HOT WIRE ANEMOMETER STUDIES OF A TWO DIMENSIONAL DIFFUSER THAT UTILIZES VARIABLE GEOMETRY SLOT SUCTION

BY

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DIMENSIONAL DIFFUSER THAT UTILIZES

VARIABLE GEOMETRY SLOT SUCTION

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NOMENCLATURE

a	Speed of Sound in Air (ft/s)
A	Kings Law Curve fit Coefficient #1
AR	Area Ratio of Diffuser Exit Area to Inlet Area
B	Kings Law Curve fit Coefficient #2
Cp	Coefficient of Pressure Based on Wall Pressure Tap Data
Cp_{ideal}	Ideal Pressure Recovery Based only on the Area Ratio of the Diffuser
$\overline{Cp}_{exit}$	Average Exit Cp Derived from Flow Field Sweep Data
E_{leak}	Scanivalve Pressure Leakage Error (" H_2O)
E_{hys}	Pressure Transducer Hysteresis Error (" H_2O)
E_{temp}	Pressure Transducer Temperature Shift Error (" H_2O)
E_{cal}	Pressure Transducer Calibration Error (" H_2O)
E_{board}	Pressure Transducer A/D Resolution Error (" H_2O)
Fence	Bleed Slot Retaining Fence Height (inch)
I_{loc}	Local Turbulence Intensity Factor (%)
$\overline{I}_{loc}$	Average of All Local Turbulence Intensities (%)
I_{mean}	Lumped Average Turbulence Intensity $= \frac{1}{n} \sum_{np}^{n} (I_{loc}/\overline{V})$ $i=1$
L/D	Diffuser Length Non-dimensionalized by Throat Width
M#	Mach Number=(Air Velocity)/(Speed of Sound in air)
M	Total Mass Flow Rate (Lbmass/s)

n	Kings Law Curve fit Exponent
np	Number of Diffuser Sweep Location Points
V	Local Mean Flow Velocity (ft/s)
$\overline{V}$	Flow Velocity Averaged Over All Pitot Sweep Locations (ft/s) $= \frac{1}{n} \sum_{np}^{n} V_{i=1}$
V_{max}	Maximum Flow Velocity (ft/s)
V_{rms}	Local RMS Velocity Fluctuation (ft/s)
P_{exit}	Exit Plane Static Pressure (" H_2O)
P_{throat}	Static Pressure At Throat (" H_2O)
$\overline{P}_{static}$	Average of Local Static Pressures ("H_2O)
$\overline{P}_{stag}$	Average of All Local Stagnation Pressures (" H_2O)
Q	Volumetric Flow Rate (Ft /s)
RMS	Root Mean Square Deviation $= \sqrt{\frac{1}{np} \sum_{i=1}^{n} (e^2)}$
Xgap	Axial or Longitudinal Slot Gap Size (inch)
Ygap	Lateral or Radial Slot Gap Size (inch)
β	Mass Bleed Rate in Percent of Total Flow (%)
ϕ	Suction Slot Divergence Angle (Degrees)
ρ	Fluid Density (Lbm s^2/ft^4)
θ	Diffuser Total Divergence Angle(Degrees)
$\theta/2$	Divergence of each Planar Diffuser Wall (Degrees)

CHAPTER I

INTRODUCTION

Diffuser Definition

A diffuser is an integral part of many fluid and aerodynamic systems and is simply a means of converting a fluid's kinetic energy into static pressure. The diffuser is usually a passage or channel of expanding area through which a fluid flow decelerates, expands, and converts some of its kinetic energy into static fluid pressure in accordance with Bernoulli's equation.

The effectiveness of any diffuser is based on how well it converts this velocity energy into pressure. We judge diffuser performance based primarily on a pressure recovery coefficient (Cp). This coefficient is a ratio of static pressure increase in a given flow to the dynamic pressure available for conversion. The upper limit of the coefficient is of course unity, which would represent complete stagnation of the flow and maximum possible static pressure rise. Such a result would only be possible for a diffuser of infinitely large size and possessing no frictional losses. For our scope of interest and for most fluid systems, it is not really necessary to stagnate the flow. Typically these systems require a moving fluid to do the work. So the goal of a diffuser is only to decelerate and recover a part of the static pressure.

Diffuser Types

A diffuser can be of any shape as long as it consists of an area expansion of some type. Area changes can occur in a two dimensional channel, or three dimensional square or round duct. The simplest type of two dimensional diffuser is a channel with two planar diverging walls. Three dimensional diffusers may include a square duct with four sets of planar diverging walls, a conical shape that expands symmetrically about a central axis, or an annular ring type expansion typically used in jet engines. The walls of these diffusers also need not be planar, and in many conical and annular diffusers they are bell shaped. The central axis of the diffuser may also be offset to conform available space.

Inherent Diffuser Problems

In a constricting passage, the flow generally remains attached to the constricting walls and fills the cross - sectional area of the passage. It remains well behaved and attached for any reasonable contraction rate. The diffuser is the inverse of the contraction, and is much more susceptible to separation. Great care must be taken in design of the diffuser to maintain attachment of the flow to the diverging walls. Because of this sensitivity to the divergence angle of the wall, the diffusers generally must be longer and consist of a smaller divergence angle than the constricting passage design would. Great attention must be paid to the expansion of the diffuser (Area Ratio), and its length to inlet diameter ratio (L/D). These two parameters in turn control the angle of divergence of the straight walled diffuser and the contours of the curved wall diffuser. If the diffuser is designed improperly, the fluid can separate from the walls. Figure 1 on the following page shows several types of diffuser failures. The first noticeable area of separation is known as "three dimensional transitory separation", where flow separates from corner regions and walls intermittently and moves downstream as recirculating bubbles. For more extreme cases, the flow exhibits a "two dimensional separation", where the flow detaches from one diffuser wall forming a stable recirculation zone. The worst case is the "fully stalled flow", where the flow is separated from all walls, forming an unattached jet surrounded by recirculation zones on all walls. This last case is known as a fully stalled diffuser and has few if any diffusing properties.

Avoiding these types of separation are important to a good diffuser design. Only when the exhaust flow from the diffuser is homogeneous and attached on all wall perimeters can a maximum deceleration and static pressure recovery can be obtained.

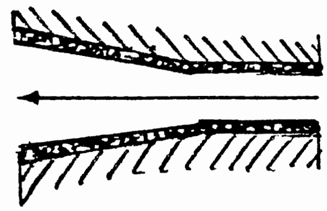
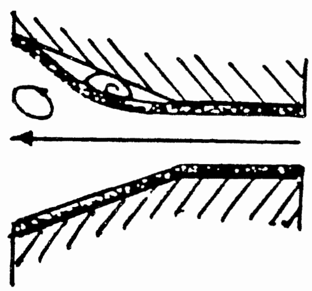
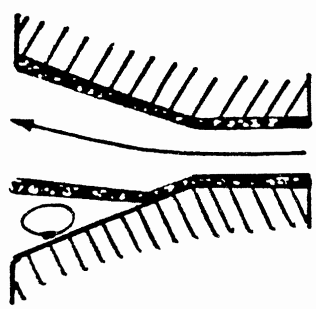
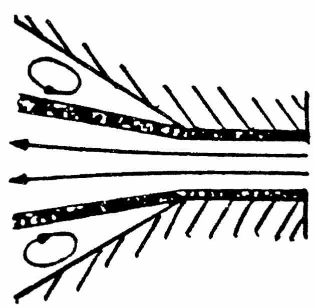
FLOW REGIME	SKETCH
No separation	
Three Dimensional Separation	
Two Dimensional Separation	
Fully Stalled Jet Flow	

Figure 1

Separated and Uunseparated Flow Regimes in a Diffuser

CHAPTER II

LITERATURE REVIEW

Modes of Diffuser Improvement

The goal of a diffuser design is to obtain the best possible static pressure recovery while providing a uniform outlet velocity. This is usually done with an extremely long diffuser in which the fluid is allowed to steadily expand and completely fill the available cross-sectional area. Unfortunately, due to size, weight and cost considerations, an extremely long diffuser is not practical. The short diffuser ($L/D < 5$) has received a great deal of consideration and experimentation recently by Adkins (1975). In the aircraft industry where aerodynamic efficiency, weight, and size are extremely important, a short diffuser is of great use. For these, reasons the literature reviewed was basically limited to various way of improving the diffusing properties of short, subsonic, air diffusers, looking particularly at Mach numbers ranging from 0.1 to 0.3.

Several systems of performance improvement have been investigated. Most were related to energizing or bleeding the unstable boundary layer of the short diffuser.

These methods should provide a more even distribution of velocity (kinetic) energy across the area of the diffuser. This should allow a more even distribution of static pressure recovery and limit chances of flow separation. These systems generally reduced to the study of mixing of the fluid by use of vortex and swirl generators as shown by Brown (1968) and Senoo (1974). 2) Boundary layer energizing by use of tangential and axial fluid injection along the diffuser walls as suggested by Duggins (1978), Fiedler (1972), and Nicoll (1970). In addition to Boundary layer bleed and removal to reduce friction between the energized core of the flow and the boundary layer was investigated by Adkins (1975, 1981, 1985) and Juhasz (1974, 1977).

Base Diffuser Study

Before the more exotic methods of performance improvement could be studied, a baseline diffuser design must be investigated. The performance of straight walled diffusers has been studied thoroughly by both empirical and computational predictions. These studies give a fair estimation of an optimum diffuser design for a required pressure recovery. These predictions exist for two dimensional, conical, and annular diffusers. For the simplest type of diffuser, the two dimensional planar diffuser, the British publication of the Engineering Sciences

Data Unit (1974) is used for example in Appendix A. For a given diffuser area ratio (AR) and non-dimensional length (L/D), limits to avoid various types of separation are shown in Appendix A. Given a diffuser area ratio and a non-dimensional length, an optimum two dimensional design can be found on a line of constant Cp.

Other references such as Binder (1983) show the effects of improved pressure recovery with variable exit blockage and increasing Mach number. More design criteria was found in articles by Hoffmann (1981, 1984) dealing with Cp performance as a function of higher inlet turbulence levels and distorted inlet velocity profiles. From these articles, it was determined that diffusers with square or "slug" velocity profiles diffuse more readily than their "fully developed" counterparts due to a higher concentration of velocity (kinetic) energy along the diffuser walls. This effect can be seen in the comparison of the ESDU chart for fully developed and under developed flows in Appendix A. Given the same diffuser geometry ($\theta/2=10^{\circ}$,L/D=2.0), the pressure recovery (Cp) increases from 0.37 to 0.53. This shows how the diffuser performance improves for underdeveloped "slug" flow compared to the "fully" developed parabolic flow. Unfortunately in most systems, the approaching flow is partially developed, so the goal of auxiliary flow improvement is to attain, if not exceed, the diffuser results when using a "slug" profile.

Vortex and Swirl Generators

The point of these types of devices is to mix the "lower energy" boundary layer with the "higher energy" central core. This pushes more of this higher energy flow nearer the diverging diffuser walls where it expands without separation or recirculation. This can be accomplished by use of vanes that stretch across the diffuser throat as described by Feil (1964) and Rao (1971). These vanes can be designed to induce swirl and to act to compartmentalize possible separation zones to one section of the annulus, and provide an evenly distributed flow as shown by Senoo (1981).

Similar to the vane system, short, wall mounted vortex generators and small blockages can accomplish the same effect. According to Brown (1968) and Senoo (1974) these devices accomplish the same results of mixing the low energy boundary layer, but with smaller devices. These methods all provide some improvement in pressure recovery, but mostly limit separation in three dimensional diffusers. The reason the pressure recovery does not improve significantly is due to the fact that these devices are in the flowing fluid. They induce some frictional losses to the overall system themselves. With any introduction of more frictional losses to the system, the overall efficiency is reduced. Though this method has some merits in avoiding separation and providing a more uniform flow, the results are not ideal.

Fluid Injection

This type of method studied by Duggins (1978), Fiedler (1972), and Nicoll (1970) is based on energizing the boundary layer by injecting higher velocity fluid along the wall boundary. By injecting fluid axially in the direction of the fluid flow, a more uniform diffuser throat velocity profile is achieved. This in turn corresponds to a more square or slug type velocity profile, which was shown by the ESDU (1974) to improve pressure recovery. These results are much more impressive than the vortex generator models. The injection method does not involve the impingement of an object into the flow, thus it does not create more friction. Unfortunately, this method can be rather sensitive with respect to the velocity of the injected fluid into the free stream. This requires the diffuser to be maintained at a consistent velocity. Otherwise the injection rate could vary wildly and provide distorted velocity profiles to the diffuser, which in turn could cause separation.

Fluid Suction

This method has been demonstrated in many studies by both suction through a single slot at the diffuser entrance as by Juhasz (1974, 1977), or suction through porous walls as demonstrated by Nayfeh (1982), Reynolds (1986), and Saric (1986). Both of these methods effect flow improvement by removing the low energy boundary layer and provide a favorable pressure gradient in the direction of the suction. This pressure gradient helps to pull the remaining flow away from the center core and toward the diffuser walls. The other type of suction system consists of continuous suction along the diffuser through semi-porous walls. This provides for continuous removal of the accumulating boundary layer and attachment of the flow on the diffuser wall throughout its length. This method has not been fully developed. applications were primarily directed towards boundary layer removal over a flat plate. This type of boundary layer removal has been used to improve flow over airfoils. Though this method has many interesting possibilities and was considered heavily, it was not pursed in this study due to manufacturing difficulties and lack of turbine pumps to provide the suction.

Hybrid Diffuser

This type of diffuser proposed by Adkins (1975, 1981, 1985) uses slot suction at the entrance of the diffuser. The slot in this case diverges slightly in the direction of the diffuser walls (Figure 2 on the following page). This results in a combination dump diffuser with a straight walled diffuser attached. The bleed slot removes the low energy boundary layer as described previously. In addition, due to the diverging geometry of the slot, the flow accelerates in the direction of the diffuser walls. This diffuser seemed to show the best possible results as far as maximum pressure recovery and diffusing length required. The research on this was limited however, and the exhaust velocity profile and turbulence were unknown.

Due to its apparent ability to diffuse a air flow efficiently over a short area, the hybrid diffuser was chosen for this study. A more extended and accurate study of this diffuser's performance could prove its effectiveness. This would be done by optimizing pressure recovery by varying the slot geometry and bleed rates. In addition, meticulous studies of the exit flow patterns could be made by use of pitot and hot wire probes. A study of turbulence growth in this diffuser has not been attempted and could add a great deal to the knowledge in this area. This turbulence knowledge could be used to prove the usefulnesses of the hybrid diffuser design.

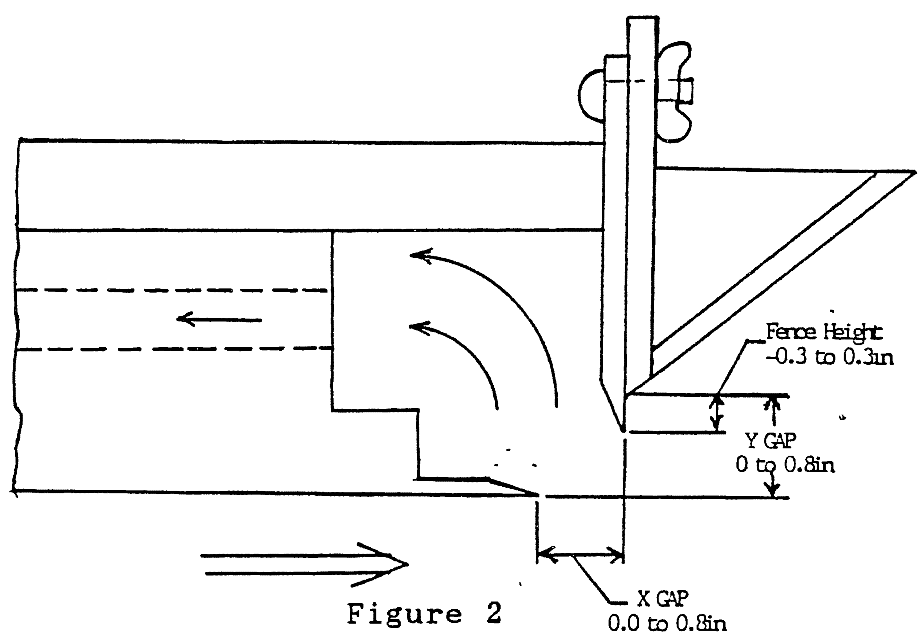


Figure 2

Geometry of the Hybrid Diffuser Slot

CHAPTER III

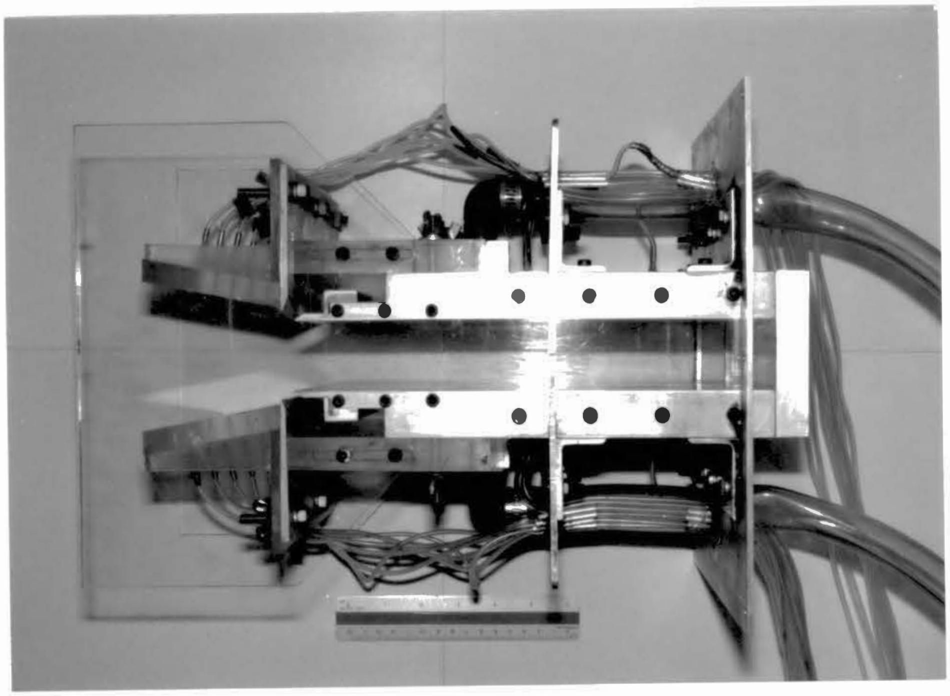
TEST RIG DESIGN

To study the hybrid diffuser system, a design must first be finalized. To aid in construction and variability, a two dimensional model was chosen. Although many actual diffusers are three dimensional (either annular or conical), the three dimensional effects of these diffusers would seem to cloud the results of the study. Since this investigation is research of basic properties of a diffuser, a two dimensional system seem to simplify matters.

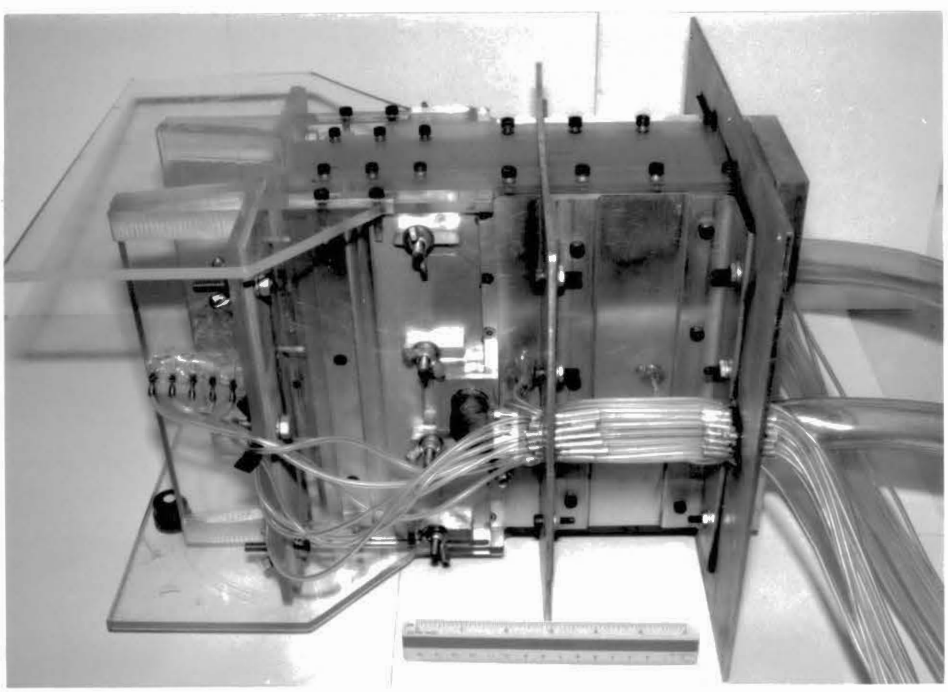
Use of an existing open-loop wind tunnel in which to conduct these experiments was required, limiting the size of the test rig design. The test section of this wind tunnel was 10 inches square. This area limits the size of any test rig that needs to fit within it. To allow for movement and adjustment of the test rig within this area, an approach height of 9 inches was chosen. Because the two dimensional aspect of the test rig must be preserved and the passage height was already known. The throat size must then be limited to simulate this two dimensional effect. Ideally, the aspect ratio (ratio of throat height to width) of the test rig should be infinite. But an infinitely thin throat would not allow probes to traverse into it. For this reason, a minimal aspect ratio of 6 was chosen, giving the diffuser throat the dimensions of 1.5 by 9.0 inches. The overall view of the test rig within the test section of the wind tunnel can be seen in Photographs 1 and 2 on the following page and in Figure 3.

An approach section was also built to be placed within the wind tunnel. The goal of this section was to translate the flow from a 10 inch by 10 inch square duct to our 1.5 inch by 9 inch rectangular duct. It was built from plywood and gloss coated to reduce frictional losses and separation of the approaching flow. This section also contained a straight walled approach to the test rig of 15 diameters. This is in addition to the 7 diameters of approach in the test rig itself. This 22 diameter approach is not enough distance to allow for a fully developed flow, though it should allow for a partially developed profile. This profile was found by measurements to have a average velocity equal to 90% of the maximum velocity. In accordance with the ESDU design criterion in Appendix A, this type of flow is considered to be fully developed.

The test rig was designed to allow complete variability in both axial suction slot gap, radial slot gap, and height of a retaining fence on the suction slot (see Figure 2 and Appendix B). To help further in variability, the test rig was designed so that diffuser walls of different expansion



Photograph #1 : Top View of Diffuser Test Rig



Photograph #2 : Side View of Diffuser Test Rig angles and length could be interchanged. Additionally, to foresee visualization studies possible in the future, the end plates on the top and bottom of the test rig were made of plexiglas to aid viewing. Similarly the diffuser walls, and suction slot walls were also made of plexiglas. The rest of the test rig was milled from aluminum so that a strong, flat, smooth approach section wall could be formed.

To facilitate static pressure tracking throughout the system, a series of 22 wall pressure taps were drilled. The layout and numbering of these taps within the test rig can be seen in Figure 4. Of these taps, 8 were used to record the approaching flow development, 14 more on the walls of the diffuser to record static pressure recovery. In addition to this data, pitot-static and hot wire probes were used to map the velocity, turbulence, static and stagnation pressures at 3 axial locations in the diffuser. The locations of these sweeps can be seen in Figure 5. The upstream data sweep is 1.0 inch upstream from the throat, the throat sweep occurs at the lip of the bleed slot, and the exit sweep at the geometric end of the diffuser.

In addition to the test rig, associated support hardware was also built. This included construction of a suction system using two sets of rotameters and vacuum fans. Also, electrical supplies and triggering mechanisms were constructed to support the pressure transducer and pressure scanning device.

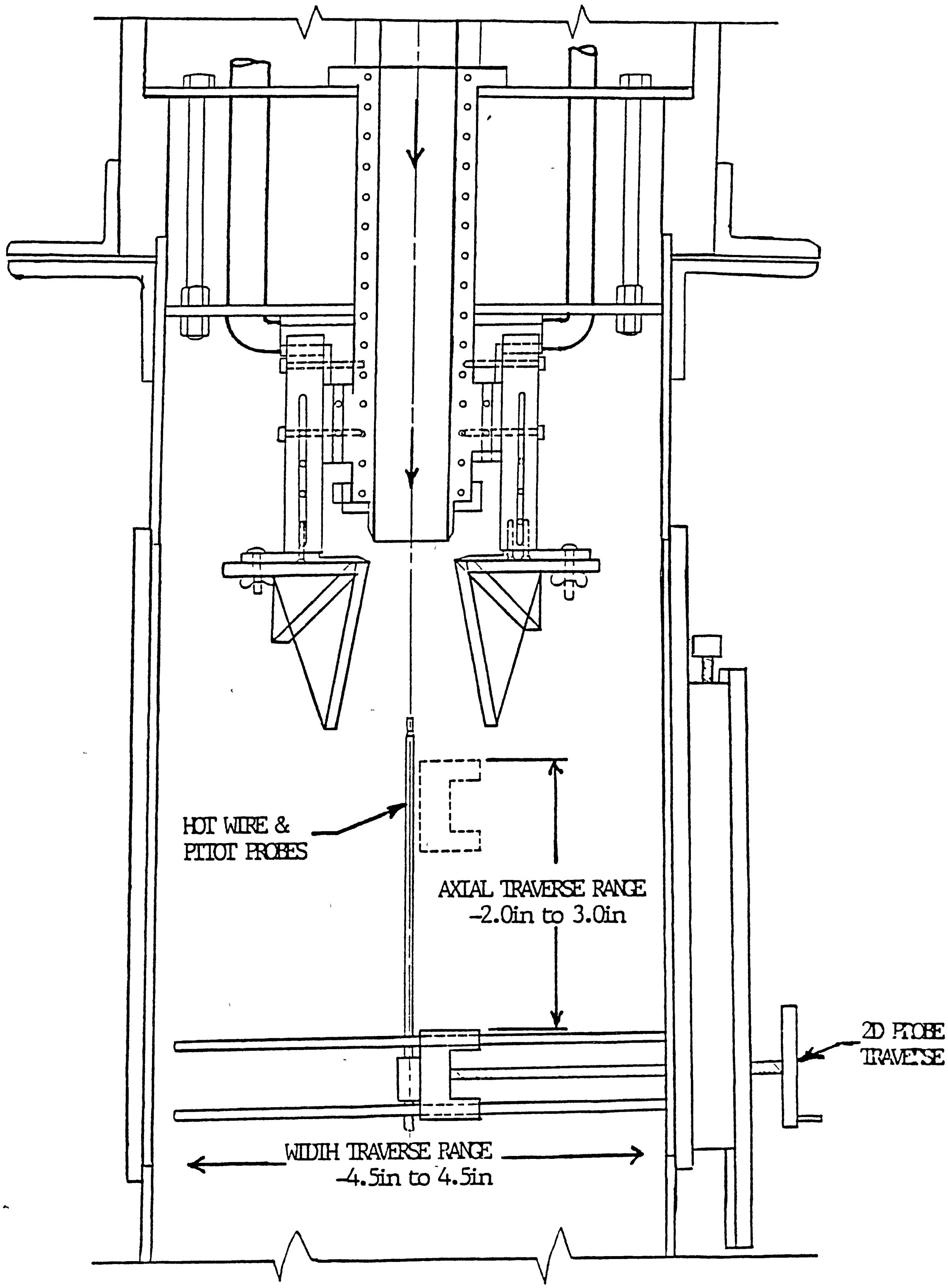


Figure 3

Overall Test Section Layout and Probe Location

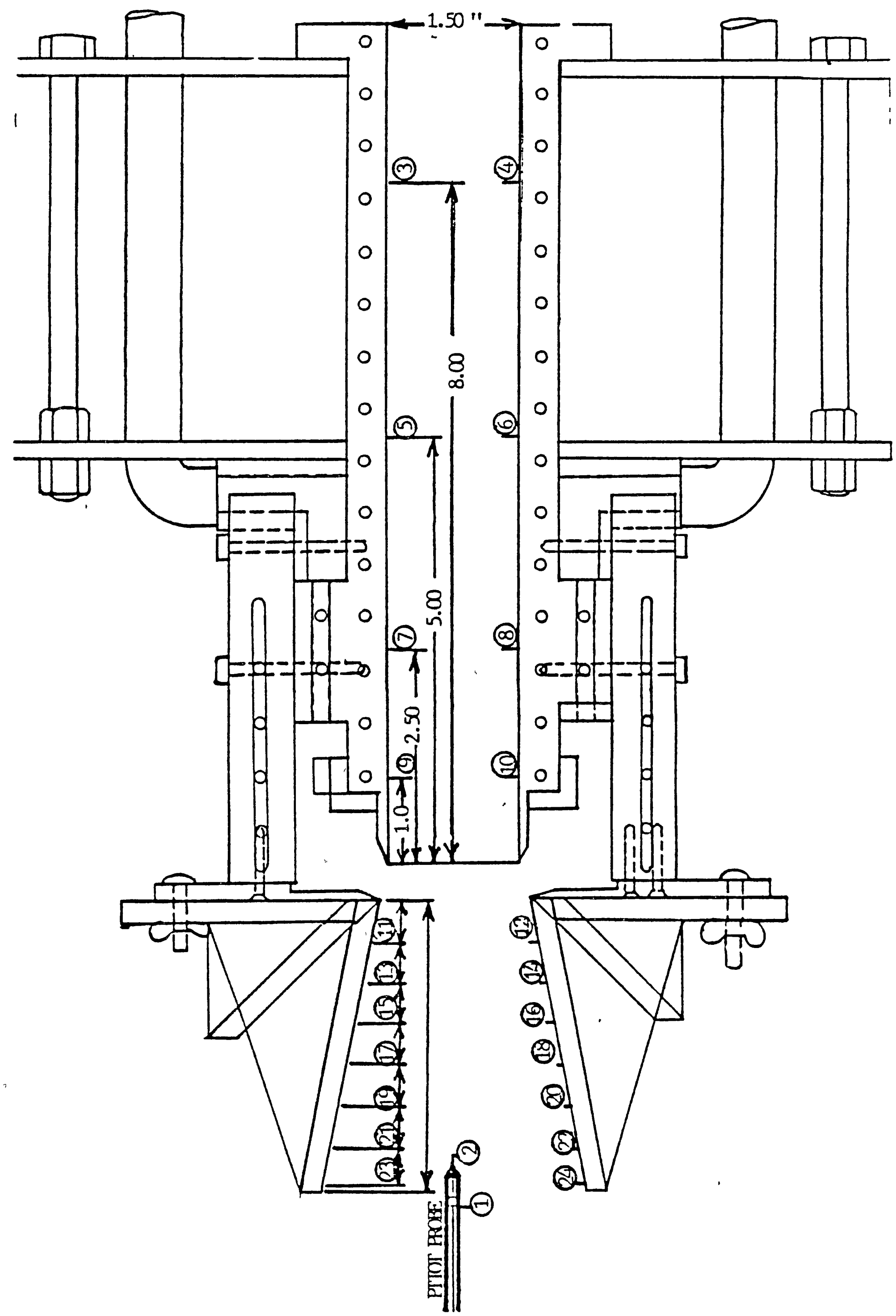


Figure 4

Pressure Tap Numbering and Location in Test Rig

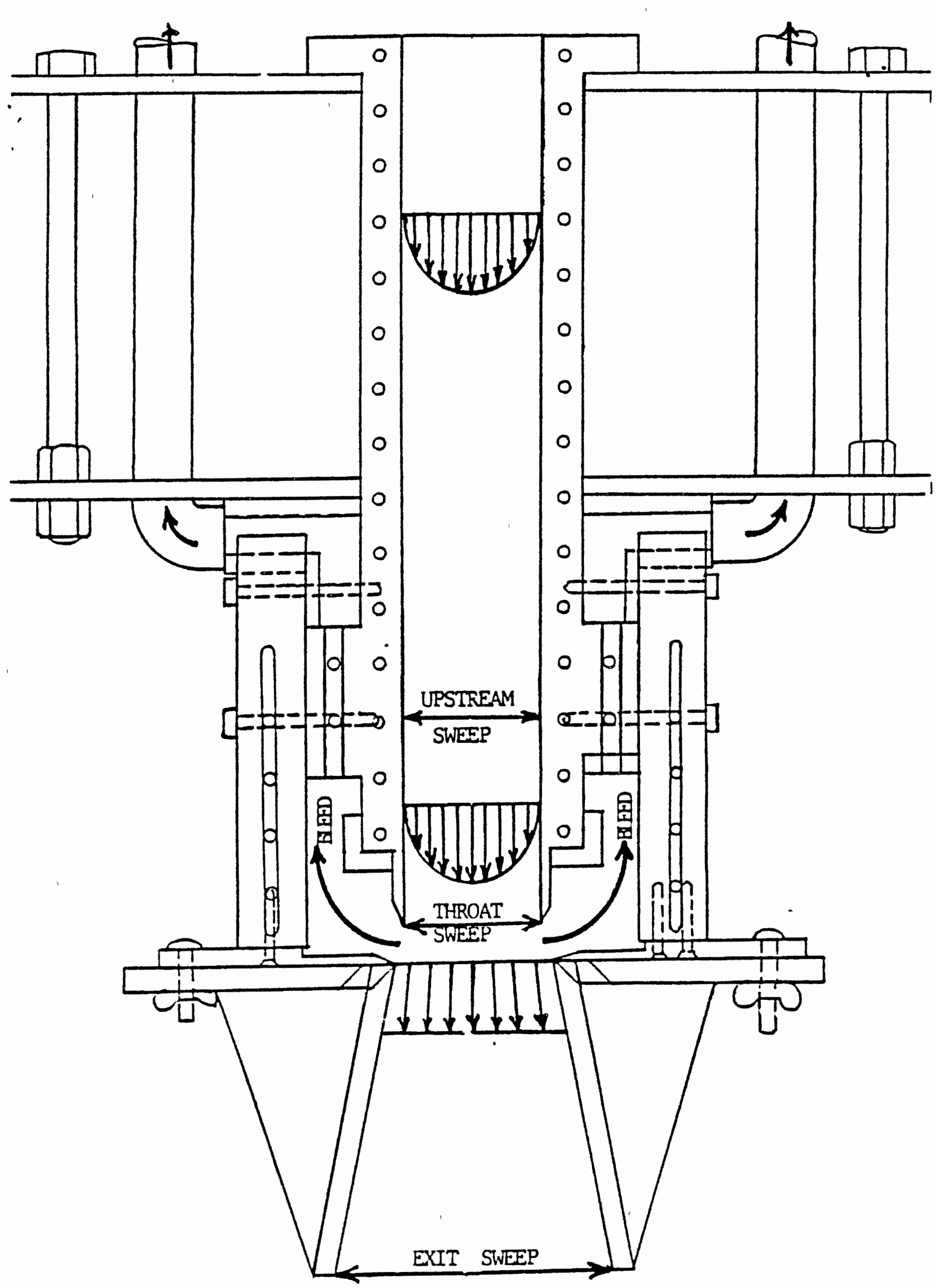


Figure 5

Pitot and Hot Wire Probe Data Sweep Locations

CHAPTER IV

INSTRUMENTATION AND ERROR INVESTIGATION

Experimental Error

With any experimental study, there is an experimental set up. Design intricacies of the diffuser test rig have been explained in the previous chapter. However, with any experimental set-up, there is an array of support hardware to actually take the data. A list of the associated hardware used is given in Appendix C. The overall system arrangement of equipment is shown in Figure 6 and in Photographs 3 and 4.

