.00	1.0103	.2476	6.100	1.530	29.00	1.644	553	359	1525.75	.5464	2.7214E-02	2.4760E-01	4.1112E-01
0.00	1.8351	.2981	4.700	1.415	29.00	1.476	552	385	1417.89	.4379	2.6258E-02	2.9808E-01	3.0739E-01
0.00	2.2474	.4207	4.650	1.405	29.00	1.473	551	385	1414.32	.4340	3.6728E-02	4.2067E-01	2.5145E-01
0.00	2.6598	.4567	7.750	1.410	29.00	1.972	551	310	1700.62	.6497	5.9688E-02	4.5673E-01	3.5295E-01
0.00	3.0722	.3510	11.450	1.425	29.00	2.423	552	254	1891.17	.8912	6.2913E-02	3.5096E-01	5.7840E-01
0.00	3.4845	.2429	11.700	1.445	29.00	2.433	553	253	1856.40	.9086	4.4373E-02	2.4279E-01	6.8798E-01
0.00	4.3093	.0889	16.800	1.440	29.00	2.949	554	203	2055.26	1.2278	2.1966E-02	8.8942E-02	1.1186E+00
0.00	5.1340	.0168	28.100	1.345	29.00	3.934	555	133	2250.75	1.9108	6.4678E-03	1.6827E-02	1.8787E+00
0.00	5.5464	.0048	33.500	1.290	29.00	4.458	555	112	2307.44	2.2389	2.1652E-03	4.8077E-03	2.2282E+00
0.00	5.9588	0.0000	39.200	1.210	29.00	4.981	555	93	2355.16	2.5684	0.	0.	2.5684E+00

XIM = 6.2913E-02 GXM = 4.5673E-01 AIRMFM = 2.5684E+00 AKXM = 4.5673E-01

RUN NO. 4 COLC FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 7

QJ/QI = .5099 LAMDA = 1.0997

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	546	24.78
TUNNEL GAS	29.000	.2400	1.399	554	249.78

RFCVJ = 2.5254E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2273	6.350	1.575	29.00	1.655	552	357	1531.36	.5677	5.1106E-02	2.2733E-01	4.3868E-01
0.00	.3918	.2285	6.350	1.575	29.00	1.655	552	357	1531.35	.5677	5.1371E-02	2.2850E-01	4.3801E-01
0.00	.5979	.2356	6.050	1.575	29.00	1.609	552	364	1503.33	.5466	5.0987E-02	2.3557E-01	4.1784E-01
0.00	1.0103	.3133	6.300	1.550	29.00	1.663	551	355	1535.05	.5626	6.9803E-02	3.1331E-01	3.8636E-01
0.00	1.4227	.3298	4.750	1.515	29.00	1.425	551	392	1381.88	.4483	5.8545E-02	3.2980E-01	3.0045E-01
0.00	1.6289	.3392	4.500	1.500	29.00	1.386	551	398	1354.88	.4286	5.7565E-02	3.3922E-01	2.8318E-01
0.00	1.8351	.3357	4.500	1.490	29.00	1.392	551	398	1359.01	.4280	5.6888E-02	3.3569E-01	2.8430E-01
0.00	2.2474	.2921	7.000	1.485	29.00	1.810	552	334	1618.68	.6055	7.0042E-02	2.9211E-01	4.2866E-01
0.00	2.6598	.2167	11.900	1.485	29.00	2.419	552	255	1890.65	.9263	7.9491E-02	2.1673E-01	7.2553E-01
0.00	3.5258	.0483	15.700	1.515	29.00	2.772	554	219	2006.33	1.1689	2.2352E-02	4.8292E-02	1.1124E+00
0.00	4.3093	.0047	25.600	1.455	29.00	3.648	554	152	2198.71	1.7742	3.3100E-03	4.7114E-03	1.7659E+00
0.00	4.5155	.0024	28.300	1.440	29.00	3.861	554	139	2231.75	1.9380	1.8077E-03	2.3557E-03	1.9334E+00
0.00	4.7216	0.0000	31.450	1.425	29.00	4.097	554	127	2263.89	2.1289	0.	0.	2.1289E+00

XIM = 7.9491E-02 GXM = 3.3922E-01 AIRMFM = 2.1289E+00 AKXM = 3.3922E-01

RUN NO. 5 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 15

QJ/CI = 3.0819 LAMDA = 6.6847

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	531	149.75
TUNNEL GAS	29.000	.2400	1.399	545	249.75

RHOVJ = 1.5476E+01

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2232	5.950	1.605	29.00	1.576	542	362	1468.80	.5468	7.8875E-03	2.2325E-01	4.2471E-01
C.0C	.5979	.2232	5.750	1.605	29.00	1.544	542	367	1448.90	.5323	7.6782E-03	2.2325E-01	4.1344E-01
0.00	1.0103	.2727	9.550	1.580	29.00	2.078	541	291	1734.69	.7923	1.3963E-02	2.7273E-01	5.7622E-01
0.00	1.8351	.3337	6.400	1.415	29.00	1.768	540	333	1579.25	.5644	1.2170E-02	3.3372E-01	3.7603E-01
0.00	2.6598	.3406	5.600	1.360	29.00	1.675	540	346	1526.64	.5039	1.1091E-02	3.4062E-01	3.3226E-01
0.00	3.0722	.3774	5.650	1.360	29.00	1.684	540	345	1530.93	.5077	1.2382E-02	3.7745E-01	3.1606E-01
0.00	3.4845	.4695	6.000	1.375	29.00	1.732	538	337	1556.60	.5341	1.6204E-02	4.6951E-01	2.8334E-01
0.00	3.8969	.5224	7.700	1.405	29.00	1.969	538	303	1678.58	.6538	2.2070E-02	5.2244E-01	3.1221E-01
0.00	4.3093	.4626	11.150	1.42C	29.00	2.393	539	251	1857.60	.8821	2.6369E-02	4.6260E-01	4.7405E-01
0.00	5.1340	.2900	15.10C	1.420	29.00	2.809	541	210	1993.77	1.1327	2.1225E-02	2.8999E-01	8.0424E-01
0.00	5.9588	.1646	15.70C	1.400	29.00	2.889	543	204	2018.32	1.1663	1.2402E-02	1.6456E-01	9.7438E-01
0.00	6.7835	.0875	18.550	1.335	29.00	3.230	544	176	2100.63	1.3356	7.5479E-03	8.7457E-02	1.2188E+00
0.C0	7.6082	.0357	22.800	1.265	29.00	3.693	545	146	2187.18	1.5896	3.6642E-03	3.5673E-02	1.5329E+00
0.00	8.4330	.0115	28.100	1.200	29.00	4.223	545	119	2260.39	1.9074	1.4184E-03	1.1507E-02	1.8855E+00
0.00	8.8454	.0058	31.100	1.110	29.00	4.627	545	103	2303.13	2.0789	7.7293E-04	5.7537E-03	2.0669E+00
0.00	9.2577	C.0000	33.950	1.09C	29.00	4.883	545	95	2325.90	2.2511	0.	0.	2.2511E+00

XIM = 2.6369E-02 GXM = 5.2244E-01 AIRMFM = 2.2511E+CO AKXM = 5.2244E-01

RUN NO. 6 CCLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 15

QJ/QI = 1.7442 LAMDA = 3.7833

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	530	84.75
TUNNEL GAS	29.000	.2400	1.399	544	249.75

RHOVJ = 8.7666E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2399	6.190	1.610	29.00	1.610	541	356	1488.14	.5650	1.5463E-02	2.3991E-01	4.2949E-01
0.00	.6392	.2466	5.620	1.610	29.00	1.521	541	370	1432.00	.5238	1.4737E-02	2.4664E-01	3.9461E-01
0.00	1.0103	.3173	9.580	1.585	29.00	2.078	540	290	1732.08	.7960	2.8807E-02	3.1726E-01	5.4345E-01
0.00	1.4227	.3576	7.000	1.535	29.00	1.776	539	331	1581.83	.6170	2.5168E-02	3.5762E-01	3.9632E-01
0.00	1.8351	.3711	6.040	1.470	29.00	1.673	539	346	1523.42	.5445	2.3047E-02	3.7108E-01	3.4243E-01
0.00	2.2474	.3632	5.630	1.445	29.00	1.623	539	353	1493.38	.5133	2.1267E-02	3.6323E-01	3.2684E-01
0.00	2.7010	.3565	5.560	1.445	29.00	1.611	539	355	1486.34	.5082	2.0667E-02	3.5650E-01	3.2704E-01
0.00	3.0722	.3711	6.190	1.445	29.00	1.714	539	340	1546.84	.5530	2.3408E-02	3.7108E-01	3.4780E-01
0.00	3.4845	.3610	8.430	1.455	29.00	2.030	539	296	1709.44	.7068	2.9105E-02	3.6099E-01	4.5167E-01
0.00	3.5258	.3610	8.490	1.455	29.00	2.038	539	295	1713.09	.7108	2.9271E-02	3.6099E-01	4.5423E-01
0.00	3.8969	.3094	12.000	1.480	29.00	2.434	540	247	1874.34	.9429	3.3280E-02	3.0942E-01	6.5116E-01
0.00	4.3093	.2433	15.100	1.485	29.00	2.744	541	216	1974.77	1.1411	3.1665E-02	2.4327E-01	8.6348E-01
0.00	5.1340	.0953	19.910	1.460	29.00	3.198	543	178	2091.83	1.4386	1.5637E-02	9.5291E-02	1.3015E+00
0.00	5.9588	.0291	20.040	1.430	29.00	3.244	544	175	2103.27	1.4415	4.7929E-03	2.9148E-02	1.3995E+00
0.00	6.7835	.0078	24.410	1.370	29.00	3.671	544	147	2182.47	1.7049	1.5262E-03	7.8475E-03	1.6916E+00
0.00	7.1959	0.0000	27.100	1.340	29.00	3.918	544	134	2219.64	1.8672	0.	0.	1.8672E+00

XIM = 3.3280E-02 GXM = 3.7108E-01 AIRMFM = 1.8672E+00 AKXM = 3.7108E-01

RUN NO. 7 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 15

QJ/QI = 1.0041 LAMDA = 2.1803

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	525	48.80
TUNNEL GAS	29.000	.2400	1.399	540	249.80

RHOVJ = 5.0719E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.2294	6.100	1.625	29.00	1.588	537	357	1468.79	.5618	2.5409E-02	2.2938E-01	4.3295E-01
0.00	.5979	.2350	5.800	1.625	29.00	1.541	536	364	1439.49	.5400	2.5024E-02	2.3503E-01	4.1310E-01
0.00	1.0103	.3006	9.990	1.595	29.00	2.119	535	282	1743.49	.8273	4.9028E-02	3.0056E-01	5.7865E-01
0.00	1.4227	.3503	7.120	1.555	29.00	1.780	535	327	1577.80	.6295	4.3474E-02	3.5028E-01	4.0898E-01
0.00	1.8351	.3684	6.020	1.520	29.00	1.638	534	348	1496.52	.5492	3.9886E-02	3.6836E-01	3.4688E-01
0.00	2.2474	.3571	5.740	1.510	29.00	1.599	535	354	1473.37	.5282	3.7185E-02	3.5706E-01	3.3959E-01
0.00	2.6598	.3186	6.240	1.510	29.00	1.679	535	342	1521.56	.5637	3.5414E-02	3.1864E-01	3.8407E-01
0.00	3.4845	.2034	12.950	1.515	29.00	2.504	537	238	1893.47	1.0107	4.0531E-02	2.0339E-01	8.0514E-01
0.00	4.3093	.0723	21.500	1.515	29.00	3.265	539	172	2098.59	1.5507	2.2110E-02	7.2316E-02	1.4385E+00
0.00	5.1340	.0113	24.220	1.480	29.00	3.514	540	156	2147.87	1.7147	3.8202E-03	1.1299E-02	1.6953E+00
0.00	5.5464	.0023	23.080	1.470	29.00	3.440	540	161	2134.74	1.6420	7.3161E-04	2.2599E-03	1.6382E+00
0.00	5.7526	C.0000	23.760	1.46C	29.00	3.504	540	156	2146.43	1.6830	0.	0.	1.6830E+00

XIM = 4.9028E-02 GXM = 3.6836E-01 AIRMFM = 1.6953E+C0 AKXM = 3.6836E-01

RUN NO. 8 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 15

QJ/QI = .5103 LAMDA = 1.1090

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	527	24.80
TUNNEL GAS	29.000	.2400	1.399	543	249.80

RHOVJ = 2.5726E+00

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.	TX R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1773	6.000	1.630	29.00	1.569	540	362	1462.37	.5531	3.8115E-02	1.7729E-01	4.5502E-01
0.00	.5979	.1854	5.920	1.630	29.00	1.557	540	364	1454.40	.5473	3.9445E-02	1.8540E-01	4.4586E-01
0.00	1.0103	.2341	9.820	1.605	29.00	2.092	539	288	1737.79	.8142	7.4077E-02	2.3407E-01	6.2360E-01
0.00	1.4227	.2758	7.600	1.580	29.00	1.831	539	323	1610.40	.6625	7.1024E-02	2.7578E-01	4.7982E-01
0.00	1.6289	.2816	7.180	1.565	29.00	1.782	538	330	1584.41	.6323	6.9206E-02	2.8158E-01	4.5426E-01
0.00	1.8351	.2804	6.800	1.560	29.00	1.731	539	337	1556.13	.6054	6.5991E-02	2.8042E-01	4.3564E-01
0.00	2.2474	.2468	7.120	1.555	29.00	1.780	539	330	1584.14	.6270	6.0150E-02	2.4681E-01	4.7222E-01
0.00	2.6598	.1808	9.600	1.555	29.00	2.102	540	287	1743.71	.7939	5.5782E-02	1.8076E-01	6.5037E-01
0.00	3.0722	.1136	14.600	1.560	29.00	2.627	541	228	1940.78	1.1177	4.9335E-02	1.1356E-01	9.9074E-01
0.00	3.4845	.0579	20.380	1.575	29.00	3.112	542	185	2071.71	1.4839	3.3418E-02	5.7937E-02	1.3979E+00
0.00	3.8969	.0209	25.280	1.570	29.00	3.485	543	158	2148.29	1.7885	1.4501E-02	2.0857E-02	1.7512E+00
0.00	4.3093	.0046	28.480	1.540	29.00	3.742	543	143	2191.71	1.9828	3.5724E-03	4.6350E-03	1.9736E+00
0.00	4.7216	0.0000	28.800	1.515	29.00	3.796	543	140	2199.94	1.9990	0.	0.	1.9990E+00

XIM = 7.4077E-02 GXM = 2.8158E-01 AIRMFM = 1.9990E+00 AKXM = 2.8158E-01

RUN NO. 9 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 3.0828 LAMDA = 6.6614

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	537	149.86
TUNNEL GAS	29.000	.2400	1.399	547	249.86

RHOVJ = 1.5400E+01

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2328	4.000	1.630	29.00	1.216	545	421	1221.05	.3977	6.0113E-03	2.3280E-01	3.0509E-01
0.00	.5979	.2466	4.050	1.630	29.00	1.226	545	419	1228.88	.4019	6.4340E-03	2.4656E-01	3.0278E-01
0.00	1.0103	.2718	11.350	1.620	29.00	2.251	544	271	1813.29	.9123	1.6100E-02	2.7179E-01	6.6434E-01
0.00	1.8351	.3394	9.650	1.550	29.00	2.112	544	288	1753.61	.7941	1.7504E-02	3.3945E-01	5.2455E-01
0.00	2.6598	.3681	7.900	1.490	29.00	1.933	543	311	1669.86	.6718	1.6059E-02	3.6812E-01	4.2452E-01
0.00	3.0722	.3739	7.450	1.490	29.00	1.871	543	320	1638.37	.6414	1.5571E-02	3.7385E-01	4.0161E-01
0.00	3.4845	.3716	7.350	1.505	29.00	1.846	543	323	1625.67	.6359	1.5343E-02	3.7156E-01	3.9964E-01
0.00	4.3093	.3211	8.600	1.500	29.00	2.018	544	300	1711.67	.7194	1.5000E-02	3.2110E-01	4.8839E-01
0.00	5.1340	.2500	13.800	1.500	29.00	2.603	544	231	1939.28	1.0562	1.7146E-02	2.5000E-01	7.9216E-01
0.00	5.9588	.1548	19.500	1.510	29.00	3.109	545	186	2077.43	1.4158	1.4233E-02	1.5482E-01	1.1966E+00
0.00	6.7835	.0596	23.050	1.515	29.00	3.385	546	166	2136.97	1.6365	6.3368E-03	5.9633E-02	1.5389E+00
0.00	7.6082	.0183	25.200	1.515	29.00	3.544	547	156	2166.93	1.7693	2.1080E-03	1.8349E-02	1.7368E+00
0.00	8.4330	.0046	26.350	1.500	29.00	3.645	547	150	2184.27	1.8382	5.4754E-04	4.5872E-03	1.8298E+00

XIM = 1.7504E-02 GXM = 3.7385E-01 AIRMFM = 1.8298E+00 AKXM = 3.7385E-01

RUN NO. 9 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .C485 INCHES, X/D= 30

CJ/QI = 3.0828 LAMDA = 6.6614

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	537	149.86
TUNNEL GAS	29.000	.2400	1.399	547	249.86

RHOVJ = 1.5400E+01

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
-7.46	3.0722	0.0000	27.050	1.310	29.00	3.960	547	132	2231.54	1.8548	0.	0.	1.8548E+00
-5.57	3.0722	.0138	27.150	1.335	29.C0	3.929	547	134	2227.04	1.8647	1.6663E-03	1.3761E-02	1.8390E+00
-4.60	3.0722	.0206	26.500	1.360	29.00	3.844	547	138	2214.77	1.8282	2.4505E-03	2.0642E-02	1.7905E+00
-3.25	3.0722	.1147	20.700	1.390	29.00	3.347	546	169	2128.66	1.4743	1.C979E-02	1.1468E-01	1.3052E+00
-2.22	3.0722	.2225	15.950	1.405	29.00	2.907	545	203	2027.02	1.1804	1.7053E-02	2.2248E-01	9.1783E-01
-1.19	3.0722	.3211	10.400	1.445	29.00	2.284	544	266	1825.44	.8320	1.7348E-02	3.2110E-01	5.6487E-01
-.00	3.0722	.3853	7.400	1.475	29.00	1.874	543	319	1640.02	.6367	1.5931E-02	3.8532E-01	3.9137E-01
.86	3.0722	.3842	7.550	1.500	29.00	1.878	543	319	1641.80	.6492	1.6194E-02	3.8417E-01	3.9977E-01
1.94	3.0722	.3670	7.400	1.505	29.00	1.853	543	322	1629.41	.6393	1.5234E-02	3.6697E-01	4.0470E-01
3.02	3.0722	.2959	9.700	1.490	29.00	2.163	544	281	1776.74	.7909	1.5196E-02	2.9587E-01	5.5692E-01
4.16	3.0722	.1560	18.250	1.490	29.00	3.025	545	193	2C57.63	1.3349	1.3519E-02	1.5596E-01	1.1267E+00
5.18	3.0722	.0688	22.900	1.465	29.00	3.432	546	163	2145.79	1.6205	7.2405E-03	6.8807E-02	1.5090E+00
6.26	3.0722	.0161	26.550	1.420	29.00	3.763	547	143	2202.84	1.8397	1.9179E-03	1.6055E-02	1.8101E+00
7.29	3.0722	.0023	27.850	1.415	29.C0	3.864	547	137	2218.02	1.9190	2.8580E-04	2.2936E-03	1.9146E+00

XIM = 1.7348E-02 GXM = 3.8532E-01 AIRMFM = 1.9146E+00 AKXM = 3.8532E-01

RUN NO. 10   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES. X/D= 30

QJ/QI = 1.7454   LAMDA = 3.7751

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	535	84.84
TUNNEL GAS	29.000	.2400	1.399	546	249.84

RHOVJ = 8.7348E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2230	4.050	1.650	29.00	1.216	544	420	1219.94	.4030	1.0288E-02	2.2296E-01	3.1317E-01
0.00	.5979	.2119	4.250	1.655	29.00	1.254	544	414	1248.93	.4197	1.0183E-02	2.1192E-01	3.3076E-01
0.00	1.0103	.2185	12.800	1.645	29.00	2.382	544	255	1862.09	1.0096	2.5260E-02	2.1854E-01	7.8895E-01
0.00	1.8351	.2748	10.300	1.595	29.00	2.154	543	282	1770.97	.8420	2.6493E-02	2.7483E-01	6.1060E-01
0.00	2.2474	.2925	9.200	1.575	29.00	2.039	543	297	1719.73	.7674	2.5697E-02	2.9249E-01	5.4293E-01
0.00	2.6598	.3024	8.500	1.570	29.00	1.956	543	308	1679.93	.7202	2.4935E-02	3.0243E-01	5.0236E-01
0.00	2.8660	.3068	8.350	1.565	29.00	1.940	543	310	1672.13	.7096	2.4928E-02	3.0684E-01	4.9188E-01
0.00	3.0722	.3024	8.350	1.565	29.00	1.940	543	310	1672.20	.7096	2.4569E-02	3.0243E-01	4.9499E-01
0.00	3.4845	.2649	9.050	1.575	29.00	2.021	543	299	1711.71	.7572	2.2963E-02	2.6490E-01	5.5660E-01
0.00	4.3093	.1898	13.150	1.550	29.00	2.494	544	243	1902.32	1.0211	2.2192E-02	1.8985E-01	8.2721E-01
0.00	5.1340	.0949	21.600	1.545	29.00	3.240	545	176	2105.07	1.5523	1.6869E-02	9.4923E-02	1.4049E+00
0.00	5.9588	.0210	26.450	1.545	29.00	3.597	546	152	2173.93	1.8526	4.4479E-03	2.0971E-02	1.8138E+00
0.00	6.7835	.0022	28.850	1.535	29.00	3.773	546	142	2202.63	1.9995	5.0532E-04	2.2075E-03	1.9951E+00

XIM = 2.6493E-02   GXM = 3.0684E-01   AIRMFM = 1.9951E+00   AKXM = 3.0684E-01

RUN NO. 10 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.7454 LAMDA = 3.7751

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	535	84.84
TUNNEL GAS	29.000	.2400	1.399	546	249.84

RHOVJ = 8.7348E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
-6.54	2.8660	0.0000	25.800	1.480	29.00	3.630	546	150	2180.01	1.8030	0.	0.	1.8030E+00
-5.51	2.8660	.0221	25.300	1.480	29.00	3.594	546	152	2173.44	1.7724	4.4793E-03	2.2075E-02	1.7333E+00
-4.43	2.8660	.0309	24.700	1.480	29.00	3.550	546	155	2165.70	1.7353	6.1399E-03	3.0905E-02	1.6817E+00
-3.35	2.8660	.0640	22.700	1.480	29.00	3.399	545	165	2137.50	1.6116	1.1812E-02	6.4018E-02	1.5085E+00
-2.22	2.8660	.1634	16.900	1.520	29.00	2.876	544	205	2017.71	1.2553	2.3477E-02	1.6336E-01	1.0503E+00
-1.13	2.8660	.2605	10.200	1.555	29.00	2.172	543	280	1779.02	.8312	2.4787E-02	2.6049E-01	6.1467E-01
0.00	2.8660	.3355	8.100	1.560	29.00	1.911	542	314	1657.18	.6925	2.6601E-02	3.3554E-01	4.6013E-01
.54	2.8660	.2020	13.300	1.565	29.00	2.496	544	242	1902.86	1.0325	2.3877E-02	2.0199E-01	8.2397E-01
1.08	2.8660	.3146	8.250	1.565	29.00	1.927	543	312	1665.60	.7029	2.5315E-02	3.1457E-01	4.8182E-01
1.13	2.8660	.2042	12.550	1.565	29.00	2.420	544	251	1876.35	.9844	2.3012E-02	2.0419E-01	7.8336E-01
2.16	2.8660	.2009	13.100	1.565	29.00	2.476	544	245	1896.03	1.0197	2.3451E-02	2.0088E-01	8.1485E-01
3.24	2.8660	.0728	21.500	1.565	29.00	3.211	545	178	2099.34	1.5483	1.2913E-02	7.2848E-02	1.4355E+00
4.32	2.8660	.0177	24.850	1.570	29.00	3.454	546	161	2148.91	1.7567	3.5517E-03	1.7660E-02	1.7257E+00
5.40	2.8660	.0044	25.500	1.505	29.00	3.578	546	154	2171.05	1.7879	9.0370E-04	4.4150E-03	1.7800E+00

XIM = 2.6601E-02 GXM = 3.3554E-01 AIRMFM = 1.8030E+00 AKXM = 3.3554E-01

RUN NO. 11 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES. X/D= 30

QJ/QI = 1.0048 LAMDA = 2.1691

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	539	48.84
TUNNEL GAS	29.000	.2400	1.399	548	249.84

RHOVJ = 5.0097E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1898	4.350	1.665	29.00	1.268	546	414	1262.87	.4273	1.6191E-02	1.8985E-01	3.4614E-01
0.00	.5979	.1766	4.500	1.665	29.00	1.297	546	409	1284.35	.4392	1.5484E-02	1.7660E-01	3.6166E-01
0.00	1.0103	.1766	13.450	1.660	29.00	2.434	546	250	1885.69	1.0504	3.7030E-02	1.7660E-01	8.6494E-01
0.00	1.4227	.1965	12.100	1.640	29.00	2.315	546	264	1841.45	.9614	3.7704E-02	1.9647E-01	7.7252E-01
0.00	1.8351	.2196	10.950	1.620	29.00	2.208	546	277	1798.61	.8848	3.8793E-02	2.1965E-01	6.9044E-01
0.00	2.2474	.2318	10.100	1.615	29.00	2.117	546	288	1759.61	.8286	3.8340E-02	2.3179E-01	6.3658E-01
0.00	2.4536	.2296	9.900	1.605	29.00	2.101	546	290	1752.64	.8144	3.7324E-02	2.2958E-01	6.2747E-01
0.00	2.6598	.2274	9.950	1.605	29.00	2.107	546	289	1755.24	.8177	3.7114E-02	2.2737E-01	6.3180E-01
0.00	3.0722	.2009	10.800	1.615	29.00	2.195	546	278	1793.60	.8743	3.5060E-02	2.0088E-01	6.9869E-01
0.00	3.4845	.1634	12.950	1.620	29.00	2.416	547	252	1879.67	1.0137	3.3056E-02	1.6336E-01	8.4813E-01
0.00	3.8969	.1192	16.800	1.600	29.00	2.791	547	214	1999.59	1.2558	2.9882E-02	1.1921E-01	1.1061E+00
0.00	4.3093	.0728	21.450	1.575	29.00	3.196	547	180	2100.36	1.5435	2.2444E-02	7.2848E-02	1.4310E+00
0.00	5.1340	.0110	28.700	1.565	29.00	3.726	548	145	2199.21	1.9909	4.3864E-03	1.1038E-02	1.9689E+00
0.00	5.5876	.0044	29.850	1.555	29.00	3.815	548	140	2212.81	2.0604	1.8158E-03	4.4150E-03	2.0513E+00

XIM = 3.8793E-02 GXM = 2.3179E-01 AIRMFM = 2.0513E+00 AKXM = 2.3179E-01

RUN NO. 11 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.0048 LAMDA = 2.1691

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	539	48.84
TUNNEL GAS	29.000	.2400	1.399	548	249.84

RHOVJ = 5.0097E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-5.40	2.2474	0.0000	20.550	1.545	29.00	3.157	548	183	2093.09	1.4825	0.	0.	1.4825E+00
-4.81	2.2474	.0022	20.950	1.545	29.00	3.189	548	181	2100.02	1.5075	6.6428E-04	2.2075E-03	1.5042E+00
-4.27	2.2474	.0066	21.300	1.545	29.00	3.216	548	179	2105.87	1.5294	2.0217E-03	6.6225E-03	1.5192E+00
-3.19	2.2474	.0309	21.500	1.545	29.00	3.232	548	178	2108.76	1.5421	9.5135E-03	3.0905E-02	1.4945E+00
-2.16	2.2474	.0938	18.900	1.555	29.00	3.013	547	195	2057.93	1.3818	2.5879E-02	9.3819E-02	1.2522E+00
-1.08	2.2474	.1854	13.000	1.555	29.00	2.474	546	246	1899.89	1.0098	3.7376E-02	1.8543E-01	8.2252E-01
0.00	2.2474	.2583	9.450	1.585	29.00	2.062	546	295	1734.86	.7829	4.0364E-02	2.5828E-01	5.8070E-01
1.08	2.2474	.2506	9.500	1.595	29.00	2.061	546	295	1734.45	.7872	3.9369E-02	2.5055E-01	5.8994E-01
2.22	2.2474	.1258	15.550	1.600	29.00	2.680	547	225	1967.14	1.1769	2.9559E-02	1.2583E-01	1.0288E+00
3.24	2.2474	.0364	20.750	1.575	29.00	3.142	548	184	2088.99	1.4994	1.0901E-02	3.6424E-02	1.4448E+00
4.38	2.2474	.0088	20.950	1.570	29.00	3.162	548	183	2094.11	1.5108	2.6630E-03	8.8300E-03	1.4975E+00
4.92	2.2474	.0033	20.350	1.570	29.00	3.115	548	187	2083.58	1.4734	9.7385E-04	3.3113E-03	1.4685E+00

XIM = 4.0364E-02 GXM = 2.5828E-01 AIRMFM = 1.5192E+00 AKXM = 2.5828E-01

RUN NO. 12 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = .5110 LAMDA = 1.1001

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	542	24.84
TUNNEL GAS	29.000	.2400	1.399	548	249.84

RHOVJ = 2.5409E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1407	4.650	1.670	29.00	1.322	547	406	1303.83	.4510	2.4985E-02	1.4075E-01	3.8755E-01
0.00	.5979	.1362	4.550	1.675	29.00	1.301	547	409	1288.43	.4434	2.3769E-02	1.3621E-01	3.8299E-01
0.00	1.0103	.1283	12.950	1.665	29.00	2.381	547	257	1868.10	1.0181	5.1394E-02	1.2826E-01	8.8751E-01
0.00	1.4227	.1362	12.200	1.645	29.00	2.321	547	264	1845.53	.9676	5.1870E-02	1.3621E-01	8.3579E-01
0.00	1.8351	.1498	11.850	1.635	29.00	2.293	547	267	1834.36	.9439	5.5662E-02	1.4983E-01	8.0250E-01
0.00	2.2474	.1407	11.950	1.635	29.00	2.303	547	266	1838.49	.9504	5.2644E-02	1.4075E-01	8.1659E-01
0.00	2.6598	.1226	13.100	1.635	29.00	2.419	547	252	1882.00	1.0244	4.9422E-02	1.2259E-01	8.9878E-01
0.00	3.4845	.0579	20.400	1.645	29.00	3.044	548	192	2066.50	1.4866	3.3869E-02	5.7889E-02	1.4005E+00
0.00	4.3093	.0102	29.800	1.595	29.00	3.762	548	143	2204.83	2.0629	8.2942E-03	1.0216E-02	2.0419E+00
0.00	4.7216	0.0000	31.350	1.590	29.00	3.867	548	137	2220.60	2.1578	0.	0.	2.1578E+00

XIM = 5.5662E-02 GXM = 1.4983E-01 AIRMFM = 2.1578E+00 AKXM = 1.4983E-01

RUN NO. 12 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = .5110 LAMDA = 1.1001

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	542	24.84
TUNNEL GAS	29.000	.2400	1.399	548	249.84