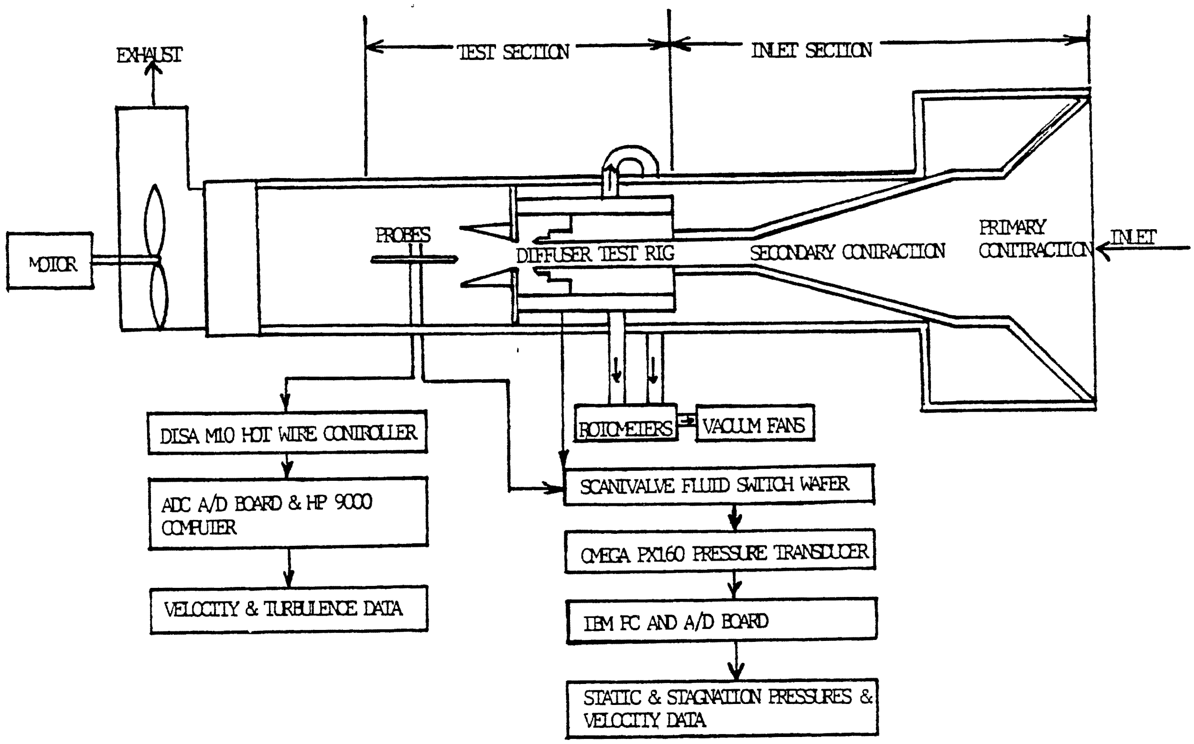
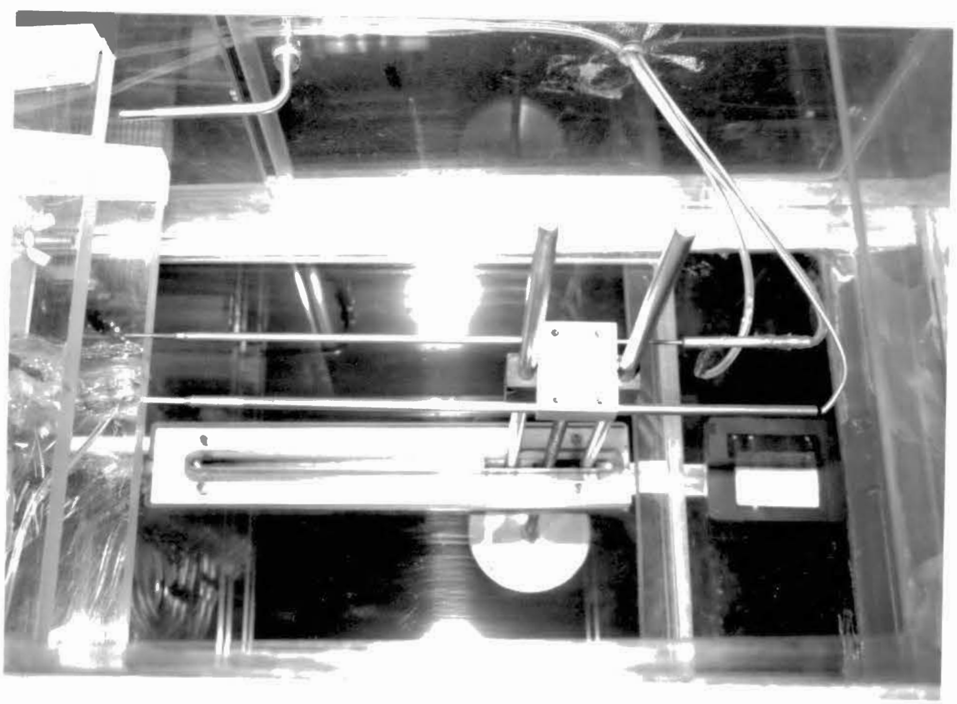


Figure 6 : Experimental Equipment System Diagram

Photograph #3 : Experimental Set-Up



Photograph #4:Hot Wire and Pitot Probes Within Test Section

With any experimental study, associated errors are incurred. This diffuser study likewise is just as susceptible. These errors can take many forms, but four stand out. These four error types are 1) inherent design defect in the original test article, 2) sampling errors in taking the data, 3) errors in analyzing the results, and of course 4) human error. All of these errors should be quantified. It is unlikely that some of these errors, especially human error, can be evaluated. The majority of the analysis will be on the errors in the data sampling process, since those are the most easily qualifiable errors.

Pressure Sampling

Due to the fact that the diffuser is a used for pressurizing a fluid flow, pressure data is of great interest to our study. For this reason, 22 static wall taps were used throughout the system to record the progress of this recovery process, in addition pressure measurements from a traversing pitot-static probe were taken.

Low pressures (<1 PSI) in aerodynamic systems have typically been measured by using a bank of manometers. The accuracy and dynamic response of these manometers is a problem. Since lag time was incurred between the reading of each manometer, the data was not being gathered at the same time.

seemed to be more useful. Use of a single pressure transducer with data gathered digitally was a good solution. A great deal of time was spent trying to enable a large student-produced switching valve to work and act as a pressure multiplexer. Results from this were less than satisfactory, so a commercial device known as a fluid switch wafer was employed. This device was essentially a stepper motor controlled mechanical switch for use with low pressure systems. The cumulative error results of the pressure sampling loop follow (with further discussion in Appendix D).

The pressure gathering system consisted of 22 pressure taps in the diffuser rig leading to the Scanivalve fluid switch wafer (model W0601/1P-24T), which had a quoted pressure leakage rate of 2 %/hour. We were only interested in sampling pressures of less than 12 inches of H_2O, for a maximum of 20 seconds. This would result in a total pressure loss possible of 0.0013 inches of H_2O. Since the test article was a dynamic system, this lost fluid would have been replaced, making this error almost negligible.

The pressure transducer itself was not nearly as accurate as its switching valve. The model used was an Omega PX160-10D5V which was calibrated up to 12 inches H_2O Full Scale Output. The calibration curve of this transducer can be seen in Figure 7 on the following page. This transducer had a Repeatability and Hysteresis combined error of 0.25% FSO, or 0.030 inch H_2O. It also had a Temperature

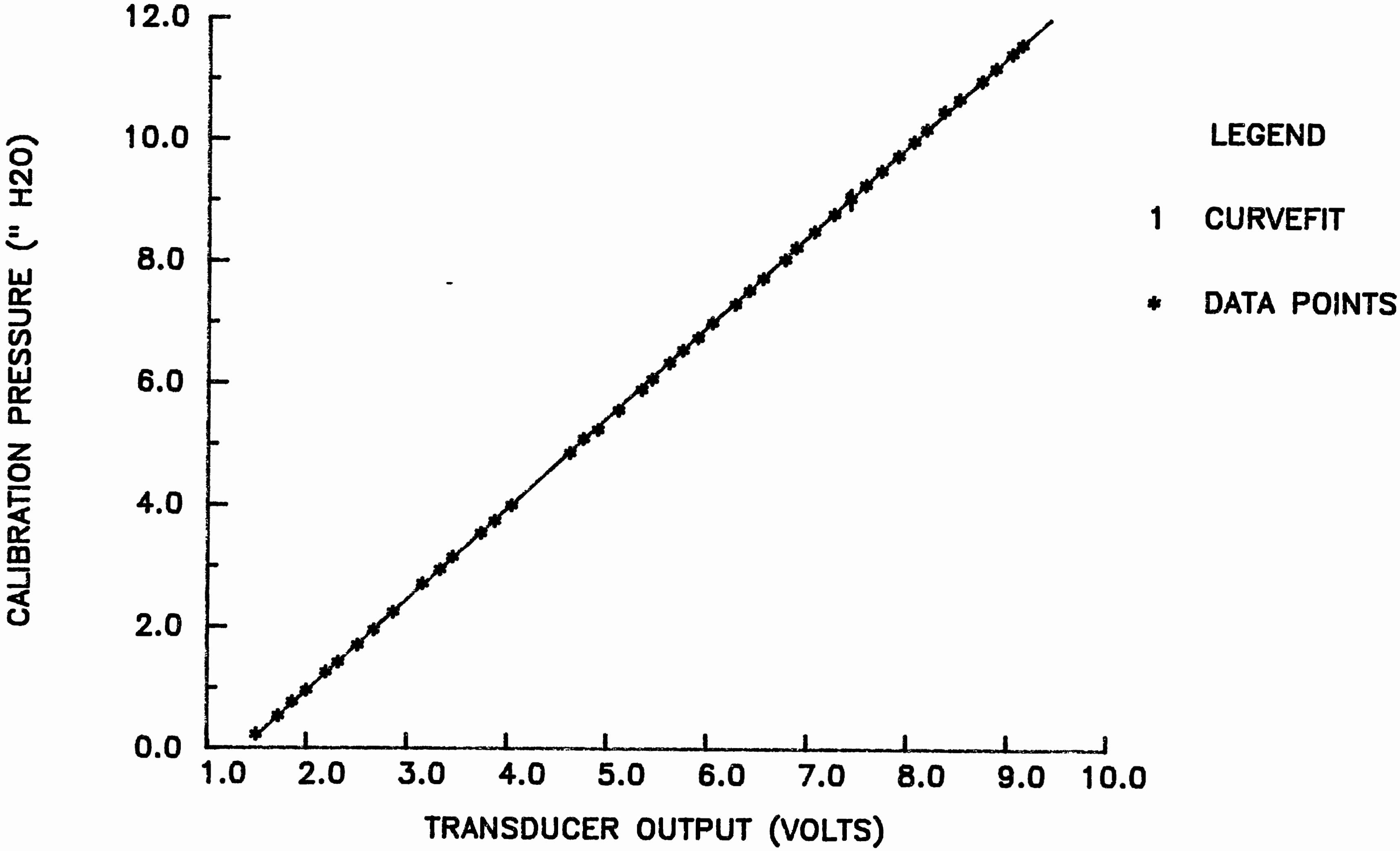


Figure 7. Pressure Transducer Calibration Curve

Sensitivity shift of 0.05% FSO/ C, which for our case where temperature varied a total of 4°C, results in a temperature error of 0.024 inch H_2O. Since this transducer was calibrated against a Slant-tube manometer, a calibration error was also possible. This calibration or curve fitting error was calculated to be 0.021 inch H_2O. Additionally, because the data itself was recorded by use of a 12 bit analog to digital sampling board, bit sampling error was also incurred. Assuming a statistically high number of data points were taken (over 1000), the noise and discretization error of this board can be reduced to 1.5 bit variations or 0.004 Volts. This error voltage corresponds to a pressure error of 0.006 inch H_2O. The total incurred error of this whole system is represented as the root mean sum of the individual errors.

$$\sqrt{E_{leak}^2+E_{hysteresis}^2+E_{temperature}^2+E_{calibration}^2+E_{board}^2}$$

The resulting global error $E_{pressure}$ for all pressure measurements is approximately $E_{pressure} = +-0.044$ inches H_2O. See Appendix D for further error analysis.

Slot Bleed

The bleed rate in this experiment was limited to a small enough range that useful diffuser improvement could be gained with only a small cost in fluid loss. Many experiments in this area have resulted in good pressure recoveries, but at the expense of bleeding of up to 40% of the mass of the flow as indicated by Juhasz (1974, 1977). Obviously in a real system, this loss of the working fluid would result in an impractical design. The bleed rates were limited to 0, 1 and 2% of the total mass flow. The goal of the study was to find the best possible slot configuration for these minimal bleed rates. Although it is quite possible that higher pressure recoveries are possible at higher bleeds, these areas seemed of little interest if it did not result in a practical design. To accomplish this slot bleed, a set of two vacuum fans were used in series with two mass flow rate rotameters for setting the mass bleed rate. Use of orifice plates to track suction rates was considered, but the rotameters for this particular purpose are much simpler and nearly as accurate. The division of bleed rates consisted of only two actual bleed rates, so extremely fine measurements were not critical.

The design goal of the diffuser itself was to run at a subsonic mean throat velocity of 200 ft/s through a throat area of 0.09375ft^2. The resulting total mass flow rate would be in the range of 80 lb_m/minute (or PPM). To bleed 2% from the system requires a rotameter that could measure 0.8 PPM. In actuality, the rotameters used had ranges of 1.2 PPM and a readability of 0.025 PPM. These identical rotameters were then calibrated against a third to insure consistency in bleed rate from both slots. However, due to pressure and temperature effects, the mass flow rate indicated was not always correct. The rotameters were calibrated at the factory at an air density corresponding to 760 mm Hg and 55°F. At other temperatures and atmospheric pressures, these readings must be biased so the correct bleed rate obtained. This bias was rarely more than 4% of the total bleed rate. Assuming that the atmospheric differences were corrected, then the only bleed rate error possible is a readability error which was +-0.025 PPM.

Hot Wire Anemometer

Use of a traversable hot wire anemometer augments the use of the pitot-static probe. Like the pitot probe, the hot wire can be used to measure velocity at any point in the diffuser test rig. A pitot probe might be slightly more accurate than the hot wire, for measuring average velocity, due to the hot wire's declining sensitivity at high velocities (> 100 ft/s). A typical calibration curve for the hot wire probe can be seen in Figure 8 on the following page. The pitot probe is fairly accurate for measuring mean, time invariant pressure, but has no frequency response. Frequency response is the realm of the hot wire. Velocity fluctuations (turbulence) are of great interest in evaluating the performance of an aerodynamic system. So the hot wire was used to evaluate RMS velocity perturbations,

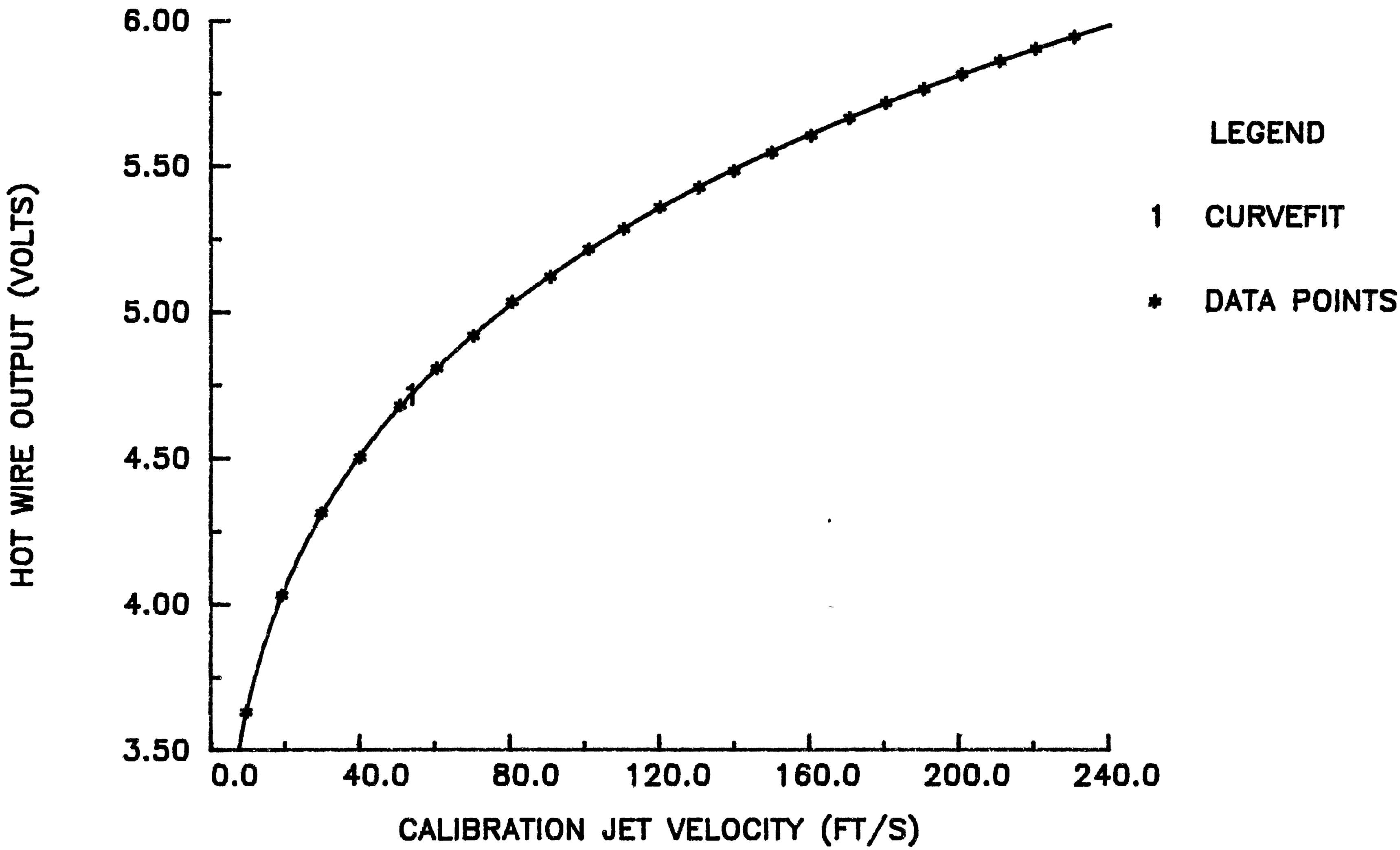


Figure 8. Hot Wire Calibration Curve

while the pitot probe was used to quantify average velocities, static and total pressures. To use the hot wire anemometer, the probe must first be calibrated to a known low turbulence velocity source. This was done by use of a calibration jet nozzle with a known supply pressure. From Bernoulli's equation, the velocity of the exiting nozzle fluid is determined from that supply pressure. The resulting data correlates the increasing output voltage from the DISA M01 hot wire unit with respect to increasing air velocity. Although a hot wire is very accurate at low velocities (< 50 Ft/s), it has limited sensitivity in the range needed in our test. From calibration curve fitting, the relation between output voltage and air velocity follows a King's law form.

$$(\text{Output Voltage})^2 = A + B(\text{Air Velocity})^n \qquad n=0.3 \text{ to } 0.5$$

From this calibration, an RMS curve fitting error of less than 1 ft/s was found. Since this data was also recorded digitally, an analog to digital discretization error was incurred. By sampling a large number of points, the noise component of this error can be eliminated, resulting in a voltage error of 0.00244 volts. The maximum this error could be occurs at high velocities where the calibration curve is flat resulting in a maximum velocity error of 0.60 ft/s, resulting in a total RMS error less than 1 ft/s.

Design Shortcomings

The diffuser test rig was designed to provide the maximum flexibility for future tests. It was constructed laboriously over a period of 6 months and milled to the best available tolerances with the best available techniques. Even with these precautions, there are always shortcomings to any design and working prototype. The set-up was designed to provide the longest approach section possible within the wind tunnel available (approximately 22 diameters). This is just above the limits of what would be required for a fully developed flow. Velocity profile mapping was done downstream to insure this, and the results appeared to be reasonably parabolic (see Figure 8). The approach section was as smooth and as planar as possible, but due to the small aspect ratio of the diffuser (AS=6), the results are also pushing the limits of two dimensional flow.

The symmetry of the suction at the throat is also of concern. A series of dump chambers and baffles were incorporated into the design to insure uniform suction rate from top to bottom of each slot, though the results of this design are difficult to assess. The movable walls of the diffuser and suction slot were required for variability. But movable parts do not seal well and may leak. In addition, these movable parts may also be tripping the flow if not joined properly, where a ridged, one piece structure would not. This tripping effect may also be induced by the wall pressure tap holes in the approach section and in the diffuser walls.

The last possible problem was an uneven wind tunnel suction rate. Possibly due to the fact that the test rig has a rather thin throat, the fluid jet that exhausts from the diffuser does not completely fill the wind tunnel walls. This may cause the fan downstream powering the experiment to receive a non-uniform approach flow. This may in turn cause uneven velocity profiles upstream in the test rig. From the static pressure profiles obtained, this might be the case.

The static pressure (which drives the flow), is shifted towards one wall of the approach section (as in Figure 25 at 0% bleed). Whether this shift is caused by the downstream fan, the probe traversing mechanism, or the short approach section itself is unknown. This shift does however cause the approach flow in the test rig to be peaked slightly off center.

CHAPTER V

PRELIMINARY STUDIES

Approach Flow Investigations

Before the majority of the experimental work was pursued, a few smaller experiments were completed. These included making pitot probe sweeps of the approach flow. These investigations included use of different types of upstream screens to change the velocity profiles of the approaching flow, and changes in the approaching flow with increased slot bleed downstream. In addition, general mapping of the velocity profiles was done with the results compared to the fully developed model equation from White (1974), eq. (3-42).

Rectangular Section: $-a < y < a$, $-b < z < b$:

$$U = \frac{16a^2}{\mu\pi^3}\left[-\frac{dp}{dx}\right]\sum_{i=1,3,5..}^{\infty}(-1)^{(i-1)/2}\left[1-\frac{\cosh(i\pi z/2a)}{\cosh(i\pi b/2a)}\right]\frac{\cos(i\pi y/2a)}{i^3}$$

In Figure 9 a typical inlet velocity profile is plotted along with a "slug" and a "fully developed" velocity profile derived from the equation above. Numerically integrating

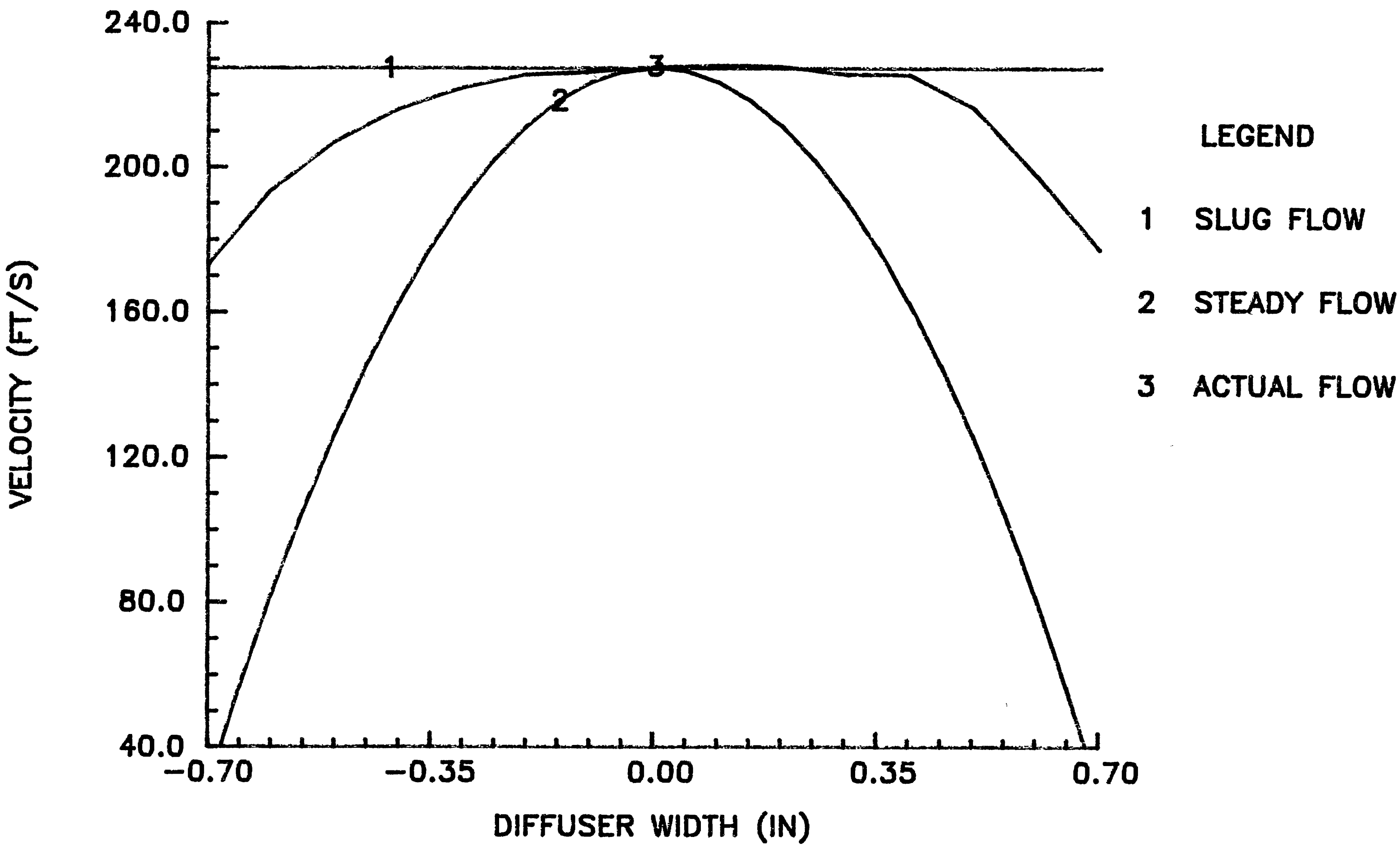


Figure 9. Various Types of Inlet Velocity Profiles

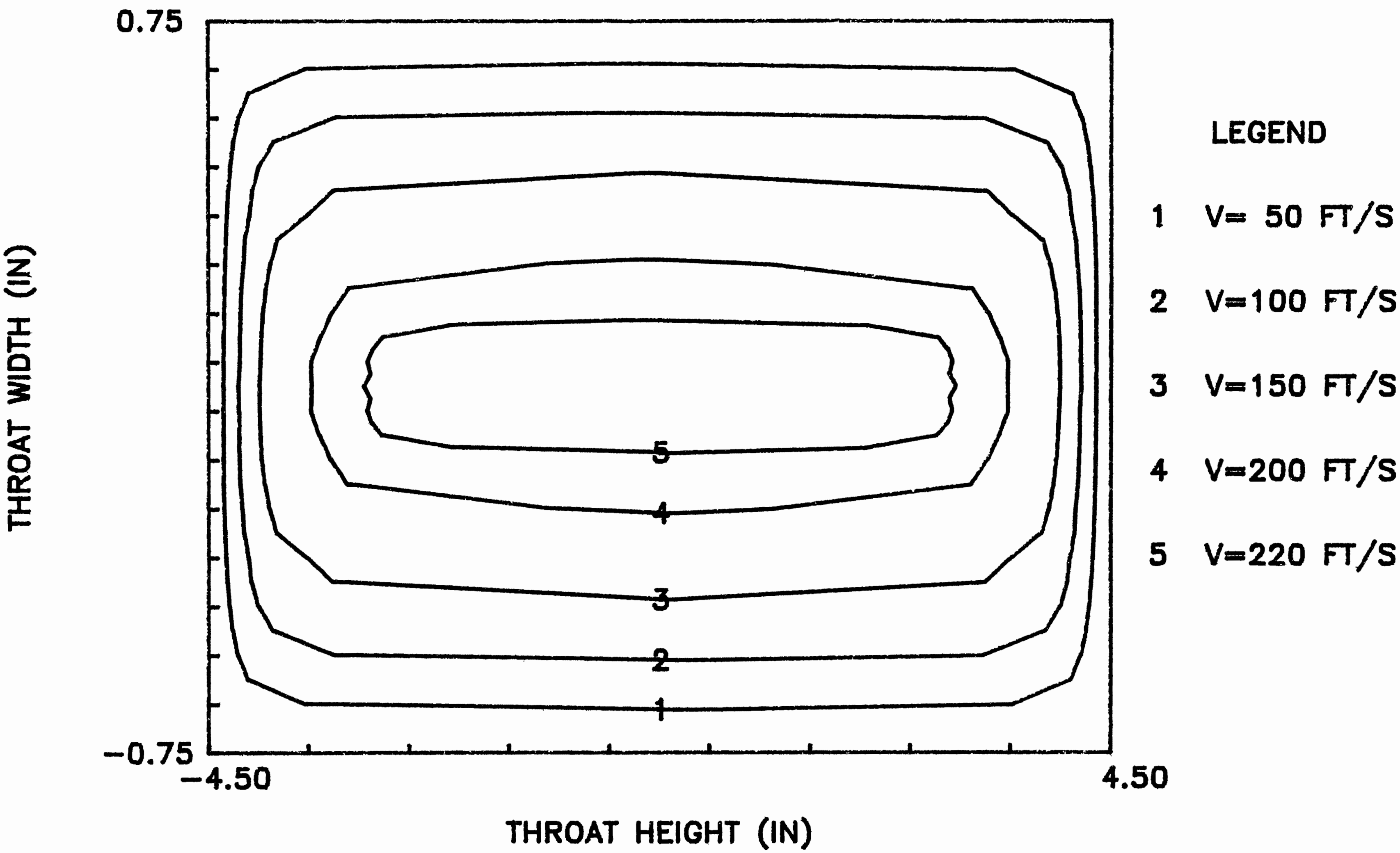


Figure 10. Three Dimensional Fully Developed Velocity Profile in the Throat

these velocities results in volumetric flow rates of 1706 ft^3/min (CFM) for the slug flow, 1099 CFM for developed flow, and 1552 CFM for this flow. These flow rates correspond to $\overline{V}/V_{max}$ of 1.00 for slug flow, 0.65 for developed flow, and 0.909 for this flow.

The three dimensional representation of this fully developed flow equation is shown in Figure 10 as bands of constant velocity at the throat. If these 3D effects are considered, the volumetric flow rate drops to 794 CFM, and the velocity ratio $\overline{V}/V_{max}$ ratio drops to 0.46. The flow appears to be closer to slug flow than parabolic, this middle ground is a good starting point for future experiments. Because the flow appears to be more slug like in shape, edge effects at the top and bottom boundary layers will be ignored. The average velocity used for calculating Cp will be derived strictly by integrating velocities at the middle of the diffuser, resulting in a $\overline{V}/V_{max}$ of approximately 0.9 for most of our diffuser systems. A typical development of this velocity profile in the hybrid diffuser can be seen in Figure 11. In addition to these, pitot sweeps pressure recovery data was gathered for several very wide angle diffusers.

90 Degree Diffuser Study

Initially an extreme diffuser geometry was studied. A very short L/D of unity was used at a divergence angle of

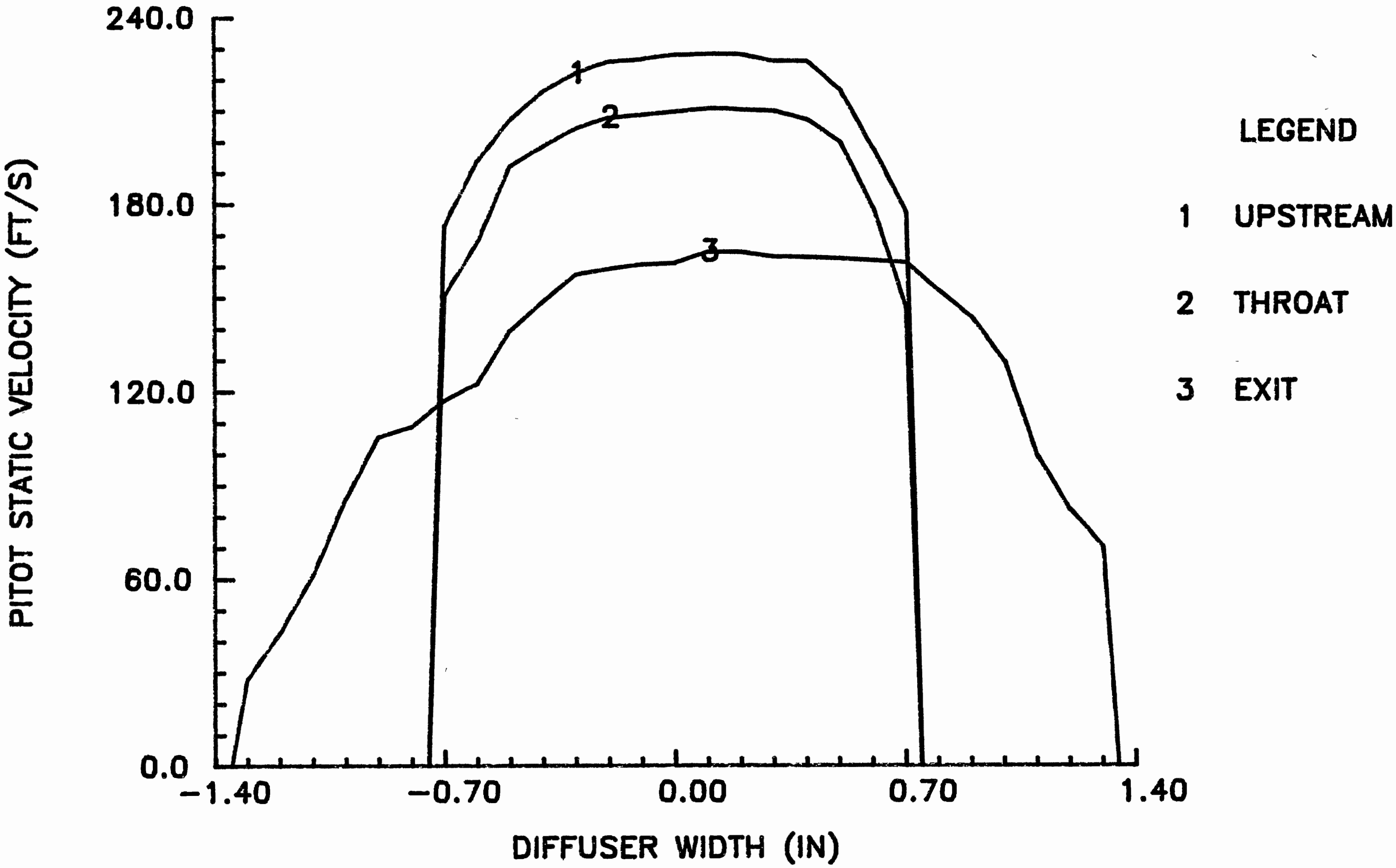


Figure 11. Velocity Profile Development (Geometry 1 @ 2% Bleed)

$\theta/2$ equal to 45° or a total divergence angle of 90°. Remembering that Cp for this system will be represented by:

$$Cp = \frac{(P_{static} \text{ at Throat}) - (P_{static} \text{ at Exit})}{1/2\ \rho\ \overline{v}^{\,2}}$$

$$\text{where} \quad \overline{v} = 1/\text{Throat}\int v(x)dx$$

From the area ratio standpoint the ideal pressure recovery is:

$$Cp_{ideal} = 1 - AR^{-2}$$

For this geometry, this would allow an ideal pressure recovery of Cp of 0.89. But from the ESDU Flow Regime Diagram in Appendix A, this type of design would surely result in flow separation. It was hoped that with enough slot suction, decent pressure recovery would be attainable for a geometry that otherwise would be fully stalled. This would allow use of an extremely short diffuser to obtain a good pressure recovery.

But the results did not show even a reasonable pressure recovery. For all but a few test cases, the Cp results indicated that the flow was completely separated and un-diffused (see Appendix E). The maximum attainable pressure recovery was 0.20 even with a 2% bleed. So this particular diffuser design was rejected.

Other Diffuser Geometries

To investigate other possible diffuser geometries, a variable divergence angle diffuser wall was employed. With this device, it was hoped that a suitable wall divergence angle ($\theta/2$) could be found where the flow would attach. An angle that was more aggressive than that indicated by other design criterion was desired, but less than the failed 90° diffuser. The results of a few of these tests are shown in Table I.

TABLE I

EXPERIMENTAL Cp AT VARYING DIVERGENCE RATES WITH 2% BLEED

	Angle=5	Angle=10	Angle=15	Angle=20	Angle=30
Cp	0.310	0.310	0.153	0.139	0.111

These results did not indicate any great pressure recoveries above that which would be expected from a normal straight walled diffuser even with 2% bleed. So a different way of comparison was necessary. Using the empirical ESDU plots (Appendix A), a comparison was made between fully developed flow similar to that expected in a real system, and a flat or slug velocity profile. Comparing various geometries and their empirical expected pressure recoveries and finding the greatest shift in Cp performance. This would correspond to what might be expected if success was made in removing the boundary layer by suction and achieved the ideal slug profile. That comparison follows in Table II. It indicates a very large shift in pressure recoveries at $\theta/2$ equal to 10° and varying L/D ratios. From this study it was determined that a diffuser wall angle of 10° and an L/D of 2.0 be used because it would show the greatest increase in pressure recovery with increasing suction while still being very short in length.

TABLE II

Cp FOR SLUG, AND DEVELOPED FLOW FOR VARIOUS GEOMETRIES

Angle	L/D	Cp(Developed)	Cp(Slug)	Cp(Shift)
8	2.0	0.37	0.52	0.15
8	3.0	0.44	0.62	0.18
8	4.0	0.47	0.65	0.18
10	2.0	0.36	0.55	0.19
10	3.0	0.43	0.61	0.18
10	4.0	0.43	0.61	0.18
15	2.0	0.36	0.49	0.13
15	3.0	0.36	0.52	0.16
15	4.0	0.36	0.54	0.18

CHAPTER VI

RESULTS

Optimization Study

The study of this diffuser's performance relies mainly on static wall tap data, and their associated pressure recoveries. This is supplemented by use of extensive hot wire and pitot probe mapping of the flow field in the diffuser. In addition spectrum analysis is also done by use of the hot wire to determine the frequency of the various turbulence components in the flow. But before these somewhat more laborious studies could be made, a starting point had to be found. Because the geometry of this test rig is fully variable, a relative optimum geometry must be found before more extensive tests could be made.

This initial series of tests consisted of over a hundred variations in slot geometry. This was done primarily by using wall tap pressure recovery data to determine a few geometries of interest to be studied further. The variables involved for testing were 1) mean fluid velocity through the diffuser throat, 2) the associated bleed rate from the diffuser slots. In addition geometries of the slot such as the 3) axial or x gap distance, 4) lateral or y gap distance, and the 5) slot retaining fence height could all be varied. For this set of experiments, the diffuser wall was chosen to to have a divergence angle of 10°, though this too is a variable. With all of these variables, an infinite number of experiments would be required. Choosing to investigate only one throat flow rate where the maximum center line velocity was set at a Mach number of 0.2 limits the investigation. Additionally, the bleed rates of interest were chosen to be 0, 1, 2% of the total fluid mass. So then an assortment of various slot geometries were tested to determine an optimum design based on wall tap pressure recovery. At each of these geometries and bleed rates, a scan of all 22 pressure taps was taken and pressure recoveries calculated. A few of these results are summarized in Table 3 on the following page.

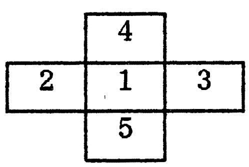
From these results, it was determined that an increase in fence height rarely caused an improvement in the pressure recovery for a given x,y slot dimension. A particular geometry that seemed to provide a good pressure recovery was that with an Xgap of 0.10 in and Ygap of 0.05 in. This geometry along with four others that surrounded this optimum, were chosen and are double boxed in Table III. Each of these other geometries were chosen to demonstrate the performance of the diffuser if the particular Xgap dimension of the slot were increased or decreased sightly

TABLE III

EXHAUST TAP PRESSURE RECOVERIES FOR VARIOUS SLOT GEOMETRIES

Ygap(IN)=		0.00			0.05			0.10			0.20		
Xgap (IN)	BLEED (%)	FENCE(IN) .00	.05	.10	FENCE(IN) .00	.05	.10	FENCE(IN) .00	.05	.10	FENCE(IN) .00	.05	.10
0.00	0.00	.26	.14	.14	.16	.12	.10	.10	.10	.10			
	1.00	.33	.29	.19	.47	.16	.12	.19	.12	.11			
	2.00	.34	.30	.31	.49	.42	.16	.47	.15	.13			
0.05	0.00	.28	.18	.13	.16	.11	.14	.11	.09	.09			
	1.00	.40	.41	.28	.50	.34	.24	.21	.12	.11			
	2.00	.44	.48	.39	.56	.56	.60	.48	.16	.14			
0.10	0.00	.28	.19	.06	.18	.12	.10	.13	.10	.10			
	1.00	.40	.08	.14	.49	.44	.31	.30	.15	.13			
	2.00	.43	.31	.20	.56	.58	.60	.53	.45	.29			
0.15	0.00	.25	.10	.07	.22	.13	.12	.13	.10	.10			
	1.00	.39	.22	.14	.52	.50	.43	.29	.16	.14			
	2.00	.45	.33	.19	.56	.56	.53	.53	.43	.34			
0.20	0.00				.25	.17	.15	.13	.11	.10	.10	.08	.09
	1.00				.50	.49	.41	.34	.20	.18	.12	.11	.11
	2.00				.54	.56	.51	.52	.51	.40	.14	.12	.12
0.30	0.00				.30	.20	.17	.16	.13	.12	.10	.09	.09
	1.00				.46	.41	.33	.41	.24	.21	.12	.12	.11
	2.00				.54	.49	.43	.55	.56	.45	.16	.15	.14

Geometry Label



over the optimum. The Cp data gathered for each of these slot geometries can be seen in Appendix F labeled as Geometries 1,2,3,4,5. The data was taken for each of these geometries for three three different bleed rates of 0, 1 and 2% of the total mass flow. Generally the results of this wall tap data indicate poor pressure recovery at 0% bleed, no doubt due to the discontinuity of the slot itself. With 1% bleed, respectable recoveries are accomplished, approaching the pressure recovery at 2% bleed rate.

The optimal slot geometry from this study was Xgap of 0.10in and Ygap of 0.05in. This was compared with a base diffuser study whose results can also be seen in Appendix F. The base diffuser consists of the same diffuser walls but tested with no bleed slot or suction. The pressure recoveries of this optimum hybrid diffuser geometry 1 and that of the base diffuser with no bleed can be seen in Figure 12. This indicates graphically the great improvement possible in Cp performance.

A few oddities with these diffuser studies indicate that the pressure recoveries along the two walls of our diffuser do not always agree. This could be due to the two dimensional separation effect discussed in the introduction, where the flow attaches more readily to one of the diffuser walls. In this case, the pressure recovery over one wall is better than the other. For that reason, all pressure recoveries plotted will be the average of those obtained over the two walls. A typical shift of the Cp data can be seen in Figure 13.

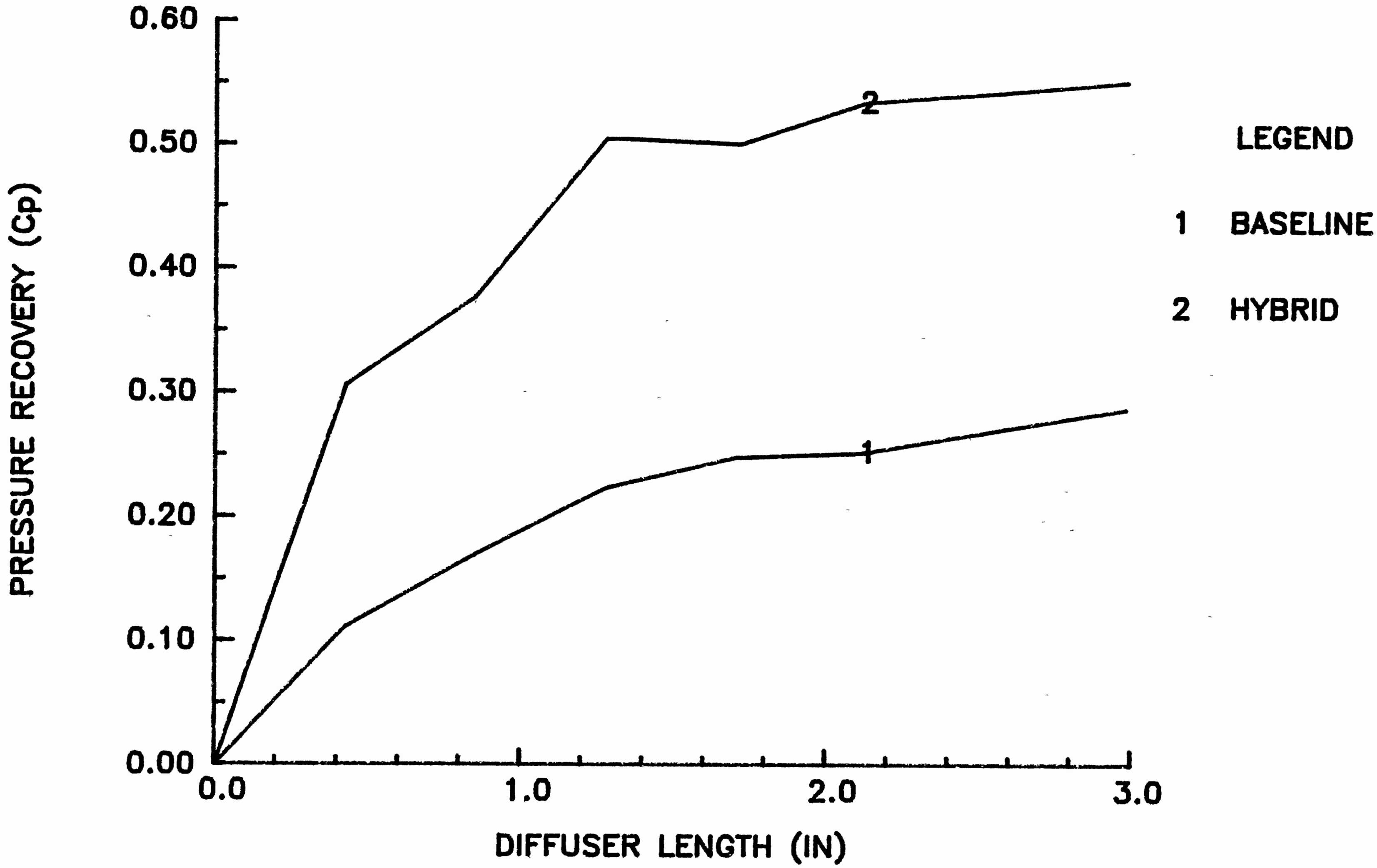


Figure 12. Pressure Recovery of the Base, and Hybrid Diffuser (Geometry 1 @2% Bleed)

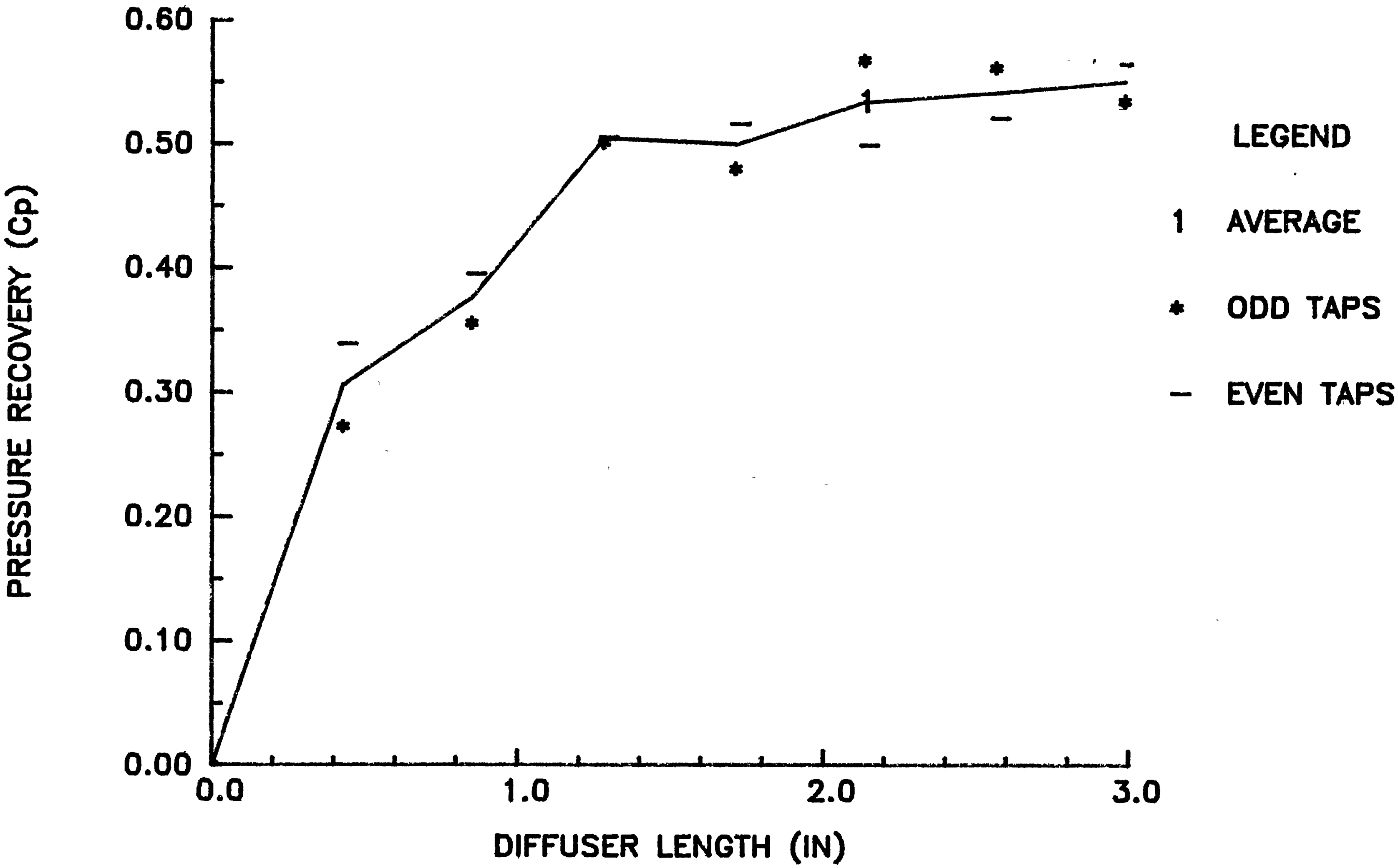


Figure 13. Shift in Wall Pressure Recoveries (Geometry 1 @2% Bleed)

Flow Field Study

With our five particular geometries chosen, a more extensive batch of tests were performed. For each of these 5 slot geometries, a separate group of tests were performed for each of the three bleed rates. These tests included a wall pressure tap scan, and three hot wire and pitot probe sweeps across the flow field 1 inch upstream from the throat, at the throat, and at the exit plane (shown in Figure 5). In addition, a turbulence spectrum was also taken at these three locations. For each of these locations, a sample was taken in both the center of the flow, and along the wall in the boundary layer. All of this data is presented for the Base Diffuser and optimum Geometry 1 in Appendix F. For the non-optimum geometries 2,3,4,5, the Cp data and the probe sweeps at the exit plane only are presented. From the wall tap pressure recovery data, trends in diffuser performance can be noticed (see Appendix F labeled as Geometry 1, 2, 3, 4, 5). For each of these slot geometries, three tests were done for each of the three design bleed rates of 0, 1, 2%. Plotted results are shown in Figures 14-18. Generally the results of this wall tap data indicate poor pressure recoveries at 0% bleed, no doubt due to the discontinuity of the slot itself. But at 1% bleed, respectable recoveries are accomplished, approaching those for bleed rate of 2%. Figure 19 shows how each of the geometries' pressure recoveries compare at a 2% slot bleed rate.