RHOVJ = 2.5409E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
-4.32	1.8351	.0045	17.200	1.550	29.00	2.873	548	207	2023.91	1.2736	2.2758E-03	4.5403E-03	1.2678E+00
-3.78	1.8351	.0068	17.650	1.565	29.00	2.897	548	205	2030.33	1.3037	3.4945E-03	6.8104E-03	1.2949E+00
-3.19	1.8351	.0136	18.300	1.565	29.00	2.953	548	200	2044.46	1.3446	7.2079E-03	1.3621E-02	1.3263E+00
-2.11	1.8351	.0477	18.300	1.570	29.00	2.948	548	200	2042.84	1.3455	2.5244E-02	4.7673E-02	1.2813E+00
-1.08	1.8351	.1067	15.050	1.590	29.00	2.643	547	229	1956.71	1.1434	4.8016E-02	1.0670E-01	1.0214E+00
0.00	1.8351	.1771	10.450	1.615	29.00	2.156	547	284	1778.42	.8508	5.9295E-02	1.7707E-01	7.0018E-01
1.08	1.8351	.1612	11.050	1.620	29.00	2.219	547	276	1804.75	.8905	5.6488E-02	1.6118E-01	7.4695E-01
2.16	1.8351	.0636	17.100	1.625	29.00	2.794	548	214	2001.75	1.2770	3.1946E-02	6.3564E-02	1.1958E+00
3.30	1.8351	.0148	17.800	1.625	29.00	2.853	548	209	2018.59	1.3207	7.6699E-03	1.4756E-02	1.3012E+00
3.94	1.8351	.0091	17.200	1.605	29.00	2.821	548	212	2009.79	1.2804	4.5761E-03	9.0806E-03	1.2688E+00
4.38	1.8351	.0045	16.750	1.590	29.00	2.796	548	214	2002.85	1.2502	2.2341E-03	4.5403E-03	1.2445E+00

XIM = 5.9295E-02 GXM = 1.7707E-01 AIRMFM = 1.3263E+00 AKXM = 1.7707E-01

RUN NO. 13 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 60

QJ/QI = 3.0822 LAMDA = 6.6538

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	538	149.78
TUNNEL GAS	29.000	.2400	1.399	547	249.78

RHOVJ = 1.5378E+01

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1970	4.250	1.625	29.00	1.269	545	413	1262.31	.4178	5.3515E-03	1.9699E-01	3.3546E-01
0.00	.5979	.2121	5.300	1.625	29.00	1.459	545	382	1397.71	.4990	6.8809E-03	2.1205E-01	3.9318E-01
0.00	1.0103	.2225	12.300	1.615	29.00	2.354	545	259	1854.43	.9727	1.4073E-02	2.2248E-01	7.5629E-01
0.00	1.8351	.2364	13.350	1.615	29.00	2.460	545	247	1892.21	1.0404	1.5993E-02	2.3638E-01	7.9447E-01
0.00	2.6598	.2596	12.900	1.615	29.00	2.415	545	252	1876.10	1.0117	1.7076E-02	2.5956E-01	7.4909E-01
0.00	3.0722	.2688	12.400	1.630	29.00	2.353	545	259	1853.18	.9812	1.7153E-02	2.6883E-01	7.1741E-01
0.00	3.4845	.2827	11.950	1.605	29.00	2.326	544	262	1842.78	.9494	1.7456E-02	2.8273E-01	6.8100E-01
0.00	3.8969	.2804	11.500	1.585	29.00	2.294	544	266	1830.47	.9181	1.6741E-02	2.8042E-01	6.6062E-01
0.00	4.3093	.2827	11.350	1.580	29.00	2.282	544	267	1825.64	.9078	1.6691E-02	2.8273E-01	6.5114E-01
0.00	5.1340	.2619	11.700	1.575	29.00	2.323	545	262	1842.02	.9298	1.5834E-02	2.6188E-01	6.8631E-01
0.00	5.9588	.2109	13.900	1.560	29.00	2.560	545	236	1926.31	1.0690	1.4661E-02	2.1089E-01	8.4359E-01
0.00	6.7835	.1344	18.800	1.535	29.00	3.025	546	193	2058.27	1.3747	1.2017E-02	1.3441E-01	1.1900E+00
0.00	7.6082	.0579	24.200	1.520	29.00	3.465	546	161	2152.15	1.7085	6.4369E-03	5.7937E-02	1.6095E+00
0.00	8.4330	.0151	27.900	1.520	29.00	3.728	547	145	2197.40	1.9370	1.8975E-03	1.5064E-02	1.9079E+00
0.00	9.2577	.0023	29.900	1.520	29.00	3.863	547	137	2217.87	2.0604	3.1051E-04	2.3175E-03	2.0556E+00
0.00	9.4639	.0023	30.300	1.520	29.00	3.889	547	136	2221.65	2.0851	3.1424E-04	2.3175E-03	2.0803E+00
0.00	9.6701	0.0000	30.600	1.535	29.00	3.889	547	136	2221.70	2.1057	0.	0.	2.1057E+00

XIM = 1.7456E-02 GXM = 2.8273E-01 AIRMFM = 2.1057E+00 AKXM = 2.8273E-01

RUN NO. 14 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 60

QJ/QI = 1.7446 LAMDA = 3.7763

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	542	84.78
TUNNEL GAS	29.000	.2400	1.399	554	249.78

RHOVJ = 8.6720E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX -DEG.R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1727	4.250	1.635	29.00	1.264	552	418	1266.14	.4157	8.2782E-03	1.7271E-01	3.4388E-01
0.00	.5979	.1812	5.200	1.635	29.00	1.437	552	391	1391.12	.4891	1.0222E-02	1.8124E-01	4.0048E-01
0.00	1.0103	.1876	11.550	1.630	29.00	2.265	552	273	1831.21	.9201	1.9908E-02	1.8763E-01	7.4745E-01
0.00	1.8351	.1919	12.700	1.630	29.00	2.383	552	259	1876.54	.9941	2.1997E-02	1.9190E-01	8.0332E-01
0.00	2.6598	.2090	12.450	1.635	29.00	2.354	551	262	1865.35	.9788	2.3584E-02	2.0896E-01	7.7425E-01
0.00	3.0722	.2196	12.250	1.655	29.00	2.319	551	266	1851.62	.9682	2.4520E-02	2.1962E-01	7.5557E-01
0.00	3.4845	.2154	12.100	1.640	29.00	2.315	551	266	1850.16	.9569	2.3762E-02	2.1535E-01	7.5081E-01
0.00	3.8969	.2132	12.250	1.610	29.00	2.353	551	262	1864.90	.9632	2.3683E-02	2.1322E-01	7.5785E-01
0.00	4.3093	.1962	12.600	1.600	29.00	2.397	552	257	1881.45	.9844	2.2267E-02	1.9616E-01	7.9129E-01
0.00	5.1340	.1514	15.250	1.575	29.00	2.674	552	227	1975.08	1.1493	2.0063E-02	1.5139E-01	9.7530E-01
0.00	5.9588	.0832	20.850	1.550	29.00	3.176	553	184	2106.72	1.4951	1.4336E-02	8.3156E-02	1.3708E+00
0.00	6.7835	.0235	27.300	1.530	29.00	3.674	554	150	2202.54	1.8895	5.1103E-03	2.3454E-02	1.8452E+00
0.00	7.6082	.0043	30.550	1.525	29.00	3.899	554	137	2237.16	2.0880	1.0267E-03	4.2644E-03	2.0791E+00
0.00	7.8144	0.0000	30.950	1.525	29.00	3.925	554	136	2240.94	2.1124	0.	0.	2.1124E+00
0.00	8.0206	0.0000	31.300	1.530	29.00	3.941	554	135	2243.18	2.1346	0.	0.	2.1346E+00

XIM = 2.4520E-02 GXM = 2.1962E-01 AIRMFM = 2.1346E+00 AKXM = 2.1962E-01

RUN NO. 15   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES, X/D= 60

QJ/QI = 1.0038   LAMDA = 2.1688

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	543	48.78
TUNNEL GAS	29.000	.2400	1.399	553	249.78

RHOVJ = 4.9850E+00

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG	TX .R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1404	4.300	1.650	29.00	1.266	552	418	1267.39	.4205	1.1839E-02	1.4035E-01	3.6147E-01
0.00	.5979	.1513	5.300	1.650	29.00	1.446	551	389	1396.68	.4977	1.5106E-02	1.5132E-01	4.2236E-01
0.00	1.0103	.1568	11.400	1.645	29.00	2.238	551	276	1819.81	.9122	2.8693E-02	1.5680E-01	7.6920E-01
0.00	1.8351	.1568	12.300	1.635	29.00	2.339	551	264	1859.49	.9692	3.0485E-02	1.5680E-01	8.1722E-01
0.00	2.2474	.1579	12.450	1.635	29.00	2.354	551	262	1865.23	.9788	3.1003E-02	1.5789E-01	8.2428E-01
0.00	2.6598	.1579	12.600	1.645	29.00	2.362	551	261	1868.02	.9896	3.1343E-02	1.5789E-01	8.3332E-01
0.00	3.4845	.1382	13.550	1.645	29.00	2.455	552	250	1902.26	1.0502	2.9105E-02	1.3816E-01	9.0508E-01
0.00	4.3093	.1075	15.900	1.600	29.00	2.711	552	224	1985.69	1.1935	2.5727E-02	1.0746E-01	1.0653E+00
0.00	5.1340	.0614	21.300	1.570	29.00	3.190	552	182	2108.63	1.5265	1.8802E-02	6.1404E-02	1.4327E+00
0.00	5.9588	.0175	28.600	1.545	29.00	3.744	553	146	2211.88	1.9731	6.9438E-03	1.7544E-02	1.9385E+00
0.00	6.3711	.0066	30.700	1.540	29.00	3.889	553	138	2233.72	2.1012	2.7730E-03	6.5789E-03	2.0874E+00
0.00	6.7835	C.0000	31.800	1.535	29.00	3.966	553	134	2244.66	2.1679	0.	0.	2.1679E+00

XIM = 3.1343E-02   GXM = 1.5789E-01   AIRMFM = 2.1679E+00   AKXM = 1.5789E-01

RUN NO. 16 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 60

QJ/QI = .5114 LAMDA = 1.1090

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	29.000	.2400	1.399	540	24.86
TUNNEL GAS	29.000	.2400	1.399	554	249.86

RHOVJ = 2.5476E+00

Y/D	Z/D	K	PT2X	PIX	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1145	5.560	1.660	29.00	1.483	552	384	1423.00	.5171	2.3246E-02	1.1452E-01	4.5789E-01
0.00	.5979	.1145	5.960	1.660	29.00	1.546	552	374	1464.18	.5462	2.4552E-02	1.1452E-01	4.8362E-01
0.00	.8041	.1157	8.910	1.645	29.00	1.956	552	313	1695.12	.7482	3.3979E-02	1.1570E-01	6.6160E-01
0.00	1.0103	.1181	11.260	1.645	29.00	2.223	552	278	1815.23	.9024	4.1821E-02	1.1806E-01	7.9587E-01
0.00	1.4227	.1145	11.460	1.645	29.00	2.244	552	275	1823.98	.9153	4.1146E-02	1.1452E-01	8.1050E-01
0.00	1.8351	.1110	12.160	1.635	29.00	2.325	552	266	1855.73	.9593	4.1790E-02	1.1098E-01	8.5284E-01
0.00	2.6598	.0921	14.010	1.650	29.00	2.495	553	246	1918.02	1.0790	3.9003E-02	9.2090E-02	9.7962E-01
0.00	3.4845	.0708	17.110	1.650	29.00	2.773	553	218	2005.50	1.2744	3.5436E-02	7.0838E-02	1.1841E+00
0.00	4.3918	.0354	23.410	1.590	29.00	3.328	554	172	2139.61	1.6582	2.3053E-02	3.5419E-02	1.5994E+00
0.00	5.1340	.0118	29.810	1.560	29.00	3.806	554	142	2223.31	2.0477	9.4896E-03	1.1806E-02	2.0235E+00
0.00	5.3402	.0071	31.010	1.560	29.00	3.883	554	138	2234.86	2.1212	5.8982E-03	7.0838E-03	2.1062E+00
0.00	5.5464	.0047	31.860	1.550	29.00	3.951	554	135	2244.37	2.1718	4.0260E-03	4.7226E-03	2.1616E+00
0.00	5.7526	0.0000	32.610	1.550	29.00	3.998	554	132	2250.95	2.2177	0.	0.	2.2177E+00

XIM = 4.1821E-02 GXM = 1.1806E-01 AIRMFM = 2.2177E+00 AKXM = 1.1806E-01

RUN NO. 17   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES,   X/D= 30

QJ/QI = 1.000   LAMDA = .7758

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	4.000	1.2420	1.666	538	44.30
TUNNEL GAS	29.000	.2400	1.399	548	249.80

RHOVJ = 1.7915E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.3210	4.600	1.725	20.97	1.266	545	399	1486.65	.3907	1.3349E-02	6.1216E-02	3.6675E-01
0.00	.5979	.3120	4.680	1.742	21.20	1.273	546	398	1484.49	.3988	1.3105E-02	5.8868E-02	3.7534E-01
0.00	1.0103	.3080	10.600	1.718	21.30	2.071	546	276	2005.04	.7702	2.4867E-02	5.7840E-02	7.2567E-01
0.00	1.8351	.3890	10.680	1.695	19.27	2.086	545	269	2106.46	.7424	3.3452E-02	8.0726E-02	6.8245E-01
0.00	2.6598	.4320	9.600	1.678	18.20	1.973	544	281	2103.73	.6633	3.5154E-02	9.4945E-02	6.0034E-01
0.00	2.8660	.4150	10.100	1.678	18.62	2.031	545	274	2112.07	.6980	3.4727E-02	8.9128E-02	6.3582E-01
0.00	3.4845	.3130	11.720	1.678	21.05	2.214	546	257	2082.62	.8288	2.7955E-02	6.0428E-02	7.7871E-01
0.00	4.3093	.1620	17.880	1.680	24.95	2.790	547	205	2132.02	1.2607	1.8276E-02	2.5972E-02	1.2279E+00
0.00	5.1340	.0370	26.680	1.625	28.07	3.515	548	156	2191.96	1.8531	5.4528E-03	5.2716E-03	1.8433E+00
0.00	5.5464	.0150	28.920	1.597	28.62	3.700	548	146	2206.39	1.9998	2.3398E-03	2.0961E-03	1.9956E+00
0.00	5.9588	.0060	29.560	1.578	28.85	3.766	548	143	2210.02	2.0420	9.4822E-04	8.3189E-04	2.0403E+00
0.00	6.7835	0.0000	30.000	1.555	29.00	3.824	548	140	2214.35	2.0696	0.	0.	2.0696E+00

XIM = 3.5154E-02   GXM = 9.4945E-02   AIRMFM = 2.0696E+00   AKXM = 4.3200E-01

RUN NO. 17 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = .7758

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	4.000	1.2420	1.666	538	44.30
TUNNEL GAS	29.000	.2400	1.399	548	249.80

RHCVJ = 1.7915E+00

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG	TX .R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
-5.47	2.6598	C.0000	23.280	1.502	29.00	3.417	548	165	2146.29	1.6466	0.	0.	1.6466E+00
-4.64	2.6598	.0034	23.280	1.525	28.91	3.390	548	166	2143.62	1.6480	4.3267E-04	4.7034E-04	1.6472E+00
-4.26	2.6598	.0080	23.280	1.540	28.80	3.372	548	167	2143.59	1.6477	1.0219E-03	1.1111E-03	1.6459E+00
-3.95	2.6598	.0150	22.920	1.540	28.62	3.344	548	169	2143.31	1.6220	1.8977E-03	2.0961E-03	1.6186E+00
-3.19	2.6598	.0410	21.560	1.550	27.97	3.226	548	176	2138.71	1.5266	4.9955E-03	5.8624E-03	1.5176E+00
-2.43	2.6598	.1930	16.440	1.563	24.17	2.769	547	206	2154.54	1.1475	2.0455E-02	3.1934E-02	1.1109E+00
-2.05	2.6598	.2700	14.280	1.568	22.25	2.557	546	222	2164.47	.9873	2.6750E-02	4.8539E-02	9.3937E-01
-1.59	2.6598	.3600	11.840	1.580	20.00	2.294	545	245	2166.36	.8105	3.2572E-02	7.2000E-02	7.5210E-01
-1.14	2.6598	.4350	9.880	1.598	18.12	2.059	544	269	2153.24	.6720	3.6008E-02	9.6000E-02	6.0746E-01
-.83	2.6598	.4900	8.760	1.632	16.75	1.899	544	287	2143.49	.5916	3.8641E-02	1.1701E-01	5.2237E-01
-.45	2.6598	.5270	8.400	1.650	15.82	1.839	544	293	2164.88	.5593	4.1586E-02	1.3321E-01	4.8479E-01
0.00	2.6598	.5330	7.800	1.662	15.67	1.757	544	305	2120.40	.5251	3.9870E-02	1.3601E-01	4.5372E-01
.53	2.6598	.5070	8.160	1.668	16.32	1.801	544	300	2108.82	.5546	3.8459E-02	1.2423E-01	4.8573E-01
1.36	2.6598	.3750	10.760	1.675	19.62	2.109	545	266	2100.75	.7508	3.2033E-02	7.6433E-02	6.9343E-01
2.12	2.6598	.1580	17.320	1.677	25.05	2.747	547	210	2115.88	1.2285	1.7301E-02	2.5230E-02	1.1975E+00
2.88	2.6598	.0590	21.000	1.675	27.52	3.054	548	188	2114.04	1.4992	7.1749E-03	8.5740E-03	1.4863E+00
3.64	2.6598	.0110	22.68C	1.668	28.72	3.192	548	180	2108.80	1.6259	1.3902E-03	1.5318E-03	1.6234E+00
4.02	2.6598	.0080	22.760	1.685	28.80	3.181	548	181	2104.29	1.6346	1.0138E-03	1.1111E-03	1.6327E+00
4.48	2.6598	.0050	22.720	1.695	28.87	3.169	548	182	2099.40	1.6349	6.3209E-04	6.9264E-04	1.6337E+00
5.16	2.6598	.0030	22.360	1.700	28.92	3.139	548	185	2091.11	1.6141	3.7378E-04	4.1487E-04	1.6134E+00
5.93	2.6598	C.0000	22.120	1.700	29.00	3.121	548	186	2085.06	1.6006	0.	0.	1.6006E+00

XIM = 4.1586E-02 GXM = 1.3601E-01 AIRMFM = 1.6472E+C0 AKXM = 5.3300E-01

RUN NO. 18 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 1.1152

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	8.200	.6467	1.599	547	45.30
TUNNEL GAS	29.000	.2400	1.399	552	249.81

RHOVJ = 2.5661E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1856	5.360	1.730	25.14	1.405	551	388	1469.30	.4769	1.1250E-02	6.0539E-02	4.4800E-01
0.00	.3918	.1856	5.360	1.738	25.14	1.401	551	389	1466.34	.4773	1.1261E-02	6.0539E-02	4.4841E-01
0.00	.5979	.1832	5.360	1.730	25.19	1.405	551	388	1467.95	.4773	1.1092E-02	5.9638E-02	4.4881E-01
0.00	1.0103	.1892	12.080	1.718	25.06	2.240	551	266	1944.18	.9104	2.1960E-02	6.1898E-02	8.5402E-01
0.00	1.8351	.2695	12.840	1.700	23.39	2.320	551	253	2038.64	.9298	3.4228E-02	9.4463E-02	8.4196E-01
0.00	2.6598	.3053	11.480	1.678	22.65	2.197	551	266	2016.00	.8353	3.5980E-02	1.1053E-01	7.4298E-01
0.00	3.0722	.2634	12.360	1.679	23.52	2.289	551	257	2021.08	.9010	3.2243E-02	9.1827E-02	8.1829E-01
0.00	3.4845	.2071	14.600	1.682	24.69	2.505	551	235	2059.22	1.0544	2.8261E-02	6.8775E-02	9.8192E-01
0.00	4.3093	.0898	22.280	1.653	27.13	3.169	552	180	2161.18	1.5610	1.6509E-02	2.7140E-02	1.5186E+00
0.00	5.1340	.0180	28.960	1.608	28.63	3.689	552	148	2212.83	1.9965	4.0117E-03	5.1562E-03	1.9862E+00
0.00	5.5876	.0060	30.080	1.585	28.88	3.791	552	142	2221.21	2.0681	1.3732E-03	1.7039E-03	2.0646E+00
0.00	5.9588	.0028	30.760	1.575	28.94	3.848	552	139	2227.64	2.1101	6.5236E-04	7.9332E-04	2.1085E+00

XIM = 3.5980E-02 GXM = 1.1053E-01 AIRMFM = 2.1085E+00 AKXM = 3.0530E-01

RUN NO. 18 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

CJ/QI = 1.000 LAMDA = 1.1152

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	8.200	.6467	1.599	547	45.30
TUNNEL GAS	29.000	.2400	1.399	552	249.81

RHOVJ = 2.5661E+00

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
-4.56	2.6598	0.0000	23.280	1.480	29.00	3.443	552	164	2159.01	1.6377	0.	0.	1.6377E+00
-2.96	2.6598	.0060	23.200	1.520	28.88	3.390	552	167	2152.53	1.6356	1.0861E-03	1.7039E-03	1.6328E+00
-1.52	2.6598	.1066	19.560	1.555	26.78	3.055	552	188	2146.44	1.3767	1.7510E-02	3.2637E-02	1.3318E+00
-.76	2.6598	.2408	14.160	1.577	23.99	2.547	551	229	2099.90	1.0058	3.2260E-02	8.2303E-02	9.2304E-01
-.38	2.6598	.3210	11.360	1.577	22.32	2.257	551	257	2055.60	.8143	3.7418E-02	1.1791E-01	7.1828E-01
-.00	2.6598	.3964	9.600	1.585	20.75	2.048	550	280	2026.58	.6895	4.2084E-02	1.5661E-01	5.8155E-01
1.52	2.6598	.3820	9.640	1.660	21.05	2.002	550	287	1990.07	.7020	4.0699E-02	1.4878E-01	5.9754E-01
3.04	2.6598	.0695	20.840	1.660	27.55	3.056	552	190	2121.66	1.4824	1.1949E-02	2.0683E-02	1.4518E+00
4.56	2.6598	.0042	23.560	1.660	28.91	3.265	552	176	2126.43	1.6772	7.7855E-04	1.1912E-03	1.6752E+00

XIM = 4.2084E-02 GXM = 1.5661E-01 AIRMFM = 1.6752E+00 AKXM = 3.9640E-01

RUN NO. 19 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 1.6582

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	17.600	.3433	1.490	538	47.00
TUNNEL GAS	29.000	.2400	1.399	545	249.87

RHOVJ = 3.8406E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1758	5.040	1.735	27.00	1.354	544	395	1371.36	.4715	1.4071E-02	1.1461E-01	4.1746E-01
0.00	.3918	.1758	5.040	1.770	27.00	1.336	544	397	1358.74	.4733	1.4125E-02	1.1461E-01	4.1906E-01
0.00	.5979	.1538	5.280	1.767	27.25	1.378	544	391	1383.27	.4931	1.2757E-02	9.9347E-02	4.4415E-01
0.00	1.0103	.1538	12.440	1.759	27.25	2.256	544	266	1866.27	.9743	2.5204E-02	9.9347E-02	8.7754E-01
0.00	1.4227	.1934	13.640	1.742	26.80	2.380	544	250	1928.40	1.0421	3.4470E-02	1.2703E-01	9.0975E-01
0.00	1.8351	.2240	12.640	1.722	26.45	2.298	544	259	1907.64	.9722	3.7735E-02	1.4907E-01	8.2727E-01
0.00	2.2474	.2506	11.360	1.705	26.14	2.180	543	272	1868.50	.8857	3.8907E-02	1.6871E-01	7.3629E-01
0.00	2.4536	.2615	10.960	1.700	26.02	2.141	543	277	1855.40	.8583	3.9531E-02	1.7689E-01	7.0648E-01
0.00	2.6598	.2640	10.760	1.698	25.99	2.121	543	280	1847.37	.8451	3.9337E-02	1.7877E-01	6.9399E-01
0.00	2.8660	.2593	10.840	1.698	26.04	2.129	543	279	1849.60	.8508	3.8819E-02	1.7523E-01	7.0173E-01
0.00	3.0722	.2420	11.240	1.699	26.24	2.172	543	274	1861.99	.8788	3.7139E-02	1.6231E-01	7.3615E-01
0.00	3.4845	.1977	13.200	1.710	26.75	2.362	544	252	1923.07	1.0104	3.4225E-02	1.3009E-01	8.7894E-01
0.00	4.3093	.0813	21.920	1.665	28.07	3.135	545	182	2109.59	1.5701	2.0838E-02	5.0970E-02	1.4901E+00
0.00	4.7629	.0352	26.760	1.650	28.60	3.496	545	158	2166.44	1.8787	1.0597E-02	2.1663E-02	1.8380E+00
0.00	5.1340	.0176	28.960	1.640	28.80	3.653	545	148	2187.56	2.0180	5.6516E-03	1.0756E-02	1.9963E+00
0.00	5.5454	0.0000	29.960	1.620	29.00	3.742	545	144	2195.89	2.0819	0.	0.	2.0819E+00

XIM = 3.9531E-02 GXM = 1.7877E-01 AIRMFM = 2.0819E+00 AKXM = 2.6400E-01

RUN NO. 19 COLD FLCW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 1.6582

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	17.600	.3433	1.490	538	47.00
TUNNEL GAS	29.000	.2400	1.399	545	249.87

RHOVJ = 3.8406E+CC

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG	TX .R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
-5.24	2.4536	0.0000	21.400	1.538	29.00	3.232	545	177	2103.47	1.5388	0.	0.	1.5388E+00
-3.80	2.4536	.0046	21.960	1.560	28.95	3.251	545	175	2109.01	1.5757	1.1474E-03	2.7968E-03	1.5713E+00
-3.04	2.4536	.0198	21.8C0	1.572	28.77	3.225	545	177	2108.52	1.564C	4.9320E-03	1.2111E-02	1.5451E+00
-2.28	2.4536	.0659	2C.000	1.580	28.25	3.073	545	187	2090.06	1.4435	1.5432E-02	4.1058E-02	1.3842E+C0
-1.52	2.4536	.1605	15.6CC	1.582	27.17	2.692	544	218	2021.32	1.1525	3.1197E-02	1.0397E-01	1.0326E+C0
-1.14	2.4536	.2197	12.440	1.615	26.50	2.358	544	252	1929.47	.9492	3.6069E-02	1.4594E-01	8.1069E-01
-.76	2.4536	.2725	10.520	1.640	25.89	2.134	543	278	1856.56	.8231	3.9696E-02	1.8522E-01	6.7065E-01
-.38	2.4536	.3010	9.760	1.665	25.57	2.031	543	290	1819.10	.7733	4.1717E-02	2.0719E-01	6.1307E-01
0.00	2.4536	.3033	9.720	1.680	25.54	2.016	543	292	1812.90	.7718	4.1997E-02	2.0899E-01	6.1049E-01
.76	2.4536	.2880	9.920	1.690	25.72	2.033	543	290	1815.37	.7875	4.0416E-02	1.9710E-01	6.3230E-01
2.28	2.4536	.0725	19.840	1.690	28.17	2.954	545	197	2063.46	1.4460	1.7052E-02	4.5291E-02	1.3805E+C0
3.73	2.4536	.0110	22.320	1.680	28.87	3.155	545	182	2090.38	1.6125	2.8151E-03	6.7049E-03	1.6017E+00
4.55	2.4536	0.0000	22.120	1.710	29.00	3.112	545	186	2077.19	1.6063	0.	0.	1.6063E+00

XIM = 4.1997E-02 GXM = 2.0899E-01 AIRMFM = 1.6063E+00 AKXM = 3.0330E-01

RUN NO. 20 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 1.8662

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	22.000	.2910	1.450	540	47.76
TUNNEL GAS	29.000	.2400	1.399	547	249.90

RHOVJ = 4.3151E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1530	5.150	1.770	27.93	1.357	546	397	1353.30	.4878	1.3625E-02	1.2052E-01	4.2903E-01
0.00	.5979	.1530	5.200	1.765	27.93	1.368	546	396	1361.07	.4914	1.3723E-02	1.2052E-01	4.3214E-01
0.00	1.0103	.1430	10.600	1.760	28.00	2.070	546	292	1767.37	.8639	2.2495E-02	1.1236E-01	7.6684E-01
0.00	1.8351	.2000	12.800	1.720	27.60	2.320	546	260	1883.66	.9966	3.6817E-02	1.5942E-01	8.3769E-01
0.00	2.2474	.2200	11.750	1.700	27.46	2.229	546	271	1851.41	.9257	3.7813E-02	1.7626E-01	7.6258E-01
0.00	2.6598	.2350	11.050	1.690	27.35	2.162	545	278	1826.47	.8786	3.8481E-02	1.8900E-01	7.1253E-01
0.00	3.0722	.2110	11.600	1.695	27.52	2.217	546	272	1844.79	.9164	3.5818E-02	1.6866E-01	7.6185E-01
0.00	3.4845	.1750	13.400	1.710	27.77	2.385	546	253	1903.49	1.0360	3.3278E-02	1.3861E-01	8.9236E-01
0.00	4.3093	.0750	22.050	1.650	28.47	3.162	547	181	2107.12	1.5814	2.1236E-02	5.7946E-02	1.4898E+00
0.00	5.1340	.0060	28.550	1.625	28.96	3.645	547	150	2185.55	1.9906	2.1028E-03	4.5583E-03	1.9816E+00
0.00	5.3402	0.0000	29.150	1.620	29.00	3.690	547	147	2191.69	2.0280	0.	0.	2.0280E+00

XIM = 3.8481E-02 GXM = 1.8900E-01 AIRMFM = 2.0280E+00 AKXM = 2.3500E-01

RUN NO. 20   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES,   X/D= 30

QJ/QI = 1.000   LAMDA = 1.8662

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	22.000	.2910	1.450	540	47.76
TUNNEL GAS	29.000	.2400	1.399	547	249.90

RHOVJ = 4.3151E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-4.55	2.6598	0.0000	22.950	1.570	29.00	3.315	547	171	2124.54	1.6367	0.	0.	1.6367E+00
-3.04	2.6598	.0400	21.750	1.605	28.72	3.186	547	180	2105.46	1.5615	1.1088E-02	3.0641E-02	1.5136E+00
-2.50	2.6598	.0850	19.600	1.620	28.40	3.002	546	194	2071.96	1.4241	2.1726E-02	6.5833E-02	1.3303E+00
-1.67	2.6598	.1900	13.550	1.640	27.67	2.453	546	245	1931.04	1.0364	3.6282E-02	1.5107E-01	8.7982E-01
-.98	2.6598	.2850	9.700	1.675	27.00	2.023	545	296	1773.19	.7860	4.2290E-02	2.3218E-01	6.0349E-01
0.00	2.6598	.3020	9.400	1.690	26.89	1.978	545	301	1754.96	.7666	4.3899E-02	2.4712E-01	5.7713E-01
1.57	2.6598	.1120	18.000	1.690	28.22	2.808	546	211	2026.63	1.3297	2.6910E-02	8.7326E-02	1.2136E+00
3.04	2.6598	0.0000	23.250	1.735	29.00	3.169	547	182	2093.88	1.6772	0.	0.	1.6772E+00

XIM = 4.3899E-02   GXM = 2.4712E-01   AIRMFM = 1.6772E+00   AKXM = 3.0200E-01

RUN NO. 21 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 2.3647

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	36.000	.1647	1.504	538	46.80
TUNNEL GAS	29.000	.2400	1.399	543	249.85

RHOVJ = 5.4868E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1300	5.000	1.750	29.91	1.340	542	396	1291.63	.4942	1.4093E-02	1.5647E-01	4.1686E-01
0.00	.5979	.1340	5.000	1.745	29.94	1.342	542	396	1292.65	.4942	1.4514E-02	1.6113E-01	4.1458E-01
0.00	1.0103	.1500	8.400	1.725	30.05	1.837	542	320	1587.96	.7456	2.4419E-02	1.7970E-01	6.1160E-01
0.00	1.8351	.1680	10.850	1.690	30.18	2.139	542	279	1722.82	.9138	3.3378E-02	2.0042E-01	7.3062E-01
0.00	2.2474	.1750	10.450	1.680	30.22	2.102	542	283	1705.71	.8865	3.3678E-02	2.0844E-01	7.0173E-01
0.00	2.6598	.1800	10.100	1.670	30.26	2.070	542	287	1690.73	.8623	3.3653E-02	2.1414E-01	6.7761E-01
0.00	3.0722	.1740	10.000	1.670	30.22	2.059	542	289	1687.38	.8545	3.2285E-02	2.0729E-01	6.7739E-01
0.00	3.4845	.1580	10.650	1.675	30.11	2.128	542	280	1720.78	.8971	3.0890E-02	1.8893E-01	7.2759E-01
0.00	4.3093	.1090	16.200	1.630	29.76	2.705	543	218	1934.61	1.2503	3.0042E-02	1.3184E-01	1.0854E+00
0.00	5.1340	.0430	25.600	1.585	29.30	3.487	543	157	2133.87	1.8248	1.7570E-02	5.2831E-02	1.7284E+00
0.00	5.9588	.0080	29.950	1.555	29.06	3.820	543	139	2200.61	2.0792	3.7560E-03	9.9119E-03	2.0586E+00
0.00	6.7835	0.0000	31.300	1.550	29.00	3.915	543	134	2217.18	2.1589	0.	0.	2.1589E+00

XIM = 3.3678E-02 GXM = 2.1414E-01 AIRMFM = 2.1589E+00 AKXM = 1.8000E-01

RUN NO. 21 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 2.3647

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	36.000	.1647	1.504	538	46.80
TUNNEL GAS	29.000	.2400	1.399	543	249.85

RHOVJ = 5.4868E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-4.71	2.6598	0.0000	22.950	1.515	29.00	3.377	543	166	2128.85	1.6353	0.	0.	1.6353E+00
-3.19	2.6598	.0050	23.400	1.545	29.03	3.376	543	166	2126.94	1.6690	1.8858E-03	6.1994E-03	1.6587E+00
-1.67	2.6598	.0700	19.900	1.580	29.49	3.064	543	187	2039.13	1.4721	2.2927E-02	8.5453E-02	1.3463E+00
-1.45	2.6598	.0790	18.900	1.590	29.55	2.973	543	194	2014.61	1.4119	2.4764E-02	9.6234E-02	1.2761E+00
-1.29	2.6598	.0930	17.650	1.600	29.65	2.858	543	204	1981.36	1.3365	2.7505E-02	1.1291E-01	1.1856E+00
0.00	2.6598	.1670	10.750	1.650	30.17	2.156	542	276	1730.14	.9026	3.2783E-02	1.9928E-01	7.2276E-01
1.59	2.6598	.1450	11.500	1.665	30.01	2.227	542	268	1763.79	.9514	3.0156E-02	1.7391E-01	7.8595E-01
2.88	2.6598	.0560	21.500	1.660	29.39	3.110	543	184	2054.14	1.5802	1.9754E-02	6.8590E-02	1.4718E+00
4.26	2.6598	0.0000	23.400	1.690	29.00	3.224	543	177	2097.88	1.6868	0.	0.	1.6868E+00

XIM = 3.2783E-02 GXM = 1.9928E-01 AIRMFM = 1.6868E+00 AKXM = 1.6700E-01

RUN NO. 22 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.000 LAMDA = 2.4295

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	40.000	.1270	1.642	535	44.35
TUNNEL GAS	29.000	.2400	1.399	539	249.95

RHOVJ = 5.6602E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1450	4.850	1.735	30.59	1.317	539	394	1257.18	.4906	1.6433E-02	1.8957E-01	3.9763E-01
0.00	.5979	.1500	4.800	1.730	30.65	1.311	539	395	1251.46	.4868	1.6837E-02	1.9576E-01	3.9154E-01
0.00	1.0133	.1370	9.250	1.710	30.51	1.944	539	300	1619.75	.8161	2.5899E-02	1.7963E-01	6.6950E-01
0.00	1.8351	.1510	10.650	1.680	30.66	2.119	539	276	1691.25	.9143	3.1820E-02	1.9699E-01	7.3419E-01
0.00	2.2474	.1580	10.400	1.670	30.74	2.098	539	278	1679.99	.8976	3.2605E-02	2.0561E-01	7.1304E-01
0.00	2.6598	.1580	10.130	1.665	30.74	2.071	539	282	1668.91	.8782	3.1901E-02	2.0561E-01	6.9765E-01
0.00	3.0722	.1550	10.250	1.670	30.70	2.082	539	281	1674.31	.8864	3.1621E-02	2.0192E-01	7.0741E-01
0.00	3.4845	.1430	11.000	1.675	30.57	2.161	539	271	1711.15	.9360	3.0938E-02	1.8709E-01	7.6086E-01
0.00	4.3093	.1030	16.700	1.625	30.13	2.748	539	210	1922.77	1.3006	3.1418E-02	1.3673E-01	1.1228E+00
0.00	5.1340	.0450	26.050	1.580	29.49	3.521	539	153	2121.31	1.8701	2.0163E-02	6.1027E-02	1.7560E+00
0.00	5.9588	.0100	30.150	1.545	29.11	3.845	539	136	2193.00	2.1013	5.1013E-03	1.3741E-02	2.0725E+00
0.00	6.7835	.0050	31.300	1.535	29.05	3.934	539	132	2208.48	2.1682	2.6368E-03	6.8835E-03	2.1533E+00
0.00	7.6082	.0020	31.700	1.530	29.02	3.966	539	130	2214.80	2.1903	1.0667E-03	2.7565E-03	2.1843E+00

XIM = 3.2605E-02 GXM = 2.0561E-01 AIRMFM = 2.1843E+00 AKXM = 1.5800E-01

RUN NO. 22   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES,   X/D= 30

QJ/QI = 1.000   LAMDA = 2.4295

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	40.000	.1270	1.642	535	44.35
TUNNEL GAS	29.000	.2400	1.399	539	249.95

RHOVJ = 5.6602E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-4.60	2.6598	.0017	23.700	1.520	29.02	3.427	539	161	2129.35	1.6901	8.2306E-04	2.7565E-03	1.6854E+00
-2.97	2.6598	.0112	23.650	1.540	29.13	3.399	539	162	2118.36	1.6949	4.9337E-03	1.6477E-02	1.6670E+00
-2.28	2.6598	.0249	22.800	1.560	29.29	3.312	539	168	2093.57	1.6512	1.0360E-02	3.5512E-02	1.5926E+00
-1.52	2.6598	.0716	19.800	1.590	29.80	3.042	539	186	2011.03	1.4859	2.5721E-02	9.7977E-02	1.3404E+00
0.00	2.6598	.1561	10.150	1.645	30.74	2.087	539	280	1675.60	.8776	3.1878E-02	2.0561E-01	6.9714E-01
1.52	2.6598	.1225	12.600	1.660	30.37	2.338	539	251	1785.04	1.0387	3.0207E-02	1.6461E-01	8.6771E-01
3.04	2.6598	.0339	21.900	1.660	29.41	3.139	539	180	2051.77	1.6129	1.4341E-02	5.0328E-02	1.5317E+00
3.88	2.6598	.0116	23.700	1.678	29.16	3.255	539	172	2088.33	1.7182	6.2448E-03	2.0573E-02	1.6828E+00
4.71	2.6598	.0022	24.000	1.695	29.07	3.260	539	172	2094.45	1.7346	2.5303E-03	8.2571E-03	1.7202E+00

XIM = 3.1878E-02   GXM = 2.0561E-01   AIRMFM = 1.7202E+00   AKXM = 1.5800E-01

RUN NO. 23   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES,   X/D= 60

QJ/QI = 1.000   LAMDA = .7735

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	4.000	1.2420	1.666	541	44.35
TUNNEL GAS	29.000	.2400	1.399	547	249.90

RHOVJ = 1.7885E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1785	4.820	1.809	24.54	1.275	546	405	1380.14	.4385	7.1340E-03	2.9098E-02	4.2573E-01
0.00	.5979	.1725	4.820	1.800	24.69	1.279	546	404	1379.53	.4393	6.8645E-03	2.7949E-02	4.2700E-01
0.00	1.0103	.1940	9.470	1.797	24.15	1.910	546	305	1811.75	.7465	1.3411E-02	3.2133E-02	7.2249E-01
0.00	1.4227	.2140	12.250	1.797	23.65	2.197	546	266	1968.12	.9115	1.8445E-02	3.6195E-02	8.7848E-01
0.00	2.0412	.2440	12.900	1.800	22.90	2.253	546	257	2021.49	.9391	2.2379E-02	4.2620E-02	8.9912E-01
0.00	2.4536	.2720	12.800	1.807	22.20	2.236	546	257	2042.59	.9223	2.5274E-02	4.9009E-02	8.7714E-01
0.00	2.8660	.2995	12.410	1.818	21.51	2.189	546	261	2050.99	.8889	2.7677E-02	5.5689E-02	8.3939E-01
0.00	3.2784	.3240	12.000	1.830	20.90	2.139	545	266	2055.20	.8557	2.9668E-02	6.2010E-02	8.0266E-01
0.00	3.6907	.3290	11.870	1.830	20.77	2.126	545	268	2054.64	.8461	2.9965E-02	6.3345E-02	7.9247E-01
0.00	4.3093	.2940	12.800	1.800	21.65	2.238	546	256	2066.83	.9125	2.7714E-02	5.4319E-02	8.6296E-01
0.00	5.1340	.1885	16.800	1.782	24.29	2.615	546	221	2101.88	1.1951	2.0743E-02	3.1045E-02	1.1580E+00
0.00	5.9588	.0780	24.430	1.747	27.05	3.229	547	174	2167.24	1.7093	1.1023E-02	1.1534E-02	1.6896E+00
0.00	6.3711	.0340	28.900	1.735	28.15	3.541	547	155	2192.55	2.0074	5.4225E-03	4.8313E-03	1.9977E+00
0.00	6.8247	.0100	31.680	1.728	28.75	3.724	547	145	2204.53	2.1929	1.7059E-03	1.3913E-03	2.1899E+00
0.00	7.0309	.0050	32.400	1.821	28.87	3.668	547	148	2191.86	2.2536	8.7273E-04	6.9264E-04	2.2520E+00

XIM = 2.9965E-02   GXM = 6.3345E-02   AIRMFM = 2.2520E+00   AKXM = 3.2900E-01

RUN NO. 24 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 60

QJ/QI = 1.000 LAMDA = 2.4537

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	39.940	.1244	1.666	539	44.35
TUNNEL GAS	29.000	.2400	1.399	548	249.62

RHOVJ = 5.6620E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.0401	4.920	1.795	29.44	1.306	548	407	1283.74	.4831	4.6419E-03	5.4404E-02	4.5681E-01
0.00	.5979	.0644	4.900	1.786	29.70	1.306	548	406	1277.59	.4840	7.4014E-03	8.6591E-02	4.4206E-01
0.00	1.0103	.0696	12.980	1.780	29.76	2.293	548	263	1805.90	1.0529	1.7370E-02	9.3404E-02	9.5460E-01
0.00	1.8351	.0717	14.420	1.780	29.78	2.426	548	248	1852.97	1.1486	1.9504E-02	9.6148E-02	1.0381E+00
0.00	2.6598	.0748	15.200	1.797	29.82	2.482	548	241	1870.56	1.2028	2.1284E-02	1.0019E-01	1.0823E+00
0.00	3.4845	.0728	16.100	1.810	29.80	2.549	548	234	1893.38	1.2624	2.1758E-02	9.7583E-02	1.1392E+00
0.00	4.3093	.0634	17.440	1.764	29.69	2.697	548	220	1942.62	1.3403	2.0187E-02	8.5278E-02	1.2260E+00
0.00	5.1340	.0464	20.570	1.744	29.51	2.960	548	197	2021.58	1.5312	1.6984E-02	6.2805E-02	1.4350E+00
0.00	5.9588	.0327	26.370	1.703	29.36	3.411	548	163	2125.74	1.8849	1.4810E-02	4.4487E-02	1.8011E+00
0.00	6.7835	.0116	31.920	1.686	29.13	3.786	548	141	2201.27	2.2148	6.2221E-03	1.5906E-02	2.1796E+00
0.00	7.6082	0.0000	33.910	1.690	29.00	3.902	548	136	2225.57	2.3298	0.	0.	2.3298E+00

XIM = 2.1758E-02 GXM = 1.0019E-01 AIRMFM = 2.3298E+C0 AKXM = 7.4800E-02

RUN NO. 25 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 855

QJ/QI = 1.000 LAMDA = .7749

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	4.000	1.2420	1.666	542	44.35
TUNNEL GAS	29.000	.2400	1.399	550	249.90

RHOVJ = 1.7869E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.1140	5.980	1.833	26.15	1.453	549	381	1472.29	.5365	5.2357E-03	1.7438E-02	5.2716E-01
0.00	.5979	.1170	7.580	1.833	26.07	1.671	549	347	1617.90	.6465	6.4932E-03	1.7948E-02	6.3485E-01
0.00	1.0103	.1260	11.380	1.832	25.85	2.097	549	285	1851.50	.8903	9.7143E-03	1.9497E-02	8.7295E-01
0.00	1.8351	.1550	13.780	1.785	25.12	2.355	549	252	1984.63	1.0242	1.4144E-02	2.4677E-02	9.9891E-01
0.00	2.6598	.2020	14.870	1.780	23.95	2.451	549	238	2063.32	1.0703	2.0208E-02	3.3737E-02	1.0342E+00
0.00	3.4845	.2550	14.330	1.775	22.62	2.400	548	240	2096.67	1.0147	2.5600E-02	4.5083E-02	9.6894E-01
0.00	3.8969	.2680	14.100	1.780	22.30	2.375	548	243	2100.18	.9959	2.6793E-02	4.8072E-02	9.4806E-01
0.00	4.1031	.2785	14.100	1.793	22.04	2.364	548	243	2107.14	.9925	2.8078E-02	5.0550E-02	9.4236E-01
0.00	4.3093	.2690	14.200	1.815	22.27	2.359	548	244	2095.01	1.0047	2.7159E-02	4.8305E-02	9.5613E-01
0.00	4.5155	.2600	14.480	1.835	22.50	2.371	548	243	2090.33	1.0270	2.6567E-02	4.6222E-02	9.7956E-01
0.00	5.1340	.2150	16.400	1.803	23.62	2.562	549	225	2115.05	1.1580	2.3591E-02	3.6402E-02	1.1159E+00
0.00	5.9588	.1280	21.620	1.782	25.80	2.993	549	190	2160.44	1.5115	1.6786E-02	1.9845E-02	1.4815E+00
0.00	6.7835	.0440	30.200	1.775	27.90	3.579	550	153	2212.71	2.0805	7.3448E-03	6.3082E-03	2.0674E+00
0.00	7.6082	.0075	36.270	1.768	28.81	3.945	550	134	2241.25	2.4763	1.4429E-03	1.0412E-03	2.4738E+00
0.00	8.0206	0.0000	37.430	1.765	29.00	4.014	550	130	2244.98	2.5527	0.	0.	2.5527E+00

XIM = 2.8078E-02 GXM = 5.0550E-02 AIRMFM = 2.5527E+00 AKXM = 2.7850E-01

RUN NO. 26 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 200

QJ/QI = 1.000 LAMDA = .7778

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	4.000	1.2420	1.666	532	44.35
TUNNEL GAS	29.000	.2400	1.399	544	249.94

RHOVJ = 1.8036E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.0450	4.050	1.715	27.87	1.182	544	423	1217.79	.3984	1.4264E-03	6.4574E-03	3.9583E-01
0.00	.5979	.0450	4.150	1.690	27.87	1.214	544	418	1243.50	.4058	1.4529E-03	6.4574E-03	4.0318E-01
0.00	1.0103	.0590	5.600	1.680	27.52	1.475	543	376	1443.05	.5140	2.4437E-03	8.5740E-03	5.0964E-01
0.00	1.8351	.0695	10.070	1.665	27.26	2.072	543	289	1785.75	.8133	4.5984E-03	1.0197E-02	8.0505E-01
0.00	2.2474	.0740	11.480	1.662	27.15	2.227	543	269	1856.35	.9024	5.4546E-03	1.0902E-02	8.9253E-01
0.00	2.6598	.0820	13.180	1.662	26.95	2.397	543	249	1928.94	1.0074	6.7976E-03	1.2171E-02	9.9510E-01
0.00	3.0722	.0895	14.600	1.667	26.76	2.526	543	234	1980.40	1.0941	8.1144E-03	1.3377E-02	1.0794E+00
0.00	3.4845	.0960	15.980	1.680	26.60	2.638	543	222	2022.03	1.1786	9.4338E-03	1.4436E-02	1.1616E+00
0.00	3.8969	.1040	16.950	1.678	26.40	2.722	543	214	2054.11	1.2349	1.0789E-02	1.5758E-02	1.2154E+00
0.00	4.3093	.1180	17.480	1.653	26.05	2.787	543	207	2084.48	1.2584	1.2642E-02	1.8119E-02	1.2356E+00
0.00	4.7216	.1295	17.820	1.648	25.76	2.818	543	203	2103.04	1.2734	1.4195E-02	2.0107E-02	1.2478E+00
0.00	5.1340	.1395	18.000	1.649	25.51	2.831	543	201	2115.19	1.2798	1.5520E-02	2.1872E-02	1.2518E+00
0.00	5.5464	.1430	18.420	1.649	25.42	2.864	543	198	2127.54	1.3036	1.6261E-02	2.2498E-02	1.2743E+00
0.00	5.9588	.1400	19.000	1.650	25.50	2.911	543	194	2137.28	1.3402	1.6319E-02	2.1961E-02	1.3108E+00
0.00	6.7835	.1165	20.870	1.647	26.09	3.063	543	183	2155.07	1.4647	1.4507E-02	1.7863E-02	1.4386E+00
0.00	7.6082	.0750	24.380	1.648	27.12	3.325	543	166	2177.95	1.7005	1.0428E-02	1.1060E-02	1.6817E+00
0.00	8.4330	.0345	29.200	1.648	28.14	3.655	544	147	2205.87	2.0196	5.4918E-03	4.9045E-03	2.0097E+00
0.00	9.2577	.0080	32.150	1.647	28.80	3.846	544	137	2215.31	2.2181	1.3665E-03	1.1111E-03	2.2156E+00
0.00	9.6701	0.0000	32.670	1.647	29.00	3.879	544	136	2214.19	2.2555	0.	0.	2.2555E+00

XIM = 1.6319E-02 GXM = 2.2498E-02 AIRMFM = 2.2555E+00 AKXM = 1.4300E-01

RUN NO. 27 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES. X/D= 200

QJ/QI = 1.000 LANDA = 2.4465

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	39.940	.1244	1.666	538	44.35
TUNNEL GAS	29.000	.2400	1.399	544	249.67

RHOVJ = 5.6672E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) \IR MASS FLOW
0.00	.1856	.0496	4.950	1.720	29.54	1.347	544	397	1306.27	.4844	5.7320E-03	6.7056E-02	4.5196E-01
0.00	1.0103	.0306	6.640	1.678	29.33	1.635	544	353	1498.64	.6054	4.4504E-03	4.1663E-02	5.8015E-01
0.00	1.8351	.0316	12.240	1.664	29.35	2.308	544	262	1821.30	.9840	7.4675E-03	4.3008E-02	9.4169E-01
0.00	2.6598	.0327	16.030	1.664	29.36	2.664	544	223	1941.02	1.2301	9.6563E-03	4.4487E-02	1.1754E+00
0.00	3.0722	.0316	17.580	1.684	29.35	2.779	544	212	1974.74	1.3315	1.0105E-02	4.3008E-02	1.2742E+00
0.00	3.4845	.0306	19.370	1.673	29.33	2.933	544	199	2016.12	1.4439	1.C615E-02	4.1663E-02	1.3837E+00
0.00	4.3093	.0295	21.400	1.638	29.32	3.124	544	183	2061.71	1.5677	1.1115E-02	4.0181E-02	1.5047E+00
0.00	5.1340	.0284	23.150	1.639	29.31	3.253	544	173	2089.85	1.6778	1.1457E-02	3.8699E-02	1.6128E+00
0.00	8.4742	.0200	29.400	1.630	29.22	3.691	544	145	2173.62	2.0637	9.9554E-03	2.7339E-02	2.0073E+00
0.00	9.2990	.0137	30.550	1.622	29.15	3.775	544	141	2190.41	2.1301	7.0553E-03	1.8771E-02	2.0901E+00
0.00	10.0825	.0100	31.600	1.667	29.11	3.788	544	140	2194.67	2.1991	5.3242E-03	1.3721E-02	2.1690E+00
0.00	10.9072	.0060	32.550	1.726	29.07	3.779	544	141	2195.75	2.2636	3.2931E-03	8.2448E-03	2.2449E+00
0.00	11.7320	.0030	33.600	1.724	29.03	3.844	544	138	2207.21	2.3262	1.6940E-03	4.1271E-03	2.3166E+00
0.00	12.5567	C.0000	33.680	1.704	29.00	3.872	544	136	2213.18	2.3261	0.	0.	2.3261E+00

XIM = 1.1457E-02 GXM = 6.7056E-02 AIRMFM = 2.3261E+00 AKXM = 4.9600E-02

RUN NO. 28   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES,   X/D=   7

QJ/QI = 1.000   LAMDA = .7761

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	4.000	1.2420	1.666	538	44.35
TUNNEL GAS	29.000	.2400	1.399	547	249.75

RHOVJ = 1.7935E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2780	4.000	1.585	22.05	1.223	545	408	1412.25	.3506	9.8581E-03	5.0431E-02	3.3291E-01
0.00	.5979	.2770	3.720	1.582	22.07	1.166	545	418	1360.53	.3296	9.2241E-03	5.0193E-02	3.1306E-01
0.00	1.0103	.3020	3.980	1.587	21.45	1.217	545	408	1426.24	.3450	1.0832E-02	5.6317E-02	3.2555E-01
0.00	1.8351	.5330	4.390	1.478	15.67	1.341	543	373	1789.71	.3222	2.4433E-02	1.3601E-01	2.7836E-01
0.00	2.0412	.5750	4.270	1.469	14.62	1.319	543	374	1832.07	.3050	2.6745E-02	1.5726E-01	2.5704E-01
0.00	2.2474	.6120	4.400	1.460	13.70	1.346	542	367	1919.19	.3034	3.0226E-02	1.7869E-01	2.4917E-01
0.00	2.4536	.6210	4.930	1.457	13.47	1.444	542	349	2027.10	.3306	3.3975E-02	1.8434E-01	2.6962E-01
0.00	2.6598	.6090	5.780	1.455	13.77	1.589	542	325	2128.19	.3799	3.7454E-02	1.7684E-01	3.1268E-01
0.00	2.8660	.5650	7.380	1.456	14.87	1.831	543	291	2222.57	.4792	4.0595E-02	1.5193E-01	4.0640E-01
0.00	3.0722	.5110	9.020	1.457	16.22	2.051	543	264	2261.16	.5862	4.1173E-02	1.2598E-01	5.1232E-01
0.00	3.4845	.3470	12.200	1.465	20.32	2.428	545	230	2203.42	.8265	3.1468E-02	6.8290E-02	7.7002E-01
0.00	3.5876	.3100	12.000	1.467	21.25	2.410	545	234	2153.34	.8297	2.6995E-02	5.8353E-02	7.8129E-01
0.00	4.3093	.0810	17.320	1.480	26.97	2.943	546	196	2102.47	1.2405	8.3077E-03	1.2011E-02	1.2256E+00
0.00	4.7216	.0260	21.210	1.482	28.35	3.276	547	173	2135.82	1.5047	3.0776E-03	3.6684E-03	1.4992E+00
0.00	4.9278	.0105	23.520	1.468	28.74	3.475	547	160	2162.71	1.6532	1.3471E-03	1.4615E-03	1.6508E+00
0.00	5.1340	.0040	26.050	1.453	28.90	3.683	547	147	2193.44	1.8109	5.5900E-04	5.5363E-04	1.8099E+00

XIM = 4.1173E-02   GXM = 1.8434E-01   AIRMFM = 1.8099E+00   AKXM = 6.2100E-01

RUN NO. 29 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 7

QJ/QI = 1.000 LAMDA = 2.4525

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	39.940	.1244	1.666	538	44.35
TUNNEL GAS	29.000	.2400	1.399	547	249.75

RHOVJ = 5.6672E+00

Y/D COORDINATES	Z/D	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG.R.-	TX	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.1840	4.500	1.570	31.01	1.336	546	394	1270.02	.4545	1.9006E-02	2.3696E-01	3.4683E-01
0.00	.5979	.1870	4.070	1.567	31.05	1.253	546	408	1210.93	.4187	1.7774E-02	2.4057E-01	3.1797E-01
0.00	1.0103	.1820	4.670	1.569	30.99	1.368	546	389	1292.48	.4681	1.9374E-02	2.3455E-01	3.5832E-01
0.00	1.8351	.2400	4.980	1.463	31.63	1.482	545	367	1351.53	.4933	2.6383E-02	3.0310E-01	3.4379E-01
0.00	2.2474	.2880	4.670	1.440	32.15	1.435	545	372	1311.25	.4728	2.9846E-02	3.5777E-01	3.0363E-01
0.00	2.4948	.3000	5.180	1.439	32.28	1.527	545	356	1363.93	.5152	3.3744E-02	3.7117E-01	3.2399E-01
0.00	2.6598	.2820	6.180	1.438	32.09	1.695	545	331	1461.54	.5903	3.6561E-02	3.5104E-01	3.8305E-01
0.00	3.0722	.2680	10.330	1.440	31.93	2.252	545	255	1708.14	.8908	5.2692E-02	3.3521E-01	5.9221E-01
0.00	3.5258	.2080	12.650	1.448	31.28	2.509	546	230	1817.85	1.0366	4.8584E-02	2.6562E-01	7.6123E-01
0.00	3.8969	.1020	13.920	1.459	30.12	2.642	546	223	1906.20	1.0895	2.6005E-02	1.3527E-01	9.4210E-01
0.00	4.3093	.0830	17.180	1.460	29.91	2.951	546	195	1998.39	1.2950	2.5327E-02	1.1084E-01	1.1514E+00
0.00	5.1340	.0333	26.580	1.378	29.36	3.819	547	138	2190.50	1.8554	1.4828E-02	4.5293E-02	1.7714E+00
0.00	5.5464	.0114	32.200	1.341	29.12	4.275	547	117	2263.33	2.1848	6.0267E-03	1.5633E-02	2.1506E+00
0.00	5.9588	.0050	38.020	1.302	29.05	4.724	547	100	2313.02	2.5327	3.0717E-03	6.8732E-03	2.5153E+00
0.00	6.3711	0.0000	43.470	1.239	29.00	5.186	547	86	2353.53	2.8533	0.	0.	2.8533E+00

XIM = 5.2692E-02 GXM = 3.7117E-01 AIRMFM = 2.8533E+00 AKXM = 3.0000E-01

RUN NO. 31 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 7

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHCVJ = 1.3433E+00

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG	TX .R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.3450	3.280	1.573	19.69	1.081	532	431	1334.92	.2776	7.3005E-03	3.5323E-02	2.6783E-01
0.00	.5979	.3800	3.250	1.573	18.75	1.073	532	432	1359.30	.2688	8.1784E-03	4.0866E-02	2.5785E-01
0.00	1.0103	.3290	3.750	1.588	20.12	1.184	533	416	1420.00	.3160	7.7533E-03	3.2962E-02	3.0557E-01
0.00	1.4227	.4860	4.250	1.515	15.89	1.328	529	391	1738.40	.3100	1.4231E-02	6.1676E-02	2.9084E-01
0.00	1.6289	.4280	4.000	1.500	17.45	1.285	531	399	1620.50	.3083	1.1346E-02	4.9444E-02	2.9302E-01
0.00	1.8351	.4400	3.830	1.490	17.13	1.254	530	403	1605.58	.2944	1.1350E-02	5.1792E-02	2.7915E-01
0.00	2.0412	.4630	3.740	1.483	16.51	1.238	530	405	1618.83	.2833	1.1925E-02	5.6548E-02	2.6727E-01
0.00	2.2474	.4420	3.940	1.473	17.07	1.287	530	398	1640.30	.3003	1.1666E-02	5.2192E-02	2.8459E-01
0.00	2.6598	.6830	5.080	1.468	10.57	1.512	525	360	2328.04	.2909	2.8208E-02	1.3027E-01	2.5298E-01
0.00	3.0722	.5000	7.800	1.468	15.51	1.934	529	302	2253.47	.4918	2.3797E-02	6.4999E-02	4.5985E-01
0.00	3.2784	.4740	8.900	1.470	16.21	2.079	530	284	2295.00	.5584	2.4504E-02	5.8952E-02	5.2545E-01
0.00	3.4845	.4050	10.680	1.470	18.07	2.295	531	258	2289.62	.6819	2.2934E-02	4.5181E-02	6.5108E-01
0.00	3.8969	.2250	14.150	1.465	22.93	2.670	535	221	2184.52	.9642	1.4199E-02	1.9783E-02	9.4509E-01
0.00	4.3093	.1020	17.830	1.480	26.25	2.998	538	192	2140.56	1.2529	7.3070E-03	7.8343E-03	1.2431E+00
0.00	4.7216	.0380	21.180	1.493	27.97	3.264	539	172	2136.91	1.5002	3.0583E-03	2.7385E-03	1.4961E+00
0.00	5.1340	.0090	25.850	1.508	28.76	3.599	540	151	2171.48	1.8127	8.5140E-04	6.3094E-04	1.8116E+00
0.00	5.3402	.0040	28.250	1.505	28.89	3.771	540	141	2194.06	1.9655	4.0838E-04	2.7911E-04	1.9649E+00
0.00	5.5464	.0010	30.950	1.500	28.97	3.958	540	131	2217.99	2.1351	1.1059E-04	6.9582E-05	2.1349E+00
0.00	5.7526	0.0000	33.500	1.500	29.00	4.122	540	123	2238.20	2.2943	0.	0.	2.2943E+00

XIM = 2.8208E-02 GXM = 1.3027E-01 AIRMFM = 2.2943E+00 AKXM = 6.8300E-01

RUN NO. 32 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES. X/D= 15

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHOVJ = 1.3433E+00

Y/D COORD	Z/D INATES	K MOL FR.	PT2X PSIA	P1X PSIA	MWX MOL WT	MX MACH	TTX -DEG	TX .R.-	VX FT/SEC	RHOVX SLG/SQFTSEC	XI	GX MASS FR.	RHOVX*(1-GX) AIR MASS FLOW
0.00	.1856	.5990	4.200	1.648	12.84	1.247	527	402	1840.27	.2809	1.9671E-02	9.4074E-02	2.5446E-01
0.00	.1856	.6280	4.100	1.648	12.05	1.227	526	404	1874.45	.2670	2.C873E-02	1.0503E-01	2.3892E-01
0.00	.5979	.5160	4.000	1.645	15.08	1.208	529	409	1660.00	.2916	1.4979E-02	6.9000E-02	2.7150E-01
0.00	1.0103	.5450	3.950	1.630	14.29	1.205	528	409	1700.68	.2807	1.6064E-02	7.6867E-02	2.5916E-01
0.00	1.4227	.5460	4.700	1.593	14.27	1.371	528	383	1875.56	.3221	1.8499E-02	7.7154E-02	2.9724E-01
0.00	1.6289	.5250	4.600	1.580	14.83	1.359	528	386	1829.00	.3221	1.7110E-02	7.1352E-02	2.9915E-01
0.00	1.8351	.5710	4.450	1.570	13.59	1.336	527	388	1885.11	.3002	1.8924E-02	8.4691E-02	2.7475E-01
0.00	2.0412	.5460	4.280	1.563	14.27	1.307	528	393	1810.99	.2976	1.7090E-02	7.7154E-02	2.7460E-01
0.00	2.2474	.5670	4.230	1.558	13.70	1.300	528	394	1839.60	.2888	1.7936E-02	8.3435E-02	2.6468E-01
0.00	2.6598	.5810	4.550	1.548	13.32	1.368	527	383	1936.09	.3018	1.9751E-02	8.7920E-02	2.7524E-01
0.00	3.0722	.4960	5.800	1.545	15.62	1.587	529	352	1986.87	.3950	1.8831E-02	6.4033E-02	3.6974E-01
0.00	3.4845	.4370	7.500	1.540	17.21	1.843	530	316	2082.32	.5066	1.9307E-02	5.1197E-02	4.8064E-01
0.00	3.8969	.3180	9.850	1.542	20.42	2.141	533	278	2083.78	.6838	1.5983E-02	3.1397E-02	6.6238E-01
0.00	4.3093	.2010	12.880	1.548	23.58	2.468	536	241	2083.26	.9122	1.1672E-02	1.7187E-02	8.9655E-01
0.00	4.7216	.1080	17.650	1.550	26.09	2.912	538	200	2124.02	1.2469	7.7473E-03	8.3466E-03	1.2365E+00
0.00	5.1340	.0390	22.900	1.550	27.95	3.334	539	167	2152.09	1.6129	3.3777E-03	2.8133E-03	1.6083E+00
0.00	5.5464	.0080	26.430	1.548	28.78	3.592	540	151	2169.27	1.8551	7.7375E-04	5.6031E-04	1.8540E+00
0.00	5.9588	C.0000	28.350	1.535	29.00	3.740	540	142	2185.40	1.9794	0.	0.	1.9794E+00