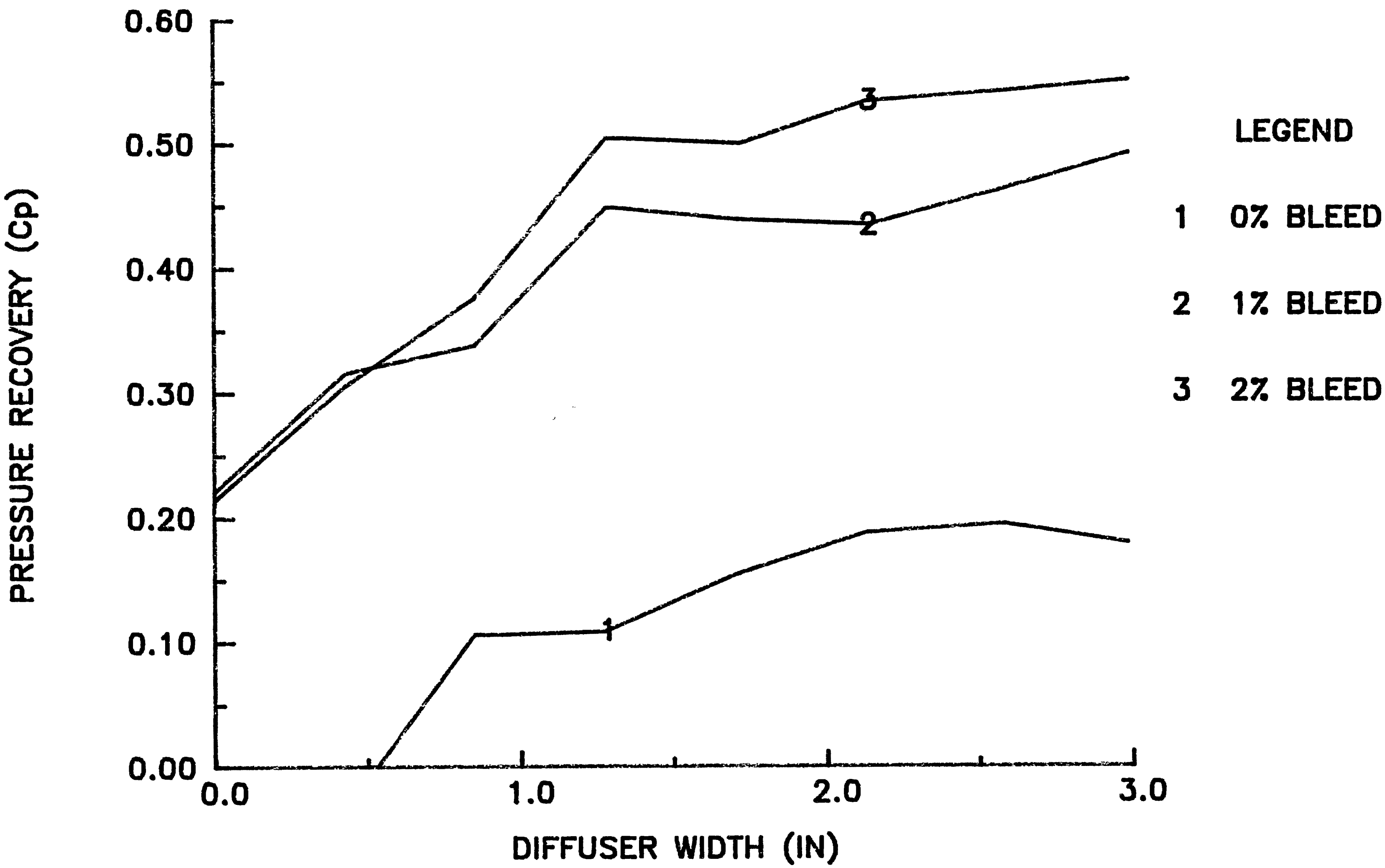


Figure 14. Pressure Recoveries of Geometry 1 at Various Bleed Rates

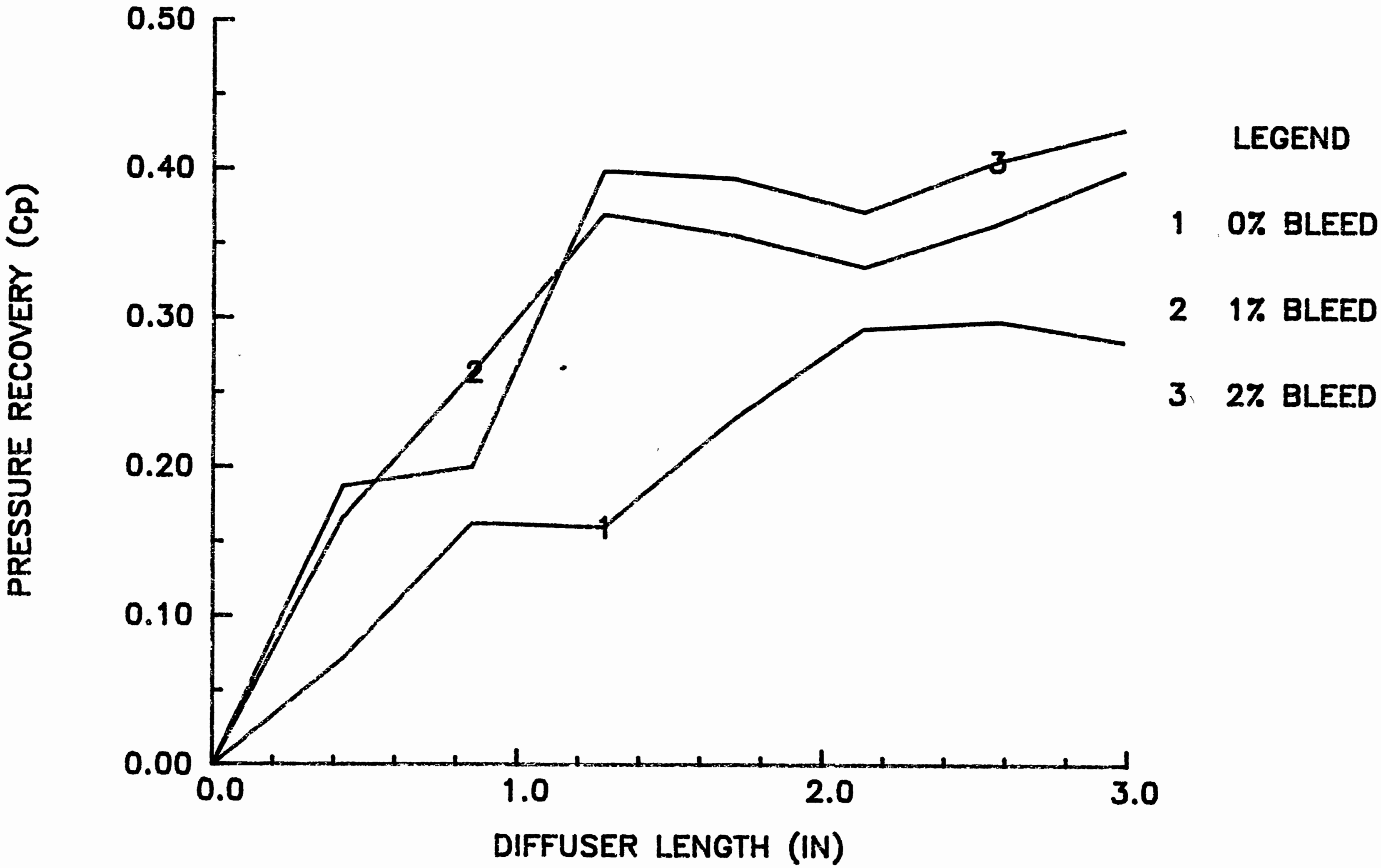


Figure 15. Pressure Recoveries of Geometry 2 at Various Bleed Rates

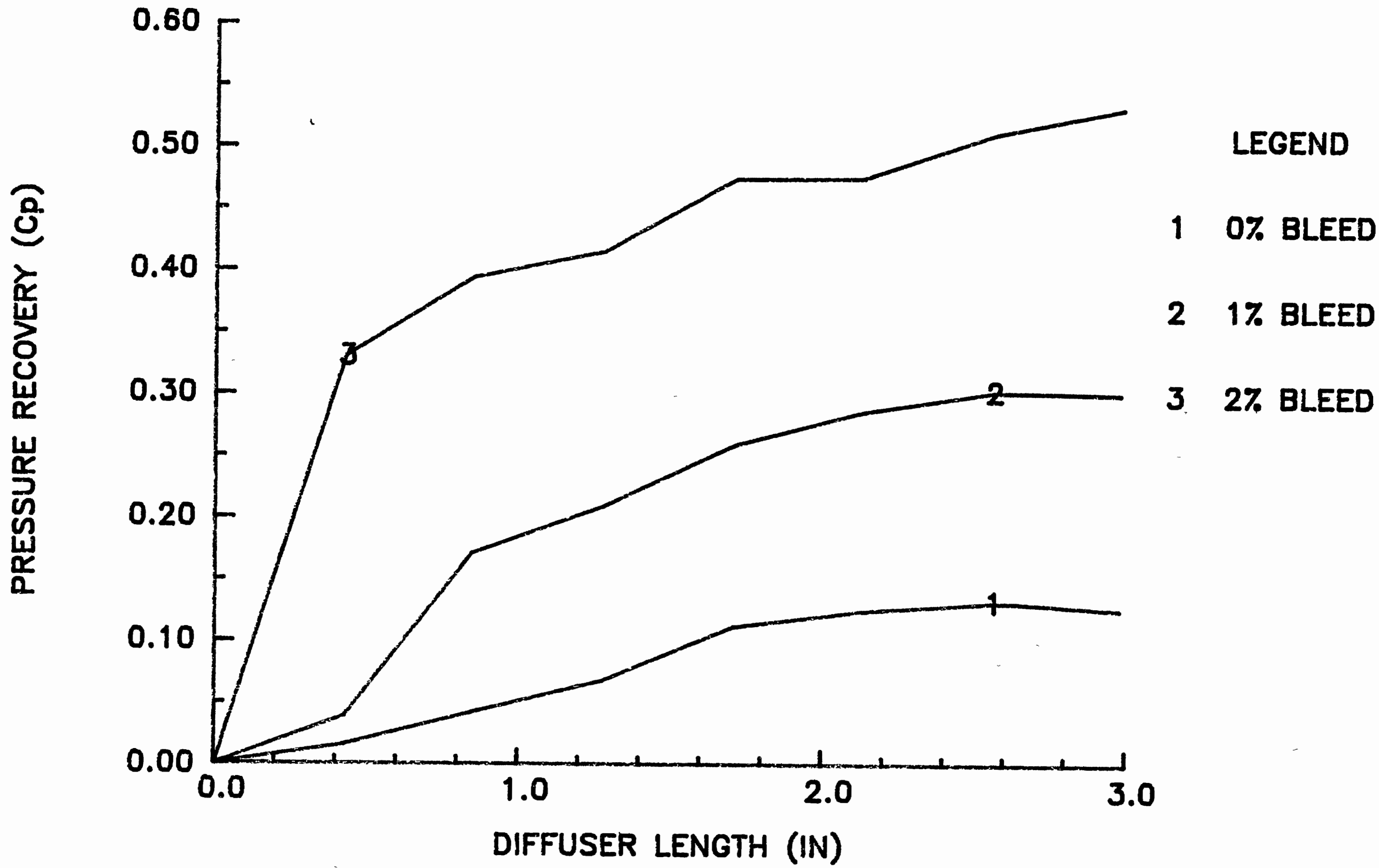


Figure 16. Pressure Recoveries of Geometry 3 at Various Bleed Rates

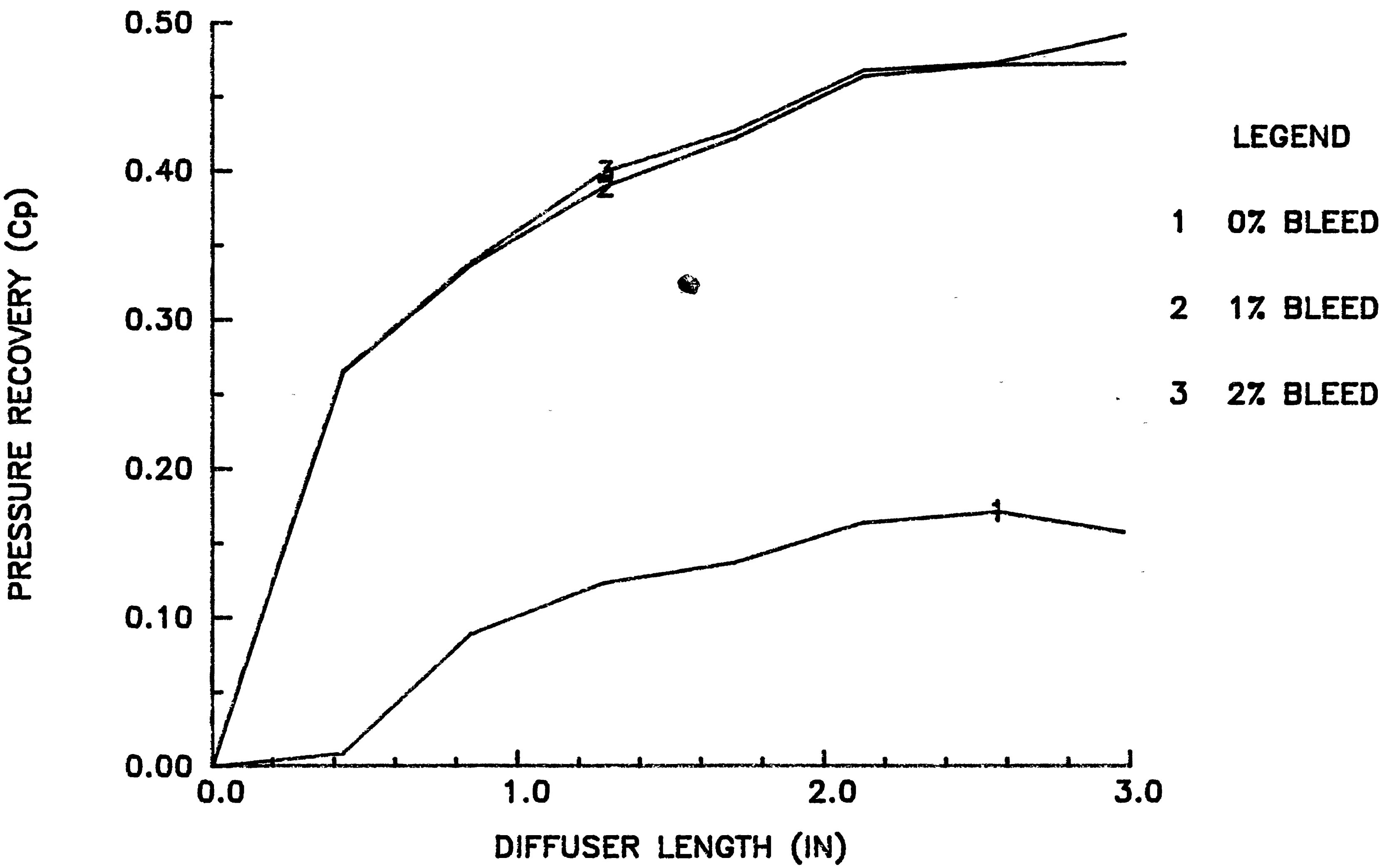


Figure 17. Pressure Recoveries of Geometry 4 at Various Bleed Rates

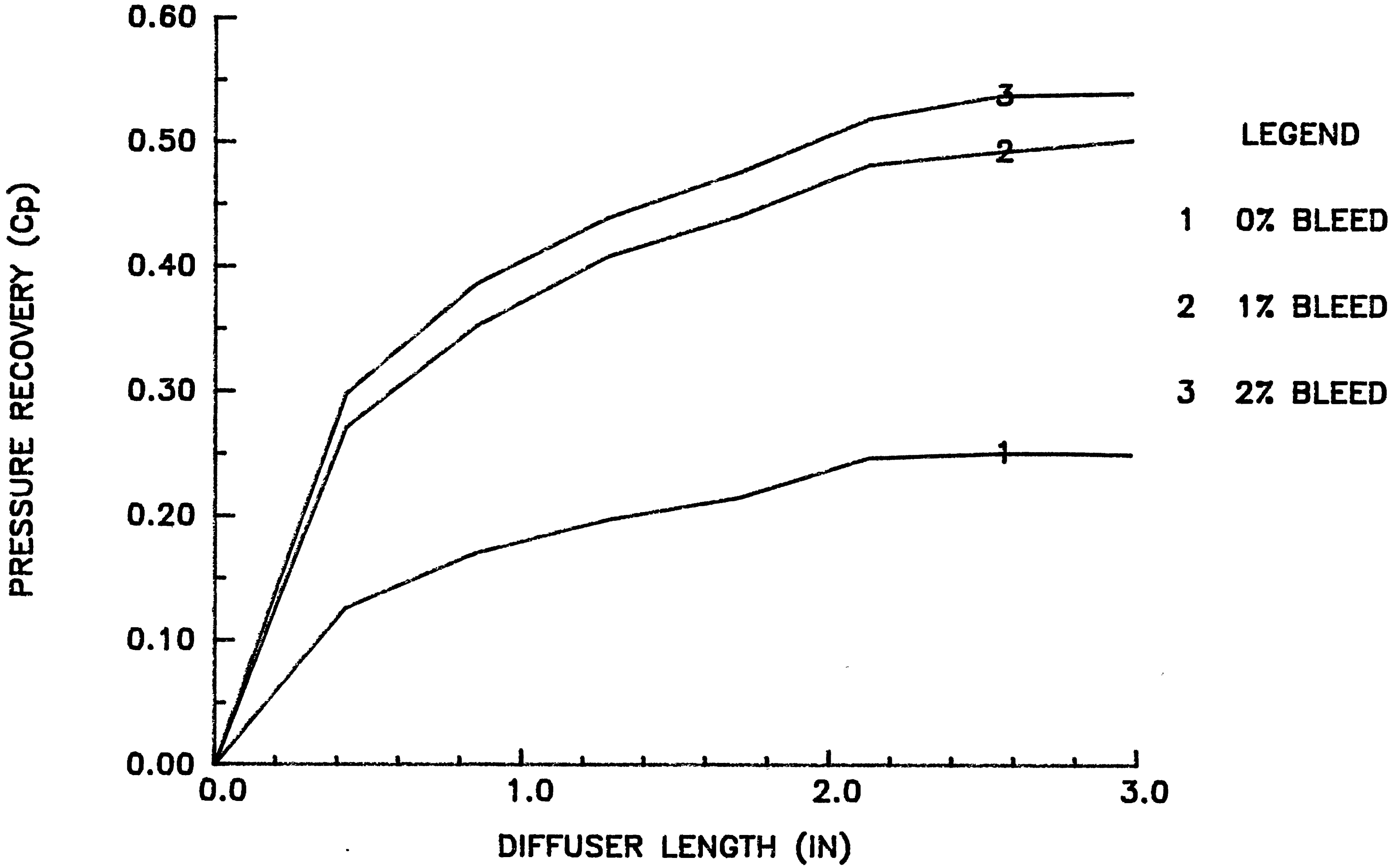


Figure 18. Pressure Recoveries of Geometry 5 at Various Bleed Rates

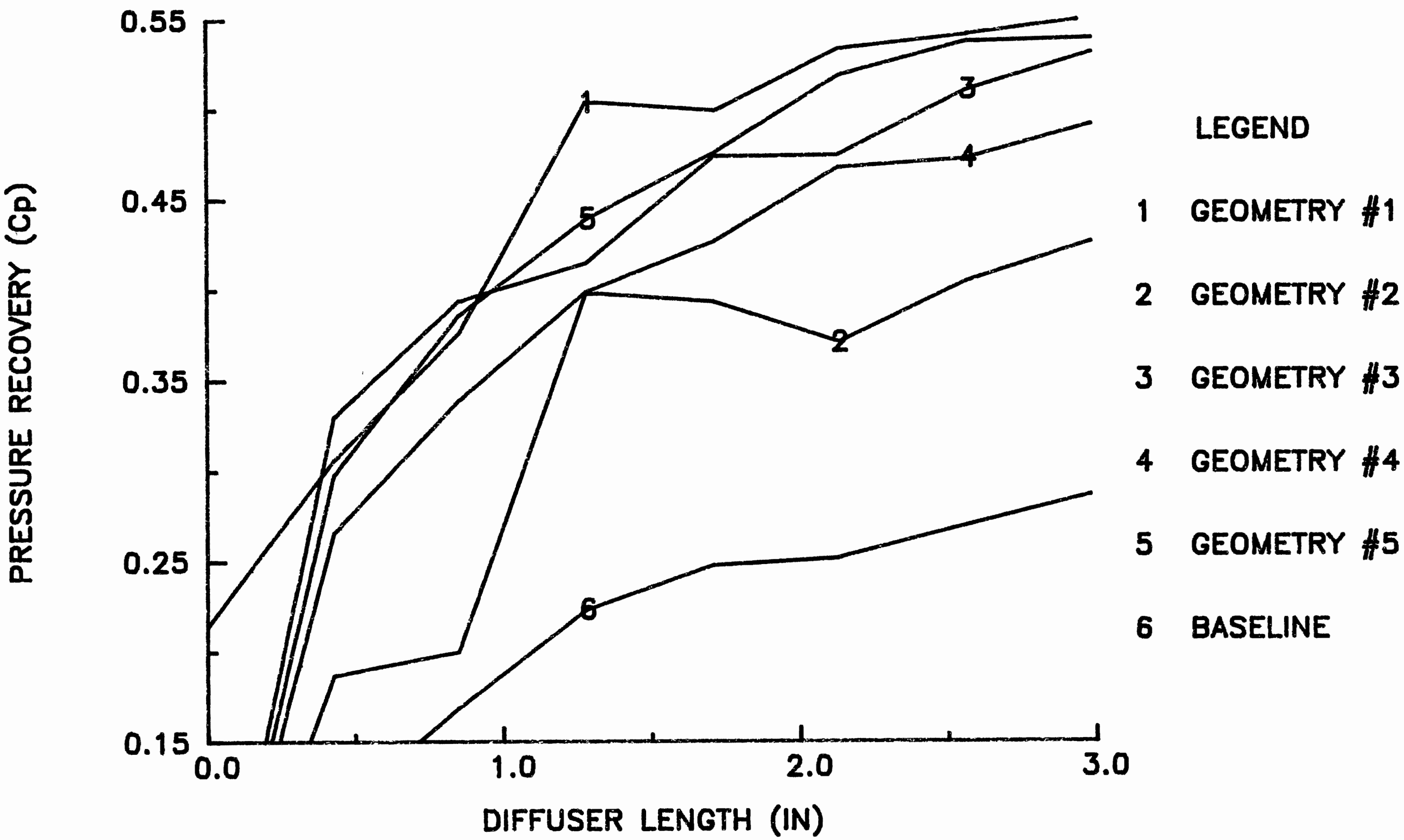


Figure 19. Pressure Recoveries for All 5 Geometries at 2% Bleed

As the flow continues downstream from the suction slot and attaches to the diffuser wall, the fluid continues to decelerate and the static pressure rises. This attachment of the flow to the diffuser wall is critical to the continuing deceleration (stagnation) of the flow. These plots (Fig. 14 - 19) track the recovery from a point 1 inch upstream of the throat, to the throat itself (0.0 on the graphs) to the exhaust plane of the diffuser (3.1in). Most of these geometries show the same trend a large increase of pressure recovery with the use of 1% bleed and only a moderate increase when this bleed is boosted to 2%.

Pitot Static Probe Results

In addition to this wall tap data, a pitot-static probe sweep at three different cross-sections of the diffuser were performed. Providing adequate suction is applied and wall attachment is maintained, a smooth exit profile results at the exhaust plane (Figures 20-24). Unfortunately, if adequate suction is not provided, the flow will separate from one or both of the diffuser walls and not recover fully. Most of these plots show the effect of how increasing bleed rate evens out a flow that is biased or attached on one wall, thus improving the exhaust profile. One interesting result was that for Geometry 4 at 2% bleed (Figure 23). A double hump can be seen in the profile development. These humps may be caused by the suction slots

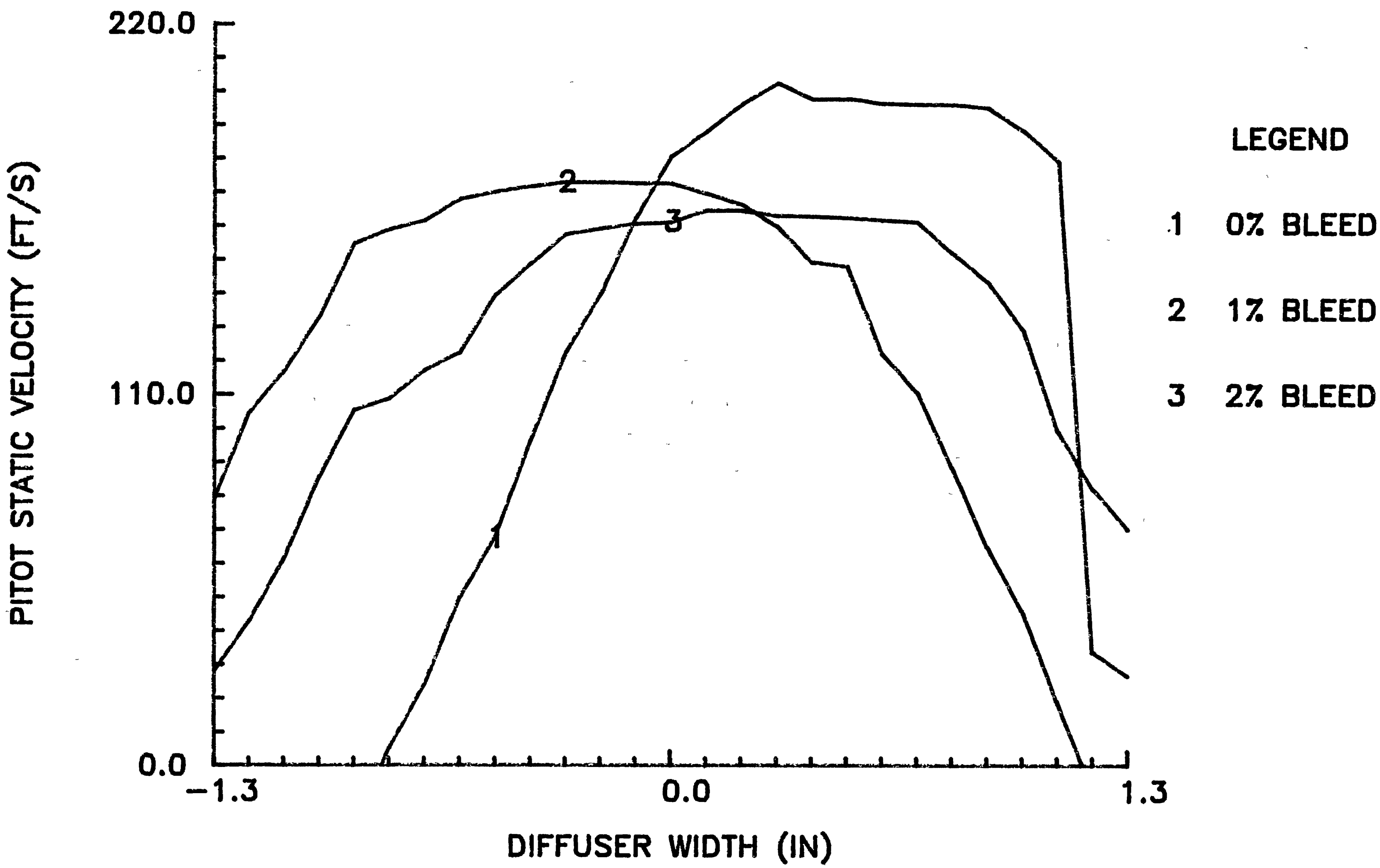


Figure 20. Exit Velocity Profiles for Geometry 1

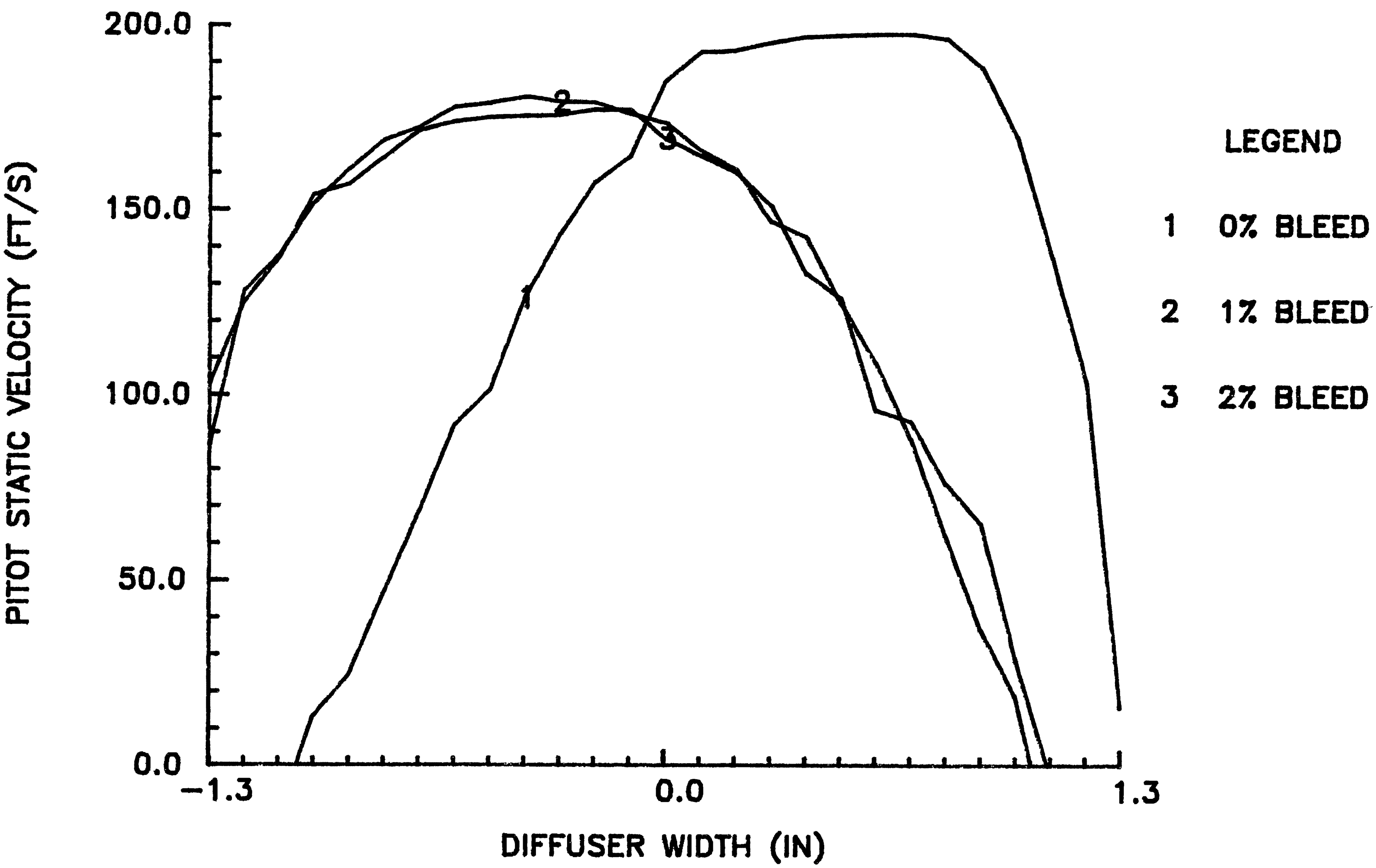


Figure 21. Exit Velocity Profiles for Geomtry 2

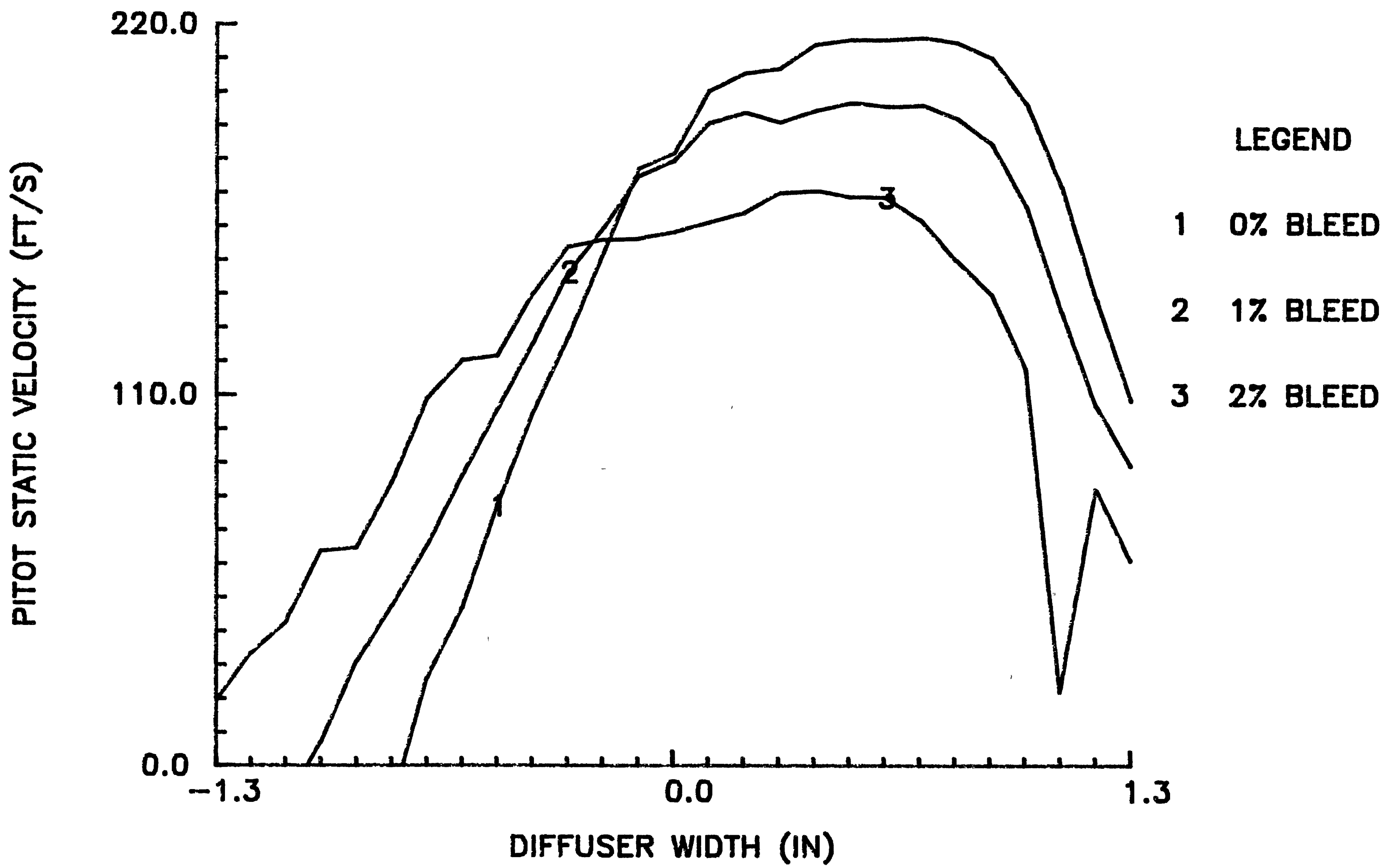


Figure 22. Exit Velocity Profiles for Geometry 3

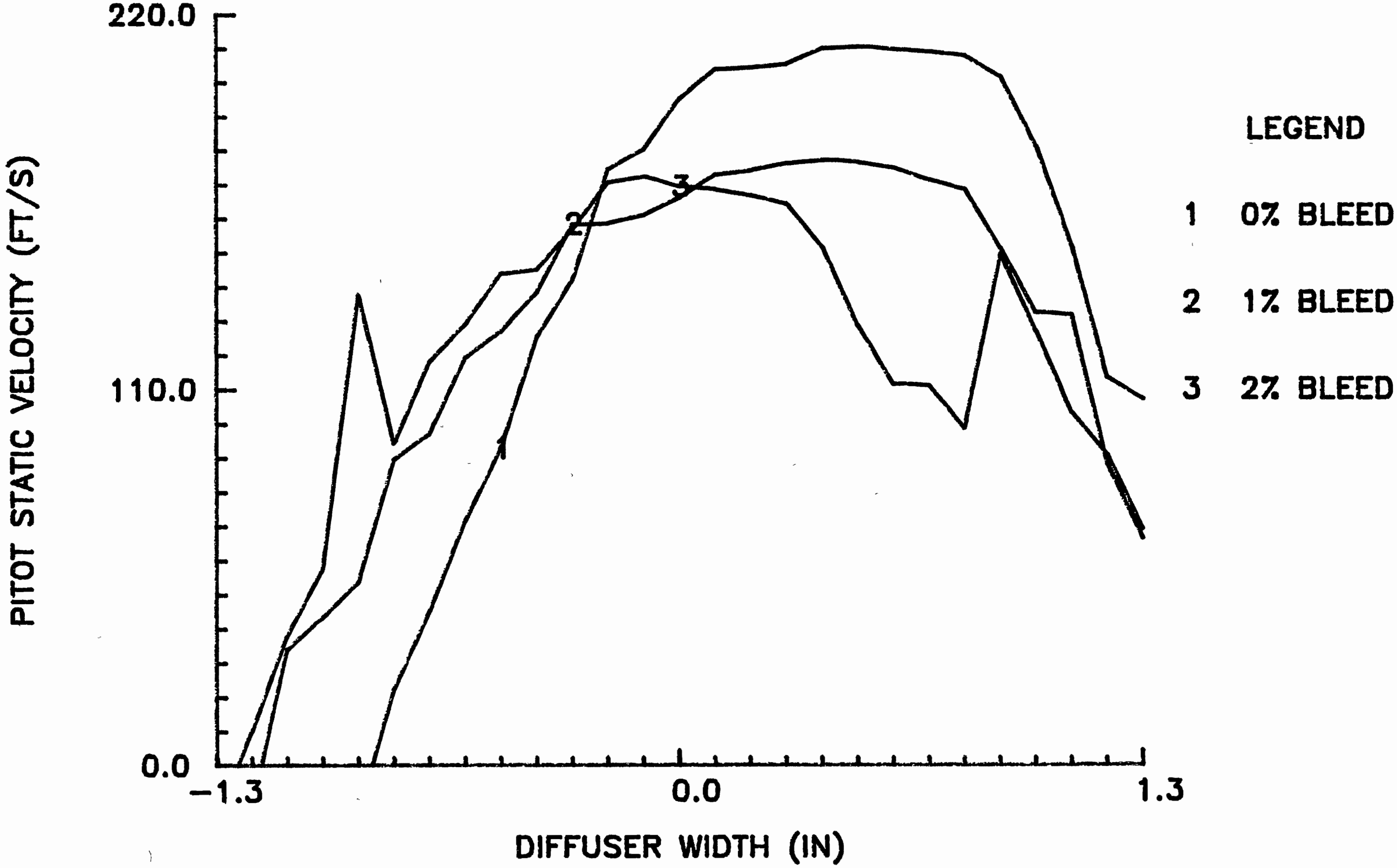


Figure 23. Exit Velocity Profiles for Geometry 4

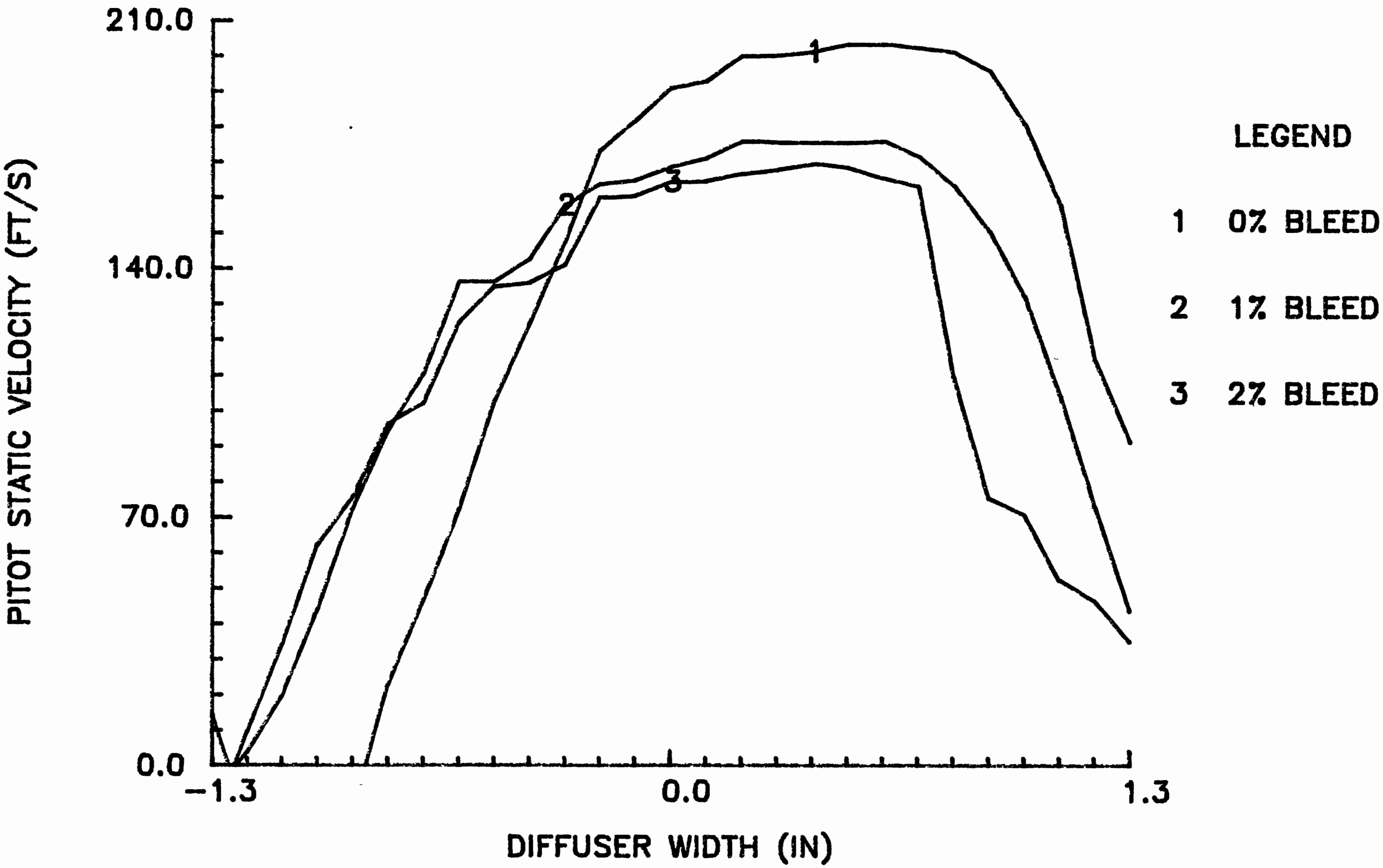


Figure 24. Exit Velocity Profiles for Geometry 5

themselves. For this geometry, the slots have only a lateral Ygap displacement, no axial gap. In other words, they are oriented 90° to the approach wall. This odd orientation may be adversely affecting the velocity profile at the exit and be causing those irregular dips.

A simple reason for the increasing pressure recovery at increasing bleed rate can be seen in Figure 25. At 0% bleed the flow is separated downstream and attached to one wall. But, with increasing bleed the profile becomes more symmetric. Figure 25 indicates that the flow at the throat experiences a more favorable pressure gradient along the wall than in the center, and a more favorable gradient at the throat than upstream (Figure 26). This effect is obviously caused by the boundary layer removal by the bleed itself. This pressure gradient encourages flow to move towards the walls, simulating slug flow, thus providing a better flow for the diffuser downstream. By using the static pressures gathered at the exit plane, a more accurate coefficient of pressure can be found (see Table IV). This new Cp is calculated as follows:

$$\overline{Cp} = \frac{Pthroat_{static} - \overline{Pexit}_{static}}{1/2\ \rho\ \overline{v}^{2}}$$

where

$$\overline{Pexit} = 1/(\text{exit width}) \int Pstatic(x)dx$$

$$\overline{v} = 1/\text{throat} \int v(x)dx$$

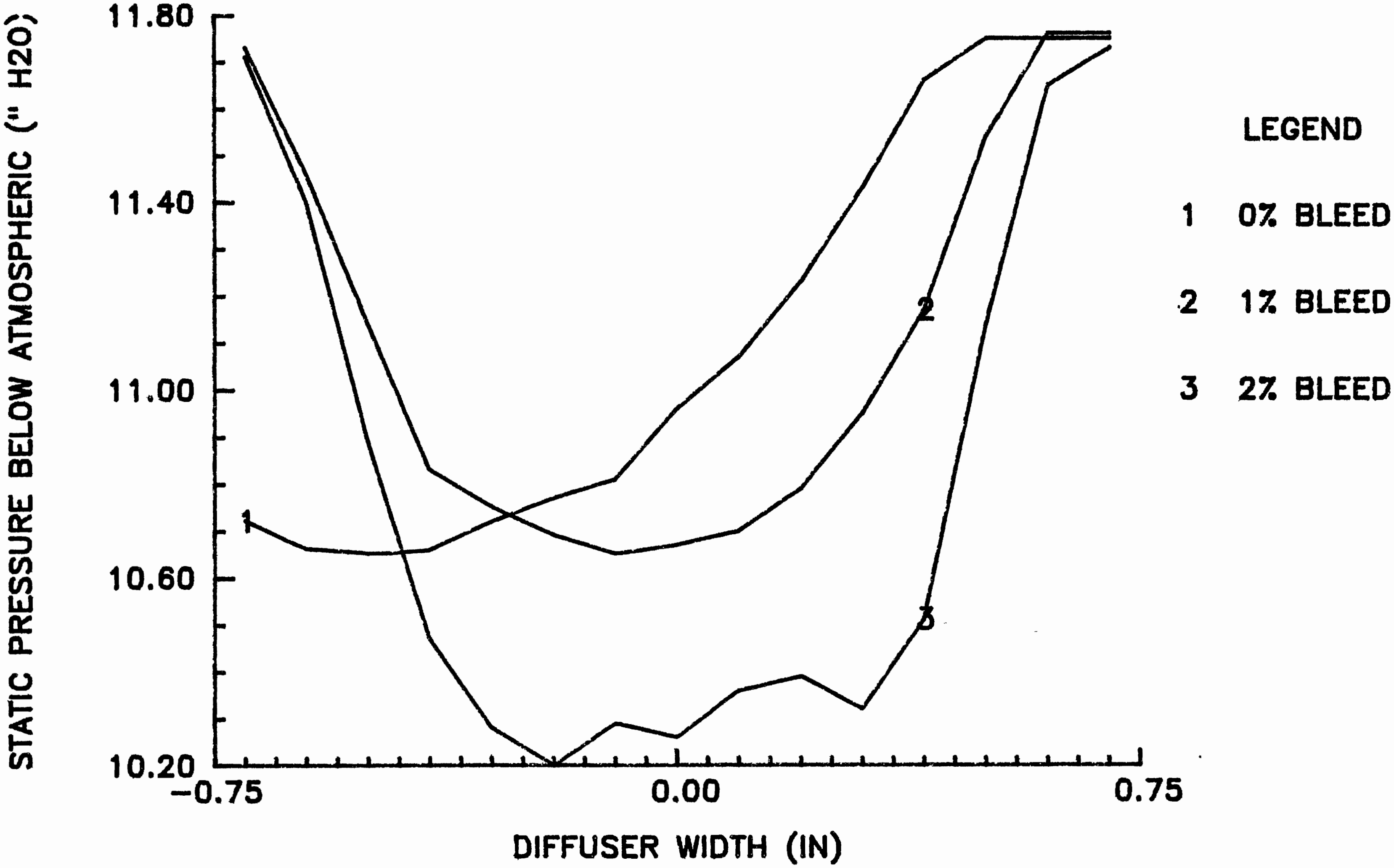


Figure 25 : Static Pressure Profile at Throat for Geometry 5

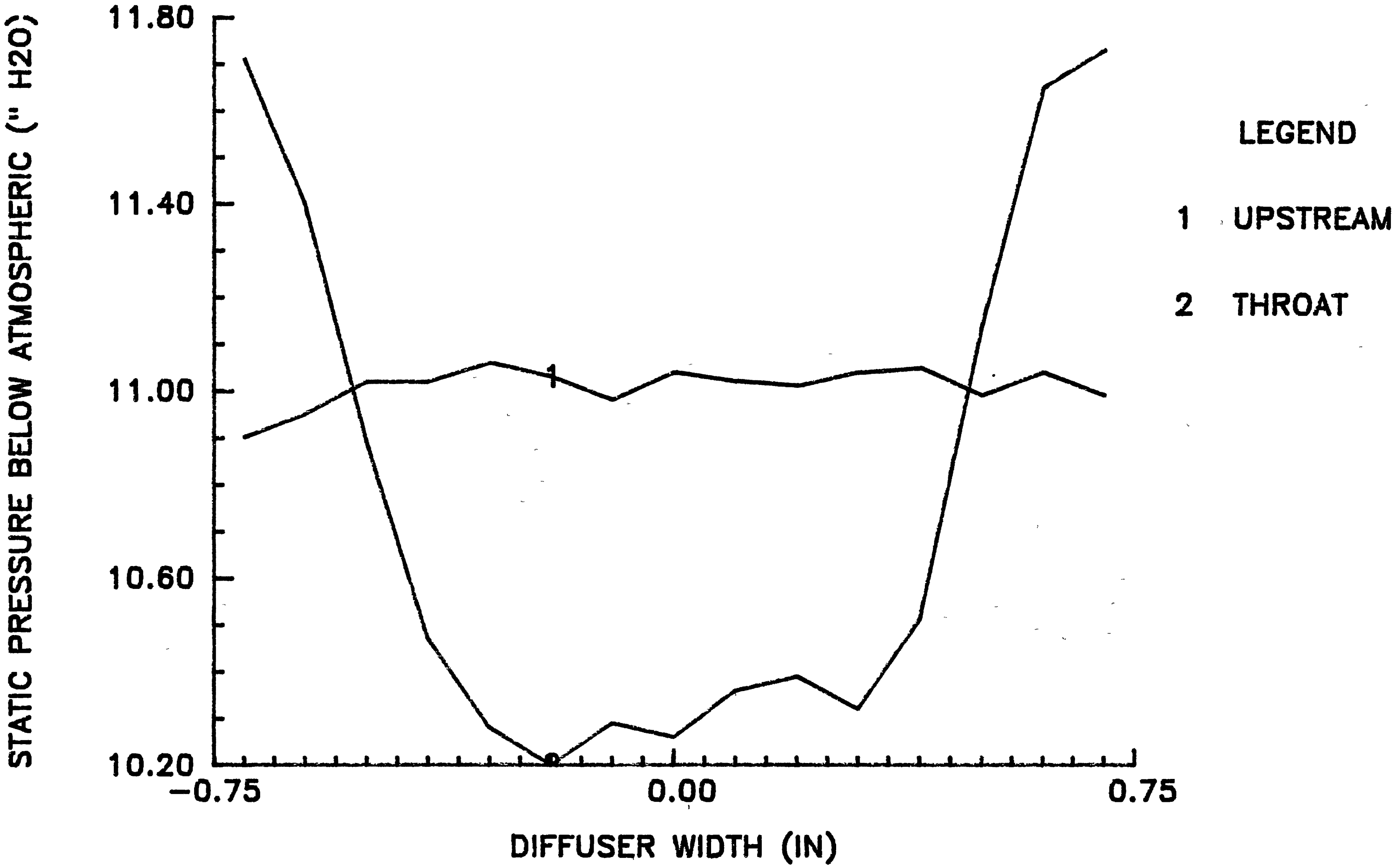


Figure 26 : Approach Flow Static Pressure for Geometry 5 at 2% Bleed

TABLE IV

WALL AND EXIT AVERAGED STATIC PRESSURE RECOVERIES

Y(IN)		0.00	0.05	0.10
X(IN)	Bleed(%)	$Cp_{wall}/\overline{Cp}_{exit}$	$Cp_{wall}/\overline{Cp}_{exit}$	$Cp_{wall}/\overline{Cp}_{exit}$
0.00	0.0	0.287/0.296	0.157/0.147	
	1.0		0.473/0.468	
	2.0		0.492/0.499	
0.10	0.0	0.284/0.286	0.179/0.222	0.125/0.109
	1.0	0.399/0.432	0.492/0.490	0.300/0.292
	2.0	0.427/0.451	0.551/0.537	0.532/0.521
0.20	0.0		0.249/0.242	
	1.0		0.502/0.484	
	2.0		0.540/0.540	

Pressure loss can be studied by looking at the total pressure head of the pitot probe. Generally a total pressure curve resembles Figure 27. Large pressure loses occur in the boundary layer, but are minimal at the center. At the exit, plots of total pressure in Figure 28 indicate the reduced loses, which we would expect to accompany increasing bleed rate. This increased bleed causes better flow attachment to walls and increased diffuser efficiency.