XIM = 2.0873E-02 GXM = 1.0503E-01 AIRMFM = 1.9794E+00 AKXM = 6.2800E-01

RUN NO. 33 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHOVJ = 1.3433E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.4400	3.250	1.692	17.13	1.012	530	440	1353.57	.2583	9.9582E-03	5.1792E-02	2.4491E-01
0.00	.1856	.4710	3.250	1.692	16.29	1.012	530	439	1386.98	.2521	1.0937E-02	5.8288E-02	2.3738E-01
0.00	.5979	.4790	3.250	1.695	16.07	1.010	529	440	1394.14	.2504	1.1198E-02	6.0074E-02	2.3536E-01
0.00	1.0103	.5400	5.000	1.676	14.43	1.380	528	382	1874.69	.3438	1.9309E-02	7.5450E-02	3.1785E-01
0.00	1.4227	.5730	6.470	1.662	13.54	1.621	527	345	2160.47	.4078	2.5905E-02	8.5327E-02	3.7304E-01
0.00	1.6289	.5800	6.680	1.654	13.35	1.656	527	340	2205.83	.4149	2.7054E-02	8.7591E-02	3.7857E-01
0.00	1.8351	.5860	6.500	1.648	13.19	1.633	527	343	2199.33	.4034	2.6900E-02	8.9584E-02	3.6724E-01
0.00	2.0412	.5710	6.630	1.644	13.59	1.655	527	340	2185.28	.4156	2.6201E-02	8.4691E-02	3.8038E-01
0.00	2.2474	.5090	6.650	1.641	15.27	1.659	529	341	2068.58	.4407	2.2051E-02	6.7221E-02	4.1105E-01
0.00	2.6598	.4290	6.850	1.636	17.42	1.691	531	337	1963.14	.4807	1.7762E-02	4.9637E-02	4.5685E-01
0.00	3.0722	.4080	7.380	1.634	17.99	1.766	531	327	1985.96	.5176	1.7615E-02	4.5720E-02	4.9389E-01
0.00	3.4845	.3510	8.350	1.631	19.53	1.895	532	310	1990.83	.5934	1.6006E-02	3.6235E-02	5.7190E-01
0.00	3.8969	.2700	9.630	1.632	21.71	2.050	534	290	1976.71	.6996	1.3056E-02	2.5067E-02	6.8211E-01
0.00	4.3093	.2320	11.480	1.625	22.74	2.261	535	264	2033.87	.8233	1.2606E-02	2.0568E-02	8.0639E-01
0.00	4.7216	.1710	14.420	1.618	24.39	2.559	536	232	2083.05	1.0257	1.0794E-02	1.4137E-02	1.0112E+00
0.00	5.1340	.1080	18.700	1.601	26.09	2.950	538	196	2134.42	1.3161	8.1774E-03	8.3466E-03	1.3051E+00
0.00	5.5464	.0570	23.730	1.578	27.46	3.364	539	165	2176.30	1.6537	5.1513E-03	4.1844E-03	1.6468E+00
0.00	5.9588	.0180	27.450	1.566	28.51	3.641	540	148	2187.20	1.9123	1.8116E-03	1.2726E-03	1.9099E+00
0.00	6.3711	.0050	29.190	1.552	28.87	3.775	540	140	2195.61	2.0296	5.2760E-04	3.4921E-04	2.0288E+00

XIM = 2.7054E-02 GXM = 8.9584E-02 AIRMFM = 2.0288E+00 AKXM = 5.8600E-01

RUN NO. 33 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHOVJ = 1.3433E+CC

Y/D	Z/D	K	FT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-12.16	1.0103	.0020	8.180	1.558	28.95	1.923	540	311	1661.03	.6986	7.2437E-05	1.3929E-04	6.9848E-01
-10.56	1.0103	.0060	7.2C0	1.578	28.84	1.777	540	331	1587.84	.6322	1.9741E-04	4.1945E-04	6.3197E-01
-9.12	1.0103	.0190	7.21C	1.591	28.49	1.770	540	332	1593.35	.6303	6.3094E-04	1.3446E-03	6.2950E-01
-7.60	1.0103	.0350	7.200	1.599	28.06	1.764	539	333	1601.42	.6258	1.1716E-03	2.5150E-03	6.2418E-01
-6.09	1.0103	.0360	9.450	1.601	28.03	2.051	539	293	1748.88	.7759	1.4956E-03	2.5894E-03	7.7390E-01
-4.57	1.0103	.1000	1C.480	1.600	26.30	2.170	538	277	1857.86	.8177	4.6658E-03	7.6649E-03	8.1144E-01
-3.04	1.0103	.1960	11.400	1.608	23.71	2.265	536	264	1995.21	.8336	1.0342E-02	1.6665E-02	8.1974E-01
-1.45	1.0103	.4290	9.080	1.634	17.42	1.983	531	297	2159.37	.6003	2.2182E-02	4.9637E-02	5.7053E-01
0.00	1.0103	.5290	5.520	1.660	14.73	1.476	528	368	1946.40	.3749	2.0212E-02	7.2423E-02	3.4776E-01
1.52	1.0103	.4620	8.340	1.678	16.53	1.864	530	312	2137.61	.5501	2.3070E-02	5.6334E-02	5.1912E-01
3.04	1.0103	.2600	12.080	1.670	21.98	2.290	534	261	2080.17	.8486	1.5061E-02	2.3843E-02	8.2833E-01
4.63	1.0103	.1300	11.2C0	1.655	25.49	2.209	537	272	1903.01	.8555	6.5473E-03	1.0281E-02	8.4670E-C1
6.07	1.0103	.063C	1C.820	1.640	27.30	2.179	539	276	1828.73	.8582	2.9721E-03	4.6523E-03	8.5419E-01
7.59	1.0103	.0430	9.080	.635	27.84	3.278	539	171	2144.65	.6410	1.4859E-03	3.1138E-03	6.3902E-01
9.11	1.0103	.0220	8.1C0	1.645	28.41	1.855	540	320	1641.31	.6948	8.0761E-04	1.5613E-03	6.9376E-C1
10.63	1.0103	.0150	7.96C	1.628	28.60	1.848	540	321	1632.29	.6860	5.4005E-04	1.0575E-03	6.8529E-01
12.15	1.0103	0.0000	8.640	1.613	29.00	1.944	540	308	1670.16	.7355	0.	0.	7.3546E-01

XIM = 2.3070E-02 GXM = 7.2423E-02 AIRMFM = 8.54I9E-01 AKXM = 5.2900E-01

APPENDIX - Continued

RUN NO. 33 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 30

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHOVJ = 1.3433E+0C

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-10.56	1.8351	0.0000	13.670	1.524	29.00	2.569	540	233	1920.20	1.0551	0.	0.	1.0551E+00
-9.12	1.8351	.0050	13.2C0	1.539	28.87	2.508	540	239	1904.59	1.0244	2.6631E-04	3.4921E-04	1.0241E+00
-7.60	1.8351	.0110	13.080	1.551	28.70	2.486	540	242	1902.08	1.0154	5.8398E-04	7.7260E-04	1.0146E+00
-6.00	1.8351	.0090	14.8C0	1.564	28.76	2.642	540	225	1951.20	1.1276	5.2962E-04	6.3094E-04	1.1269E+00
-4.57	1.8351	.0230	15.870	1.567	28.38	2.738	539	216	1992.46	1.1884	1.4454E-03	1.6339E-03	1.1864E+00
-3.04	1.8351	.1475	14.760	1.572	25.02	2.631	537	225	2081.88	1.0536	9.3218E-03	1.1885E-02	1.0411E+00
-1.29	1.8351	.4540	9.180	1.617	16.75	2.007	530	293	2215.72	.5928	2.4115E-02	5.4645E-02	5.6042E-01
0.00	1.8351	.5850	6.480	1.640	13.21	1.635	527	343	2198.62	.4024	2.6733E-02	8.9248E-02	3.6647E-01
1.52	1.8351	.4500	8.020	1.647	16.86	1.843	530	315	2103.18	.5363	2.1486E-02	5.3817E-02	5.0746E-01
3.04	1.8351	.2170	13.570	1.650	23.14	2.452	535	243	2095.99	.9546	1.3431E-02	1.8902E-02	9.3651E-01
4.63	1.8351	.0475	16.250	1.630	27.72	2.716	539	218	2008.29	1.2063	3.1023E-03	3.4548E-03	1.2021E+00
6.07	1.8351	.0120	15.4CC	1.607	28.68	2.660	540	224	1959.24	1.1693	7.3435E-04	8.4363E-04	1.1683E+00
7.59	1.8351	.0090	14.080	1.616	28.76	2.529	540	237	1915.02	1.0878	5.1092E-04	6.3094E-04	1.0871E+00
9.11	1.8351	.0060	13.2C0	1.616	28.84	2.444	540	246	1883.32	1.0328	3.2248E-04	4.1945E-04	1.0323E+00
10.63	1.8351	.0020	13.2C0	1.600	28.95	2.457	540	245	1884.51	1.0328	1.0709E-04	1.3929E-04	1.0326E+00

XIM = 2.6733E-02 GXM = 8.9248E-02 AIRMFM = 1.2021E+00 AKXM = 5.8500E-01

RUN NO. 33 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES. X/D= 30

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHOVJ = 1.3433E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-4.19	3.8969	.0050	28.960	1.455	28.87	3.886	540	134	2211.90	2.0016	5.2033E-04	3.4921E-04	2.0009E+00
-3.35	3.8969	.0290	25.260	1.500	28.22	3.566	539	152	2185.55	1.7590	2.7131E-03	2.0719E-03	1.7554E+00
-2.97	3.8969	.0680	21.800	1.528	27.17	3.274	539	171	2169.09	1.5216	5.7160E-03	5.0465E-03	1.5139E+00
-2.66	3.8969	.1070	18.620	1.551	26.11	2.993	538	193	2144.44	1.3059	8.0305E-03	8.2608E-03	1.2951E+00
-2.21	3.8969	.1770	15.030	1.582	24.22	2.647	536	223	2119.93	1.0543	1.1562E-02	1.4731E-02	1.0388E+00
-1.83	3.8969	.2310	12.610	1.600	22.77	2.397	535	249	2090.71	.8868	1.3503E-02	2.0455E-02	8.6862E-01
-1.52	3.8969	.2430	11.560	1.608	22.44	2.282	535	262	2056.23	.8211	1.3342E-02	2.1828E-02	8.0317E-01
-1.14	3.8969	.2740	10.620	1.615	21.61	2.175	534	274	2044.28	.7534	1.4339E-02	2.5566E-02	7.3415E-01
-.69	3.8969	.3110	9.820	1.620	20.61	2.080	533	286	2043.44	.6919	1.5671E-02	3.0424E-02	6.7089E-01
-.38	3.8969	.3400	9.520	1.623	19.83	2.043	533	290	2061.90	.6627	1.7057E-02	3.4574E-02	6.3981E-01
0.00	3.8969	.3490	9.450	1.628	19.58	2.032	532	291	2067.75	.6553	1.7528E-02	3.5929E-02	6.3178E-01
.38	3.8969	.3310	9.620	1.630	20.07	2.050	533	289	2053.55	.6728	1.6654E-02	3.3251E-02	6.5043E-01
.83	3.8969	.3400	10.200	1.638	19.83	2.111	533	281	2098.39	.7016	1.8058E-02	3.4574E-02	6.7738E-01
1.14	3.8969	.3280	11.130	1.635	20.15	2.216	533	269	2134.65	.7584	1.8527E-02	3.2818E-02	7.3347E-01
1.59	3.8969	.2510	12.820	1.634	22.23	2.392	535	249	2112.63	.8919	1.5115E-02	2.2766E-02	8.7160E-01
1.97	3.8969	.2330	15.760	1.634	22.71	2.668	535	221	2193.81	1.0692	1.6462E-02	2.0681E-02	1.0471E+00
2.73	3.8969	.1610	22.760	1.635	24.66	3.232	536	174	2262.78	1.5216	1.4911E-02	1.3164E-02	1.5015E+00
3.49	3.8969	.0600	27.560	1.635	27.38	3.568	539	152	2217.44	1.8917	6.2210E-03	4.4177E-03	1.8833E+00
4.25	3.8969	.0130	29.750	1.593	28.65	3.761	540	141	2201.39	2.0627	1.4047E-03	9.1479E-04	2.0608E+00
4.63	3.8969	.0020	30.700	1.573	28.95	3.847	540	137	2203.38	2.1290	2.2076E-04	1.3929E-04	2.1287E+00

XIM = 1.8527E-02 GXM = 3.5929E-02 AIRMFM = 2.1287E+00 AKXM = 3.4900E-01

RUN NO. 34 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 60

QJ/QI = 1.0008 LAMDA = .5773

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	518	48.65
TUNNEL GAS	29.000	.2400	1.399	540	249.86

RHOVJ = 1.3433E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.3690	3.230	1.693	19.04	1.006	532	442	1279.48	.2703	7.8597E-03	3.9065E-02	2.5972E-01
0.00	.5979	.3770	3.250	1.693	18.83	1.011	532	441	1292.01	.2704	8.1255E-03	4.0369E-02	2.5947E-01
0.00	1.0103	.4260	6.100	1.685	17.50	1.553	531	358	1852.64	.4426	1.6165E-02	4.9062E-02	4.2090E-01
0.00	1.4227	.4450	7.330	1.680	16.99	1.731	530	331	2017.05	.5037	1.9797E-02	5.2796E-02	4.7711E-01
0.00	1.8351	.4510	7.700	1.677	16.83	1.782	530	324	2063.15	.5210	2.0951E-02	5.4023E-02	4.9282E-01
0.00	2.2474	.4505	8.050	1.677	16.84	1.828	530	318	2093.91	.5397	2.1665E-02	5.3920E-02	5.1065E-01
0.00	2.6598	.4460	8.500	1.675	16.97	1.886	530	310	2125.43	.5653	2.2302E-02	5.2999E-02	5.3531E-01
0.00	3.0722	.4310	8.900	1.677	17.37	1.933	531	303	2131.71	.5931	2.2087E-02	5.0023E-02	5.6346E-01
0.00	3.4845	.4050	9.450	1.685	18.07	1.993	531	296	2127.46	.6348	2.1349E-02	4.5181E-02	6.0608E-01
0.00	3.8969	.3680	10.180	1.687	19.07	2.075	532	286	2118.78	.6915	2.0027E-02	3.8904E-02	6.6463E-01
0.00	4.3093	.3200	11.230	1.673	20.37	2.199	533	271	2115.54	.7712	1.8186E-02	3.1678E-02	7.4676E-01
0.00	4.7216	.2600	12.680	1.660	21.98	2.357	534	253	2109.61	.8818	1.5651E-02	2.3843E-02	8.6076E-01
0.00	5.1340	.1930	14.950	1.648	23.79	2.584	536	229	2116.39	1.0478	1.2755E-02	1.6354E-02	1.0306E+00
0.00	5.5464	.1360	18.090	1.640	25.33	2.863	537	203	2140.73	1.2662	1.0202E-02	1.0824E-02	1.2525E+00
0.00	5.9588	.0820	22.090	1.632	26.79	3.186	538	178	2164.42	1.5422	7.0850E-03	6.1713E-03	1.5327E+00
0.00	6.3711	.0400	26.100	1.623	27.92	3.483	539	158	2181.66	1.8183	3.9093E-03	2.8882E-03	1.8130E+00
0.00	6.7835	.0170	29.050	1.615	28.54	3.689	540	145	2194.11	2.0188	1.8046E-03	1.2008E-03	2.0164E+00
0.00	6.9897	.0100	30.100	1.610	28.73	3.763	540	141	2198.75	2.0895	1.0915E-03	7.0170E-04	2.0881E+00
0.00	7.1959	.0050	30.700	1.613	28.87	3.798	540	139	2199.08	2.1318	5.5419E-04	3.4921E-04	2.1311E+00
0.00	7.4021	.0020	31.200	1.610	28.95	3.833	540	137	2201.35	2.1653	2.2453E-04	1.3929E-04	2.1650E+00

XIM = 2.2302E-02 GXM = 5.4023E-02 AIRMFM = 2.1650E+00 AKXM = 4.5100E-01

RUN NO. 35 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 120

QJ/QI = 1.0012 LAMDA = .5772

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	509	48.65
TUNNEL GAS	29.000	.2400	1.399	530	249.75

RHOVJ = 1.3552E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
0.00	.1856	.2460	3.600	1.735	22.36	1.077	525	426	1239.92	.3272	5.3545E-03	2.2178E-02	3.1993E-01
0.00	.5979	.2390	3.600	1.740	22.55	1.075	525	426	1232.67	.3286	5.1808E-03	2.1366E-02	3.2157E-01
0.00	1.0103	.2430	5.480	1.740	22.44	1.428	525	373	1535.47	.4660	7.5067E-03	2.1828E-02	4.5586E-01
0.00	1.4227	.2630	8.100	1.730	21.90	1.803	525	318	1811.42	.6257	1.1177E-02	2.4207E-02	6.1057E-01
0.00	1.8351	.2810	8.850	1.720	21.42	1.901	524	304	1889.57	.6630	1.2940E-02	2.6450E-02	6.4546E-01
0.00	2.2474	.2900	9.500	1.720	21.17	1.977	524	294	1943.15	.6975	1.4211E-02	2.7610E-02	6.7822E-01
0.00	2.6598	.3000	10.100	1.720	20.90	2.045	524	285	1992.01	.7278	1.5538E-02	2.8931E-02	7.0677E-01
0.00	3.0722	.3075	10.680	1.720	20.70	2.108	524	277	2034.49	.7575	1.6739E-02	2.9944E-02	7.3483E-01
0.00	3.4845	.3095	11.350	1.740	20.65	2.165	524	270	2065.80	.7963	1.7756E-02	3.0218E-02	7.7222E-01
0.00	3.8969	.3110	11.850	1.745	20.61	2.213	523	264	2090.89	.8241	1.8502E-02	3.0424E-02	7.9907E-01
0.00	4.3093	.3010	12.500	1.735	20.88	2.285	524	256	2110.94	.8650	1.8553E-02	2.9065E-02	8.3989E-01
0.00	4.7216	.2875	13.150	1.725	21.24	2.355	524	248	2124.14	.9081	1.8284E-02	2.7285E-02	8.8332E-01
0.00	5.1340	.2710	13.950	1.725	21.69	2.430	524	240	2134.13	.9627	1.7896E-02	2.5191E-02	9.3847E-01
0.00	5.5464	.2430	14.900	1.720	22.44	2.521	525	231	2133.95	1.0329	1.6637E-02	2.1828E-02	1.0103E+00
0.00	5.9588	.2150	16.150	1.715	23.20	2.635	526	220	2140.39	1.1216	1.5463E-02	1.8684E-02	1.1006E+00
0.00	6.3711	.1710	18.280	1.720	24.39	2.808	526	204	2143.94	1.2753	1.3304E-02	1.4137E-02	1.2573E+00
0.00	6.7835	.1300	20.700	1.723	25.49	2.994	527	189	2149.54	1.4484	1.0988E-02	1.0281E-02	1.4335E+00
0.00	7.1959	.0830	23.880	1.725	26.76	3.223	528	172	2153.63	1.6769	7.7375E-03	6.2528E-03	1.6664E+00
0.00	7.6082	.0525	26.850	1.720	27.58	3.430	529	158	2164.17	1.8839	5.3343E-03	3.8371E-03	1.8767E+00
0.00	8.0206	.0290	29.500	1.718	28.22	3.602	529	147	2171.34	2.0689	3.1632E-03	2.0719E-03	2.0646E+00
0.00	8.4330	.0165	31.430	1.715	28.55	3.725	530	140	2178.80	2.2007	1.8917E-03	1.1649E-03	2.1981E+00
0.00	8.8454	.0066	32.530	1.710	28.82	3.797	530	137	2180.04	2.2786	7.7623E-04	4.6165E-04	2.2776E+00
0.00	9.0515	.0022	32.950	1.710	28.94	3.822	530	135	2179.45	2.3094	2.6117E-04	1.5325E-04	2.3090E+00

XIM = 1.8553E-02 GXM = 3.0424E-02 AIRMFM = 2.3090E+00 AKXM = 3.1100E-01

RUN NO. 35   COLD FLOW MIXING TESTS IN MACH 4 FACILITY   JET DIAMETER = .0485 INCHES, X/D= 120

QJ/QI = 1.0012   LAMDA = .5772

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	509	48.65
TUNNEL GAS	29.000	.2400	1.399	530	249.75

RHOVJ = 1.3552E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-12.41	2.2474	.0022	14.130	1.620	28.94	2.531	530	233	1891.94	1.1051	1.2497E-04	1.5325E-04	1.1049E+00
-10.86	2.2474	.0044	13.930	1.630	28.88	2.504	530	235	1884.76	1.0922	2.4754E-04	3.0713E-04	1.0919E+00
-9.31	2.2474	.0055	13.750	1.653	28.85	2.468	530	239	1873.60	1.0827	3.0703E-04	3.8431E-04	1.0822E+00
-7.76	2.2474	.0120	14.180	1.668	28.68	2.497	530	236	1888.84	1.1090	6.9042E-04	8.4363E-04	1.1081E+00
-6.13	2.2474	.0190	15.730	1.675	28.49	2.632	530	222	1938.51	1.2058	1.1964E-03	1.3446E-03	1.2042E+00
-4.66	2.2474	.0480	16.450	1.680	27.70	2.690	529	216	1982.48	1.2359	3.1854E-03	3.4928E-03	1.2316E+00
-3.11	2.2474	.1070	15.730	1.680	26.11	2.627	528	222	2019.57	1.1573	7.0547E-03	8.2608E-03	1.1477E+00
-2.25	2.2474	.1630	14.500	1.688	24.60	2.510	527	233	2037.66	1.0520	1.0369E-02	1.3357E-02	1.0380E+00
-1.40	2.2474	.2380	12.200	1.700	22.58	2.280	525	257	2030.56	.8774	1.3759E-02	2.1251E-02	8.5874E-01
-.70	2.2474	.2810	10.300	1.708	21.42	2.075	524	282	1984.41	.7470	1.4580E-02	2.6450E-02	7.2721E-01
-.00	2.2474	.3085	9.050	1.709	20.68	1.931	524	300	1939.88	.6626	1.4707E-02	3.0081E-02	6.4262E-01
.77	2.2474	.2895	9.480	1.705	21.19	1.984	524	293	1946.55	.6953	1.4132E-02	2.7545E-02	6.7612E-01
1.55	2.2474	.2475	11.430	1.708	22.32	2.196	525	267	2003.70	.8285	1.3666E-02	2.2353E-02	8.0997E-01
3.10	2.2474	.1320	15.500	1.713	25.44	2.580	527	226	2029.44	1.1326	8.7434E-03	1.0461E-02	1.1208E+00
4.73	2.2474	.0510	16.900	1.709	27.62	2.704	529	215	1989.46	1.2659	3.4768E-03	3.7220E-03	1.2612E+00
6.12	2.2474	.0220	16.500	1.690	28.41	2.686	530	217	1957.71	1.2551	1.4461E-03	1.5613E-03	1.2531E+00
7.75	2.2474	.0125	15.050	1.680	28.66	2.567	530	229	1912.42	1.1663	7.5665E-04	8.7919E-04	1.1652E+00
8.52	2.2474	.0110	14.080	1.680	28.70	2.478	530	238	1881.60	1.1045	6.2967E-04	7.7260E-04	1.1036E+00
9.30	2.2474	.0077	13.400	1.673	28.79	2.419	530	244	1858.29	1.0612	4.2218E-04	5.3915E-04	1.0606E+00
10.00	2.2474	.0044	13.400	1.665	28.88	2.425	530	244	1857.74	1.0618	2.4065E-04	3.0713E-04	1.0615E+00
10.85	2.2474	.0022	13.950	1.660	28.94	2.481	530	238	1875.43	1.0981	1.2418E-04	1.5325E-04	1.0979E+00

XIM = 1.4707E-02   GXM = 3.0081E-02   AIRMFM = 1.2612E+00   AKXM = 3.0850E-01

RUN NO. 35 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 120

QJ/QI = 1.0012 LAMDA = .5772

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	509	48.65
TUNNEL GAS	29.000	.2400	1.399	530	249.75

RHOVJ = 1.3552E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-7.76	3.8969	.0011	25.900	1.568	28.97	3.531	530	152	2132.20	1.8477	1.0437E-04	7.6547E-05	1.8475E+00
-6.13	3.8969	.0044	27.300	1.585	28.88	3.608	530	147	2148.35	1.9353	4.3861E-04	3.0713E-04	1.9347E+00
-4.66	3.8969	.0290	25.880	1.610	28.22	3.482	529	155	2150.39	1.8291	2.7966E-03	2.0719E-03	1.8253E+00
-3.11	3.8969	.1130	20.050	1.658	25.95	3.004	528	188	2133.85	1.4136	9.1569E-03	8.7785E-03	1.4012E+00
-1.40	3.8969	.2600	13.700	1.720	21.98	2.411	525	243	2112.29	.9543	1.6789E-02	2.3843E-02	9.3152E-01
-.78	3.8969	.2990	12.230	1.735	20.93	2.258	524	259	2096.18	.8509	1.8083E-02	2.8798E-02	8.2643E-01
-.00	3.8969	.3190	11.450	1.733	20.39	2.180	523	268	2085.75	.7965	1.8536E-02	3.1537E-02	7.7136E-01
.77	3.8969	.3130	11.730	1.740	20.55	2.204	523	265	2089.36	.8159	1.8484E-02	3.0700E-02	7.9086E-01
1.62	3.8969	.2810	12.930	1.740	21.42	2.323	524	252	2101.95	.9007	1.7580E-02	2.6450E-02	8.7685E-01
3.25	3.8969	.1440	19.000	1.740	25.11	2.848	527	201	2125.42	1.3388	1.1420E-02	1.1559E-02	1.3233E+00
4.73	3.8969	.0300	26.530	1.713	28.19	3.416	529	159	2139.18	1.8827	2.9806E-03	2.1454E-03	1.8787E+00
6.20	3.8969	.0033	28.000	1.660	28.91	3.569	530	150	2140.84	1.9906	3.3802E-04	2.3011E-04	1.9902E+00
7.75	3.8969	.0022	25.550	1.638	28.94	3.428	530	158	2114.89	1.8344	2.0745E-04	1.5325E-04	1.8341E+00

XIM = 1.8536E-02 GXM = 3.1537E-02 AIRMFM = 1.9902E+00 AKXM = 3.1900E-01

RUN NO. 35 COLD FLOW MIXING TESTS IN MACH 4 FACILITY JET DIAMETER = .0485 INCHES, X/D= 120

QJ/QI = 1.0012 LAMDA = .5772

	MOL.WT.	SPECIFIC HEAT	GAMMA	AVG.TOTAL TEMP.(DEG.R)	TOTAL PRESS.(PSIA)
JET GAS	2.016	3.4300	1.403	509	48.65
TUNNEL GAS	29.000	.2400	1.399	530	249.75

RHOVJ = 1.3552E+00

Y/D	Z/D	K	PT2X	P1X	MWX	MX	TTX	TX	VX	RHOVX	XI	GX	RHOVX*(1-GX)
COORDINATES		MOL FR.	PSIA	PSIA	MOL WT	MACH	-DEG.R.-		FT/SEC	SLG/SQFTSEC		MASS FR.	AIR MASS FLOW
-6.13	6.3711	0.0000	33.300	1.571	29.00	4.013	530	126	2203.66	2.3136	0.	0.	2.3136E+00
-4.66	6.3711	.0077	31.950	1.593	28.79	3.901	530	131	2196.10	2.2246	8.8504E-04	5.3915E-04	2.2234E+00
-3.11	6.3711	.0400	27.730	1.630	27.92	3.585	529	148	2179.41	1.9371	4.1284E-03	2.8882E-03	1.9315E+00
-1.63	6.3711	.1260	20.830	1.680	25.60	3.044	527	185	2157.71	1.4538	1.0645E-02	9.9225E-03	1.4394E+00
-.00	6.3711	.1730	17.830	1.710	24.33	2.780	526	207	2137.85	1.2463	1.3183E-02	1.4334E-02	1.2284E+00
1.70	6.3711	.1475	19.400	1.727	25.02	2.891	527	197	2141.23	1.3587	1.1916E-02	1.1885E-02	1.3425E+00
3.10	6.3711	.0700	25.350	1.727	27.11	3.322	529	165	2161.03	1.7777	6.8282E-03	5.2052E-03	1.7684E+00
4.73	6.3711	.0110	31.600	1.709	28.70	3.742	530	140	2176.05	2.2159	1.2633E-03	7.7260E-04	2.2142E+00