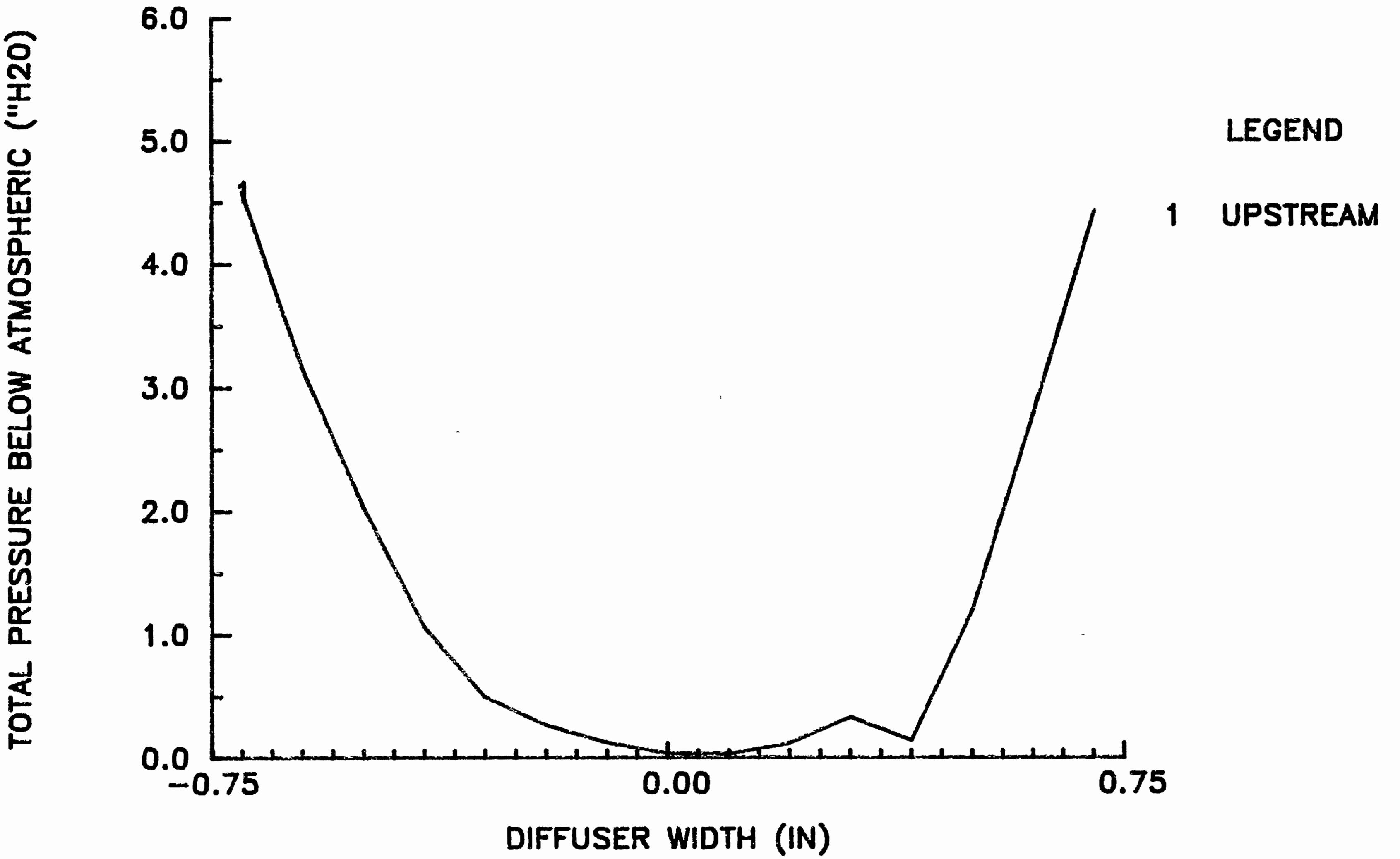


Figure 27 : Total Pressure Profile for Geometry 1 at 1% Bleed

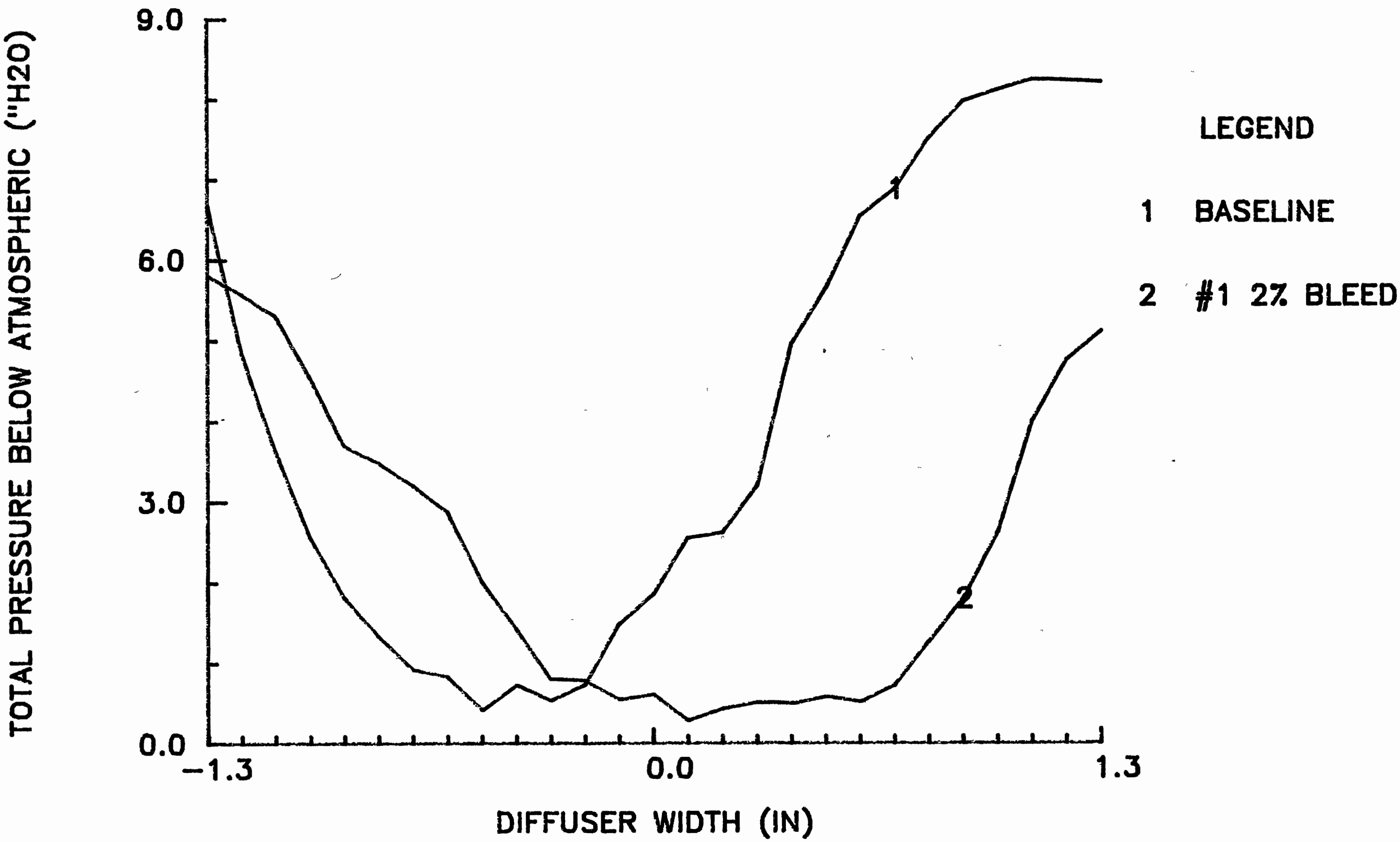


Figure 28 : Total Pressure Profile at Exit for Base and Geometry 1 Diffusers

Hot Wire Probe Results

In conjunction with and simultaneous to these pitot probe measurements, hot wire measurements were also done. Using high speed sampling (up to 40,000 Hz), velocity fluctuations affecting the hot wire were recorded. The percentage ratio of these velocity fluctuations or turbulence to the average velocity is referred to as the local turbulence intensity. In Appendix F under the hot wire data turbulence intensities at each location are shown. Figures 29-34 track the magnitudes of the turbulence at each point in exit flow. Most of these plots show a shift of turbulence towards one wall. This once again indicates a possible separation region. At higher bleeds, the turbulence may not be reduced appreciably, but the plots do show a more symmetric turbulence profile. This shape indicates an evenly distributed flow at the exit. A quantitative comparison of average exit turbulence for each of the geometries may be of interest. The average local turbulence intensities are shown in Table V as I_{loc}. But these values are based on local velocities, and an average of these may not be an accurate representation of the overall turbulence. A more accurate average would be to calculate the average of the fluctuating magnitudes, and dividing that by the average exit velocity. This lumped average turbulence intensity value is shown in Table V as I_{mean}.

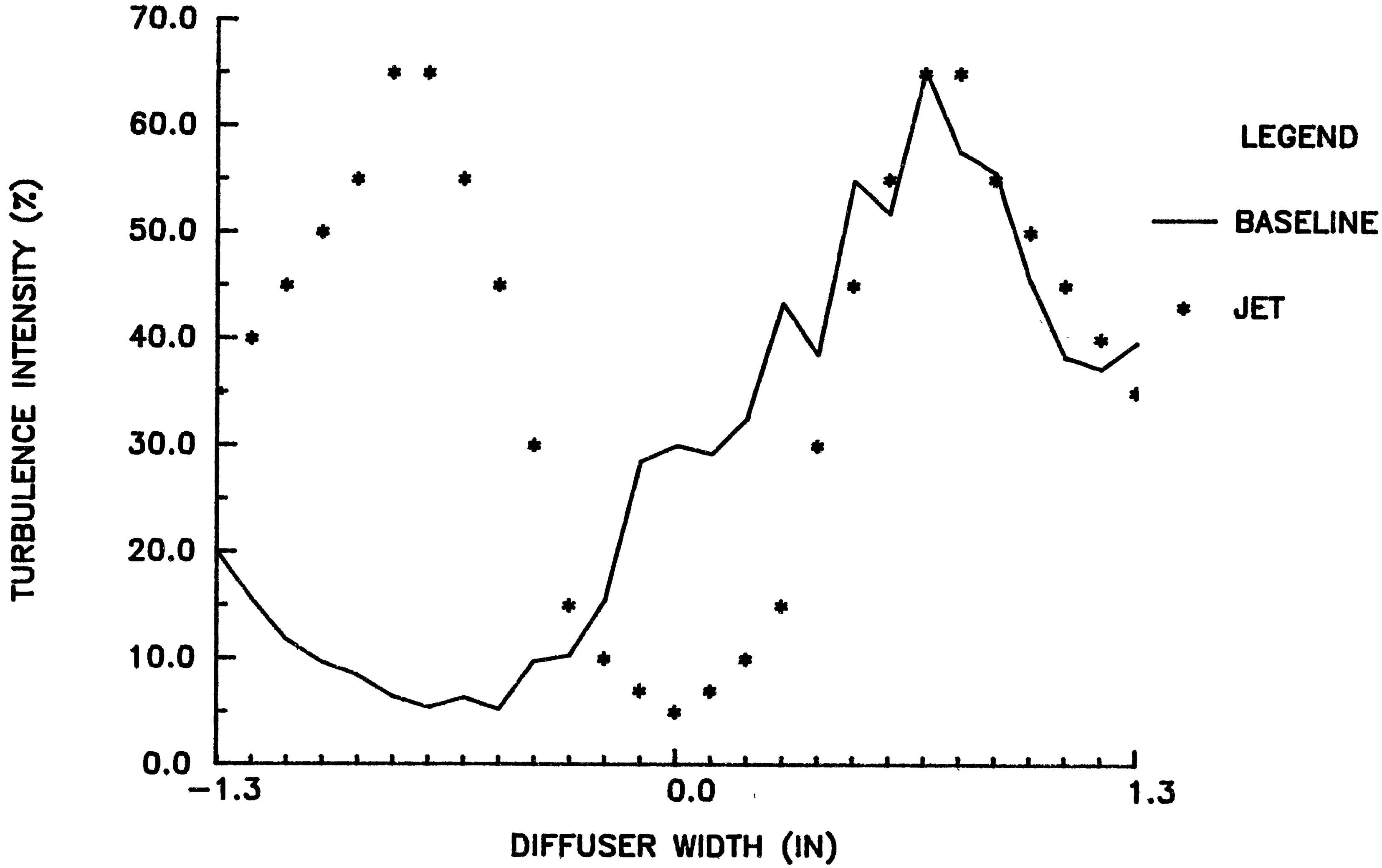


Figure 29 : Exit Turbulence of Base Diffuser and a Jet

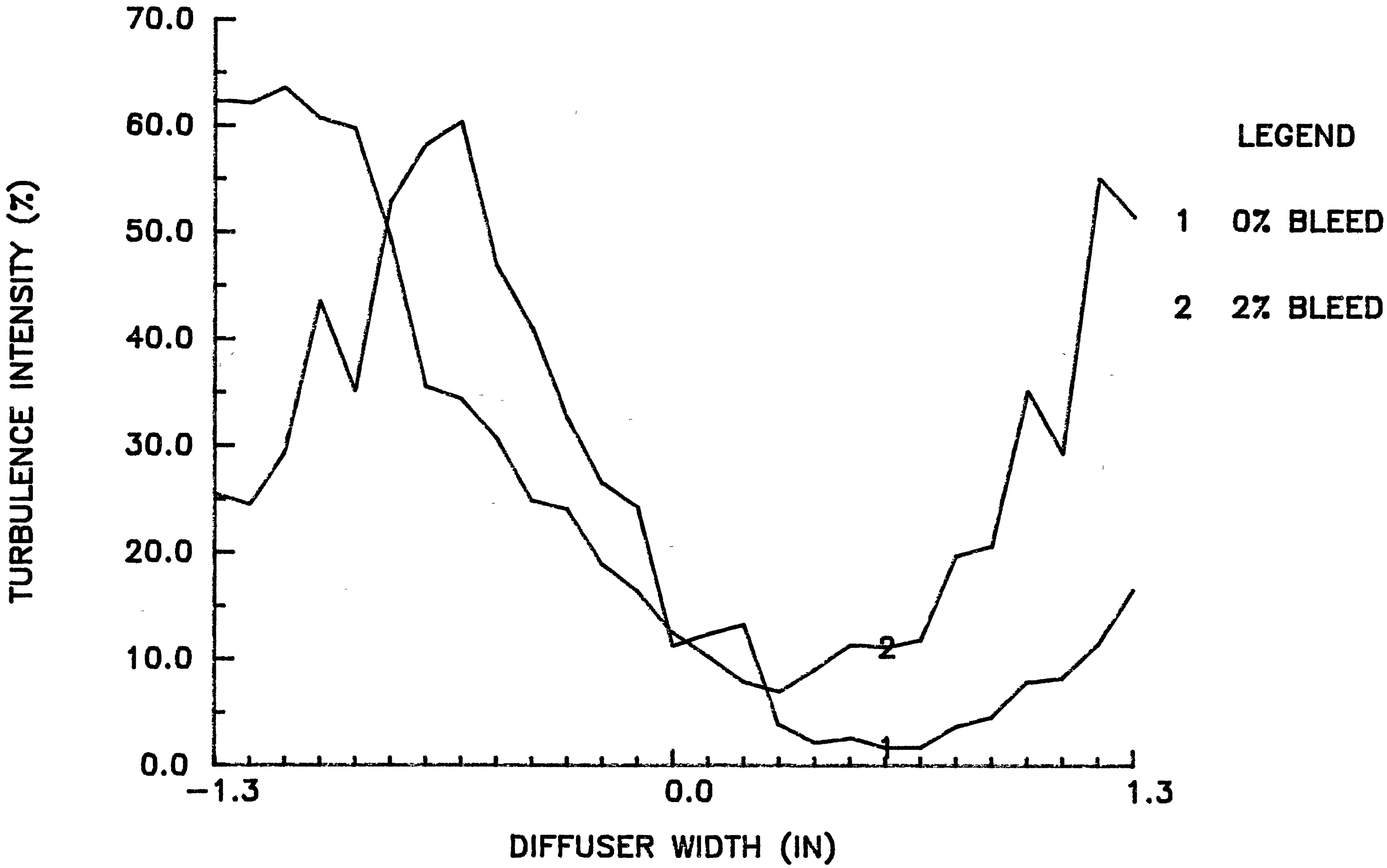


Figure 30 : Exit Turbulence for Diffuser Geometry 1

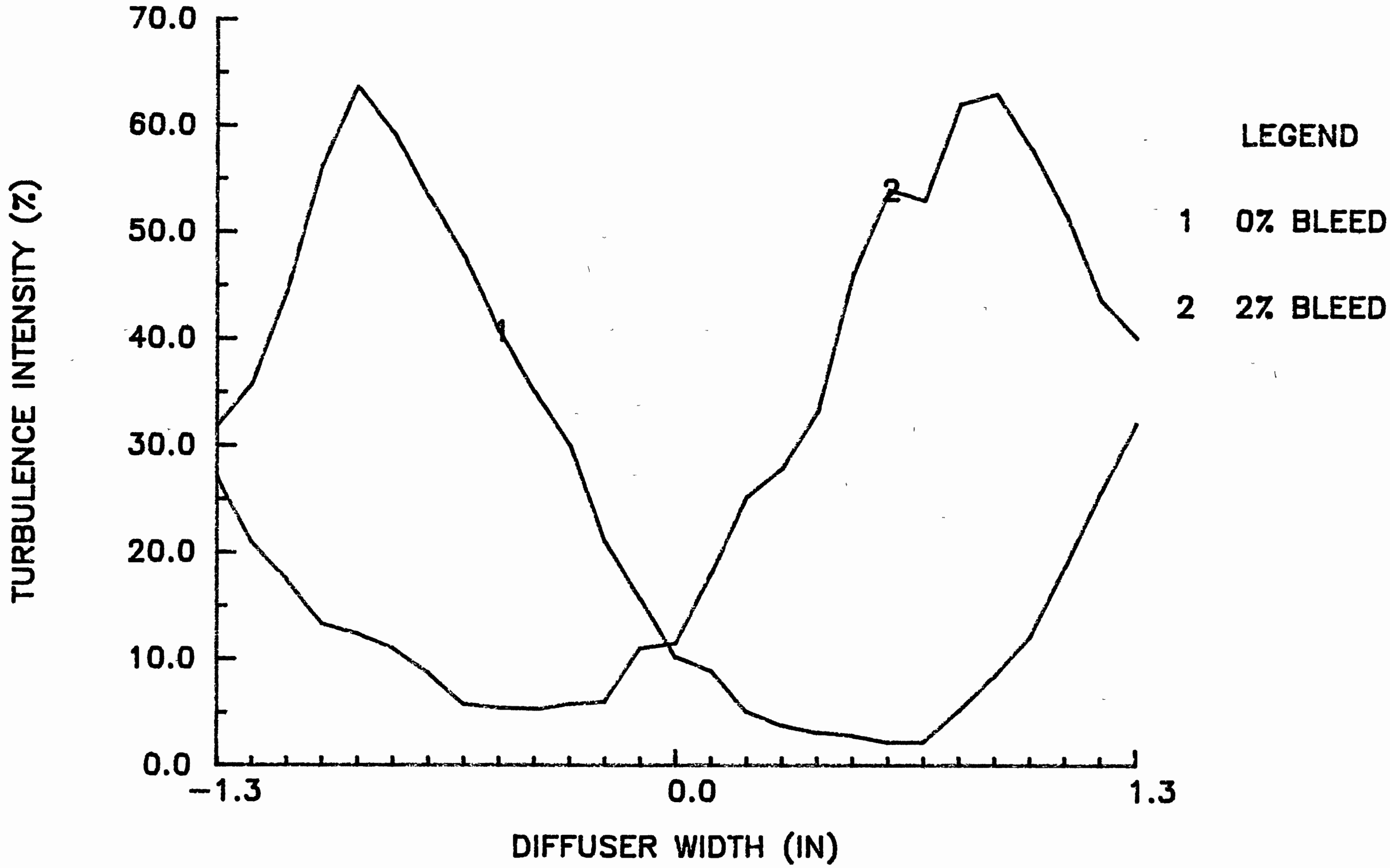


Figure 31 : Exit Turbulence for Diffuser Geometry 2

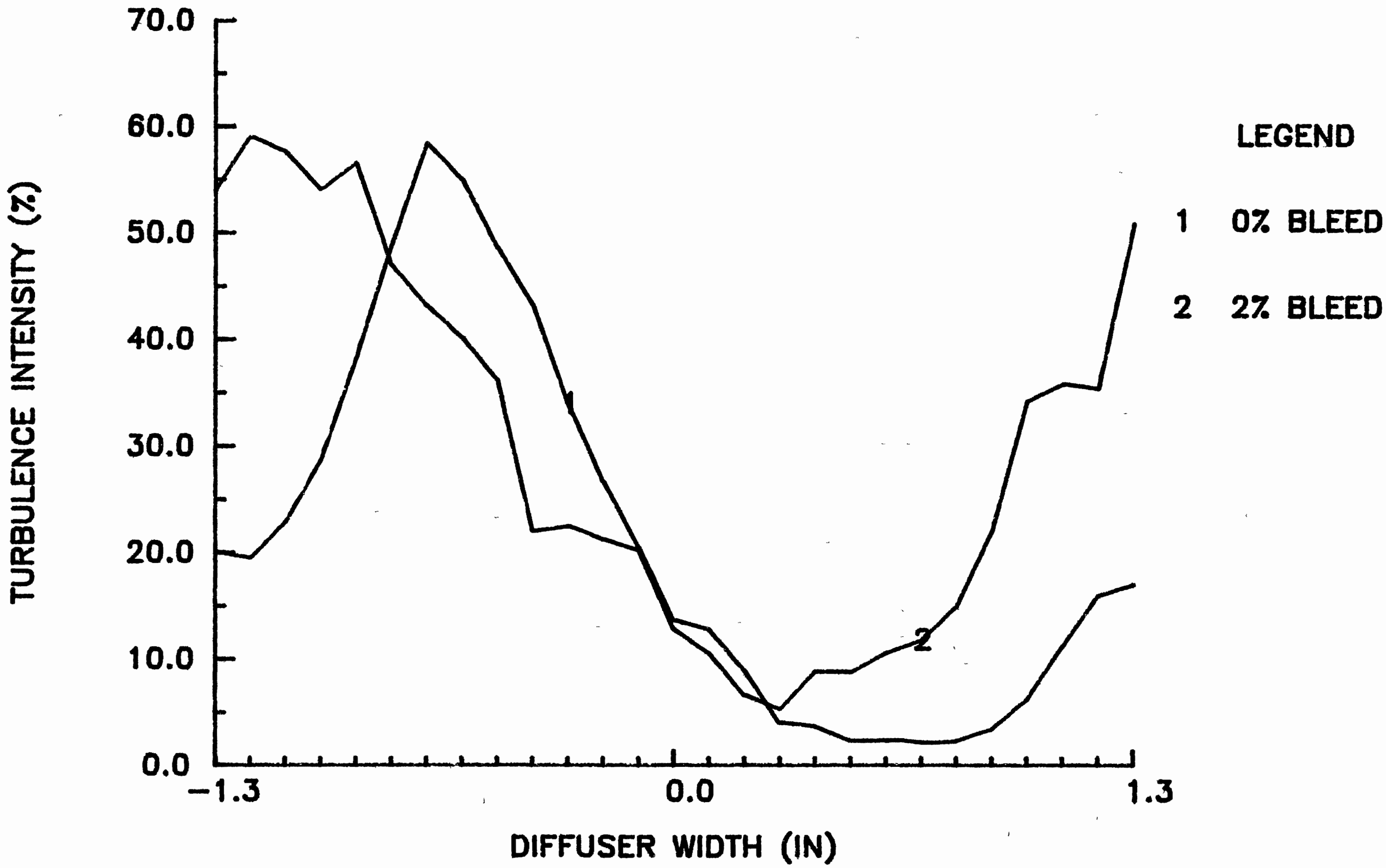


Figure 32 : Exit Turbulence for Diffuser Geometry 3

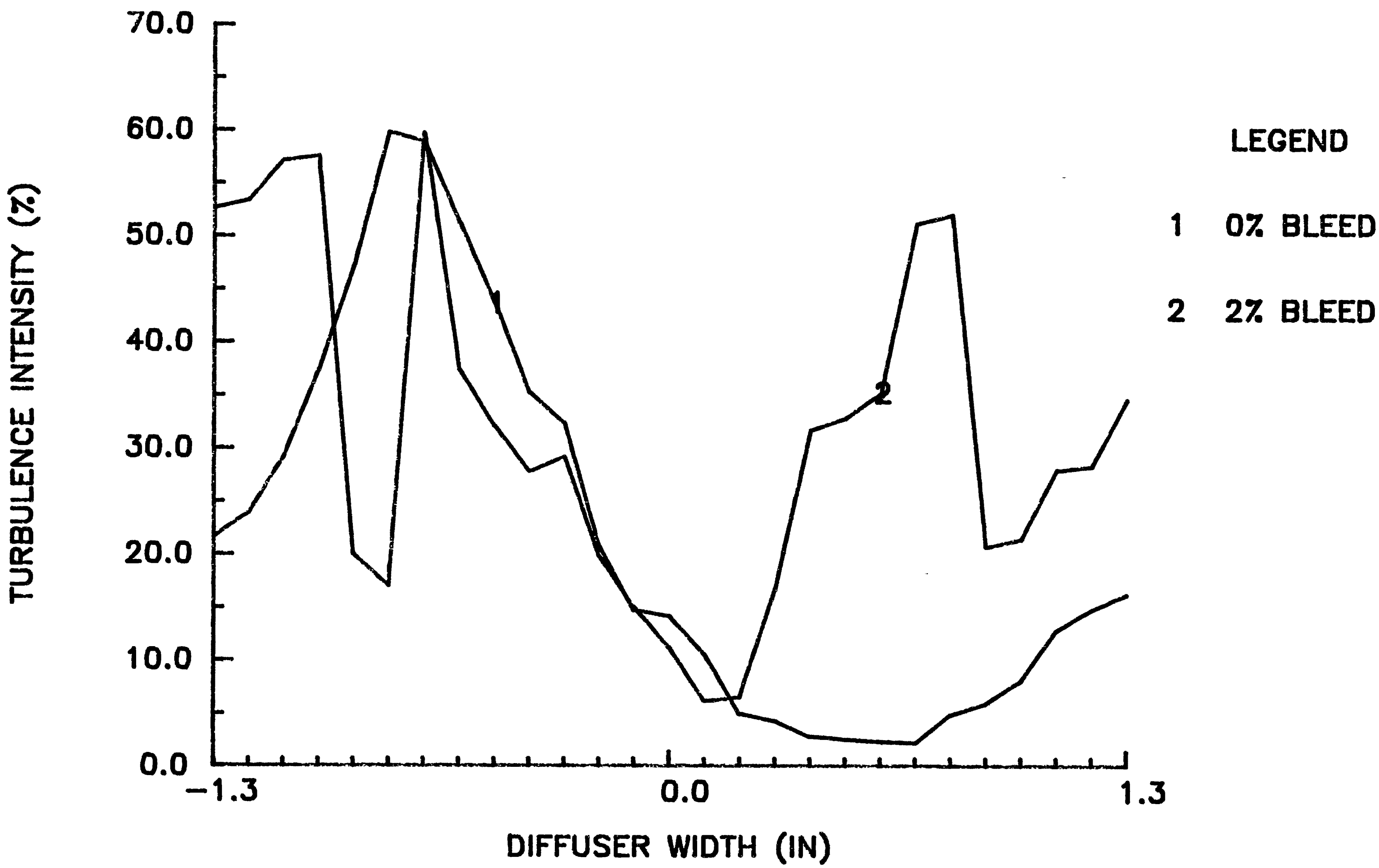


Figure 33 : Exit Turbulence for Diffuser Geometry 4

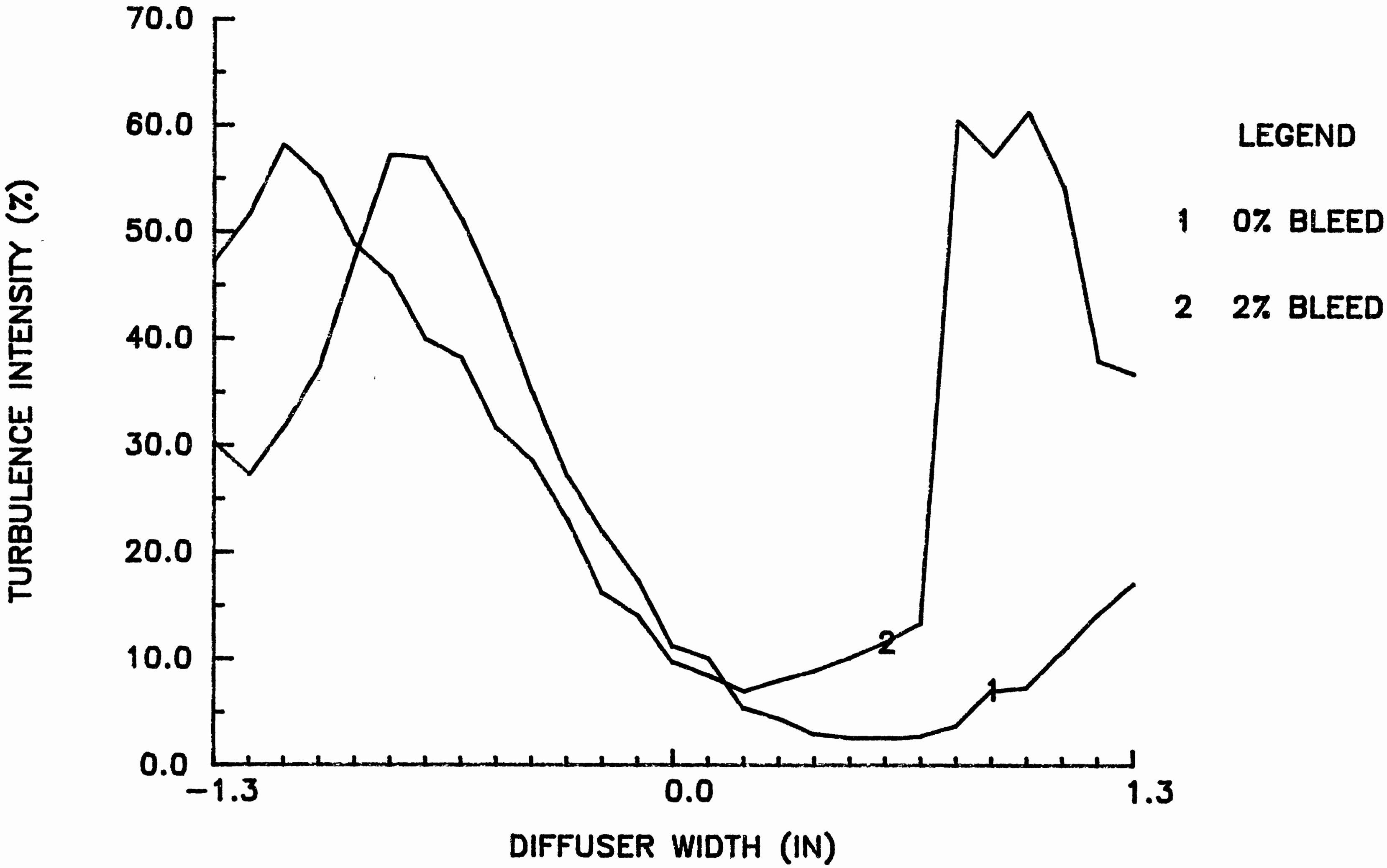


Figure 34 : Exit Turbulence for Diffuser Geometry 5

$$\overline{I}_{loc} = \frac{1}{n} \sum_{i=1}^{n} \frac{\text{RMS Velocity Fluctuations}}{\text{Local Average Velocity}} \times 100$$

$$\overline{I}mean = \frac{1/n \sum (\text{RMS Local Velocities})}{1/n \sum (\text{Local Average Velocities})} \times 100$$