XIM = 1.3183E-02 GXM = 1.4334E-02 AIRMFM = 2.3136E+00 AKXM = 1.7300E-01

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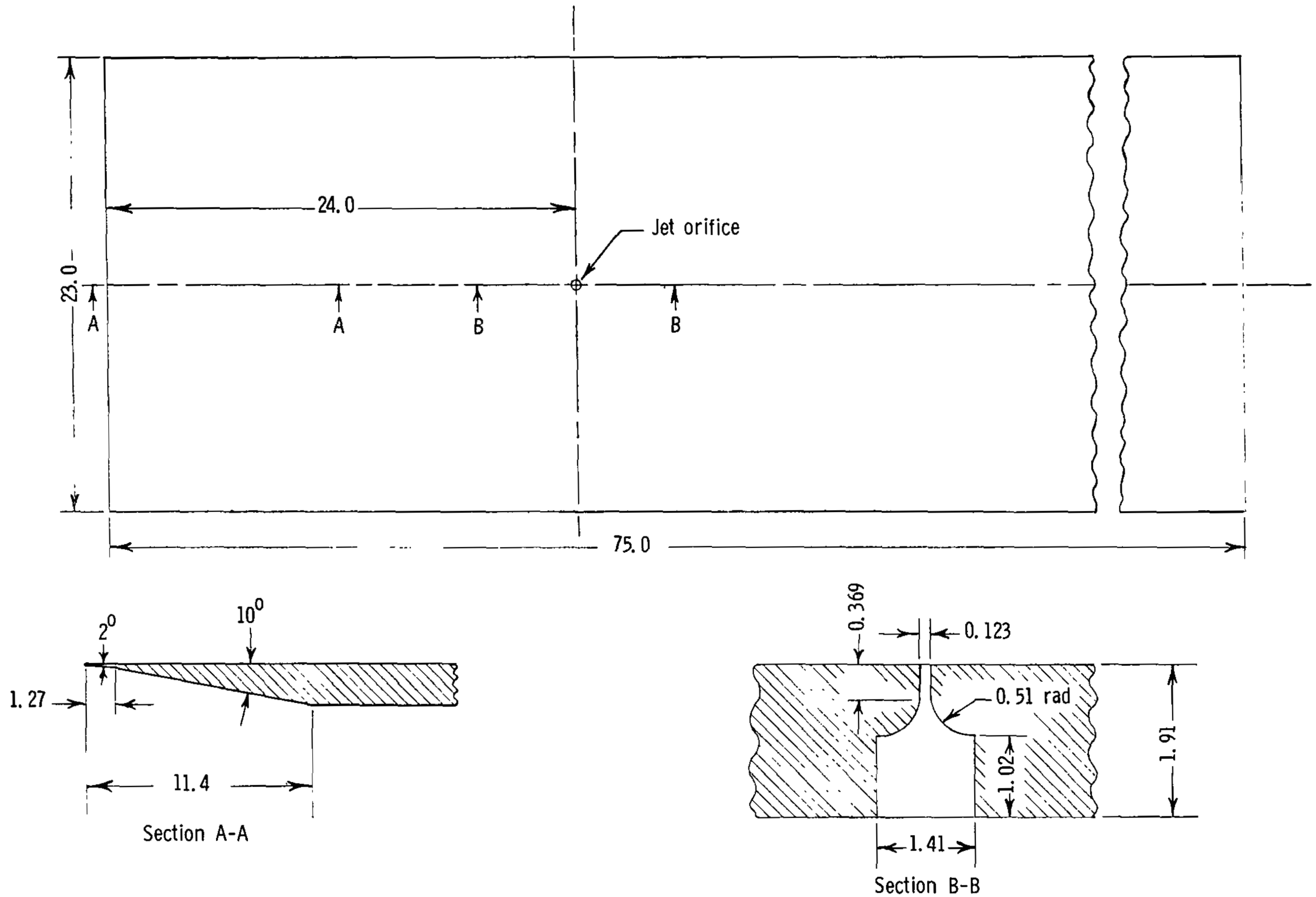
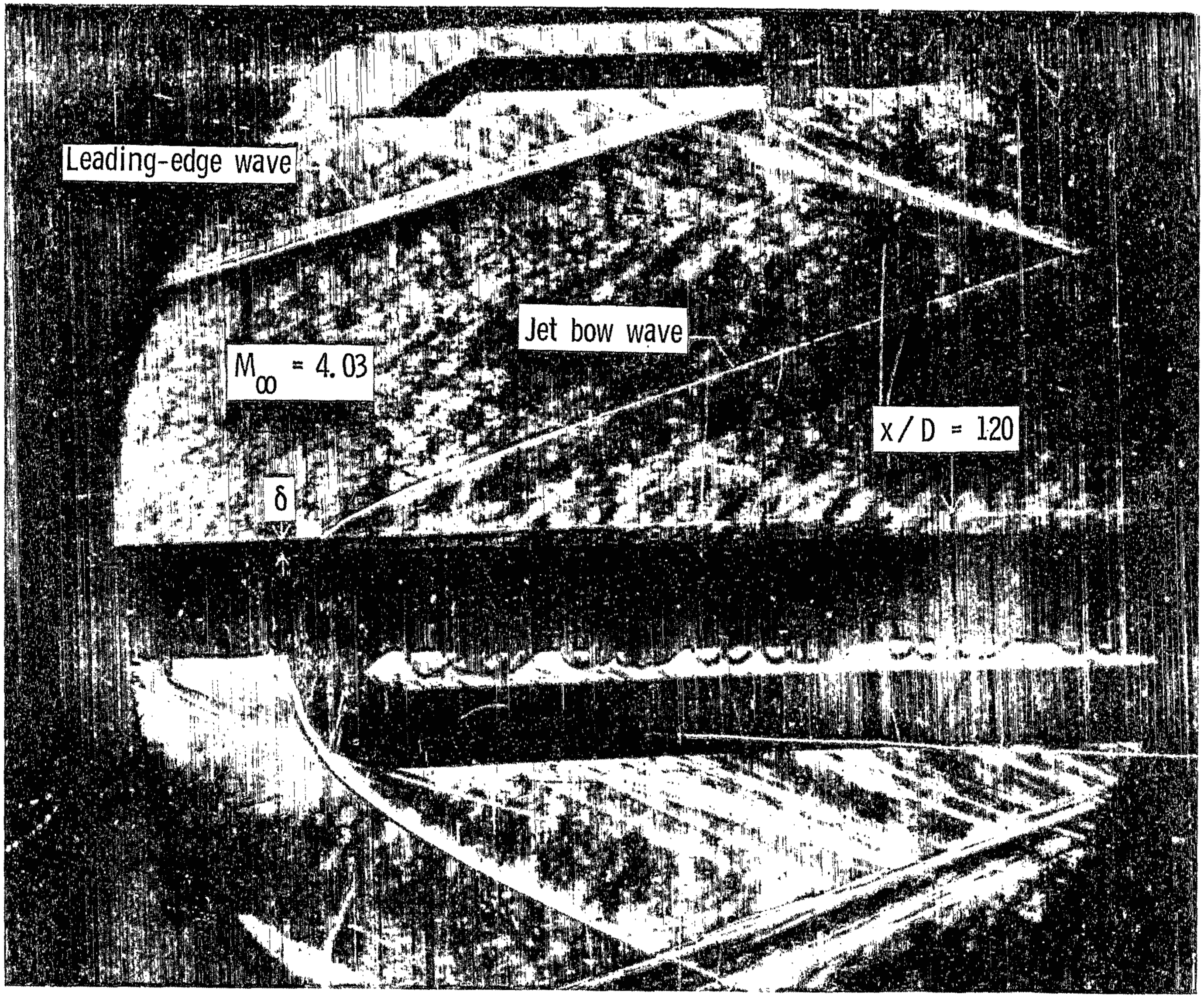


(a) Sketch of model.

Figure 1.- Description of model and test-section flow conditions. All dimensions are in centimeters.



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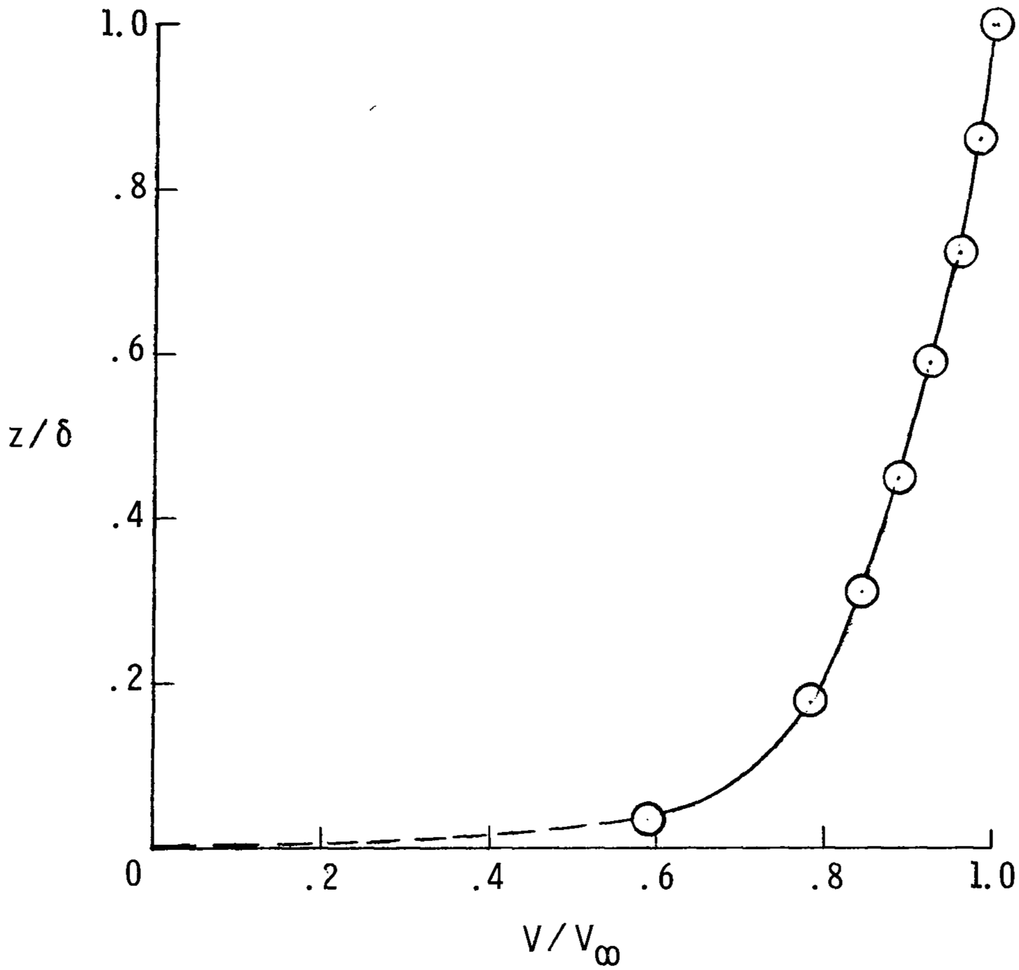
(b) Test-section schlieren photograph.

Figure 1.- Continued.



(c) Boundary-layer velocity profile. $M_\infty = 4.03$; $N \approx 7$; and $\delta/D = 3$.

Figure 1.- Concluded.

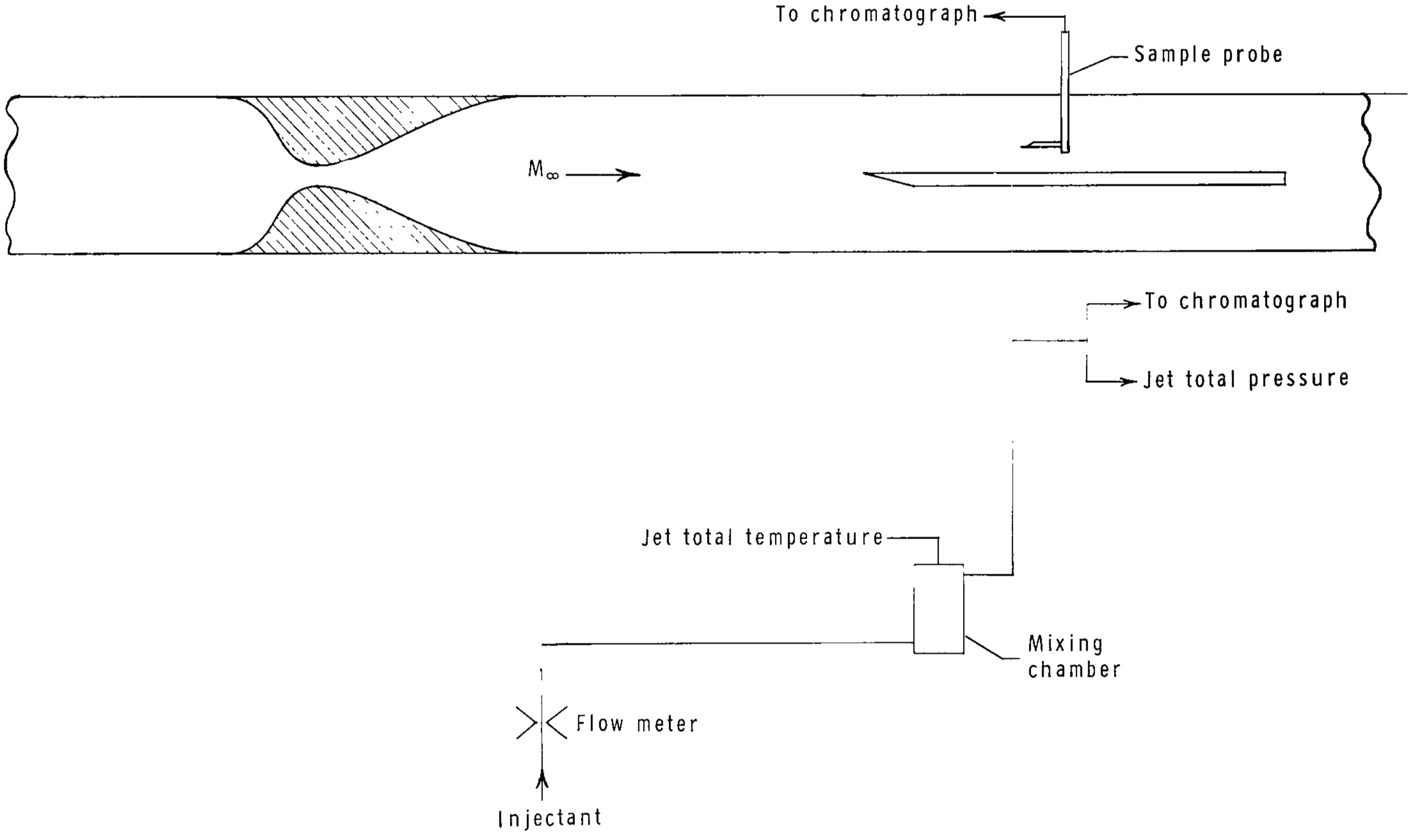


Figure 2.- Tunnel and secondary flow schematic.

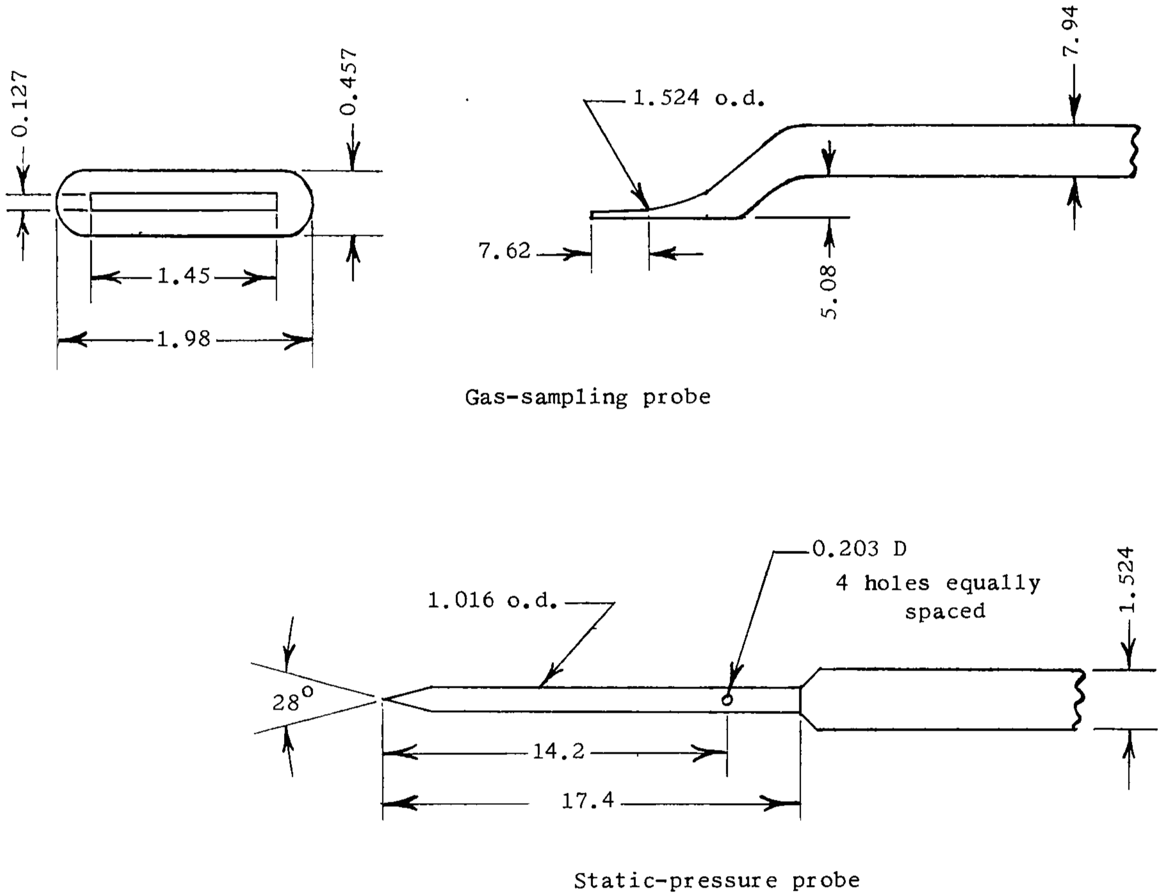
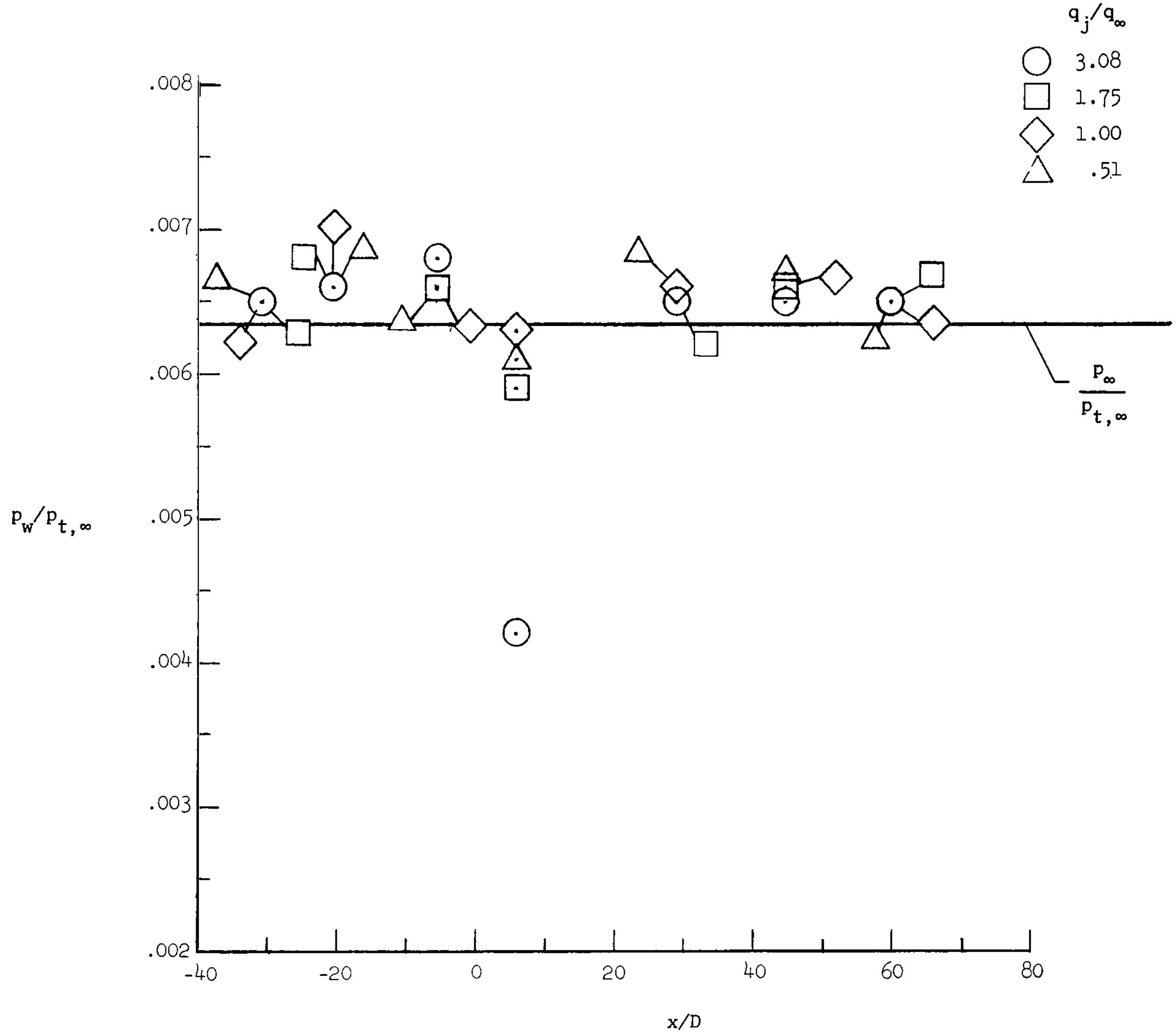
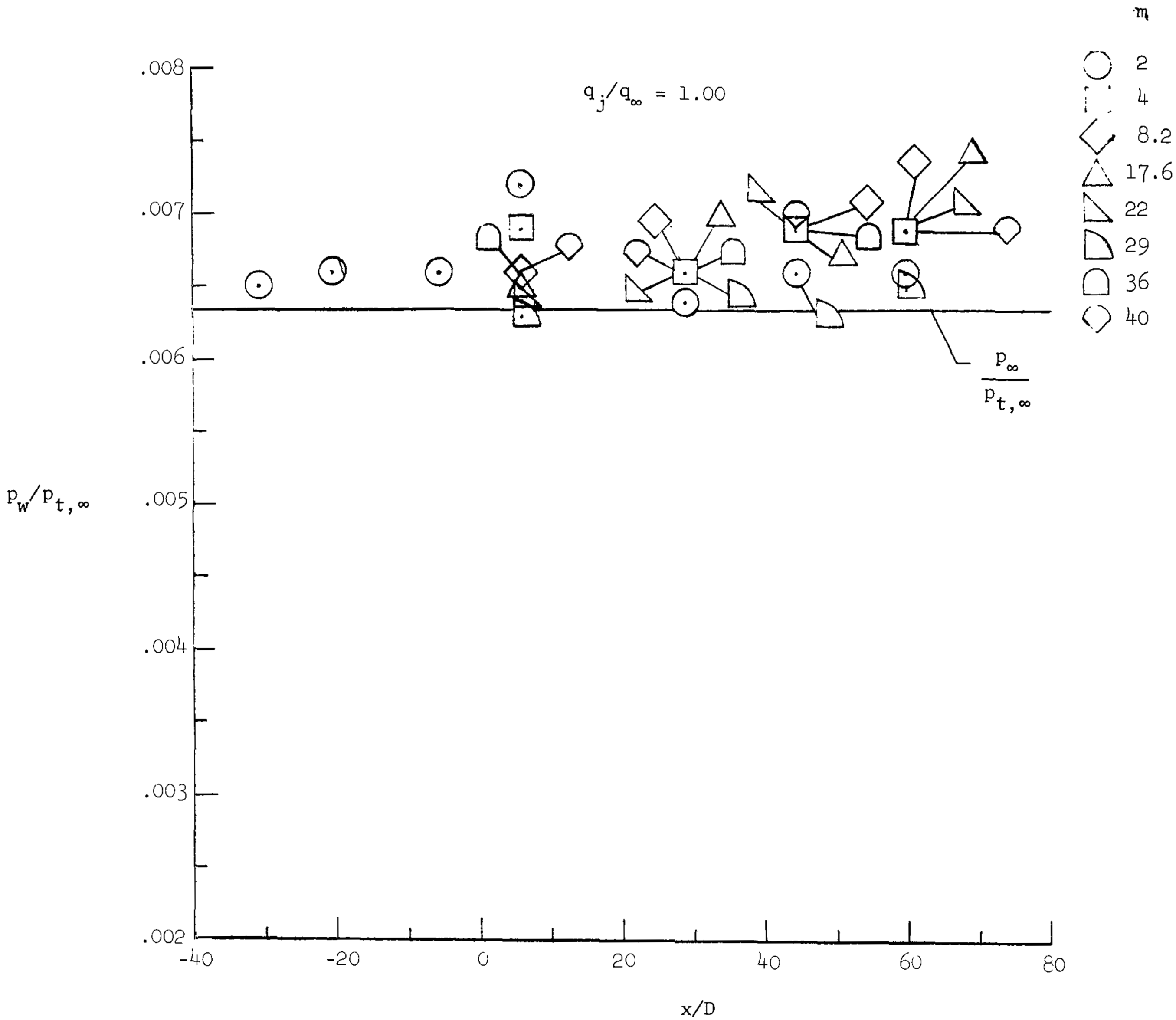


Figure 3.- Survey-probe design. All dimensions are in millimeters.



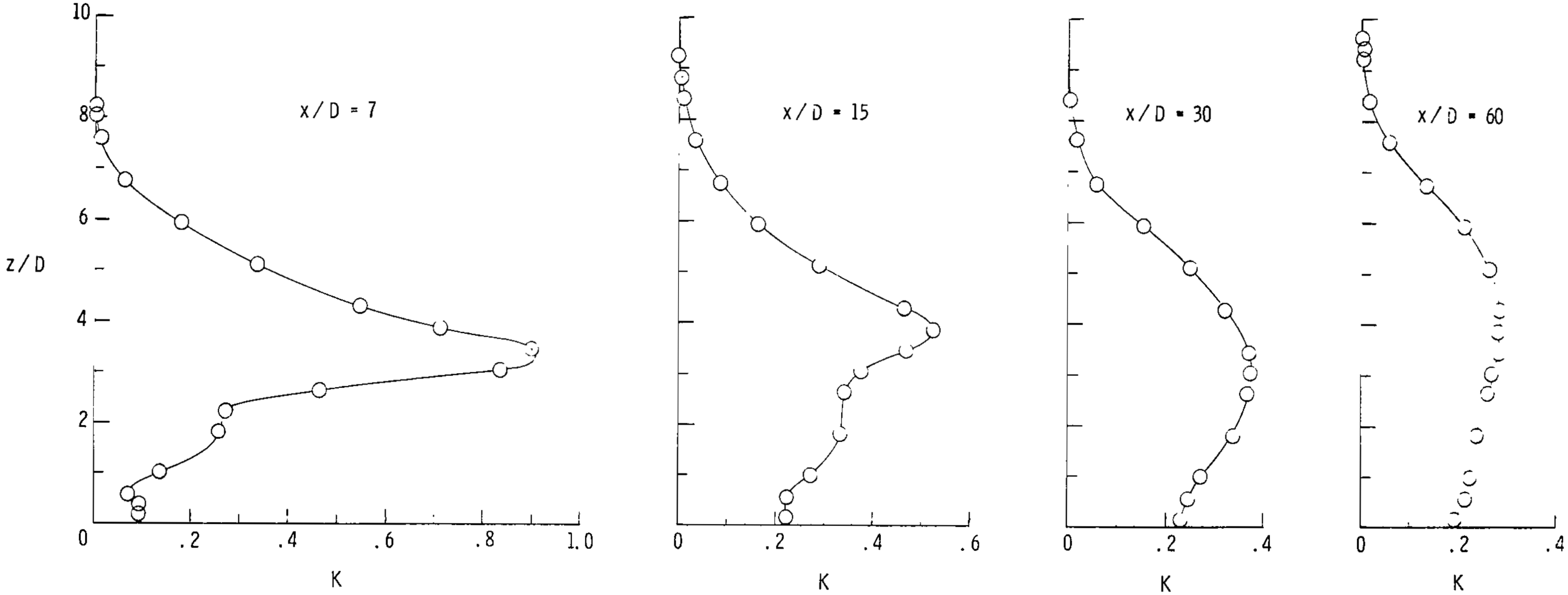
(a) Air injection.

Figure 4.- Axial-plate static-pressure distribution.



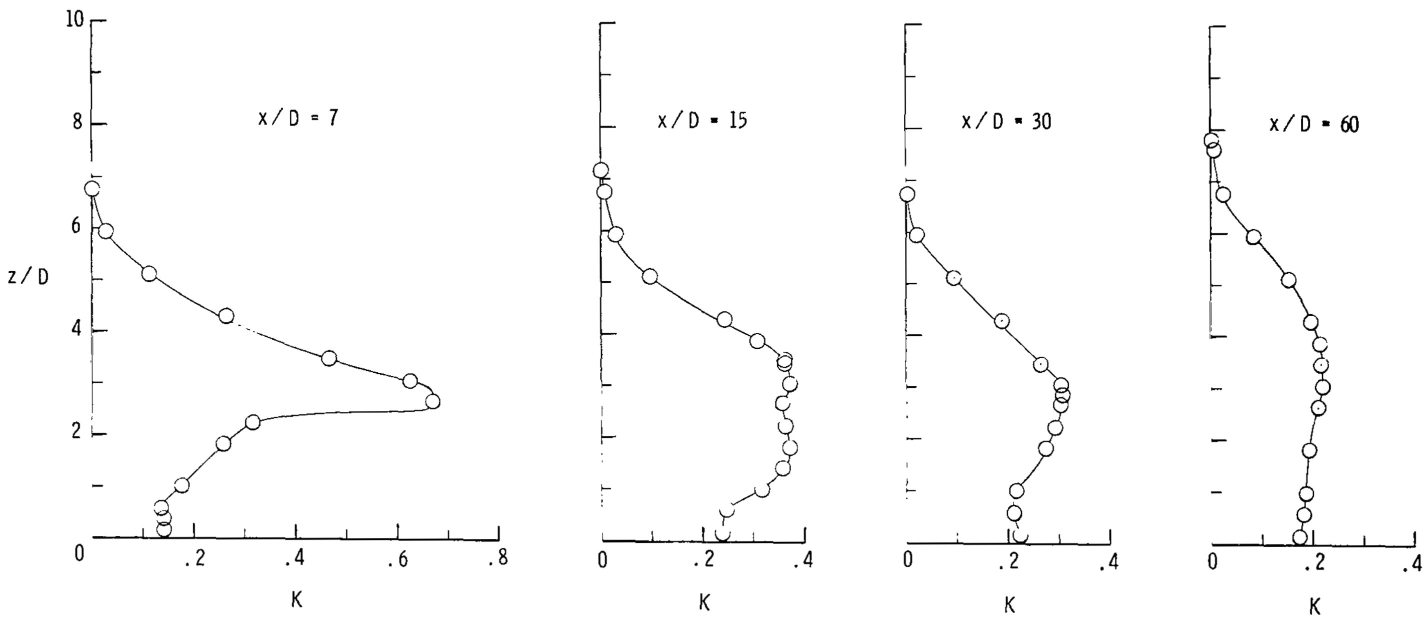
(b) Varying molecular weight injection.

Figure 4.- Concluded.



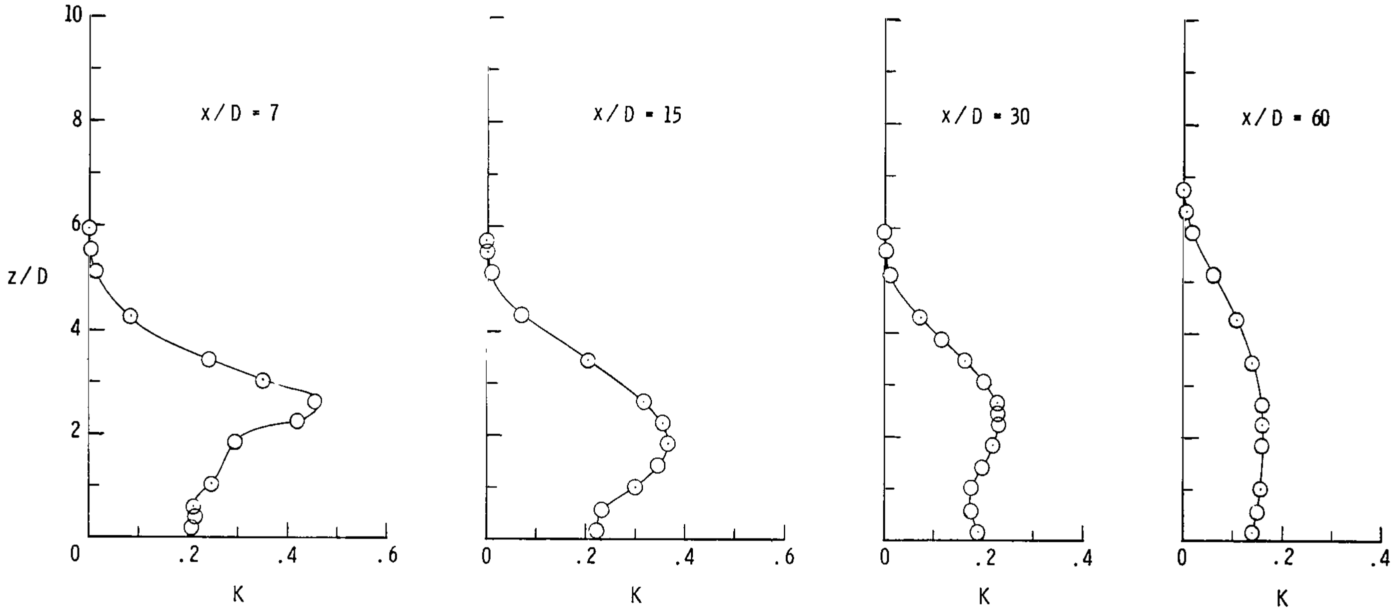
(a) Air injection; $q_j/q_\infty = 3.08$.

Figure 5.- Mass fraction concentration profiles on vertical center line.



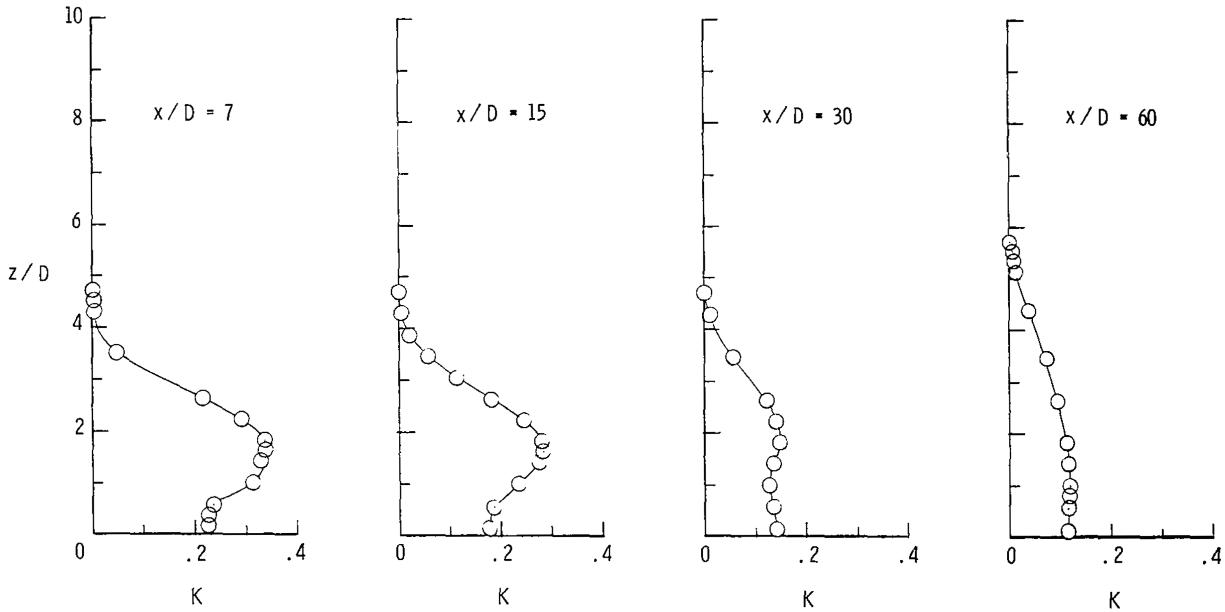
(b) Air injection; $q_j/q_\infty = 1.75$.

Figure 5.- Continued.



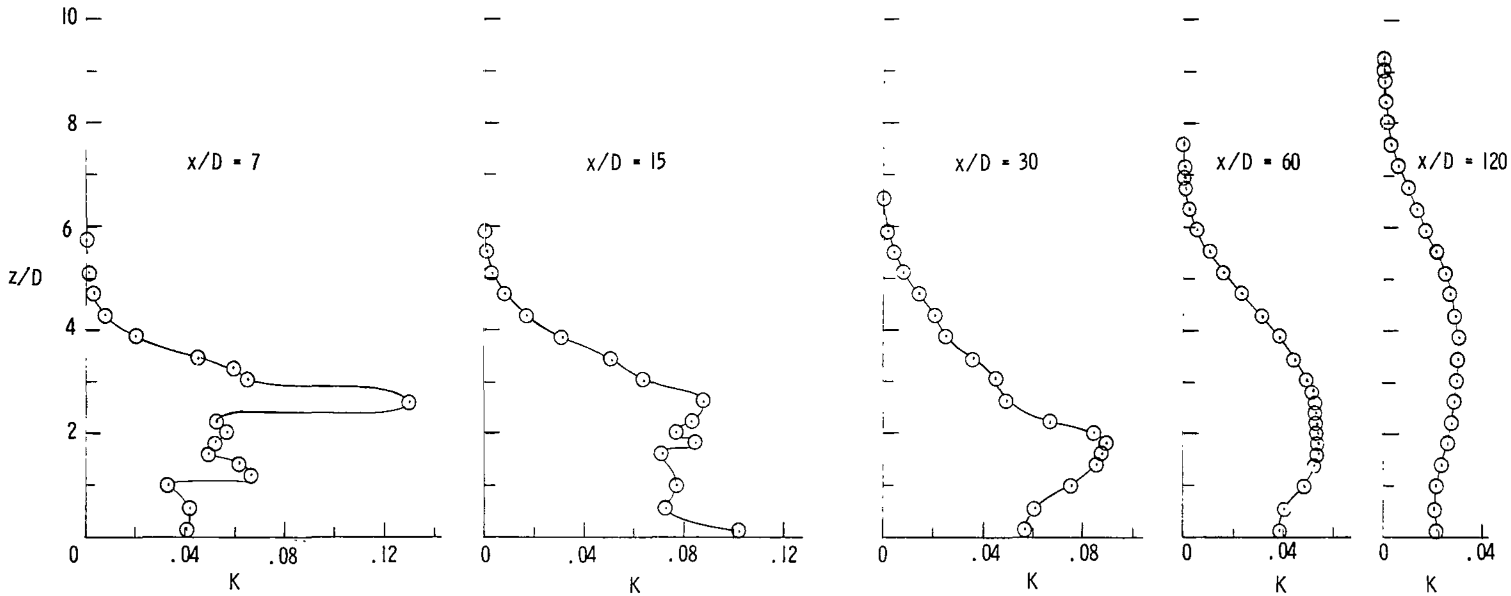
(c) Air injection; $q_j/q_\infty = 1.00$.

Figure 5.- Continued.



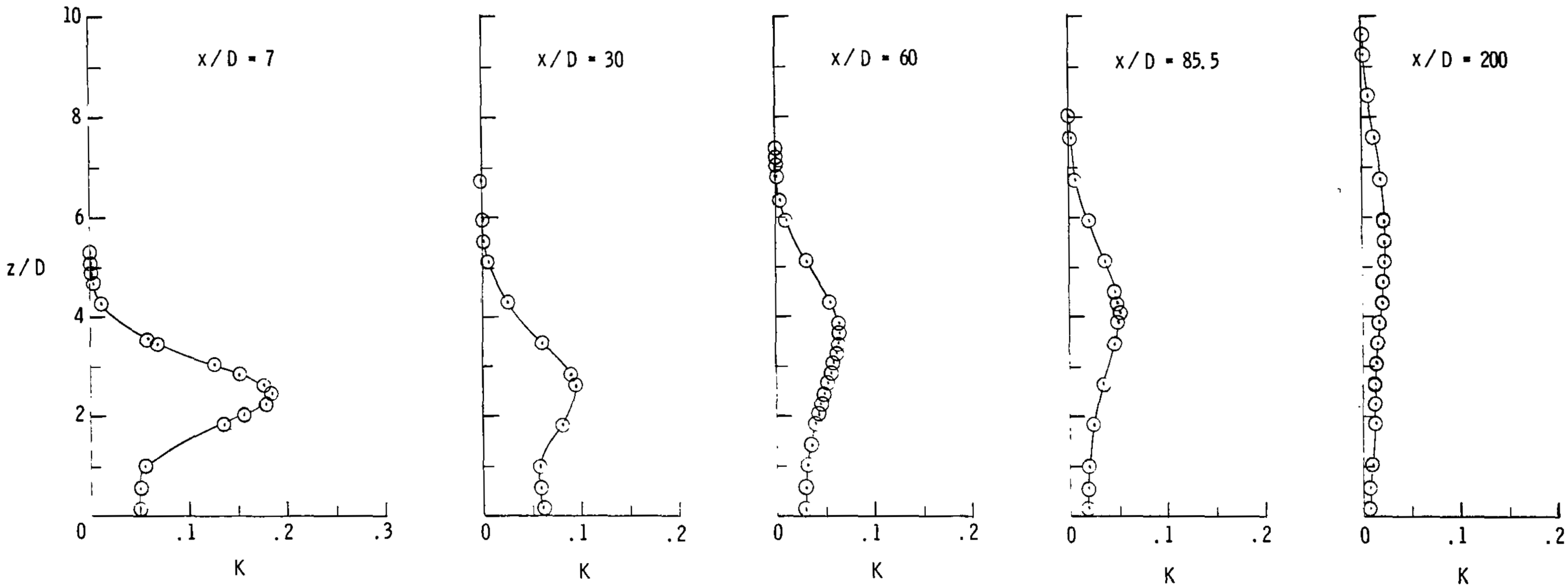
(d) Air injection; $q_j/q_\infty = 0.51$.

Figure 5.- Continued.



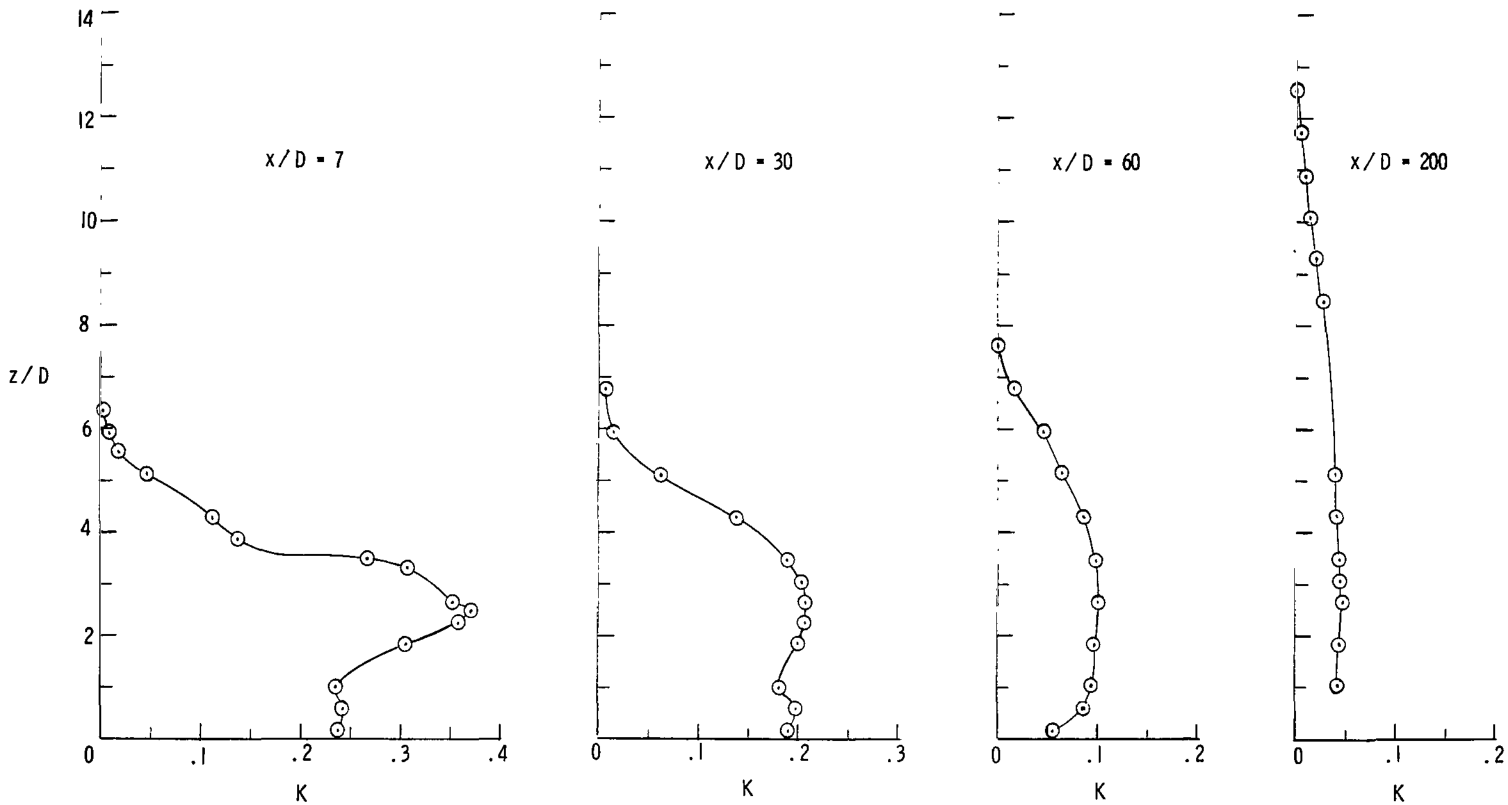
(e) Hydrogen injection; $q_j/q_\infty = 1.00$.

Figure 5.- Continued.



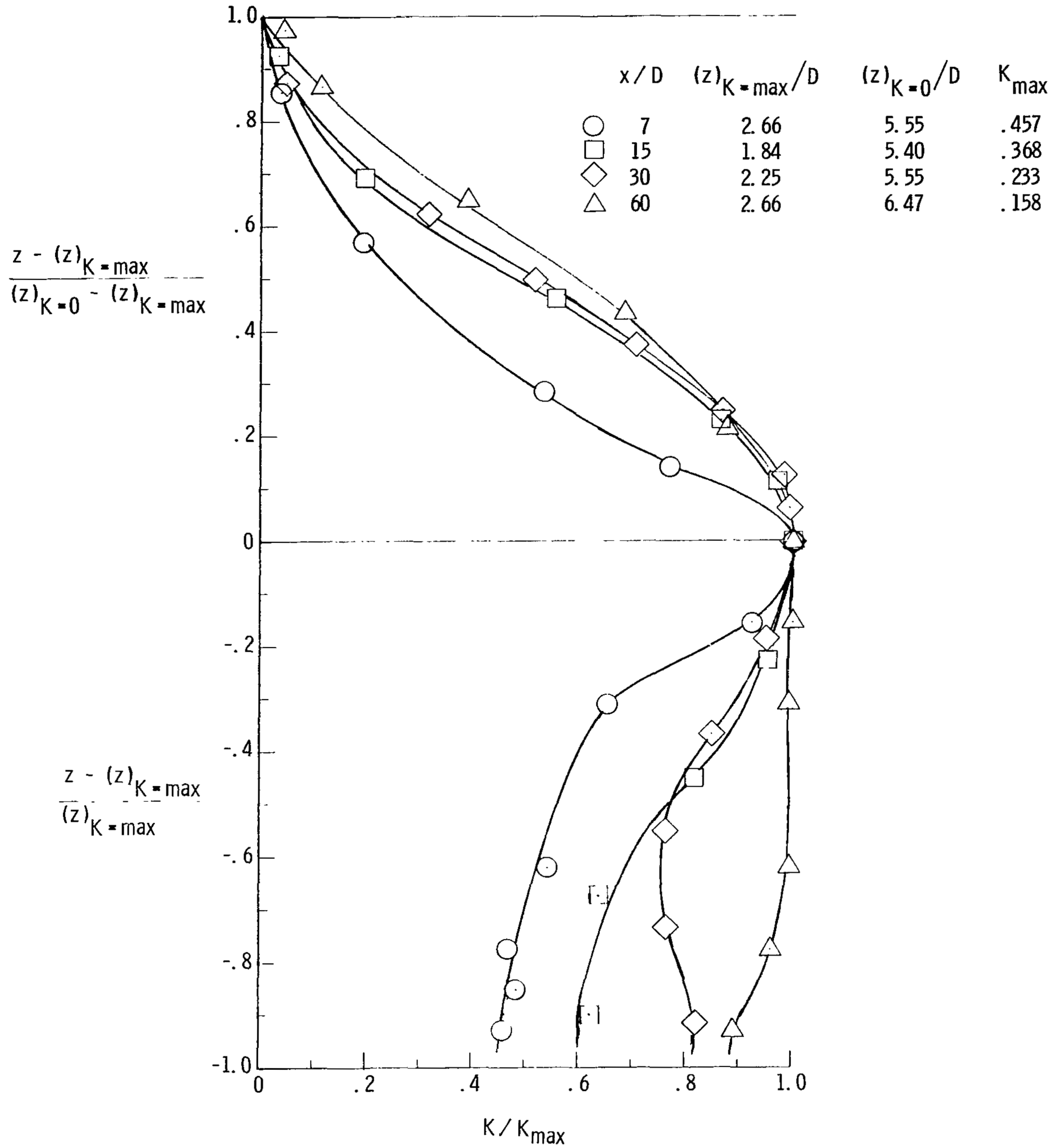
(f) Helium injection; $q_j/q_\infty = 1.00$.

Figure 5.- Continued.



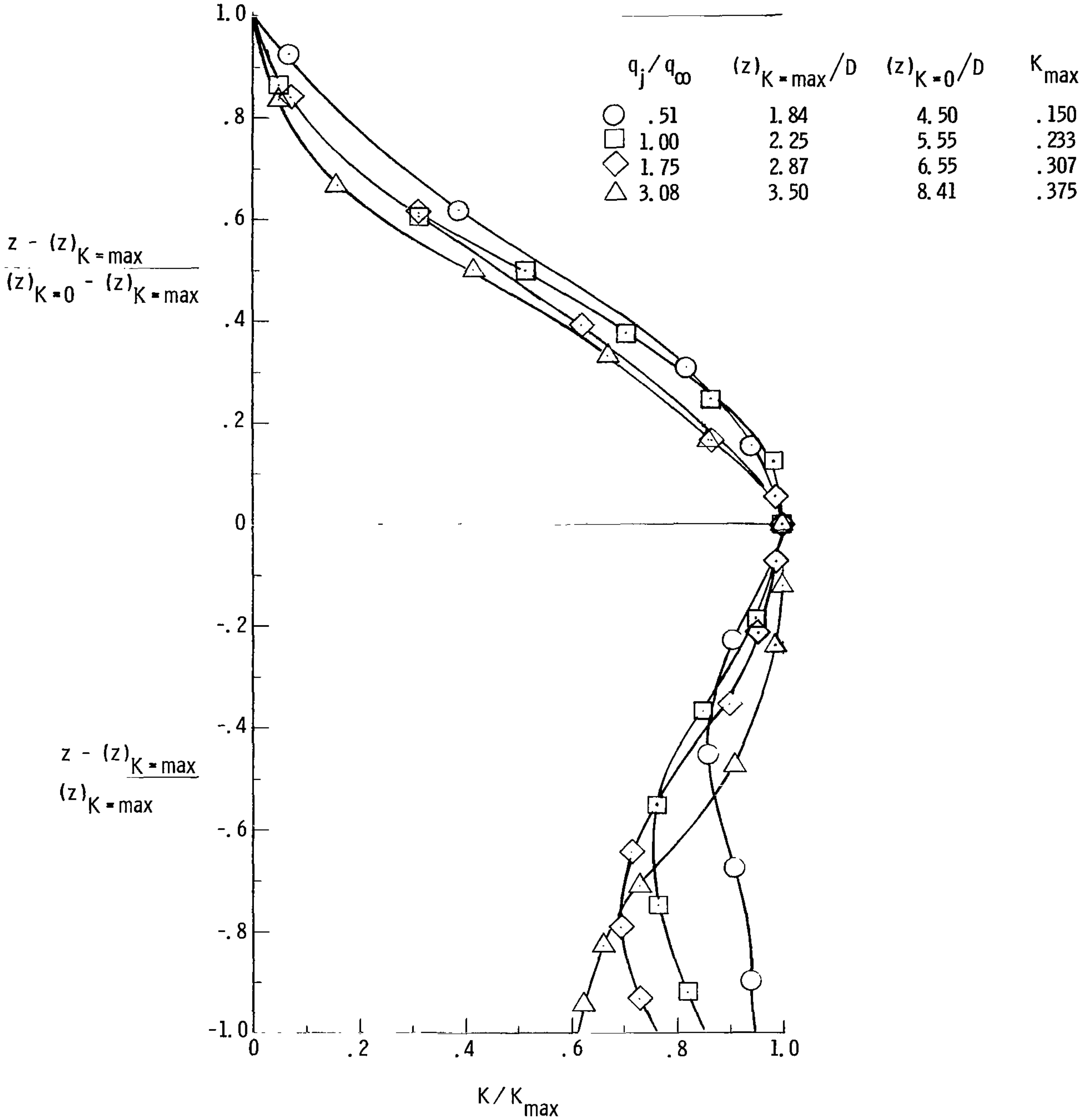
(g) Argon injection; $q_j/q_\infty = 1.00$.

Figure 5.- Continued.



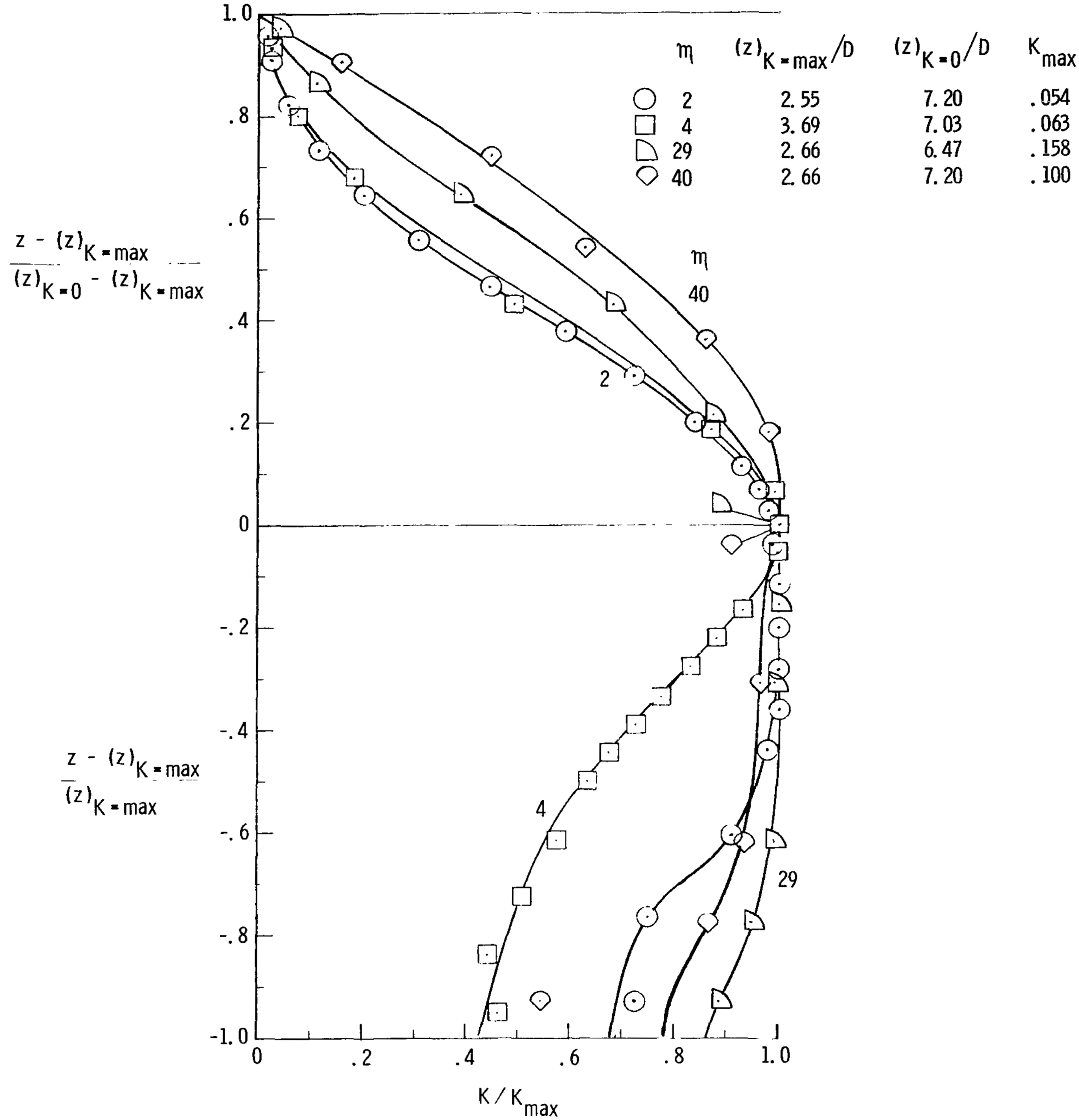
(h) Air injection, variable axial position; $q_j/q_\infty = 1.0$.

Figure 5.- Continued.



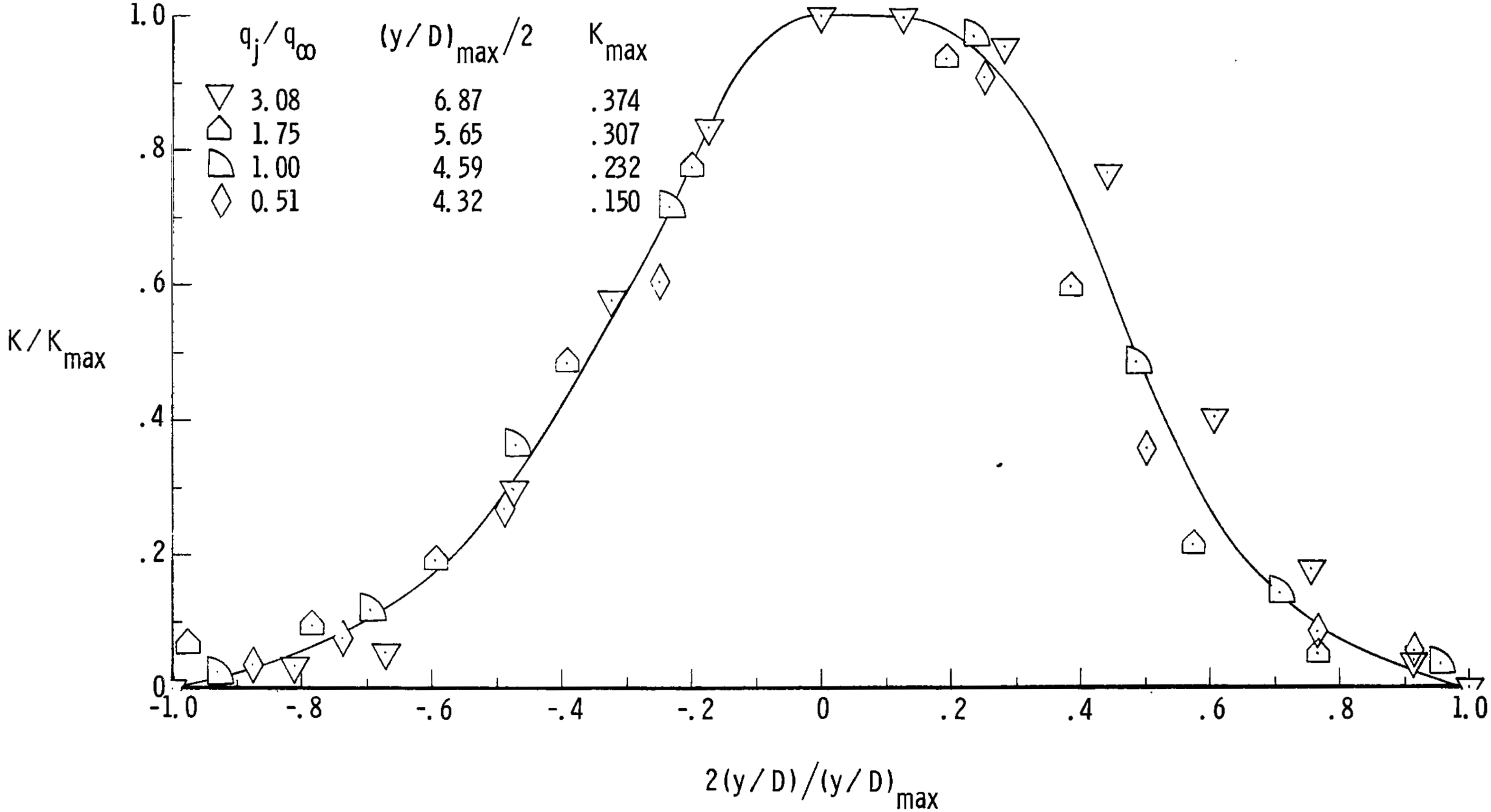
(i) Air injection variable; q_j/q_∞; $x/D = 30$.

Figure 5.- Continued.



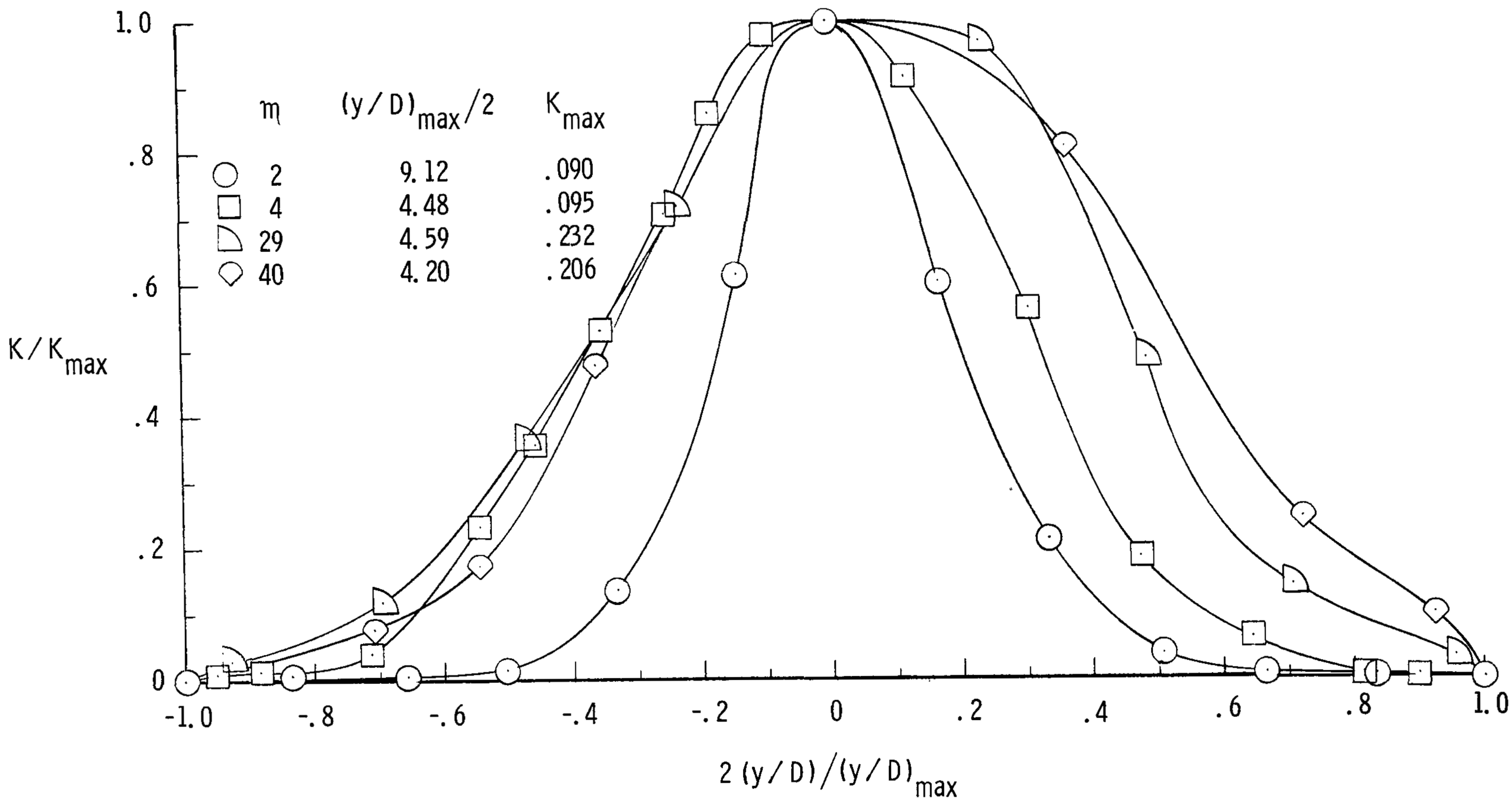
(j) Variable injectant molecular weight; x/D = 60.