TABLE V

AVERAGED TURBULENCE INTENSITIES

Y(IN)		0.00	0.05	0.10
X(IN)	Bleed(%)	$\overline{I}_{loc}/\overline{I}_{mean}$	$\overline{I}_{loc}/\overline{I}_{mean}$	$\overline{I}_{loc}/\overline{I}_{mean}$
0.00	0.0	28.5/22.2	21.5/14.2	
	1.0		29.7/22.9	
	2.0		31.6/27.0	
0.10	0.0	24.9/16.6	22.3/13.4	21.1/13.9
	1.0	27.3/19.9	22.1/18.2	26.2/18.3
	2.0	27.2/20.3	30.9/24.4	29.7/23.4
0.20	0.0		21.7/14.4	
	1.0		25.5/18.8	
	2.0		32.7/24.7	

Figure 35 (on the following page) records the relative growth in turbulence as the flow continues downstream. At the exit plane, the average turbulence of the system has increased as much as 6 times over the inlet flow. This large amount of

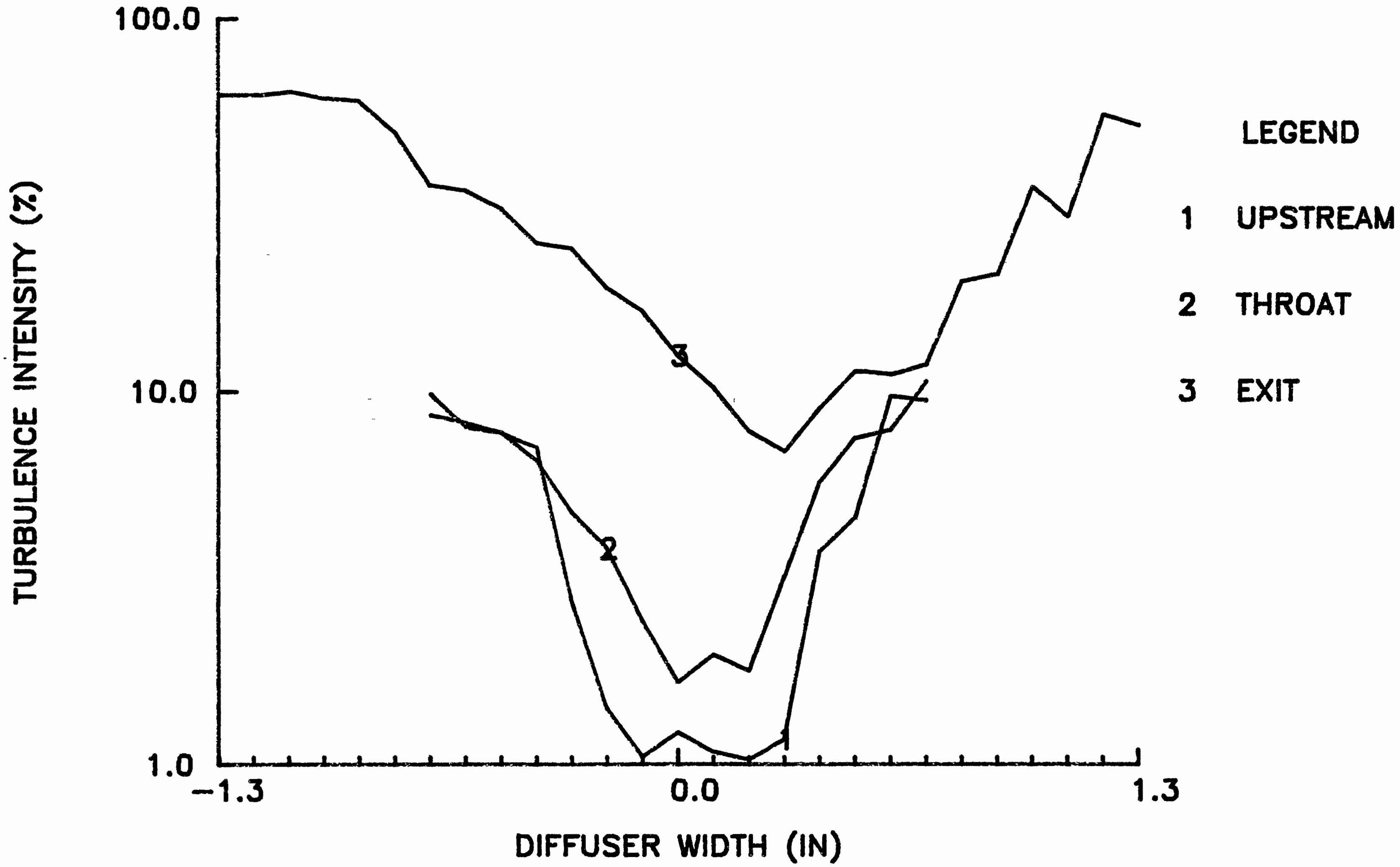


Figure 35 : Turbulence Development for Geometry 1 at 2% Bleed

turbulence in this diffuser is of concern. The bleed slots themselves may be inducing some turbulence, but Table V does not indicate that. The base diffuser turbulence in Table V is roughly the equivalent of the other turbulence intensity magnitudes. If the exit flow in the base diffuser is this turbulent, it is not likely that this number should be reduced much for the hybrid diffuser. The results seem to indicate increased turbulence with increased bleed and associated pressure recoveries. This is possibly due to some high speed mixing or pulsing along the diffuser walls. Recirculation zones do not seem to be the cause, since recirculation occurs at lower bleed rates, and the increased turbulence occurs at higher rates.

From further use of the hot wire, the frequency of the velocity fluctuations can be determined. From this spectrum analysis (Figures 36-41), possible reasons for turbulence could be found. The flow at the center line of the throat is shown in Figure 36, 37. Fluctuations appear at 4khz, 12khz, 16khz, 19khz; though most of the turbulence is at low frequencies. In Figure 37, a large spike is found to occur at 350 Hz. The fan downstream running at 2200 RPM may be causing this effect. If each of the fans blades (approximately 10) generates its own disturbance, a wake total disturbance frequency of 400 Hz would be generated. So the centrifugal fan itself is probably causing this effect. The other smaller spikes in Figure 36 might be caused by the bleed slots themselves. Looking within the boundary layer, near the wall, at the throat, we get Figure 38. The results here are much less interesting. The power spectrum plot appears as a decaying exponential with no individual frequencies standing out. This smooth spectrum is the velocity equivalent of "white noise", a completely random signal containing all possible frequency components. Similar power spectrums in Figures 39, 40, 41 at the exit plane show a generally larger magnitude but nondescript signal. Spectrums were taken for all diffusers at different locations, but all were similar in response to the sample plots. It is interesting to note the disappearance of the 350 Hz signal at the exit plane spectrum and in the boundary layers (Figures 40, 41). If this spike were caused by the main fan, its effect should be felt at all points. This signal has perhaps been "washed - out" by the effect of more turbulence at the exit in general. Greater overall turbulence at every frequency diminishes the spike at the fan frequency. Generally the frequency spectrum plots did not show any particular frequency of turbulence to be more significant than the others. With no particular frequency highlighted, the system appears to be a smooth and have a consistent distribution of turbulence. Random turbulence indicates nothing more that the assumed turbulence transition of the flow at the high operating Reynolds or Mach number.

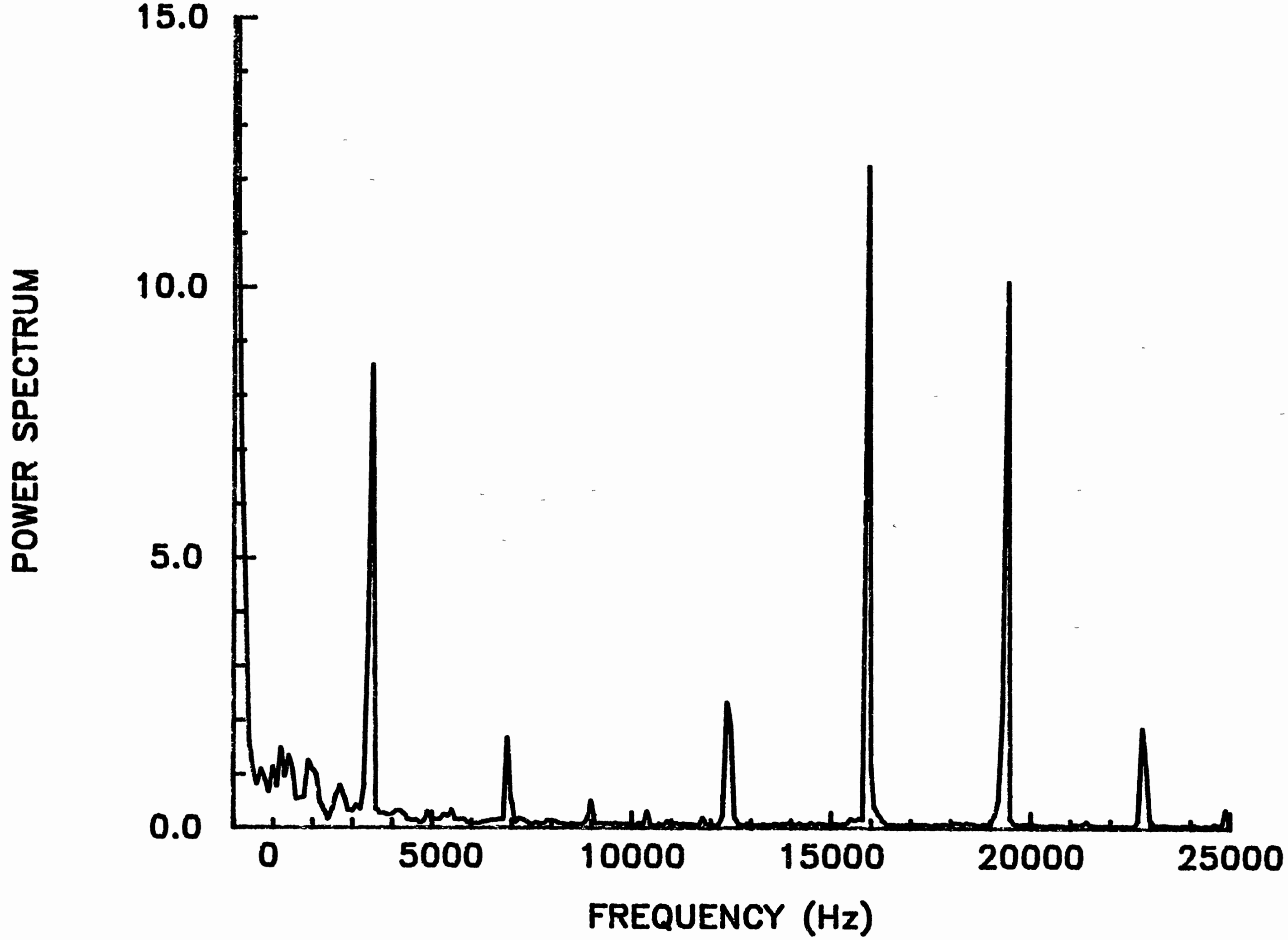


Figure 36 : Power Spectrum at Throat Center Line (#3 at 2% Bleed)

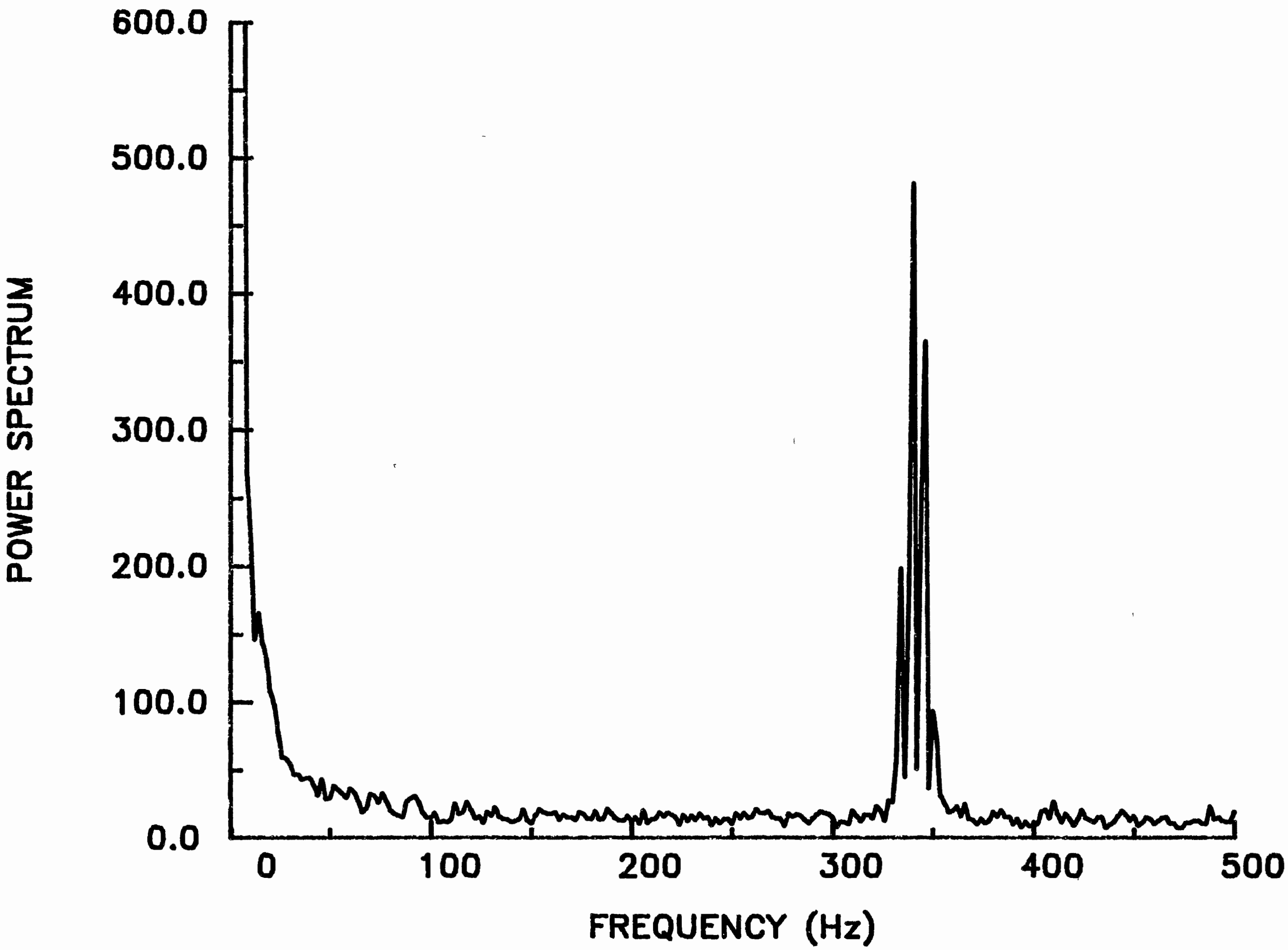


Figure 37 : Power Spectrum at Throat Center Line (#3 at 2% Bleed)

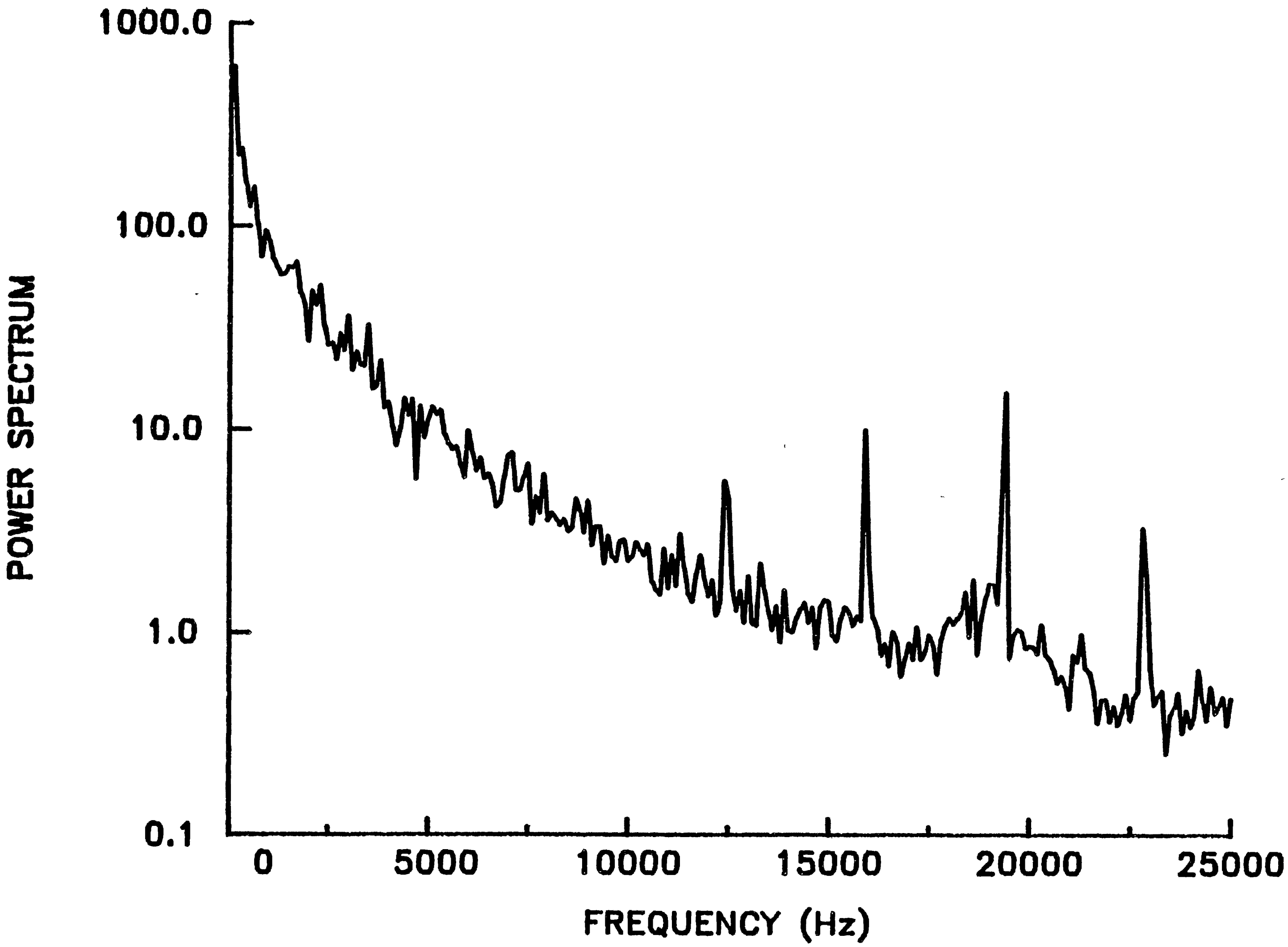


Figure 38 : Power Spectrum in Throat Boundary Layer (#3 at 2% Bleed)

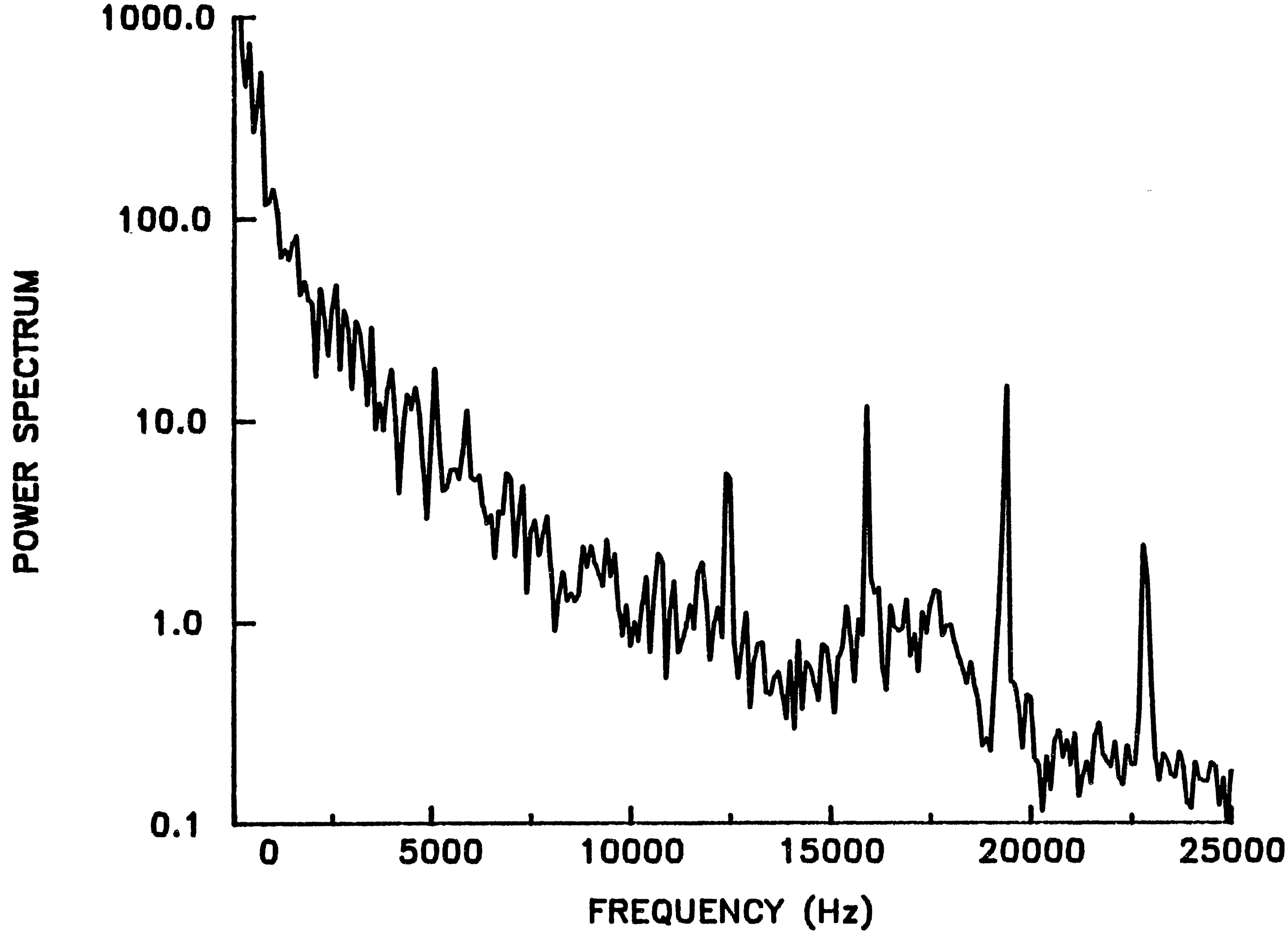


Figure 39 : Power Spectrum at Exit Center Line (#3 at 2% Bleed)

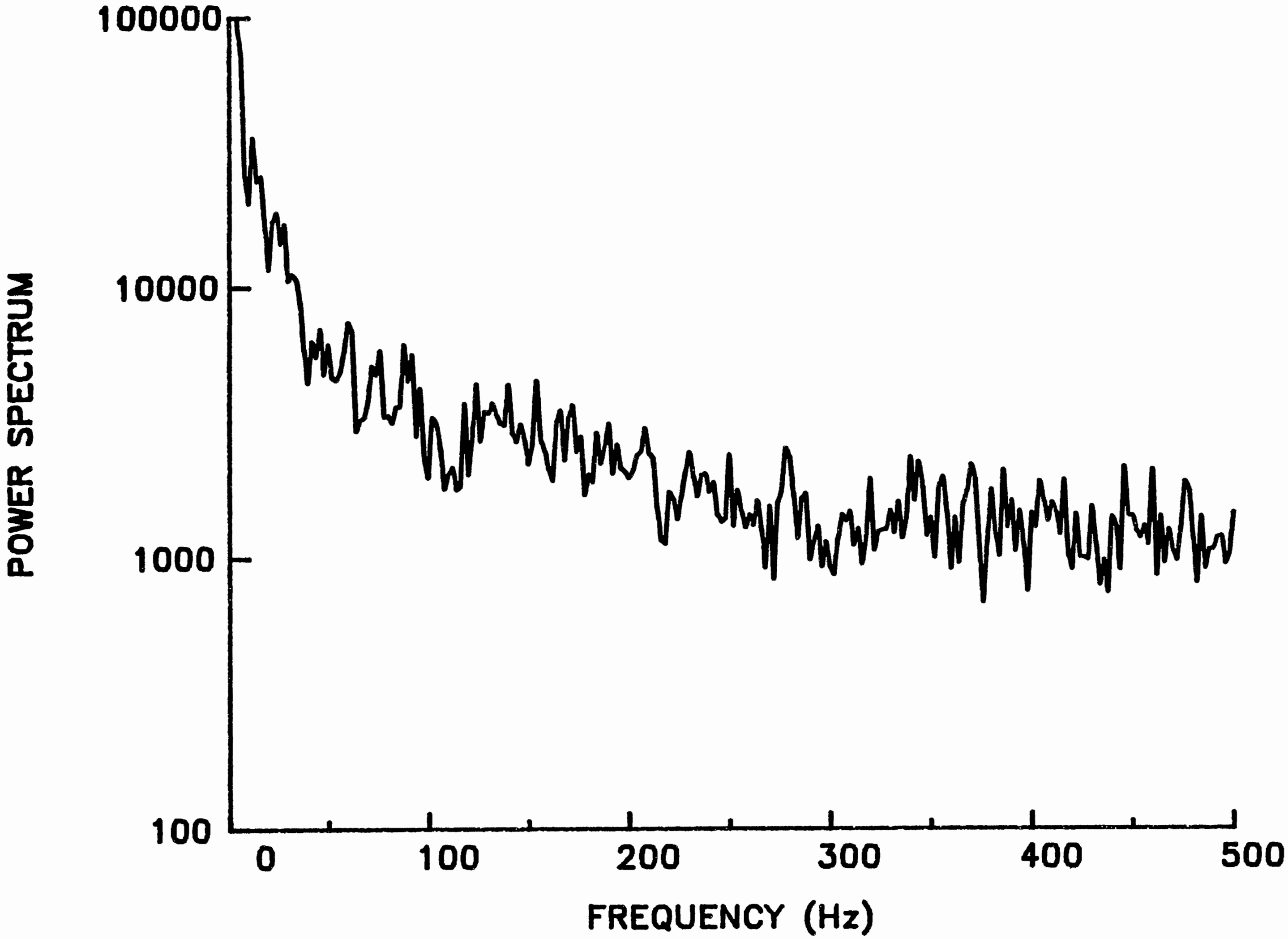


Figure 40 : Power Spectrum at Exit Center Line (#3 at 2% Bleed)

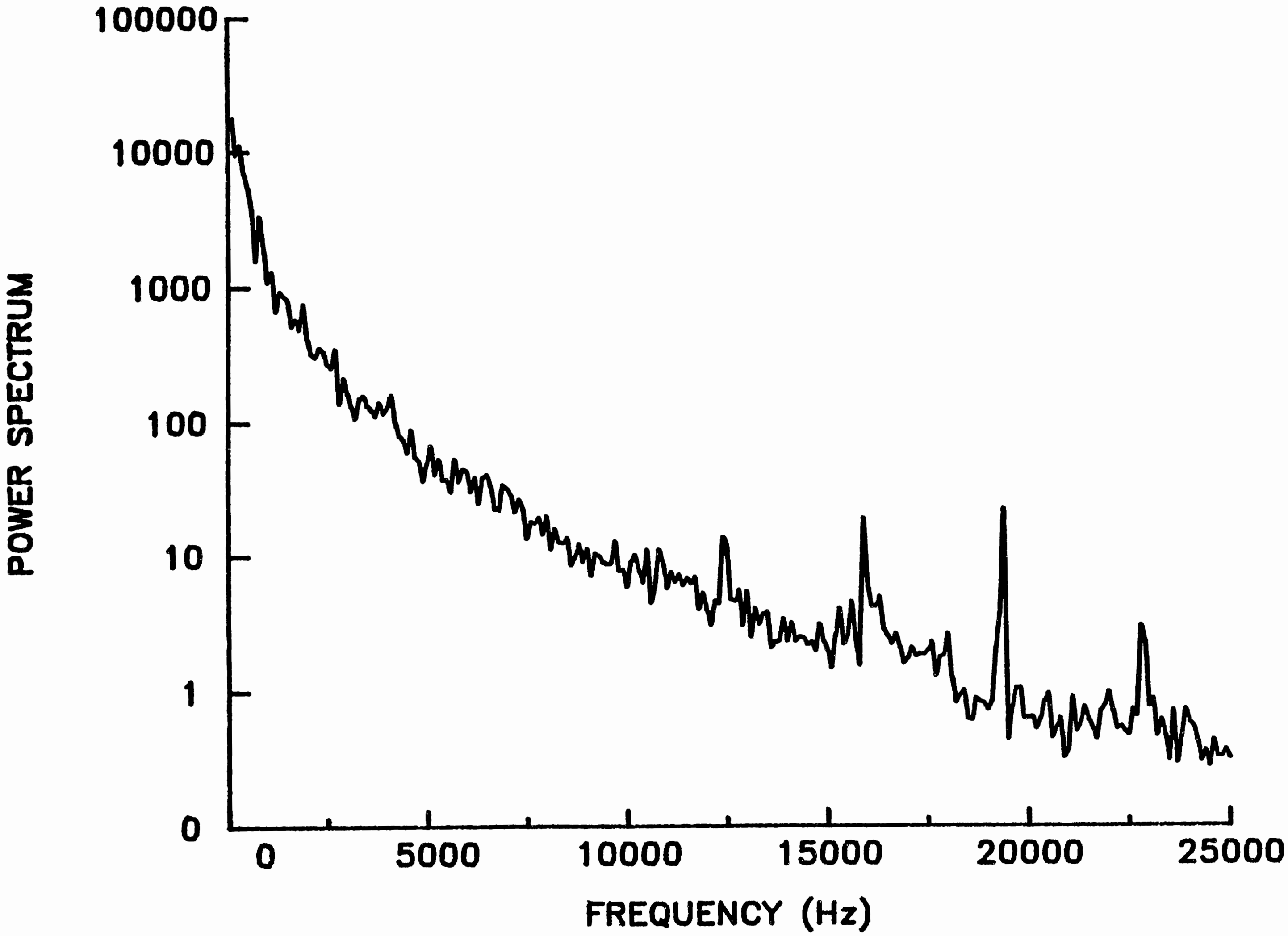


Figure 41 : Power Spectrum in Exit Boundary Layer (#3 at 2% Bleed)

CHAPTER VII

CONCLUSIONS

Diffusers are a heavily used aerodynamic device in many fluid dynamic systems. But, an efficient diffuser is difficult to design. Constraints on the size and stability of diffusers have led to a great deal of research directed toward producing a short, aerodynamically efficient diffuser. Many methods have been studied to facilitate this efficient design. For this case, the use of suction at the entrance of the diffuser was studied and showed good results.

The overall goal of this study was a preliminary series of experiments on a diverse variable system. By use of an original optimization phase, the number of possible slot geometry combinations was soon limited to just 5 possible geometries. This search showed why meticulous care should be taken with the design of these diffuser slots. At certain geometries, this diffuser acts as a hybrid between a dump diffuser and a straight walled diffuser. By use of the slot suction, the flow appeared to undergo a sudden pressure recovery after it passed over the slot, much the same way a dump diffuser would be expected to perform. But after this point, the static pressure continued to rise due to the effect of the standard diffuser walls. The result is possibly the best of both designs: a short diffuser with a reasonable pressure recovery, and little bleed. This good result is unlikely to occur with most straight walled diffusers. Also with sufficient suction, the exhaust flow velocity appears to be reasonably uniform, a difficult result for the standard dump diffuser. The results are good, but seemingly heavily dependent on and sensitive to the slot geometry provided. This may be a reason why so many other experiments have shown much greater bleed requirements to yield similar results. If adequate care is not taken when investigating the optimum geometry of the slot, the results could be less than satisfactory. The mode of this slot recovery is unclear. The work of Adkins (1975, 1981, 1985) indicated what he believed these results to be attributable to the work of a vortex retained within the suction slot. He believed that not only did the slot remove the boundary layer but that the vortex acted as a way of pumping kinetic energy into the remaining flow, allowing it to diffuse without separation.

The data taken does not reflect this thought. Hot wire anemometer studies did not show any particular frequency of recirculation that might be associated with an entrained vortex. Further, hot wire data does not even support the idea that laminar flow is maintained to a fuller extent in the hybrid diffuser. Turbulence intensity levels rose dramatically from an average of 5% at the inlet to 25 and 30% at the exit. The turbulence level also seemed to rise with increasing bleed rates and pressure recoveries. This possibly indicates that a turbulent flow mixes better and remains better attached to the diffuser walls.