Figure 5.- Concluded.



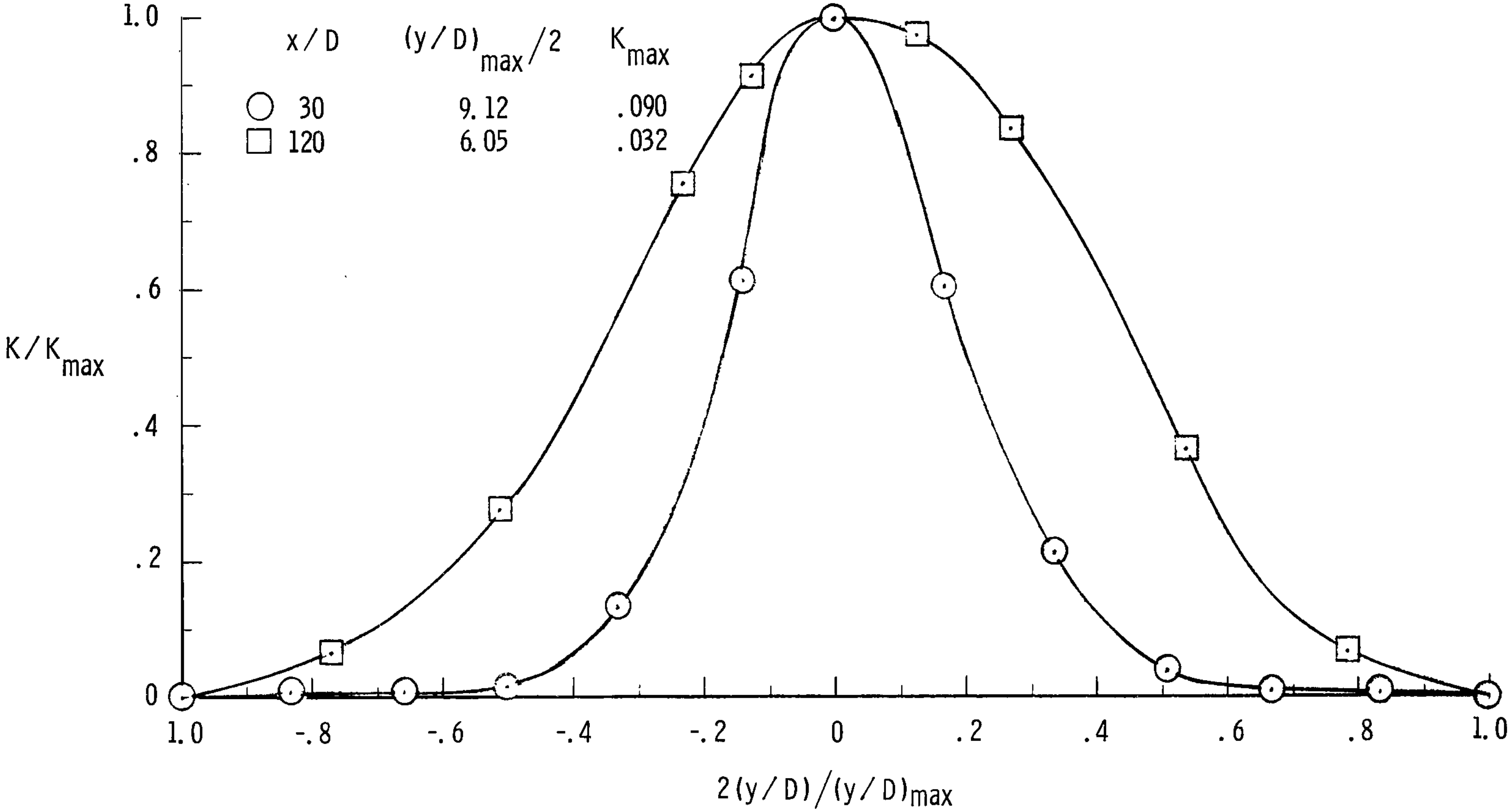
(a) Air injection; variable q_j/q_∞; $x/D = 30$.

Figure 6.- Lateral mass fraction concentration distribution.



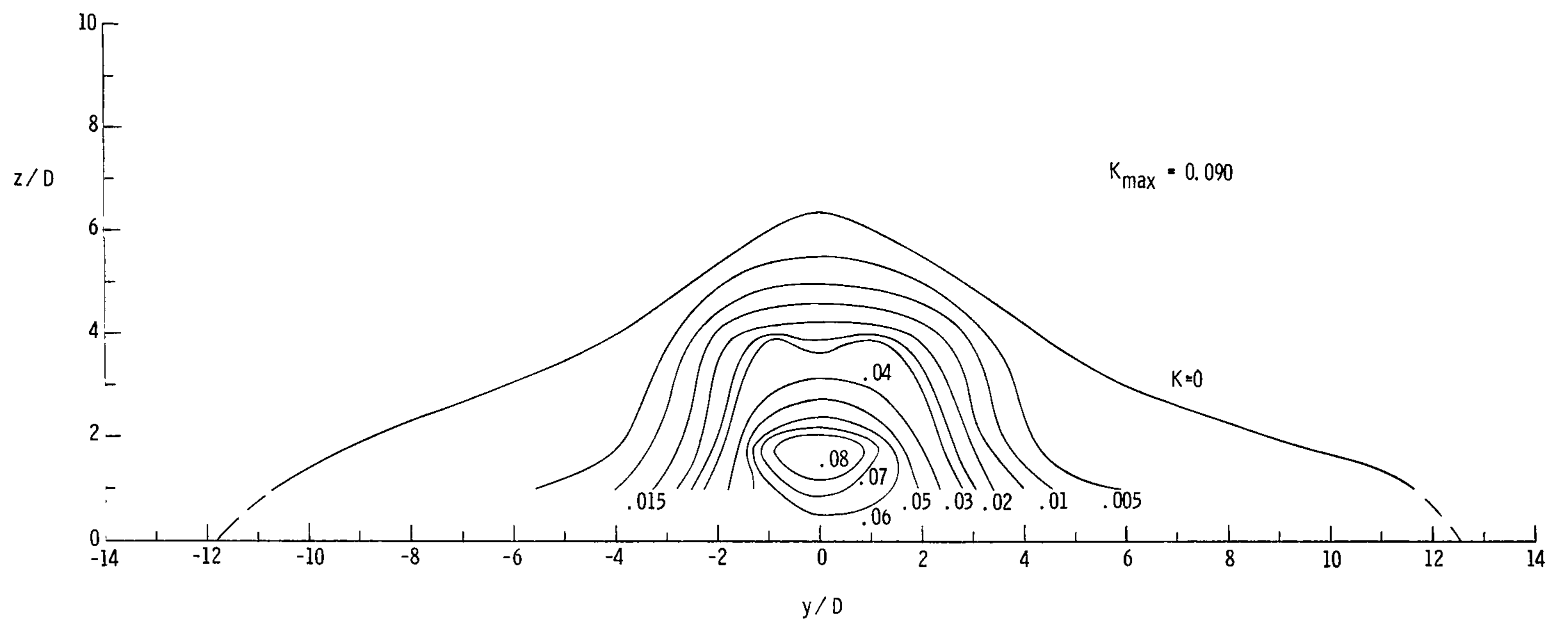
(b) Variable injectant molecular weight; $q_j/q_\infty = 1.00$; $x/D = 30$.

Figure 6.- Continued.



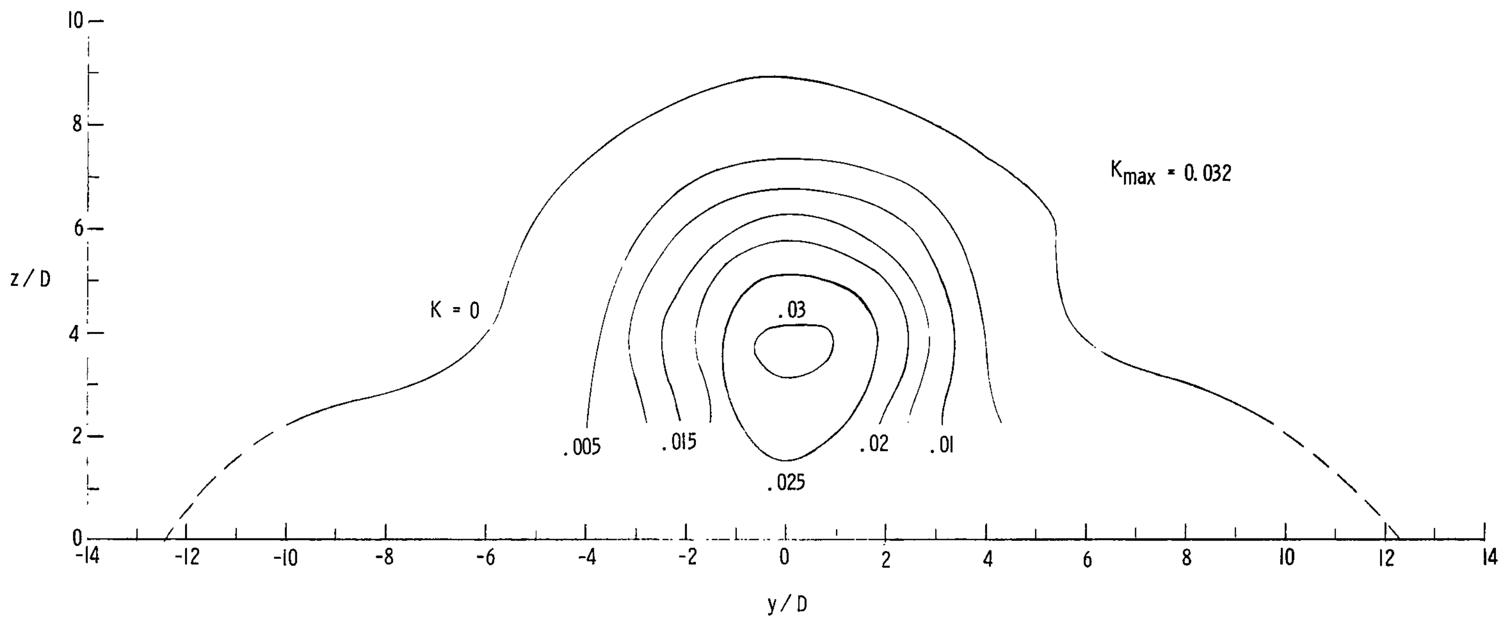
(c) Hydrogen injection; $q_j/q_\infty = 1.00$.

Figure 6.- Concluded.



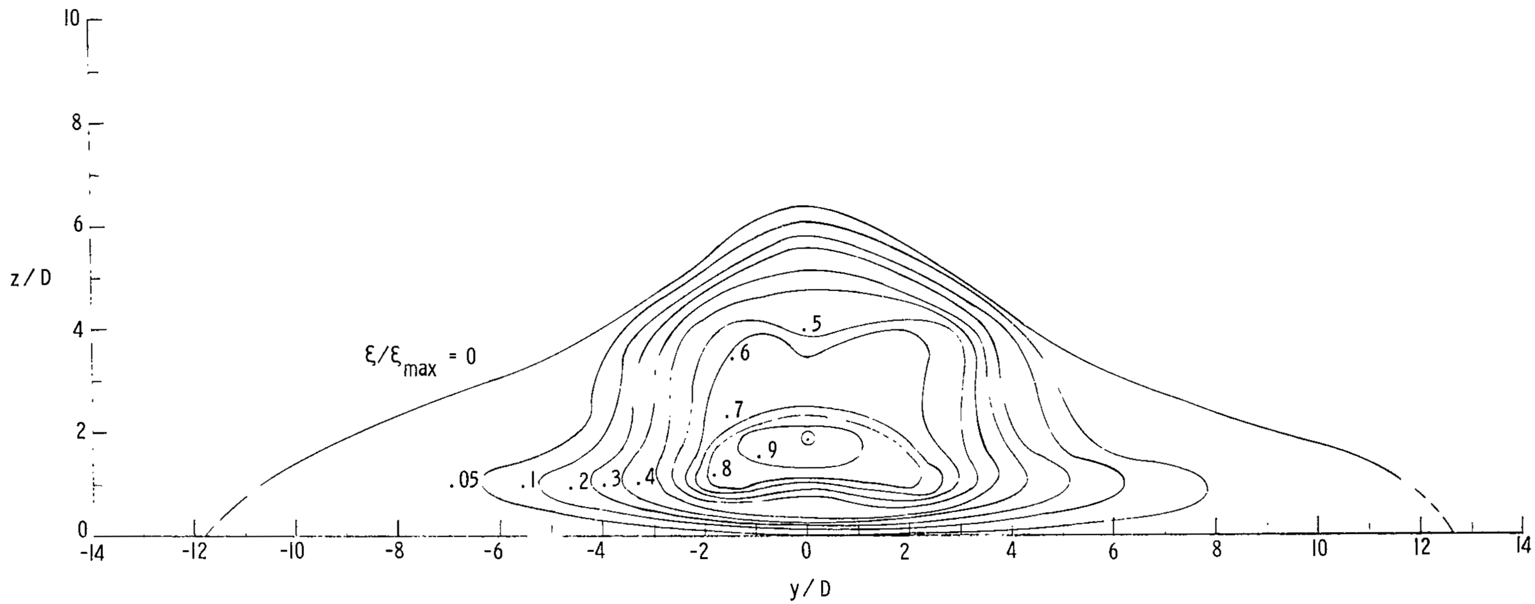
(a) x/D = 30.

Figure 7.- Hydrogen mass fraction concentration contours.



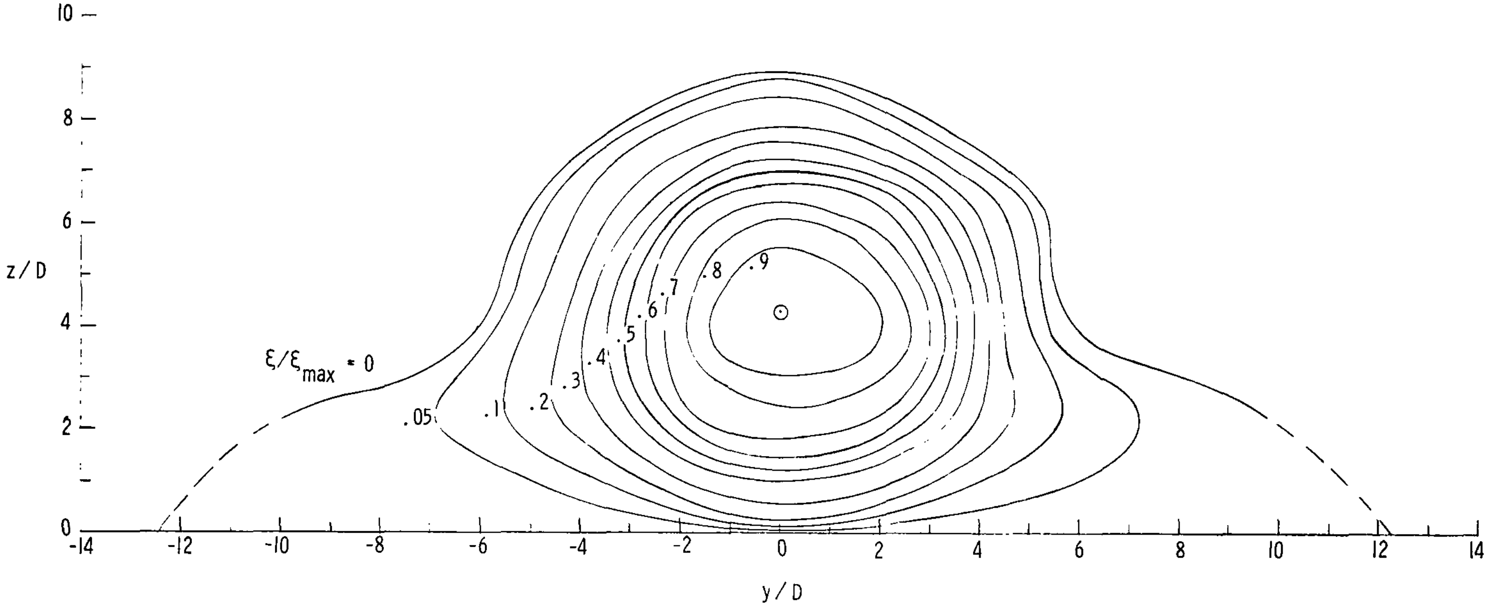
(b) x/D = 120.

Figure 7.- Concluded.



(a) x/D = 30.

Figure 8.- Hydrogen mass flow per unit area contours.



(b) x/D = 120.

Figure 8.- Concluded.

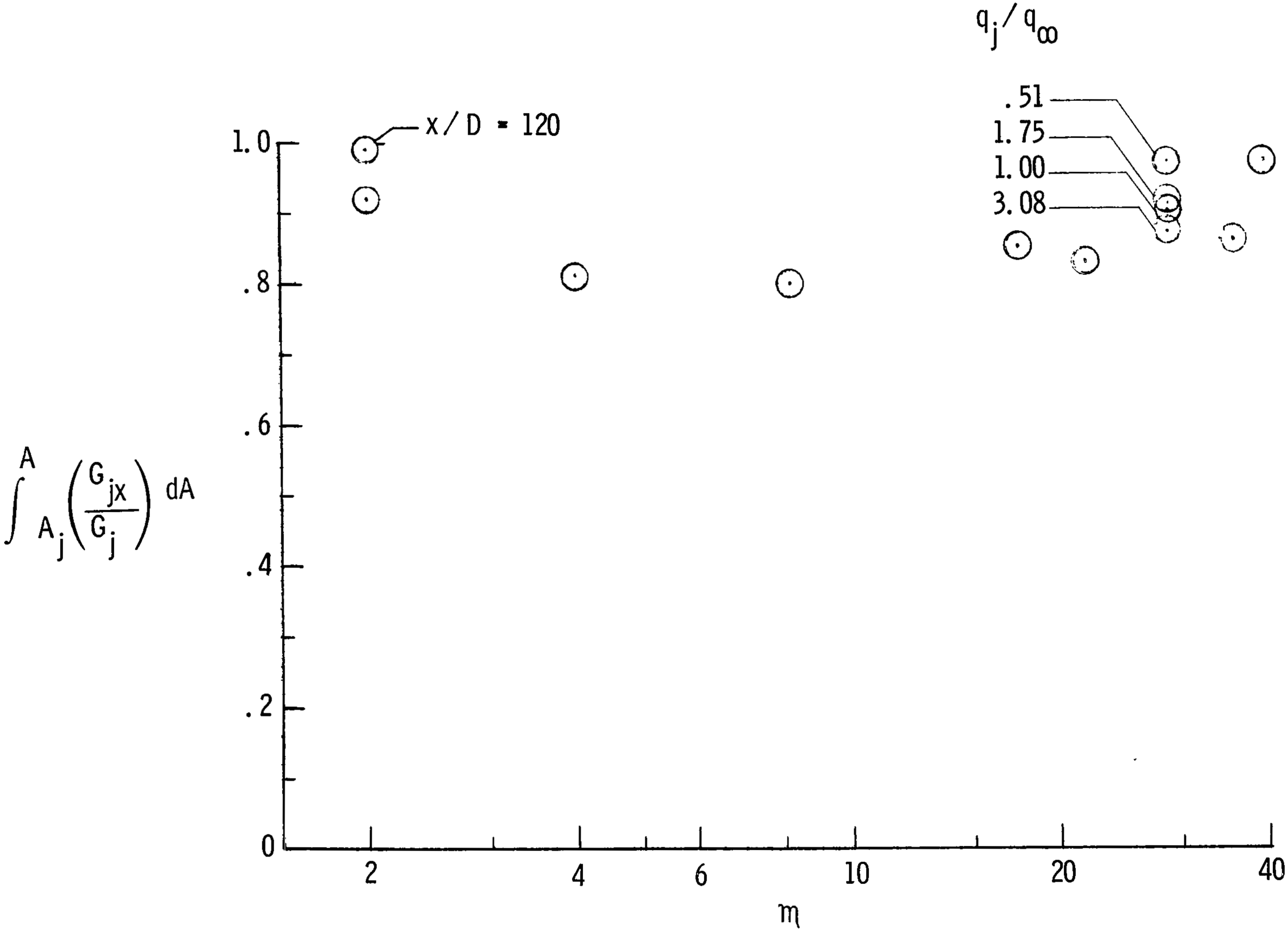
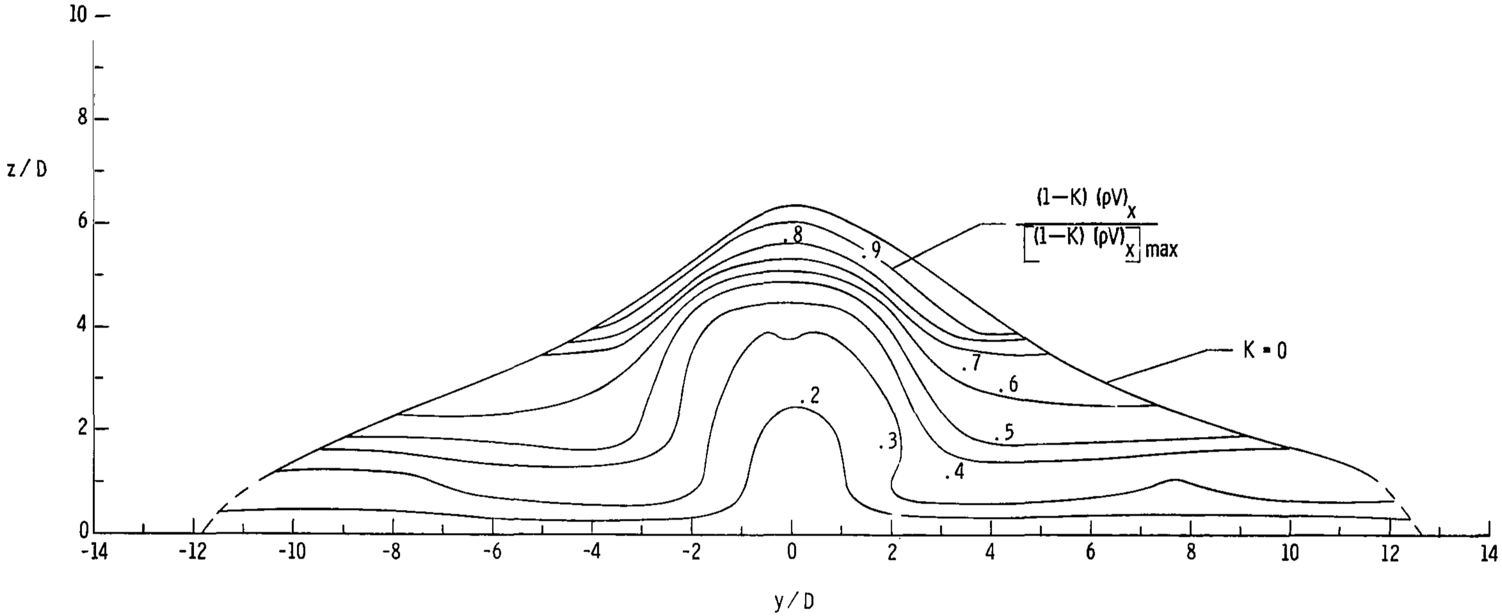
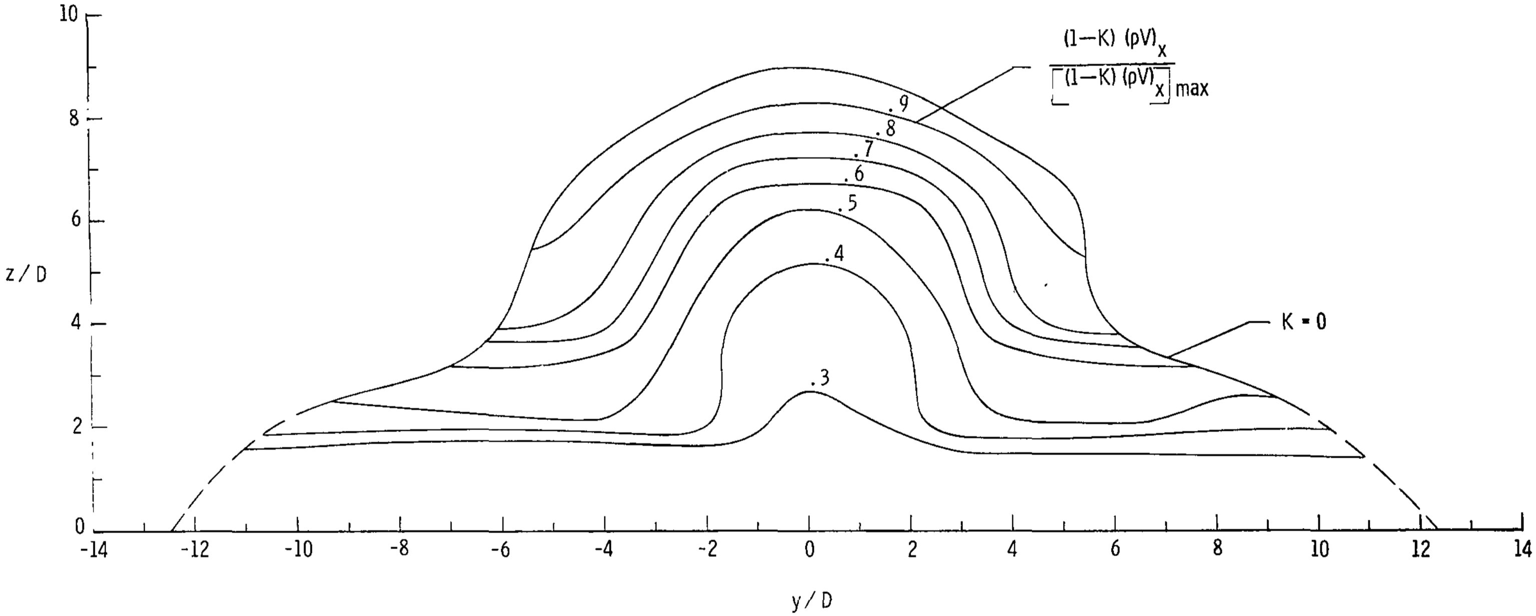


Figure 9.- Injectant mass flow integrations.



(a) x/D = 30.

Figure 10.- Air mass flow per unit area contours for hydrogen injection.



(b) x/D = 120.

Figure 10.- Concluded.

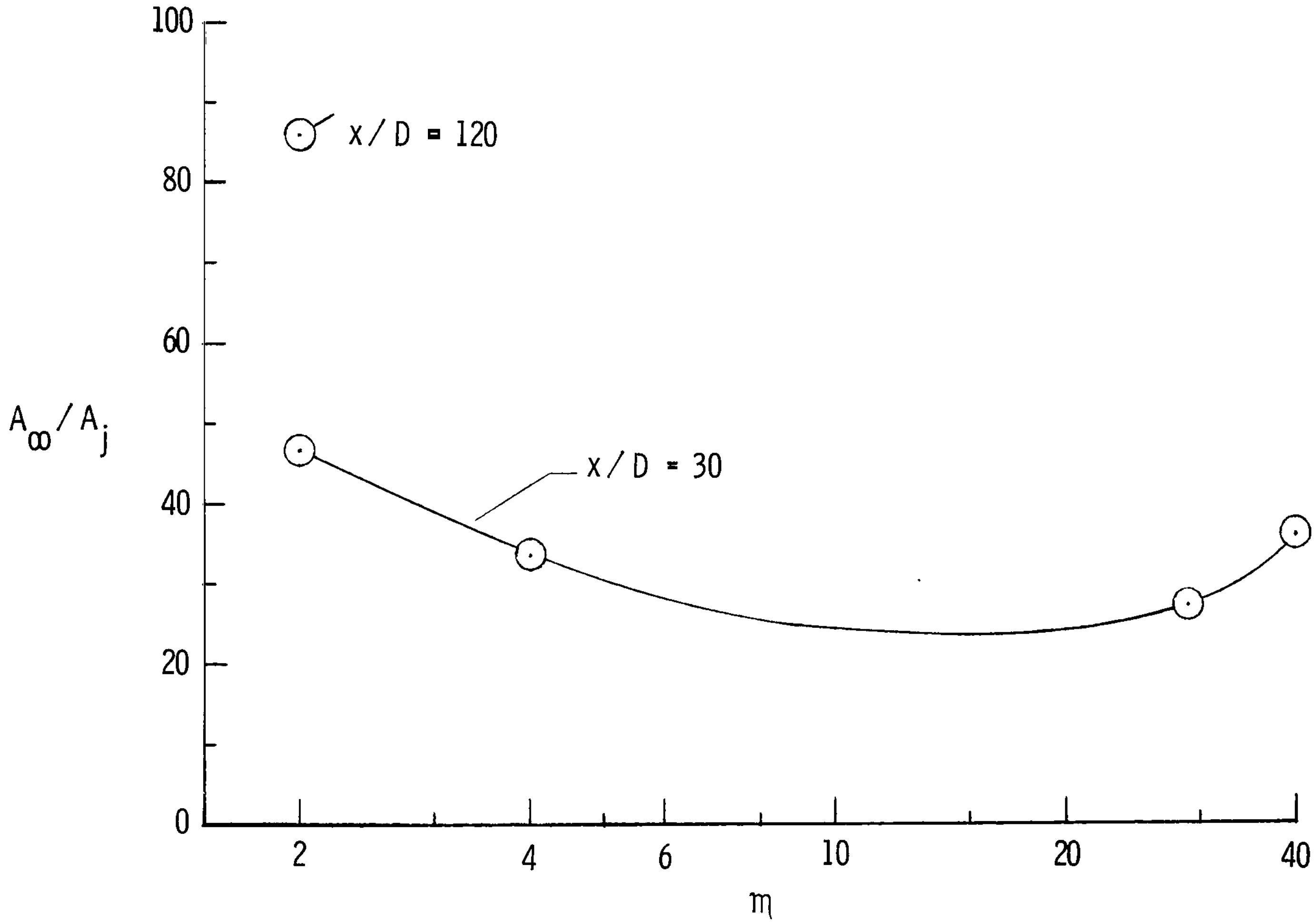
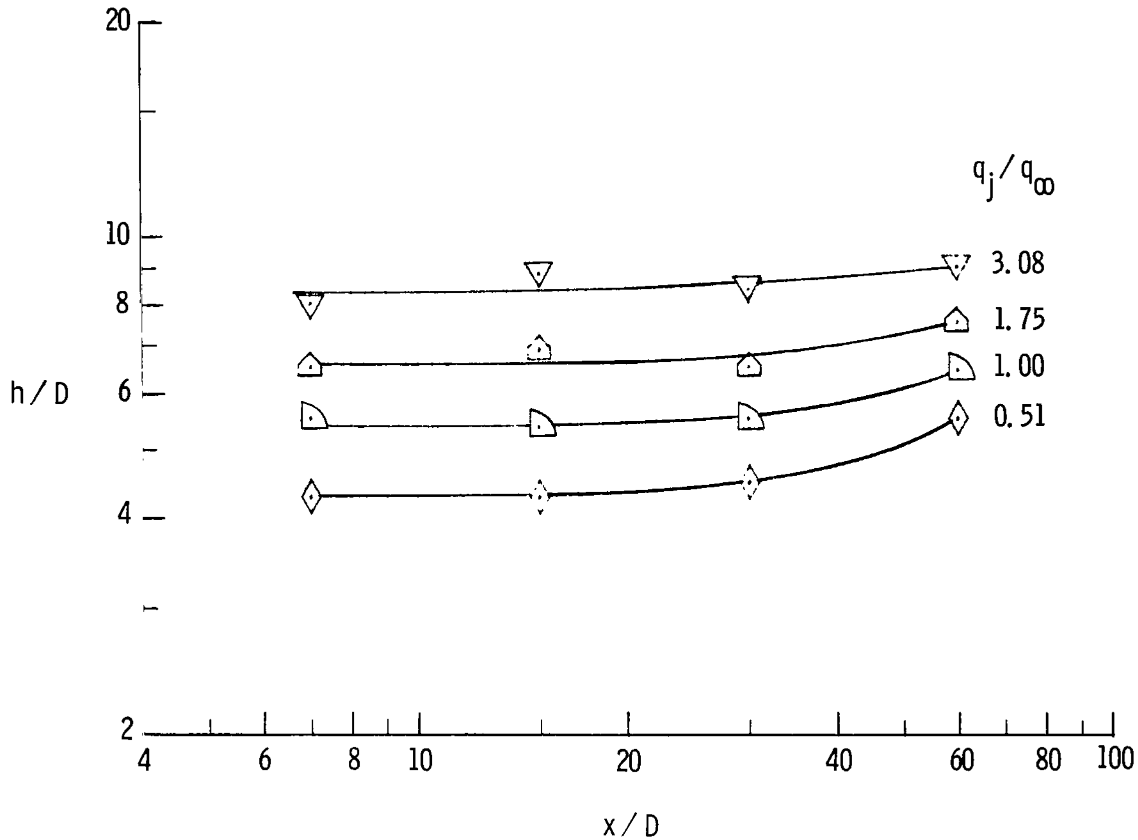
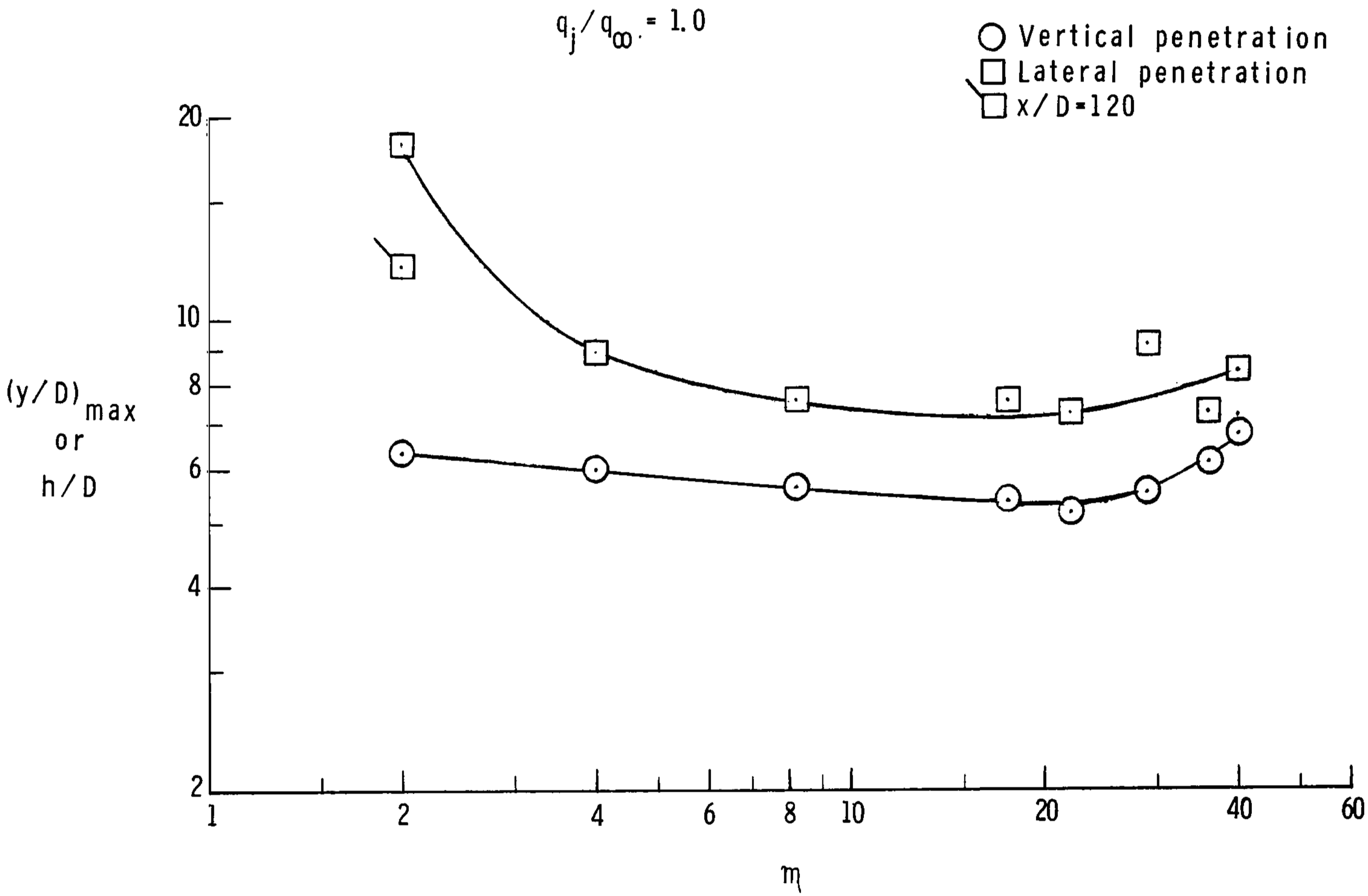