The pressure recovery improvement seems to occur from a three fold effect. First, the dead, low energy boundary layer is removed, relieving the rest of the flow from the friction and shear stress it inflicts. Secondly, this bleed causes the fluid flow at the throat to take a block or slug profile, thus concentrating more fluid velocity at the perimeters. Third, this suction should induce an acceleration and velocity component to all particles passing through the throat laterally towards the walls. This new found lateral velocity and momentum force the flow more readily toward the diffuser walls. Such a flow would be more uniformly decelerated by the diffuser. In contrast a center-peaked profile would likely separate at the walls.

The results of this experiment were reasonably good, though pressure recoveries equal to 0.55 are common. Much higher pressure recoveries would be possible by use of a downstream blockage for back pressure. This would be available in many actual systems as, for example, a combustor in a turbine system. Future studies could include the use of back pressure and blockages for diffuser improvement. An interesting property of this diffuser is the compact size. From a simple continuity calculation the perfect diffuser would have a recovery related to the following equation.

$$Cp = 1 - \frac{1}{(\text{Area Ratio})^2}$$

For our case, the area ratio is 1.7; so Cp_{ideal} is 0.66. The results of this study approached 84% of this value, even with a 2% loss of fluid and no back pressure. When compared with the ESDU (1974) Cp prediction plots in Appendix A, an expected Cp of 0.30 is projected.

The hybrid diffuser result is also very good when considering the outlet profile and pressure recovery. The overall levels of turbulence in the system appear to be high. This turbulence is possibly due to a mixing effect caused by the slot bleed. This may not be a bad result for mixing effects in a possible combustor downstream of the diffuser. This system would appear to be a practical solution and certainly worthy of further study.

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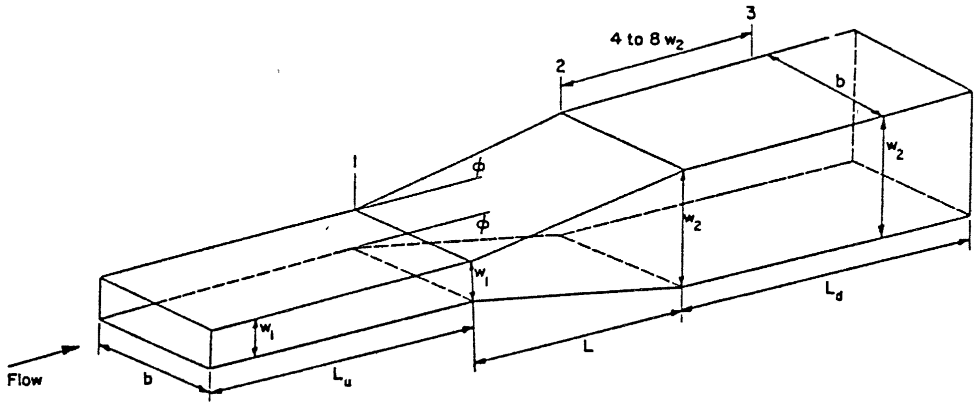
APPENDIXES

APPENDIX A

ESDU DESIGN CRITERION GRAPHS



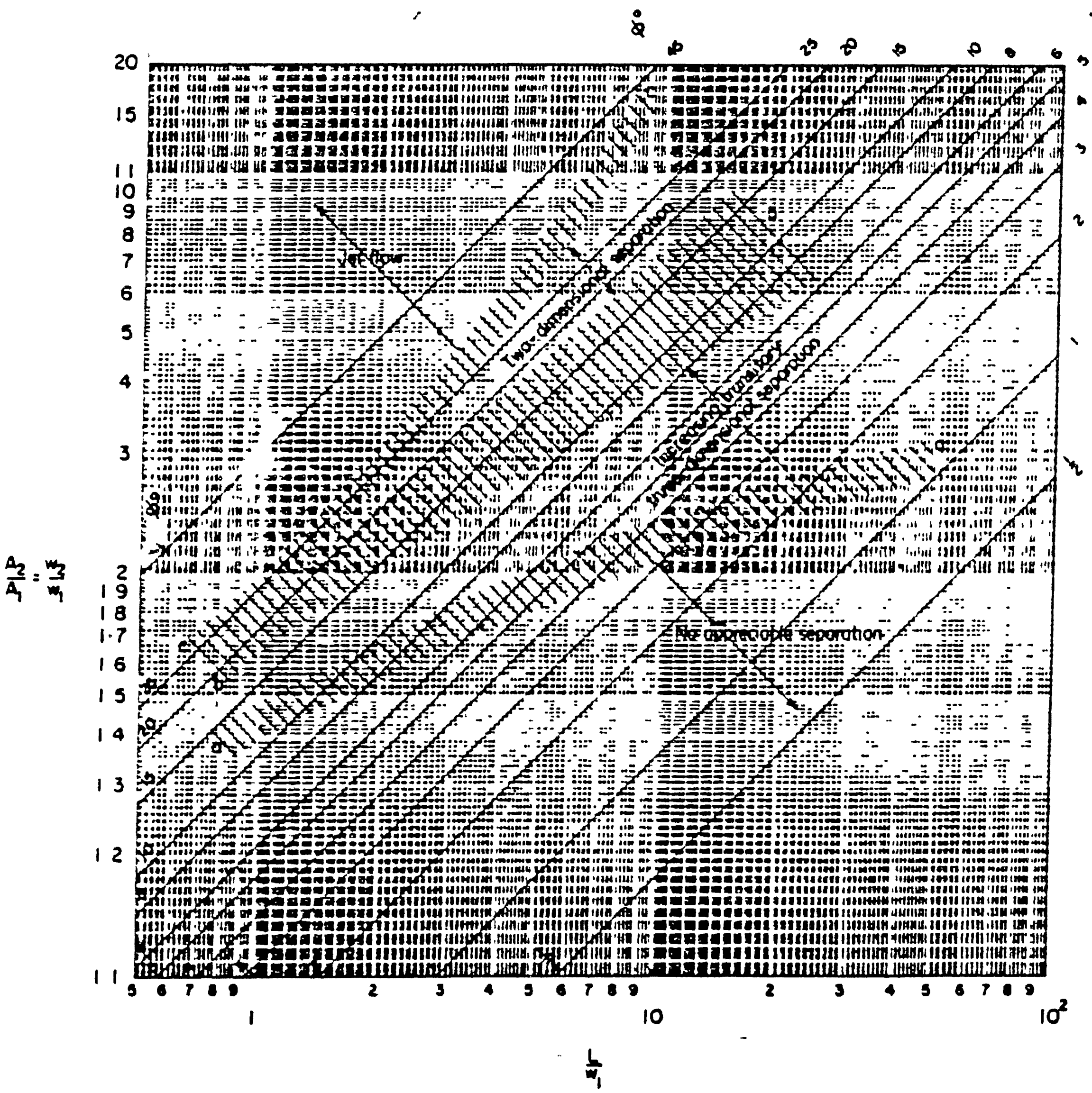


FIGURE L FLOW REGIME BOUNDARIES FOR PLANE-WALLED DIFFUSERS WITH SINGLE-PLANE EXPANSION

Figure 42

ESDU Comparison of Area Ratio to Length for 2-D Diffusers

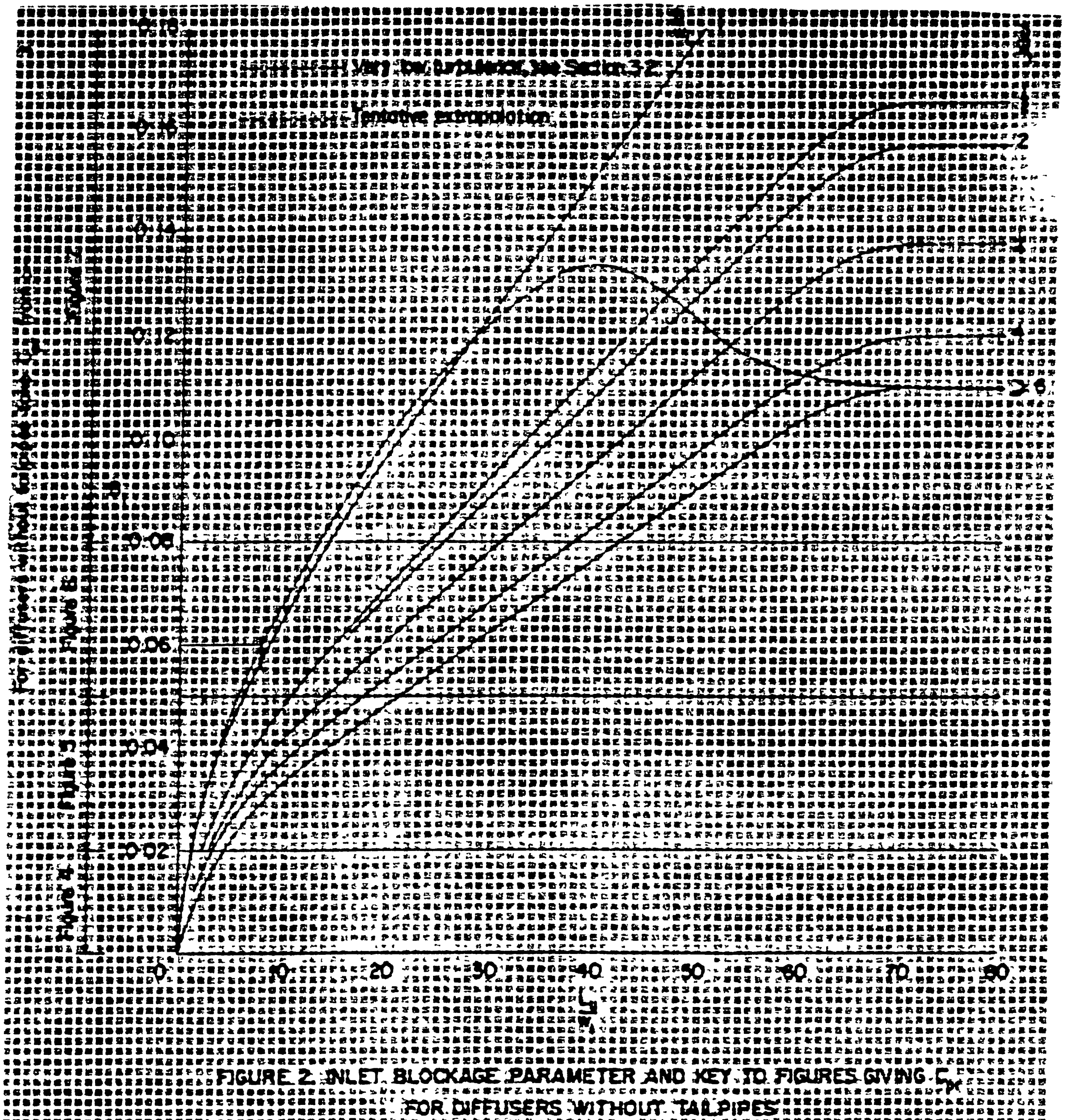


Figure 43

ESDU Key for Developing Flows vs. Approach Length

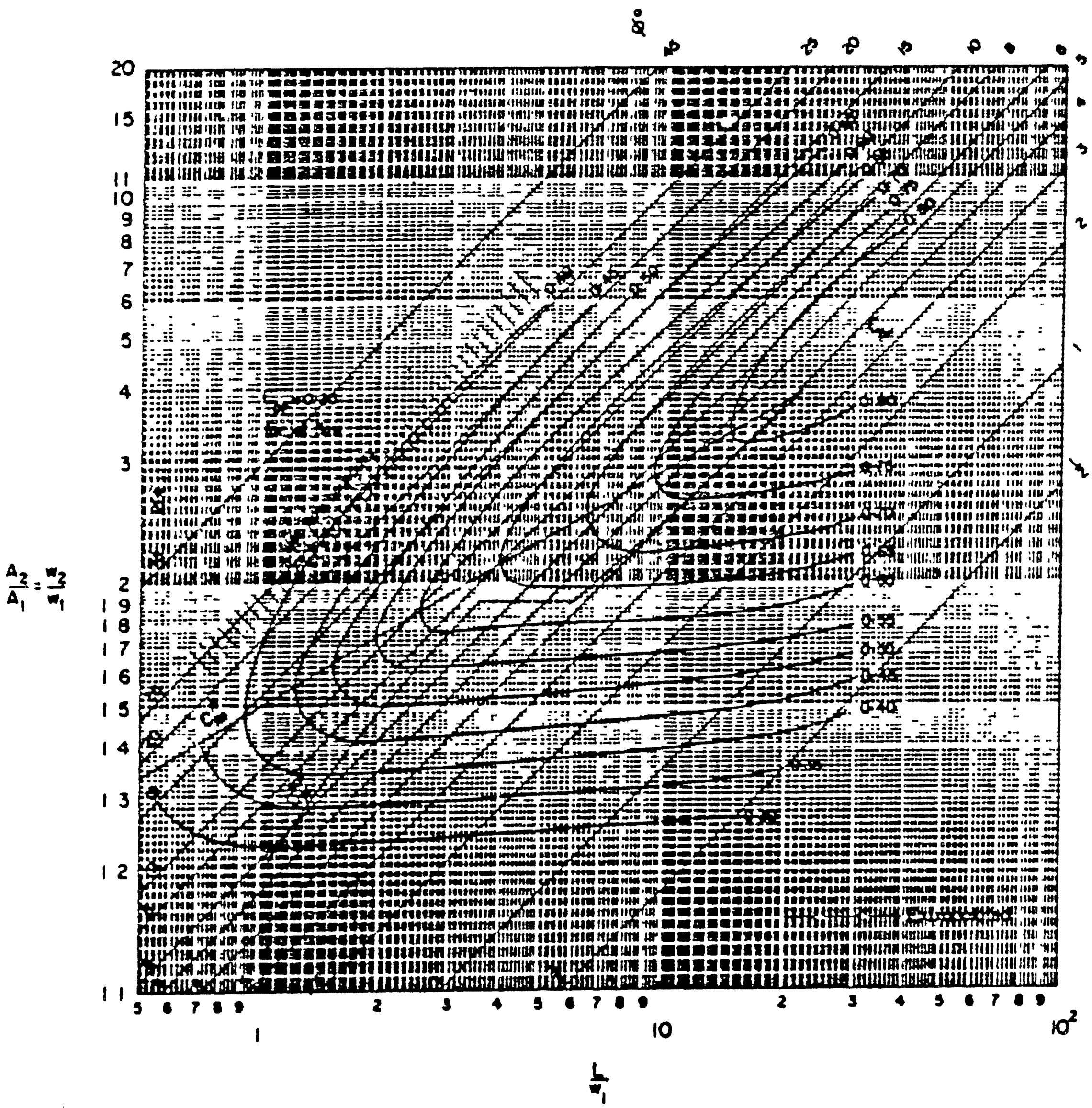


FIGURE 4 PRESSURE RECOVERY COEFFICIENT CONTOURS FOR DIFFUSERS WITHOUT TAILPIPES, $\frac{b}{w_1} > 6$ AND INLET BLOCKAGE RANGE 0 002 TO 0 02

Figure 44

ESDU Pressure Recovery Chart for Under-Developed Flows

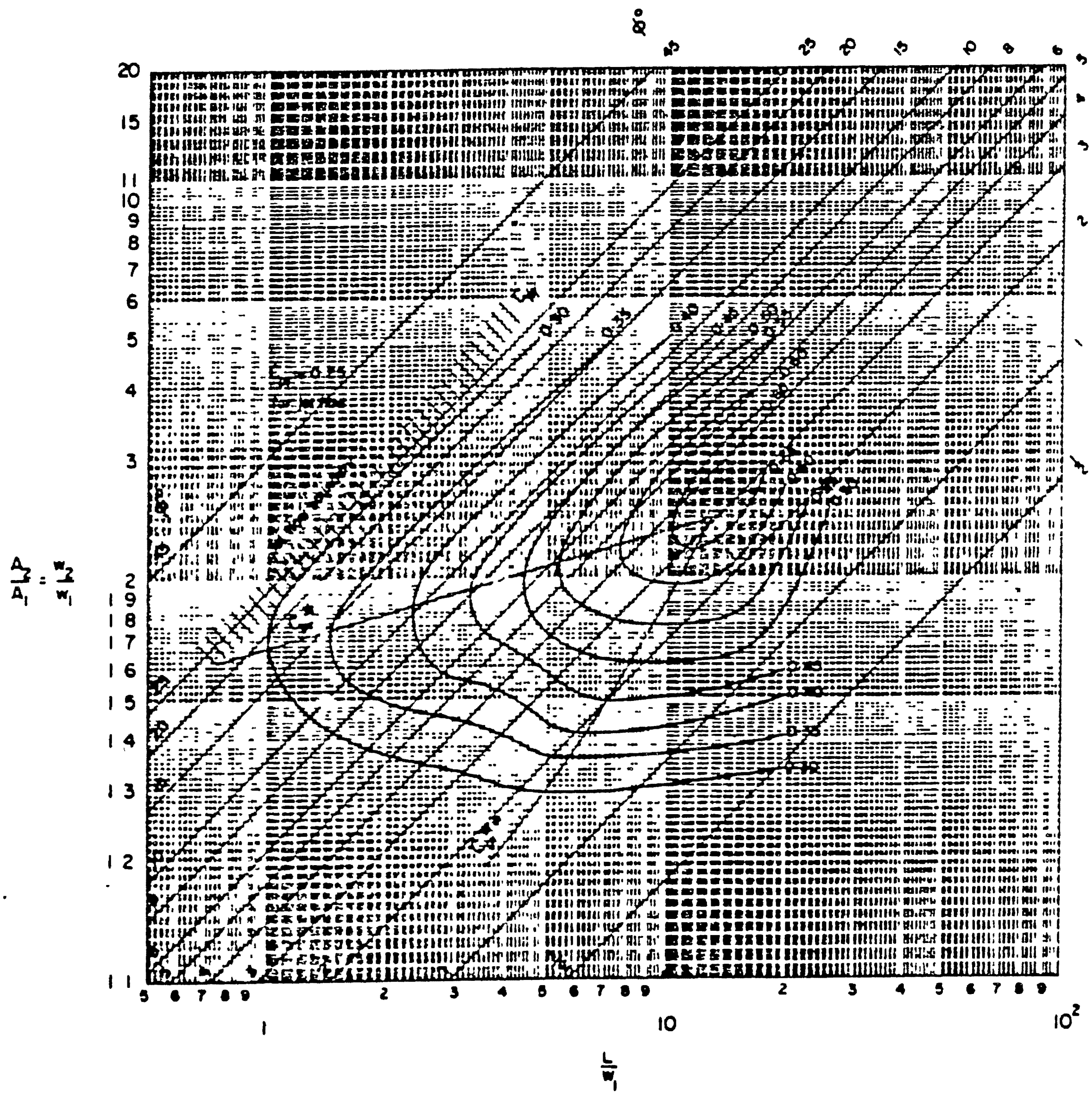


FIGURE 7 TENTATIVE PRESSURE RECOVERY COEFFICIENT CONTOURS FOR DIFFUSERS WITHOUT TAILPIPES, $\frac{b}{w_1} > 6$ AND INLET BLOCKAGE $B_1 > 0.08$

Figure 45

EDSU Pressure Recovery Chart for Fully-Developed Flows

APPENDIX B

DIFFUSER TEST RIG DESIGN LAYOUT

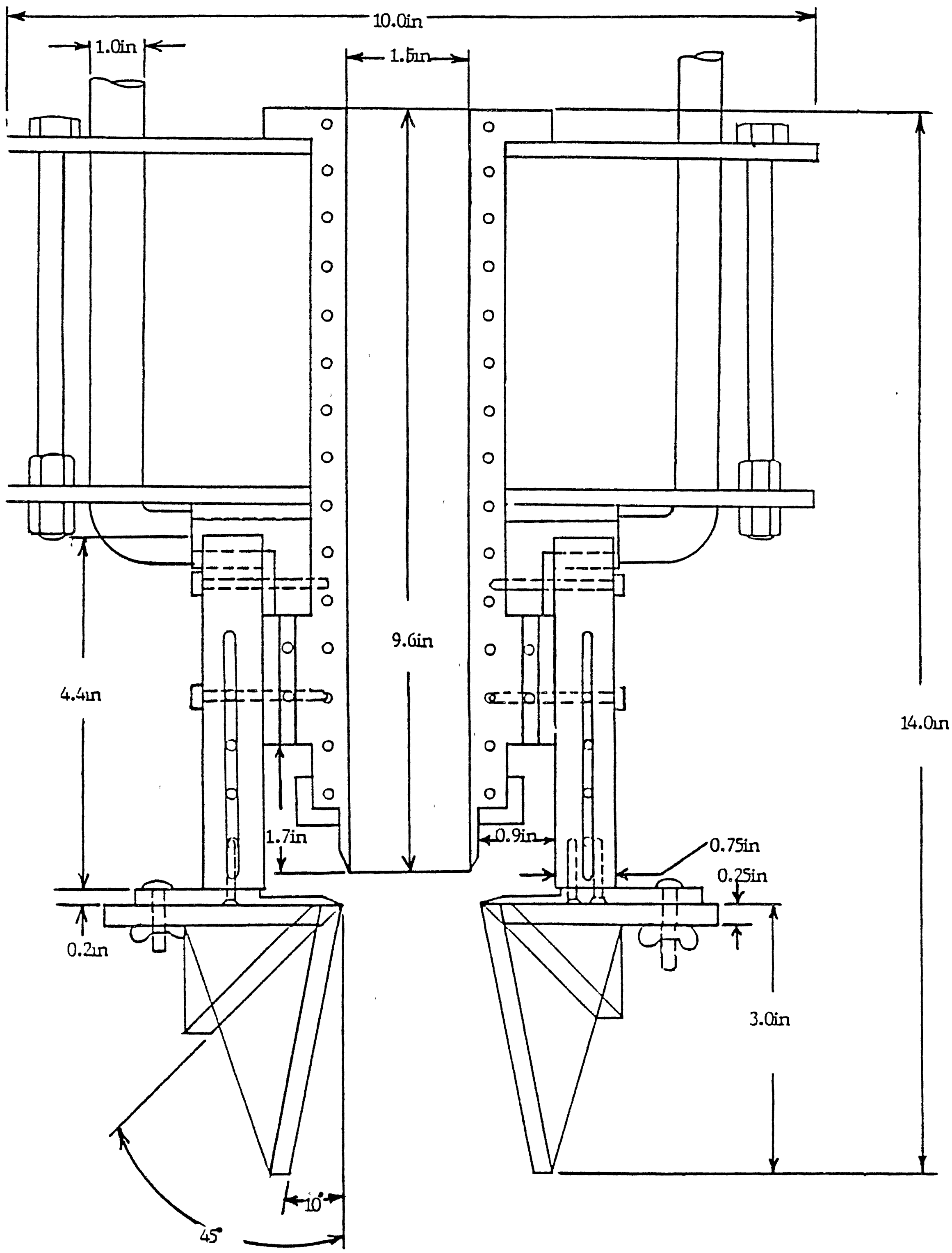


Figure 46 : Test Rig Layout Top View

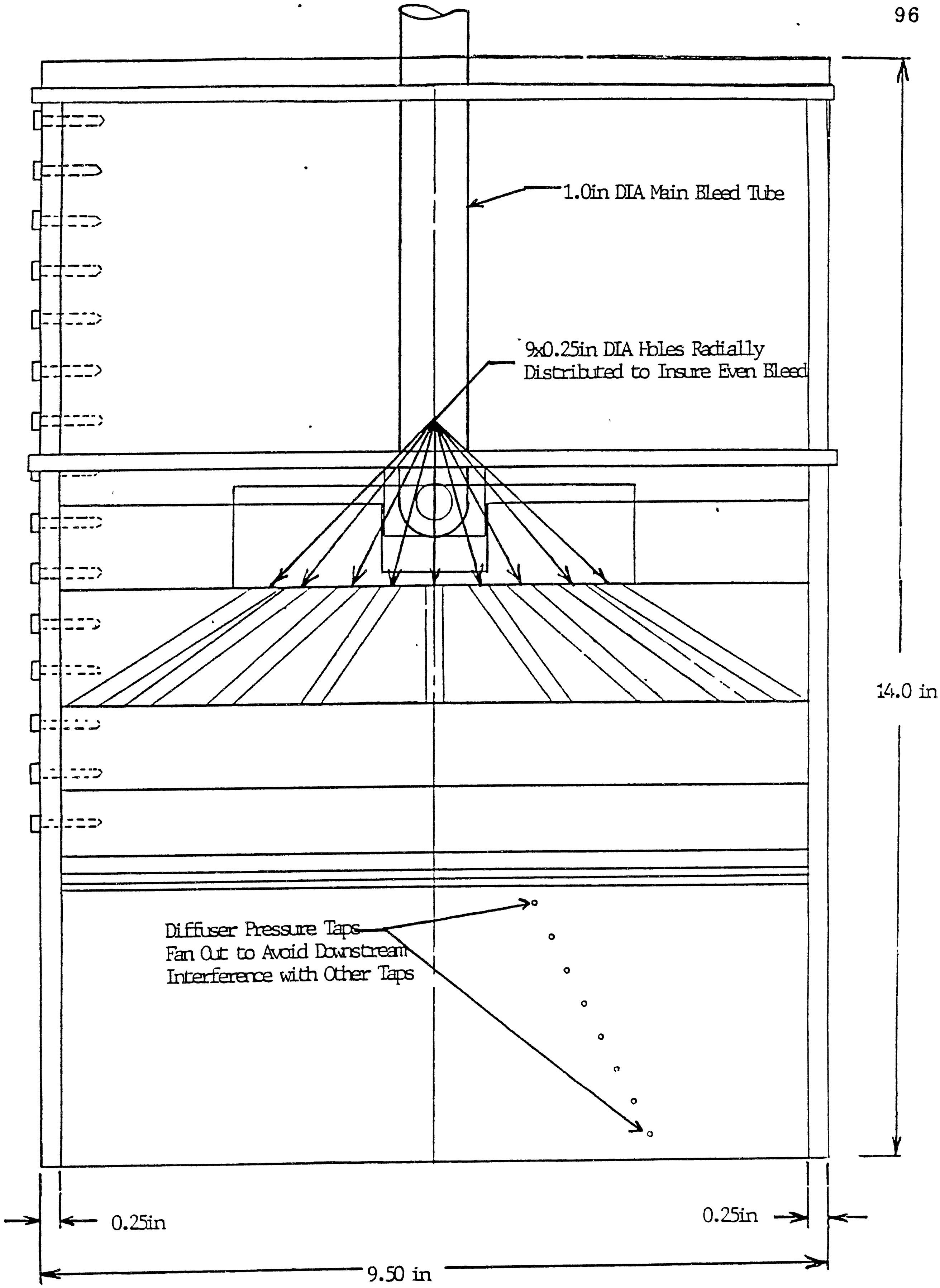


Figure 47 : Test Rig Layout Side View

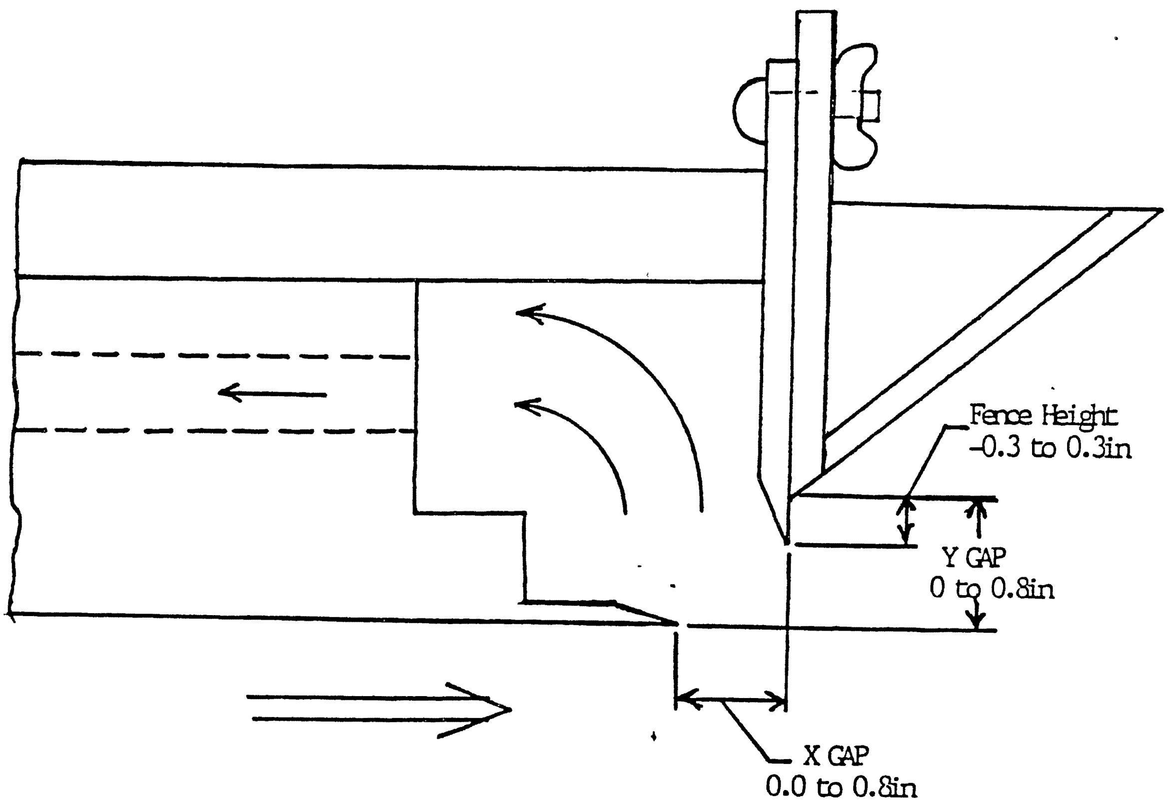


Figure 48 : Blow Up of Test Rig Slot Geometry

APPENDIX C

LIST OF EQUIPMENT

List of Equipment

1. DISA 55M01 CTA Bridge, Probe, Cables, and Filters
2. Fischer & Porter Precision Bore FlowRator (2)
3. General Radio Variac Transformer Type W5MT3
4. Hewlett Packard HP98640A 7 Channel Analog Input Interface
5. Hewlett Packard Model 9000 Series 200 Computer & Printer
6. Hewlett Packard 3468B Digital Multimeter
7. Hewlett Packard Audio Signal Generator Model 205AG
8. IBM Personal Computer & Printer
9. IBM PC 12 Bit Analog to Digital Control Board
10. Meriam Instruments 40HE35 12 inch Manometer
11. Omega Pressure Transducer PX164-10 and Dedicated Power Supply
12. Omega Model TAC 80T Thermocouple Converter
13. Omega Pitot Probe/Thermocouple Probe
14. Power One 24VDC Power Supply HN24-3.6A
15. Radio Shack Model LCD Mini Multi meter
16. Scanivalve Model W0601/1P-24T Fluid Switch Wafer, Dedicated Power Supply, and Triggering Relay
17. Sears Centrifugal Vacuum Fans (2)
18. Sola Constant Voltage Transformer Supply
19. Tektronix 561A Oscilloscope

APPENDIX D

ERROR ANALYSIS

ERROR ANALYSIS

Pressure Sampling Errors

1.Fluid Switch Wafer Leakage

Quoted Leakage Rate= 2% of FSO Per Hour

Sampling Time = 20 Seconds

Full Scale Output = 12.0 inches H_2O

$$E(\text{Leakage})=(0.02/\text{Hr})\times(1\text{Hr}/3600\text{sec})\times(20\text{sec})\times(12.0"H_2O)$$
$$= 0.0013 \text{ inches } H_2O$$

2.Pressure Transducer

Quoted Hysteresis & Repeatability=0.25% FSO

Quoted Temperature Null Shift =0.05% FSO / $^\circ$c

Temperature Shift (Maximum) =4 $^\circ$c

Full Scale Output =12 inches H_2O

$$E(\text{Trans})=(0.0025)\times(12"H_2O)+(0.0005/^\circ c)\times(12"H_2O)\times(4^\circ C)$$
$$=0.054 \text{ inches } H_2O$$

3.Calibration

E(RMS Residual Curve Fitting Error)=0.021"H_2O

4.Board Sampling Error

Board Bit Resolution = 1 part in 4095

Board Range = 10Volts

Slope of Pressure Tranducer Calibration=1.49"H_2O/V

$$E(\text{Board}) =(1/4095) \times (10V) \times (1.49"H_2O/V)$$
$$=0.006 "H_2O$$

Total Pressure Error =

$$\sqrt{E_{leak}^2 + E_{hysteresis}^2 + E_{temperature}^2 + E_{calibration}^2 + E_{board}^2}$$

$$= \pm 0.044 \text{ " } H_2O$$

Hot Wire Sampling Errors

1. Curvefitting Error

   RMS Residual From Curvefit=0.9 ft/s

   E(Curvefit) =0.9 ft/s

2. Board Sampling Error

   Board Bit Resolution = 1/4095

   Board Range = 10v

   Linearized Slope of Curvefit (Worst Case)=245 ft/s v

   E(Board)=(1/4095)x(10v)x(245 ft/s v)=0.6 ft/s

Total Hot Wire Error = $\sqrt{E^2_{curvefit} + E_{board}^2}$

= 1.08 ft/s

Rotameter Errors

E(Readability) = 0.025 LBm/MIN

Total Rotameter Error = 0.025 PPM

APPENDIX E

PRELIMINARY DIFFUSER STUDIES

Calculation of Sampled Data

Temp	Temperature in Fahrenheit
Pressure	Atmospheric Pressure in mm Hg
Density	Density of air (Lb s^2/ft^4)
CLM#	Approach Flow Center Line Mach Number
Vcl	Approach Flow Center Line Velocity (ft/s)
Vavg	Approach Flow Average Velocity (ft/s)
M	Mass Flow Through The Diffuser (PPM)
S	Bleed Rate in Percent, Indicated, or Actual PPM
PTS	The Number of Points Averaged Per Tap and Over How Much Time
P("H2O)	Pressure Transducer Calibration Used For Data
Tap#	Number of the Pressure Tap Sampled (See Figure 4)
Axial Loc	Axial Location of a Pressure Tap in inches
L/D	Axial location of the Pressure Tap, Negative Number of Diameters For Upstream Taps, Positive Number of Diameters For Downstream Taps
Min,Max	Minimum and Maximum Pressures Sampled at This Tap
Avg	The Average of All the Data Points Taken at This Pressure Tap
Avgdev	Average Data Deviation : $1/n \sum_{i=1}^{n} \text{absolute(Data-Avg)}$
Rmsdev	RMS Data Deviation: : $\sqrt{\sum (\text{Data-Avg})^2/n}$
Cp	Pressure Recovery Coefficient at Tap#

$$\frac{P_{static}(\text{throat}) - P_{static}(\text{Tap \#})}{1/2\,\rho\,\overline{v}^{2}}$$