Figure 11.- Air flow mixing. Variable molecular weight.



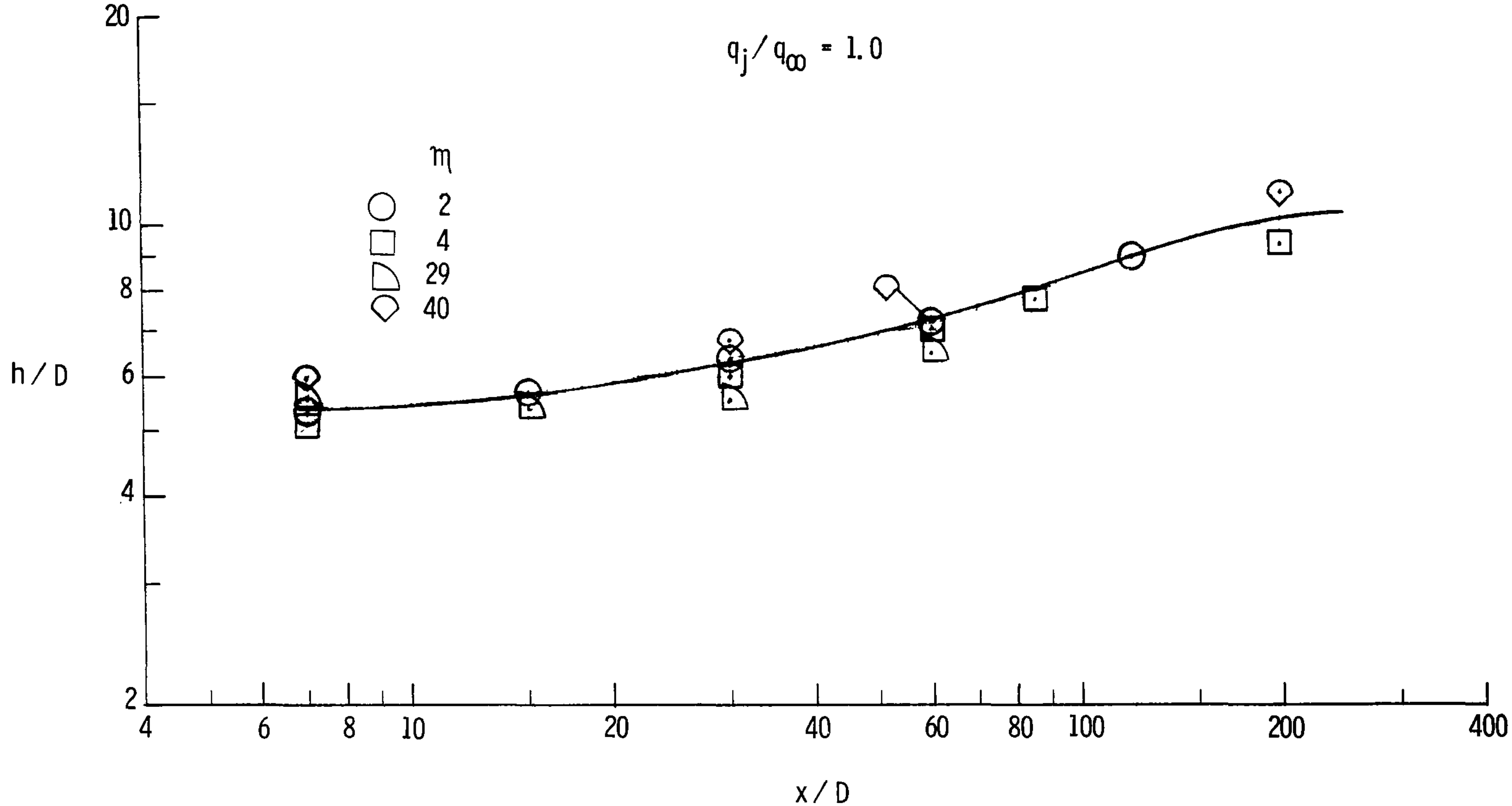
(a) Air injection; variable q_j/q_∞.

Figure 12.- Fuel penetration height.



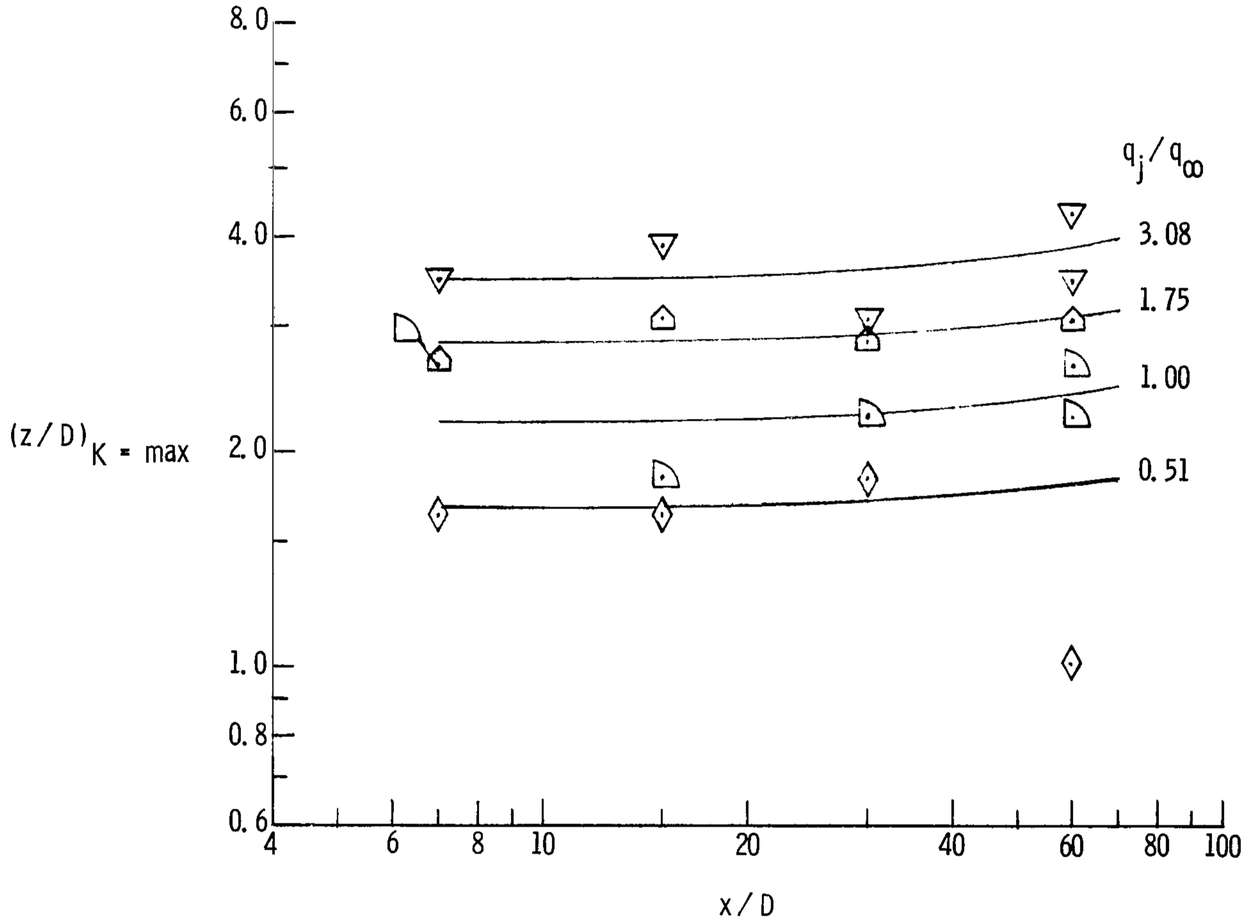
(b) Variable injectant molecular weight; x/D = 30.

Figure 12.- Continued.



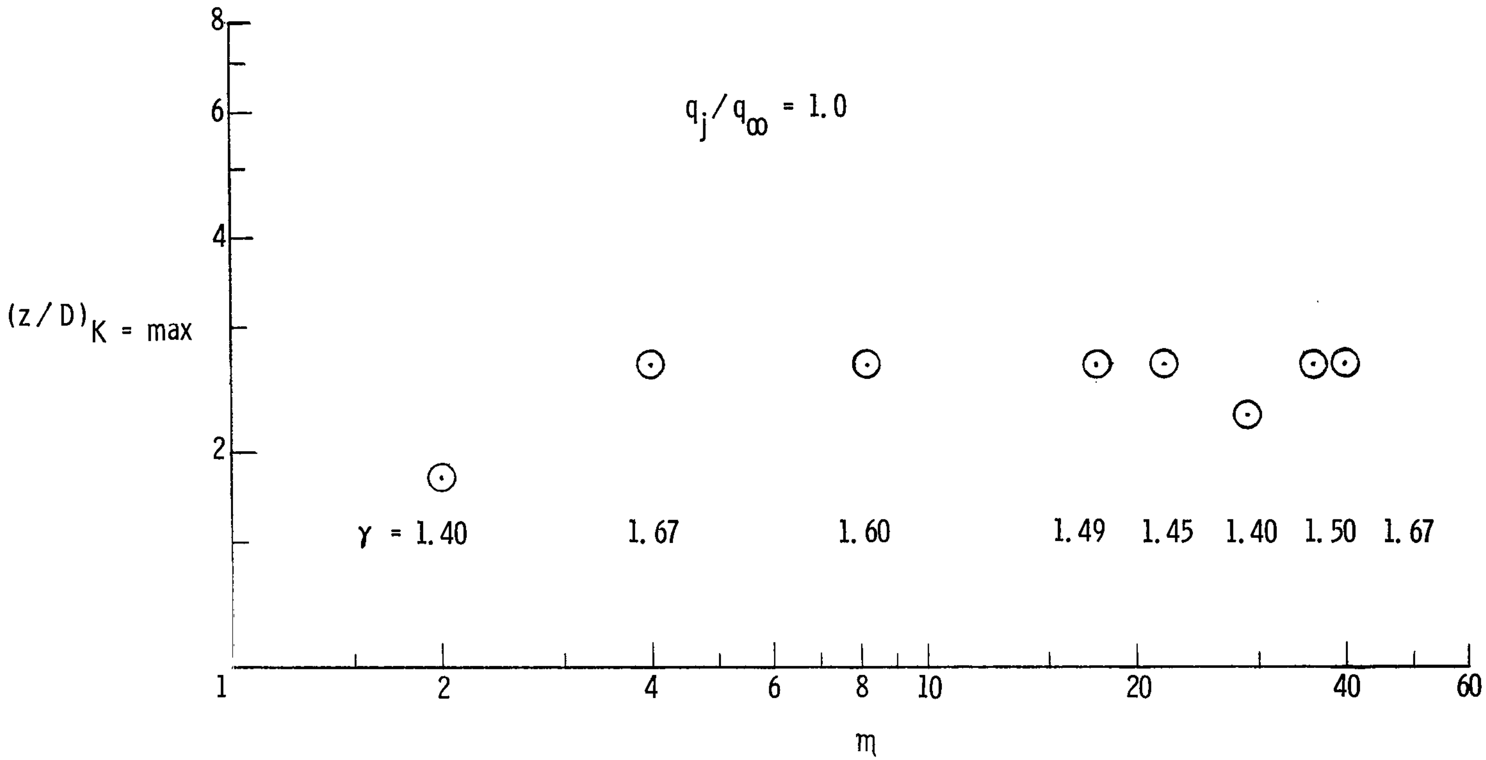
(c) Variation with axial position.

Figure 12.- Concluded.



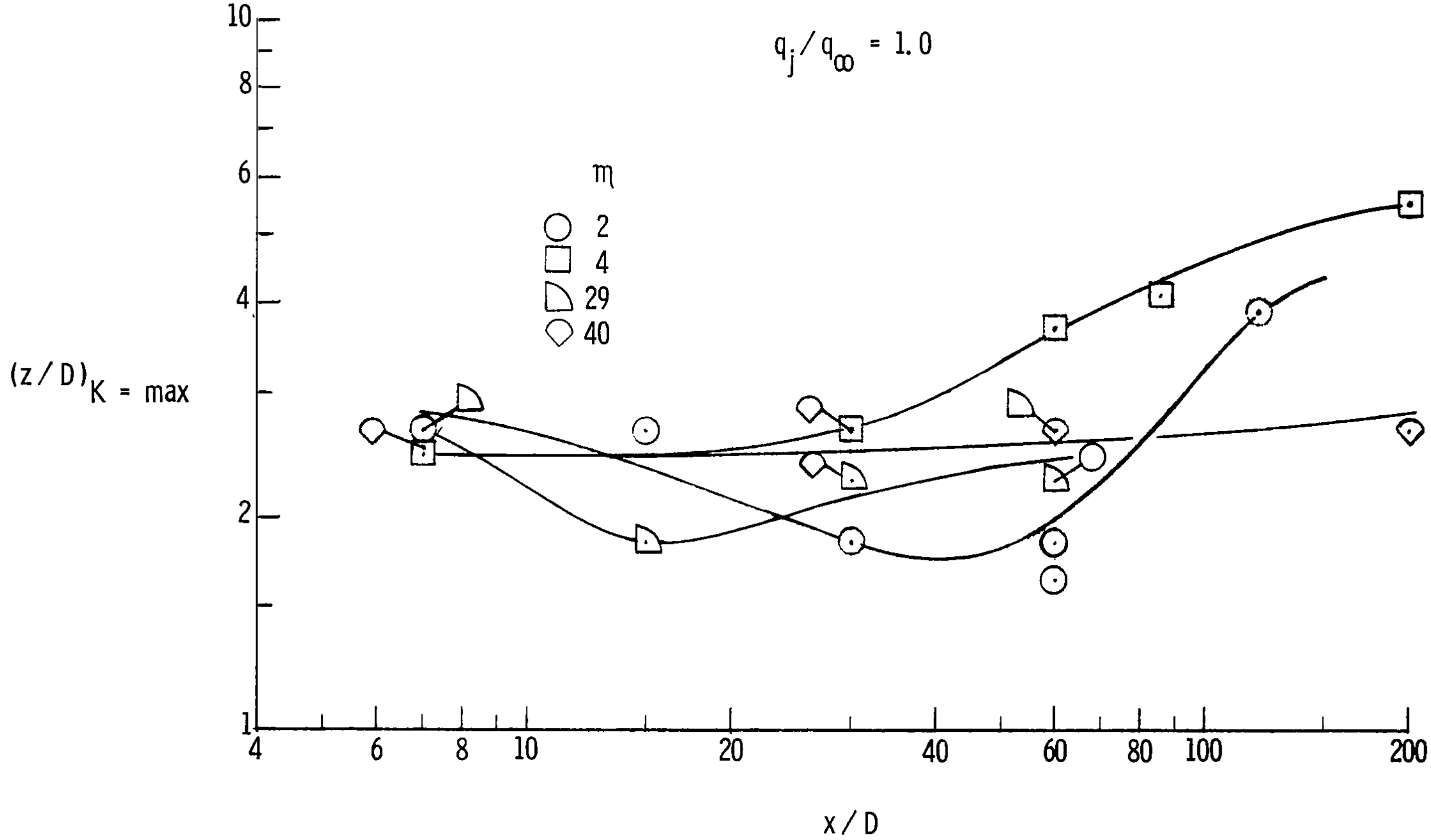
(a) Air injection; variable q_j/q_∞.

Figure 13.- Vertical position of maximum concentration point.



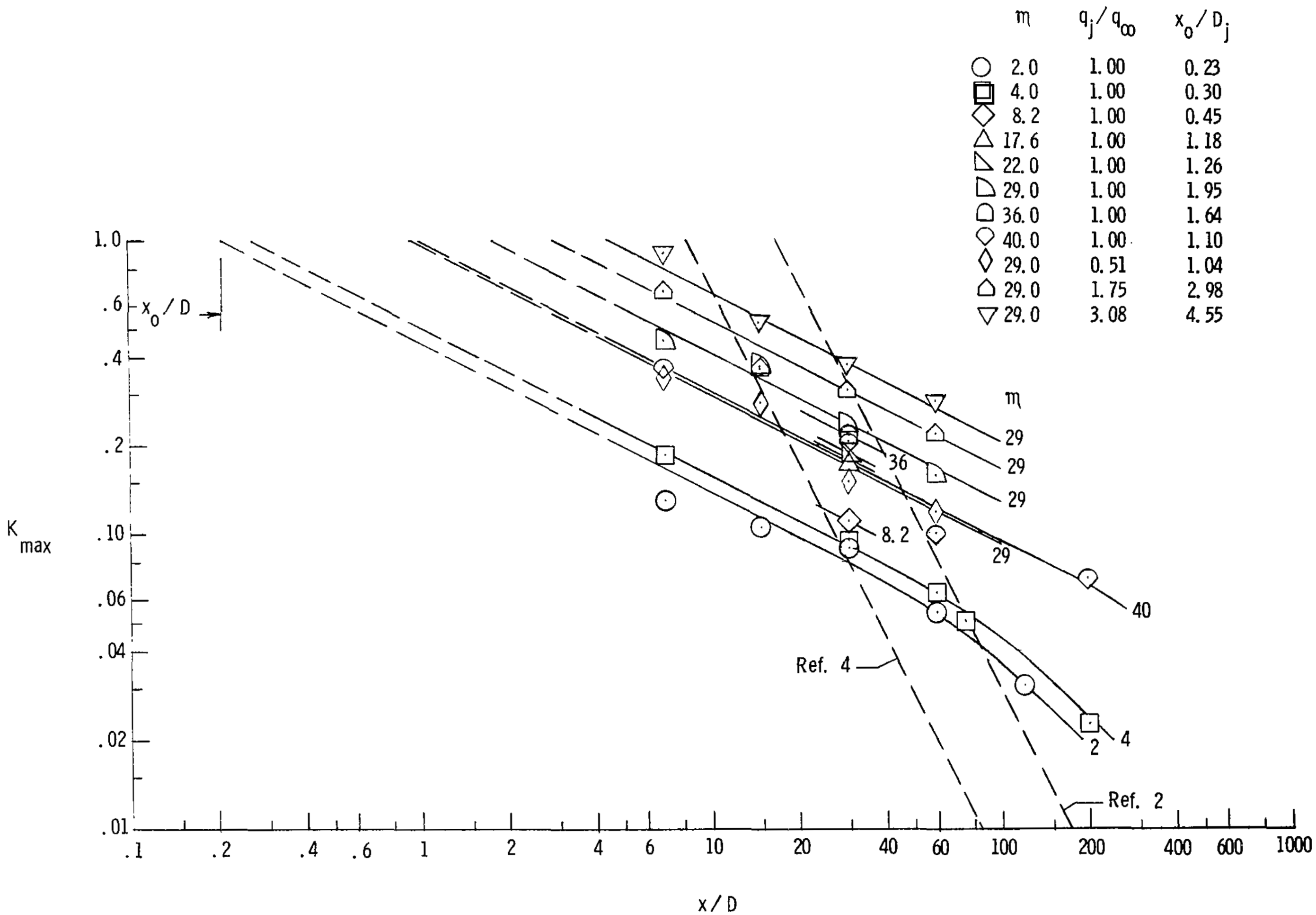
(b) Variable injectant molecular weight; x/D = 30.

Figure 13.- Continued.



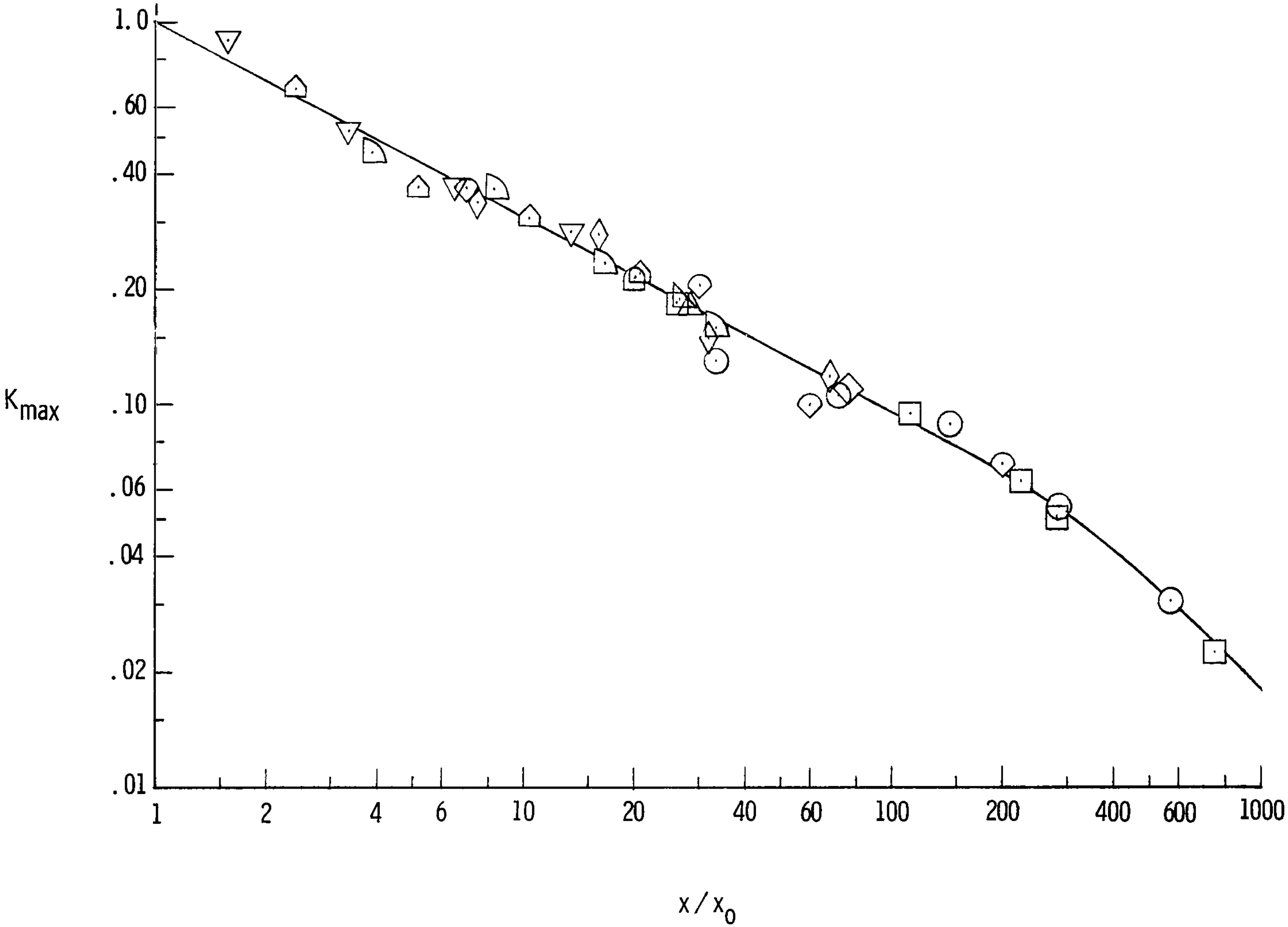
(c) Variation with axial position.

Figure 13.- Concluded.



(a) Variation with axial position.

Figure 14.- Maximum concentration decay.



(b) Correlation of data.

Figure 14.- Concluded.

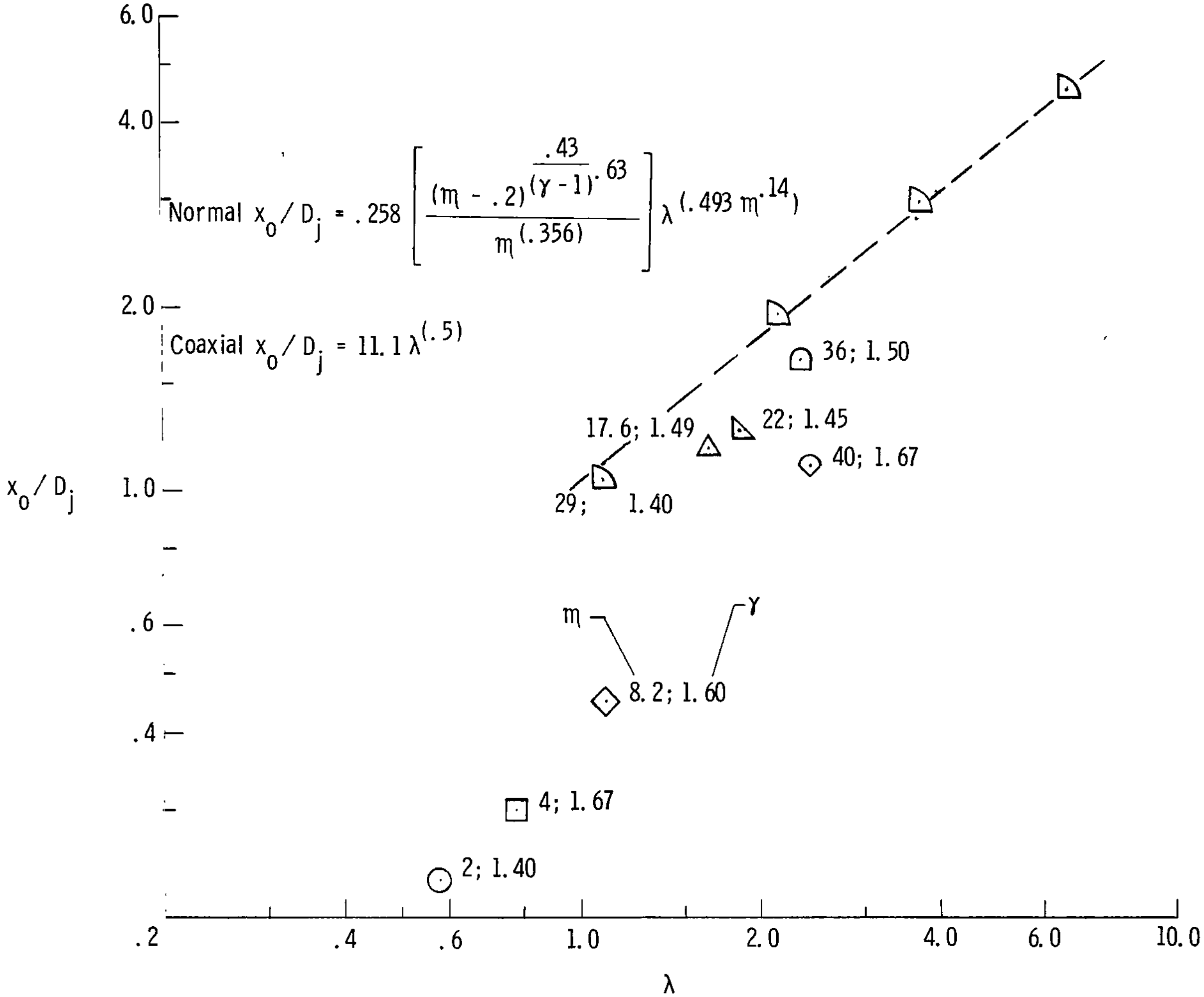


Figure 15.- Correlating parameter variation.

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