5 -Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP=73.5F PRESSURE=739mm Hg DENSITY(Lbs2/ft4)=0.002261
C.L.Mach# = 0.2309 Vcl(ft/s)= 220.22 Vavg(ft/s)= 200.60
M(LBm/min)= 82.080 S(%)=0.0 S(ind)=0.00 S(act) =0.00
Points = 800 P(" H2O)=-2.06381+ 1.36839*V HEADavg=8.749

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.65	10.77	10.72	0.026	0.022	0.002	-0.060
2	0.00	0.000	0.00	0.07	0.04	0.012	0.010	0.271	1.161
3	-8.00	-5.333	9.73	9.85	9.80	0.022	0.018	0.002	0.044
4	-8.00	-5.333	9.63	9.94	9.77	0.064	0.050	0.005	0.048
5	-5.00	-3.333	9.48	9.93	9.76	0.105	0.089	0.009	0.049
6	-5.00	-3.333	9.66	9.82	9.75	0.031	0.026	0.003	0.051
7	-2.50	-1.667	9.83	10.14	9.99	0.075	0.065	0.007	0.023
8	-2.50	-1.667	9.86	10.07	9.94	0.043	0.034	0.003	0.029
9	-1.00	-0.667	10.13	10.24	10.20	0.017	0.014	0.001	-0.001
10	-1.00	-0.667	9.95	10.33	10.19	0.094	0.075	0.007	0.001
11	-0.26	0.123	11.56	11.62	11.62	0.006	0.002	0.000	-0.163
12	0.24	0.113	11.45	11.62	11.58	0.047	0.040	0.003	-0.159
13	0.55	0.259	10.98	11.38	11.16	0.080	0.062	0.006	-0.111
14	0.53	0.250	10.88	11.15	10.98	0.056	0.046	0.004	-0.091
15	0.85	0.401	10.81	11.18	10.95	0.069	0.055	0.005	-0.087
16	0.81	0.382	10.75	11.04	10.90	0.063	0.052	0.005	-0.081
17	1.15	0.542	10.36	10.82	10.61	0.087	0.068	0.006	-0.048
18	1.15	0.542	10.34	10.61	10.47	0.063	0.054	0.005	-0.032
19	1.45	0.684	10.27	10.60	10.40	0.065	0.054	0.005	-0.023
20	1.44	0.676	10.03	10.36	10.20	0.069	0.055	0.005	-0.001
21	1.79	0.844	10.20	10.44	10.33	0.053	0.045	0.004	-0.016
22	1.74	0.820	9.70	10.02	9.88	0.071	0.058	0.006	0.036
23	2.07	0.976	10.09	10.39	10.26	0.066	0.054	0.005	-0.008
24	2.02	0.950	9.52	9.87	9.68	0.074	0.061	0.006	0.059

5 Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN NO SCREEN

TEMP(F)=73.5 PRESSURE(mm Hg)=739 DENSITY(Lbs2/ft4)=0.00226
C.L.M#=0.2282 Vcl(ft/s)=217.72 Vavg(ft/s)=198.32
M(ppm)=81.146 S(%)=2.0 S(ind)=0.79 S(act)=0.81
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.551

TAP	AXIAL LOC	L/D LOC	MIN	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV ("H2O)	Cp (%)
1	0.00	0.000	10.61	10.72	10.66	0.021	0.017	0.002	-0.035
2	0.00	0.000	0.05	0.22	0.13	0.033	0.027	0.210	1.197
3	-8.00	-5.333	9.77	9.96	9.88	0.040	0.033	0.003	0.057
4	-8.00	-5.333	9.62	10.02	9.84	0.080	0.065	0.007	0.062
5	-5.00	-3.333	9.70	9.93	9.82	0.044	0.037	0.004	0.064
6	-5.00	-3.333	9.76	9.97	9.86	0.043	0.035	0.004	0.059
7	-2.50	-1.667	9.88	10.32	10.11	0.104	0.087	0.009	0.029
8	-2.50	-1.667	9.89	10.17	10.02	0.051	0.042	0.004	0.039
9	-1.00	-0.667	10.30	10.42	10.36	0.019	0.015	0.001	-0.000
10	-1.00	-0.667	10.18	10.53	10.36	0.076	0.064	0.006	0.000
11	0.26	0.123	10.76	11.19	10.98	0.082	0.067	0.006	-0.072
12	0.24	0.113	10.70	11.09	10.86	0.075	0.061	0.006	-0.059
13	0.55	0.259	10.43	10.86	10.63	0.079	0.064	0.006	-0.032
14	0.53	0.250	10.39	10.83	10.59	0.079	0.062	0.006	-0.027
15	0.85	0.401	10.30	10.66	10.46	0.085	0.070	0.007	-0.012
16	0.81	0.382	10.24	10.60	10.42	0.074	0.060	0.006	-0.007
17	1.15	0.542	9.98	10.35	10.16	0.067	0.053	0.005	0.024
18	1.15	0.542	9.85	10.23	10.03	0.081	0.067	0.007	0.039
19	1.45	0.684	9.79	10.15	9.96	0.076	0.065	0.006	0.047
20	1.44	0.676	9.50	9.90	9.71	0.078	0.062	0.006	0.077
21	1.79	0.844	9.72	10.10	9.89	0.078	0.065	0.007	0.056
22	1.74	0.820	9.35	9.64	9.48	0.054	0.043	0.005	0.103
23	2.07	0.976	9.57	10.04	9.83	0.091	0.073	0.007	0.062
24	2.02	0.950	9.04	9.49	9.27	0.101	0.081	0.009	0.128

10°Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP(F)=72.0 PRESSURE(mm Hg)=739 DENSITY(Lbs2/ft4)=0.00227
C.L.M#=0.2288 Vcl(ft/s)=217.93 Vavg(ft/s)=198.52
M(PPM)=81.458 S(%)=0.0 S(ind)=0.00 S(act)=0.00
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.593

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.23	10.37	10.30	0.031	0.027	0.003	0.149
2	0.00	0.000	-0.03	0.02	-0.01	0.010	0.008	-0.994	1.348
3	-8.00	-5.333	9.21	9.37	9.27	0.033	0.025	0.003	0.268
4	-8.00	-5.333	9.20	9.48	9.33	0.066	0.056	0.006	0.262
5	-5.00	-3.333	9.15	9.38	9.26	0.055	0.049	0.005	0.269
6	-5.00	-3.333	9.16	9.44	9.29	0.052	0.041	0.004	0.266
7	-2.50	-1.667	9.28	9.72	9.51	0.101	0.085	0.009	0.240
8	-2.50	-1.667	9.33	9.56	9.46	0.053	0.044	0.005	0.246
9	-1.00	-0.667	9.90	10.02	9.95	0.027	0.022	0.002	0.189
10	-1.00	-0.667	9.28	9.67	9.49	0.073	0.058	0.006	0.242
11	0.26	0.123	11.62	11.62	11.62	0.000	0.000	0.000	-0.005
12	0.24	0.113	10.94	11.62	11.53	0.141	0.108	0.009	0.005
13	0.55	0.259	11.27	11.62	11.46	0.080	0.062	0.005	0.013
14	0.53	0.250	10.65	11.57	11.15	0.188	0.143	0.013	0.050
15	0.85	0.401	10.75	11.20	10.96	0.095	0.079	0.007	0.071
16	0.81	0.382	10.15	11.08	10.64	0.220	0.180	0.017	0.109
17	1.15	0.542	10.23	10.67	10.43	0.085	0.069	0.007	0.134
18	1.15	0.542	9.81	10.50	10.15	0.135	0.103	0.010	0.166
19	1.45	0.684	9.93	10.21	10.07	0.061	0.050	0.005	0.175
20	1.44	0.676	9.49	10.07	9.78	0.127	0.109	0.011	0.209
21	1.79	0.844	9.67	10.09	9.90	0.094	0.079	0.008	0.195
22	1.74	0.820	9.20	9.88	9.53	0.134	0.105	0.011	0.238
23	2.07	0.976	9.64	10.09	9.82	0.109	0.093	0.009	0.204
24	2.02	0.950	9.19	9.51	9.34	0.074	0.063	0.007	0.259

10° Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP(F)=72.0 PRESSURE(mm Hg)=739 DENSITY(Lbs2/ft4)= 0.00227
CLM#=0.2349 Vcl(ft/s)=223.72 Vavg(ft/s)=203.78
M(PPM)=83.620 S(%)=2.0 S(ind)=0.81 S(act)=0.84
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 9.055

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.76	11.00	10.87	0.044	0.036	0.003	0.081
2	0.00	0.000	-0.09	0.04	-0.02	0.023	0.018	-0.755	1.284
3	-8.00	-5.333	9.88	10.08	9.98	0.038	0.031	0.003	0.179
4	-8.00	-5.333	9.65	10.15	9.93	0.086	0.068	0.007	0.185
5	-5.00	-3.333	9.80	10.20	9.99	0.077	0.063	0.006	0.178
6	-5.00	-3.333	9.86	10.08	9.97	0.040	0.033	0.003	0.180
7	-2.50	-1.667	9.92	10.45	10.20	0.098	0.079	0.008	0.155
8	-2.50	-1.667	9.89	10.31	10.13	0.084	0.069	0.007	0.162
9	-1.00	-0.667	10.50	10.68	10.60	0.032	0.026	0.002	0.111
10	-1.00	-0.667	9.82	10.46	10.17	0.113	0.088	0.009	0.158
11	0.26	0.123	11.62	11.62	11.62	0.000	0.000	0.000	-0.002
12	0.24	0.113	11.11	11.62	11.58	0.097	0.061	0.005	0.002
13	0.55	0.259	10.82	11.40	11.10	0.122	0.103	0.009	0.055
14	0.53	0.250	10.26	11.20	10.71	0.202	0.167	0.016	0.098
15	0.85	0.401	10.20	10.77	10.54	0.110	0.085	0.008	0.118
16	0.81	0.382	9.75	10.55	10.09	0.147	0.117	0.012	0.167
17	1.15	0.542	9.67	10.22	9.97	0.108	0.090	0.009	0.181
18	1.15	0.542	9.18	9.75	9.46	0.103	0.082	0.009	0.236
19	1.45	0.684	9.51	9.90	9.70	0.057	0.044	0.004	0.210
20	1.44	0.676	8.92	9.59	9.22	0.106	0.083	0.009	0.263
21	1.79	0.844	9.15	9.61	9.34	0.087	0.071	0.008	0.249
22	1.74	0.820	8.54	9.26	8.87	0.130	0.104	0.012	0.302
23	2.07	0.976	8.94	9.45	9.19	0.103	0.087	0.009	0.267
24	2.02	0.950	8.45	9.20	8.74	0.150	0.126	0.014	0.317

15° Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP(F)=72.0 PRESSURE(mm Hg)=739 DENSITY(Lbs2/ft4)=0.00227
CLM#=0.2328 Vcl(ft/s)=221.7 9 Vavg(ft/s)=202.03
M(PPM)=82.900 S(%)=0.0 S(ind)=0.00 S(act)=0.00
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.899

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.69	10.87	10.79	0.039	0.033	0.003	0.056
2	0.00	0.000	-0.01	0.05	0.02	0.010	0.008	0.539	1.267
3	-8.00	-5.333	9.65	9.83	9.73	0.037	0.031	0.003	0.176
4	-8.00	-5.333	9.43	9.91	9.71	0.096	0.077	0.008	0.178
5	-5.00	-3.333	9.53	9.90	9.72	0.079	0.067	0.007	0.176
6	-5.00	-3.333	9.54	9.87	9.68	0.080	0.064	0.007	0.181
7	-2.50	-1.667	9.64	10.19	9.86	0.108	0.081	0.008	0.160
8	-2.50	-1.667	9.65	9.99	9.87	0.068	0.057	0.006	0.159
9	-1.00	-0.667	10.34	10.50	10.41	0.032	0.024	0.002	0.099
10	-1.00	-0.667	9.73	10.27	9.94	0.134	0.117	0.012	0.151
11	0.26	0.123	11.62	11.62	11.62	0.000	0.000	0.000	-0.037
12	0.24	0.113	10.65	11.31	10.96	0.130	0.107	0.010	0.037
13	0.55	0.259	11.62	11.62	11.62	0.000	0.000	0.000	-0.037
14	0.53	0.250	10.47	10.96	10.70	0.101	0.084	0.008	0.066
15	0.85	0.401	11.62	11.62	11.62	0.000	0.000	0.000	-0.037
16	0.81	0.382	10.49	11.02	10.72	0.112	0.091	0.009	0.064
17	1.15	0.542	11.43	11.62	11.59	0.046	0.036	0.003	-0.034
18	1.15	0.542	10.51	10.87	10.68	0.070	0.059	0.006	0.068
19	1.45	0.684	11.20	11.52	11.37	0.071	0.058	0.005	-0.010
20	1.44	0.676	10.50	10.89	10.72	0.090	0.078	0.007	0.064
21	1.79	0.844	11.00	11.38	11.19	0.090	0.078	0.007	0.011
22	1.74	0.820	10.43	10.89	10.68	0.092	0.074	0.007	0.069
23	2.07	0.976	10.84	11.40	11.09	0.113	0.092	0.008	0.022
24	2.02	0.950	10.42	11.02	10.74	0.131	0.110	0.010	0.062

15° Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP(F)=72.0 PRESSURE(mm Hg)=739 DENSITY(Lbs2/ft4)=0.00227
CLM#=0.2299 Vcl(ft/s)=218.97 Vavg(ft/s)=199.46
M(PPM)=81.845 S(%)=2.0 S(ind)=0.79 S(act)=0.82
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.674

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.38	10.54	10.45	0.030	0.024	0.002	0.050
2	0.00	0.000	-0.05	0.05	0.01	0.019	0.015	1.868	1.254
3	-8.00	-5.333	9.62	9.80	9.68	0.027	0.022	0.002	0.139
4	-8.00	-5.333	9.45	9.83	9.63	0.077	0.064	0.007	0.145
5	-5.00	-3.333	9.43	9.74	9.61	0.066	0.055	0.006	0.148
6	-5.00	-3.333	9.44	9.70	9.59	0.054	0.046	0.005	0.150
7	-2.50	-1.667	9.55	10.07	9.80	0.086	0.068	0.007	0.126
8	-2.50	-1.667	9.64	9.98	9.83	0.063	0.050	0.005	0.123
9	-1.00	-0.667	10.29	10.52	10.39	0.042	0.034	0.003	0.058
10	-1.00	-0.667	9.64	10.06	9.86	0.088	0.072	0.007	0.119
11	0.26	0.123	11.62	11.62	11.62	0.000	0.000	0.000	-0.084
12	0.24	0.113	9.78	10.67	10.16	0.193	0.165	0.016	0.084
13	0.55	0.259	11.25	11.62	11.55	0.075	0.061	0.005	-0.076
14	0.53	0.250	9.61	10.28	9.96	0.132	0.106	0.011	0.107
15	0.85	0.401	10.73	11.16	10.93	0.075	0.060	0.005	-0.005
16	0.81	0.382	9.62	10.36	9.97	0.147	0.118	0.012	0.106
17	1.15	0.542	10.16	10.67	10.44	0.097	0.079	0.008	0.052
18	1.15	0.542	9.48	10.27	9.79	0.144	0.103	0.011	0.127
19	1.45	0.684	9.96	10.33	10.13	0.067	0.052	0.005	0.088
20	1.44	0.676	9.37	9.97	9.60	0.100	0.083	0.009	0.148
21	1.79	0.844	9.80	10.19	9.98	0.074	0.059	0.006	0.105
22	1.74	0.820	9.33	9.73	9.53	0.077	0.062	0.006	0.157
23	2.07	0.976	9.62	10.10	9.88	0.092	0.075	0.008	0.116
24	2.02	0.950	9.37	9.89	9.60	0.097	0.077	0.008	0.149

20°Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP(F)=72.0 PRESSURE(mm Hg)=729 DENSITY(Lbs2/ft4)=0.00224
CLM#=0.2315 Vcl(ft/s)=220.54 Vavg(ft/s)=200.89
M(PPM)=81.318 S(%)=0.0 S(ind)=0.00 S(act)=0.00
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.681

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.36	10.52	10.44	0.029	0.022	0.002	0.063
2	0.00	0.000	0.06	0.16	0.11	0.014	0.012	0.110	1.254
3	-8.00	-5.333	9.54	9.63	9.59	0.019	0.015	0.002	0.162
4	-8.00	-5.333	9.38	9.73	9.53	0.075	0.061	0.006	0.169
5	-5.00	-3.333	9.39	9.56	9.47	0.031	0.025	0.003	0.175
6	-5.00	-3.333	9.46	9.70	9.60	0.052	0.044	0.005	0.160
7	-2.50	-1.667	9.61	9.89	9.75	0.073	0.064	0.007	0.144
8	-2.50	-1.667	9.57	9.78	9.68	0.044	0.036	0.004	0.151
9	-1.00	-0.667	9.83	9.92	9.87	0.018	0.015	0.002	0.129
10	-1.00	-0.667	9.89	10.21	10.06	0.077	0.065	0.007	0.107
11	0.26	0.123	10.15	10.64	10.37	0.104	0.083	0.008	0.072
12	0.24	0.113	11.62	11.62	11.62	0.000	0.000	0.000	-0.072
13	0.55	0.259	10.21	10.59	10.37	0.078	0.058	0.006	0.072
14	0.53	0.250	11.62	11.62	11.62	0.000	0.000	0.000	-0.072
15	0.85	0.401	10.17	10.52	10.33	0.066	0.054	0.005	0.076
16	0.81	0.382	11.62	11.62	11.62	0.000	0.000	0.000	-0.072
17	1.15	0.542	10.06	10.48	10.26	0.102	0.085	0.008	0.084
18	1.15	0.542	11.62	11.62	11.62	0.000	0.000	0.000	-0.072
19	1.45	0.684	10.03	10.45	10.23	0.099	0.081	0.008	0.088
20	1.44	0.676	11.16	11.62	11.36	0.109	0.086	0.008	-0.043
21	1.79	0.844	10.09	10.47	10.25	0.066	0.053	0.005	0.086
22	1.74	0.820	10.67	11.09	10.90	0.086	0.071	0.006	0.011
23	2.07	0.976	10.10	10.49	10.29	0.085	0.070	0.007	0.081
24	2.02	0.950	10.34	10.74	10.59	0.082	0.068	0.006	0.047

20°Diffuser: XGAP=0.1IN YGAP=0.0IN FENCE=0.0IN

TEMP(F)=72.8 PRESSURE(mm Hg)=739 DENSITY(Lbs2/ft4)=0.002264
CLM#=0.2309 Vcl(ft/s)=220.13 Vavg(ft/s)=200.52
M(PPM)=82.155 S(%)=2.0 S(ind)=0.80 S(act)=0.82
Points=800 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.754

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.58	10.75	10.67	0.031	0.025	0.002	-0.012
2	0.00	0.000	-0.06	0.07	0.00	0.022	0.017	3.579	1.206
3	8.00	-5.333	9.67	9.83	9.75	0.028	0.022	0.002	0.093
4	8.00	-5.333	9.45	9.81	9.63	0.066	0.053	0.006	0.106
5	5.00	-3.333	9.55	9.74	9.64	0.035	0.029	0.003	0.106
6	5.00	-3.333	9.64	9.81	9.71	0.033	0.027	0.003	0.098
7	2.50	-1.667	9.78	10.07	9.91	0.055	0.045	0.005	0.075
8	2.50	-1.667	9.75	10.00	9.88	0.049	0.040	0.004	0.079
9	1.00	-0.667	10.44	10.63	10.55	0.031	0.025	0.002	0.002
10	1.00	-0.667	9.80	10.07	9.94	0.050	0.039	0.004	0.072
11	0.26	0.123	11.62	11.62	11.62	0.000	0.000	0.000	-0.120
12	0.24	0.113	9.32	9.77	9.51	0.081	0.066	0.007	0.120
13	0.55	0.259	11.62	11.62	11.62	0.000	0.000	0.000	-0.120
14	0.53	0.250	9.11	9.57	9.35	0.087	0.073	0.008	0.139
15	0.85	0.401	11.06	11.50	11.23	0.072	0.056	0.005	-0.076
16	0.81	0.382	9.11	9.53	9.31	0.075	0.058	0.006	0.143
17	1.15	0.542	10.32	10.85	10.60	0.097	0.076	0.007	-0.004
18	1.15	0.542	9.15	9.47	9.31	0.049	0.039	0.004	0.143
19	1.45	0.684	10.05	10.33	10.18	0.047	0.038	0.004	0.044
20	1.44	0.676	9.19	9.47	9.35	0.050	0.041	0.004	0.139
21	1.79	0.844	9.63	10.10	9.86	0.083	0.065	0.007	0.081
22	1.74	0.820	9.20	9.50	9.36	0.069	0.060	0.006	0.138
23	2.07	0.976	9.49	9.94	9.72	0.091	0.074	0.008	0.097
24	2.02	0.950	9.24	9.61	9.44	0.061	0.046	0.005	0.128

45° Diffuser: XGAP=0.00IN Ygap=0.00DEG FENCE=0.0IN

TEMP(F)=73.0 PRESSURE(mm Hg)=734 DENSITY(Lbs2/ft4)=0.00225
CLM#=0.2302 Vcl(ft/s)=219.51 Vavg(ft/s)=199.95
M(PPM)=81.337 S(%)=0.0 S(ind)=0.00 S(act)=0.00
Points=1000 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.642

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.36	10.55	10.45	0.041	0.034	0.003	-0.019
2	0.00	0.000	-0.06	0.03	-0.02	0.014	0.011	-0.535	1.192
3	-8.00	-5.333	9.70	10.03	9.86	0.064	0.052	0.005	0.049
4	-8.00	-5.333	9.56	9.98	9.76	0.076	0.061	0.006	0.060
5	-5.00	-3.333	9.53	9.59	9.56	0.009	0.007	0.001	0.083
6	-5.00	-3.333	9.39	9.45	9.42	0.010	0.008	0.001	0.100
7	-2.50	-1.667	9.86	9.93	9.90	0.012	0.010	0.001	0.045
8	-2.50	-1.667	9.77	10.19	10.00	0.083	0.068	0.007	0.033
9	-1.00	-0.667	10.07	10.49	10.28	0.073	0.058	0.006	0.001
10	-1.00	-0.667	10.09	10.52	10.29	0.080	0.067	0.006	-0.001
11	0.26	0.123	10.67	10.85	10.77	0.036	0.029	0.003	-0.057
12	0.24	0.113	9.85	10.32	10.12	0.090	0.074	0.007	0.019
13	0.55	0.259	10.66	10.75	10.71	0.016	0.013	0.001	-0.049
14	0.53	0.250	10.33	10.39	10.36	0.009	0.007	0.001	-0.009
15	0.85	0.401	10.04	10.13	10.09	0.009	0.007	0.001	0.023
16	0.81	0.382	9.79	10.43	10.11	0.096	0.076	0.007	0.020
17	1.15	0.542	10.62	11.06	10.84	0.085	0.069	0.006	-0.064
18	1.15	0.542	10.04	10.16	10.10	0.025	0.021	0.002	0.021
19	1.45	0.684	10.69	10.88	10.81	0.038	0.032	0.003	-0.061
20	1.44	0.676	9.91	10.31	10.09	0.083	0.070	0.007	0.022
21	1.79	0.844	10.68	11.06	10.87	0.074	0.061	0.006	-0.068
22	1.74	0.820	10.28	10.34	10.31	0.010	0.008	0.001	-0.003
23	2.07	0.976	10.52	11.06	10.82	0.100	0.080	0.007	-0.063
24	2.02	0.950	9.86	10.43	10.13	0.091	0.073	0.007	0.018

45° Diffuser: Xgpa=0.00IN Ygap=0.00IN FENCE=0.0IN

TEMP(F)=72.5 PRESSURE(mm Hg)=734 DENSITY(Lbs2/ft4)= 0.00225
CLM#=0.2296 Vcl(ft/s)=218.79 Vavg(ft/s)=199.30
M(PPM)=81.148 S(%)=2.0 S(ind)=0.78 S(act)=0.81
Points=1000 P(" H2O)=-2.06381+ 1.36839*V HEADavg= 8.594

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	AVGDEV (%)	Cp
1	0.00	0.000	10.51	10.75	10.63	0.040	0.032	0.003	0.003
2	0.00	0.000	-0.08	0.05	-0.02	0.019	0.015	-0.629	1.243
3	-8.00	-5.333	10.03	10.38	10.22	0.060	0.048	0.005	0.051
4	-8.00	-5.333	9.93	10.47	10.16	0.080	0.064	0.006	0.058
5	-5.00	-3.333	10.02	10.11	10.06	0.016	0.013	0.001	0.069
6	-5.00	-3.333	9.95	10.05	10.00	0.015	0.013	0.001	0.077
7	-2.50	-1.667	10.24	10.35	10.30	0.017	0.013	0.001	0.042
8	-2.50	-1.667	10.12	10.66	10.36	0.080	0.064	0.006	0.035
9	-1.00	-0.667	10.57	10.95	10.76	0.069	0.056	0.005	-0.012
10	-1.00	-0.667	10.30	10.80	10.56	0.082	0.064	0.006	0.012
11	0.26	0.123	9.66	9.88	9.78	0.044	0.035	0.004	0.102
12	0.24	0.113	8.81	9.36	9.12	0.082	0.064	0.007	0.179
13	0.55	0.259	9.55	9.70	9.64	0.028	0.023	0.002	0.119
14	0.53	0.250	9.50	9.61	9.55	0.015	0.012	0.001	0.128
15	0.85	0.401	9.47	9.58	9.52	0.016	0.013	0.001	0.132
16	0.81	0.382	8.84	9.40	9.14	0.081	0.066	0.007	0.177
17	1.15	0.542	9.52	10.01	9.79	0.085	0.069	0.007	0.100
18	1.15	0.542	9.06	9.21	9.13	0.023	0.019	0.002	0.177
19	1.45	0.684	9.70	9.88	9.78	0.031	0.025	0.003	0.102
20	1.44	0.676	8.77	9.34	9.10	0.085	0.067	0.007	0.181
21	1.79	0.844	9.58	9.95	9.78	0.062	0.050	0.005	0.102
22	1.74	0.820	9.28	9.42	9.36	0.018	0.015	0.002	0.151
23	2.07	0.976	9.53	10.01	9.79	0.077	0.062	0.006	0.101
24	2.02	0.950	8.89	9.41	9.16	0.089	0.070	0.008	0.174

APPENDIX F

PRESSURE RECOVERY PERFORMANCE DATA

FOR THE 10° DIFFUSER WALLS

FOR 5 DIFFUSER GEOMETRIES

Legend For Sampled Data

Temp	Temperature in Fahrenheit
Pressure	Atmospheric Pressure in mm Hg
Density	Density of air ($Lb\ s^2/ft^4$)
CLM#	Approach Flow Center Line Mach Number
Vcl	Approach Flow Center Line Velocity (ft/s)
Vavg	Approach Flow Average Velocity (ft/s)
M	Mass Flow Through The Diffuser (PPM)
S	Bleed Rate in Percent, Indicated, or Actual PPM
PTS	The Number of Points Averaged Per Tap and Over How Much Time
P("H2O)	Pressure Transducer Calibration Used For Data
Tap#	Number of the Pressure Tap Sampled (See Figure 4)
Axial Loc	Axial Location of a Pressure Tap in inches
L/D	Axial location of the Pressure Tap, Negative Number of Diameters For Upstream Taps, Positive Number of Diameters For Downstream Taps
Min,Max	Minimum and Maximum Pressures Sampled at This Tap
Avg	The Average of All the Data Points Taken at This Pressure Tap
Avgdev	Average Data Deviation : $1/n \sum_{i=1}^{n} \text{absolute}(\text{Data-Avg})$
Rmsdev	RMS Data Deviation: : $\sqrt{\sum(\text{Data-Avg})^2/n}$
Cp	Pressure Recovery Coefficient at Tap#

$$\frac{P_{static}(\text{throat}) - P_{static}(\text{Tap }\#)}{1/2\ \rho\ \overline{v}^{\,2}}$$

BASELINE 10 DEGREE DIFFUSER DATA WITH NO SLOT OR SUCTION

TEMP(F)= 82.5 Density(Lbs2/ft4)=0.002178 P(mm Hg) = 728
CLmach#=0.1997 Vc.l.(ft/s) = 227.943 Vavg(ft/s)=208.56
M(LB/m)= 82.22 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/3.02s P("H2O)=-2.03419+1.49391*V HEADavg = 9.106

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	8.15	8.63	8.35	0.109	0.092	0.000
2	0.00	0.000	1.39	2.32	1.86	0.236	0.206	0.000
3	-8.00	-5.333	10.15	10.71	10.43	0.093	0.074	0.043
5	-5.00	-3.333	10.02	10.57	10.34	0.100	0.080	0.052
7	-2.50	-1.667	10.20	10.76	10.51	0.101	0.081	0.033
9	-1.00	-0.667	10.07	10.99	10.61	0.184	0.148	0.022
11	0.43	0.140	8.16	9.77	8.80	0.355	0.298	0.222
13	0.85	0.280	8.24	9.19	8.60	0.166	0.135	0.243
15	1.28	0.420	7.94	9.18	8.42	0.210	0.163	0.263
17	1.71	0.560	7.89	8.92	8.26	0.170	0.139	0.280
19	2.13	0.700	8.56	8.66	8.61	0.014	0.012	0.242
21	2.56	0.840	8.33	8.42	8.38	0.014	0.011	0.268
23	2.98	0.980	7.90	8.79	8.22	0.155	0.121	0.285
4	-8.00	-5.333	10.30	10.42	10.35	0.015	0.012	0.050
6	-5.00	-3.333	10.22	10.50	10.40	0.053	0.043	0.046
8	-2.50	-1.667	10.31	10.94	10.63	0.131	0.106	0.020
10	-1.00	-0.667	10.48	11.43	11.02	0.220	0.179	-0.022
12	0.43	0.140	10.35	11.20	10.83	0.145	0.120	-0.001
14	0.85	0.280	9.38	10.43	9.96	0.171	0.130	0.094
16	1.28	0.420	8.80	9.53	9.15	0.131	0.104	0.183
18	1.71	0.560	8.53	9.04	8.78	0.094	0.075	0.224
20	2.13	0.700	8.11	8.91	8.50	0.113	0.085	0.254
22	2.56	0.840	7.96	8.62	8.35	0.096	0.078	0.271
24	2.98	0.980	7.90	8.55	8.19	0.108	0.086	0.288

UPSTREAM PITOT STATIC PROBE DATA FOR BASE 10 DEGREE DIFFUSER
PIT60U.DAT X=0.00IN Y=0.00IN F=0.00IN
TEMP(F)= 83.0 Density(Lbs2/ft4)=0.002176 P(mm Hg) = 728
CLmach#=0.1991 Vc.l.(ft/s) = 227.393 Vavg(ft/s)=206.93
M(LB/m)= 81.50 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS	STAGNATION PORT MIN/MAX (" H2O)		STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
-1.0	-0.7	10.7	11.2	11.0	0.09	4.3	4.5	4.4	0.04	6.61	177.72
-1.0	-0.6	10.8	11.3	11.0	0.12	2.9	3.3	3.1	0.08	7.95	194.98
-1.0	-0.5	10.7	11.2	11.0	0.11	1.8	2.0	1.9	0.03	9.10	208.59
-1.0	-0.4	10.8	11.3	11.1	0.10	0.9	1.1	1.0	0.05	10.03	219.04
-1.0	-0.3	10.7	11.3	11.0	0.12	0.6	0.7	0.6	0.03	10.37	222.67
-1.0	-0.2	10.7	11.4	11.1	0.14	0.2	0.4	0.3	0.05	10.81	227.29
-1.0	-0.1	10.8	11.2	11.0	0.08	0.0	0.2	0.1	0.02	10.92	228.51
-1.0	0.0	10.8	11.3	11.0	0.10	-0.1	0.1	0.0	0.03	11.03	229.65
-1.0	0.1	10.6	11.4	11.0	0.18	0.0	0.1	0.0	0.02	10.98	229.16
-1.0	0.2	10.5	11.4	10.9	0.21	-0.1	0.0	-0.0	0.02	10.93	228.55
-1.0	0.3	10.5	11.4	11.0	0.21	0.1	0.3	0.2	0.04	10.83	227.57
-1.0	0.4	10.5	11.3	10.8	0.19	0.2	0.5	0.3	0.05	10.55	224.61
-1.0	0.5	10.5	11.1	10.9	0.13	1.1	1.3	1.2	0.03	9.70	215.36
-1.0	0.6	10.3	11.0	10.8	0.14	2.5	2.8	2.6	0.06	8.14	197.29
-1.0	0.7	10.3	10.9	10.7	0.11	3.9	4.1	4.0	0.03	6.70	178.97

UPSTREAM HOT WIRE DATA (V3:HW60U.TEXT)
X=0.00in Y=0.00in F=0.00in S=0.0% BASE GEOMETRY
CALIBRATION USED : A=0.5193 B=6.1802 n=0.320
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
-1.0	-0.7	129	226	180.0	12.5	15.44	12.2	15.08	8.58	8.38
-1.0	-0.6	151	233	201.7	11.4	13.95	10.5	12.89	6.92	6.39
-1.0	-0.5	160	236	214.3	10.2	12.49	9.9	12.42	5.83	5.79
-1.0	-0.4	168	238	218.9	8.6	11.46	14.1	16.94	5.23	7.74
-1.0	-0.3	164	236	223.1	5.8	8.59	2.8	4.24	3.85	1.90
-1.0	-0.2	179	236	224.9	3.5	5.45	3.1	3.90	2.42	1.73
-1.0	-0.1	191	239	226.2	2.7	3.73	2.5	3.11	1.65	1.37
-1.0	0.0	203	236	226.0	2.3	3.05	2.8	3.69	1.35	1.63
-1.0	0.1	199	236	226.0	2.6	3.45	1.8	2.58	1.53	1.14
-1.0	0.2	179	240	224.3	3.3	4.92	2.5	3.13	2.19	1.39
-1.0	0.3	168	239	223.8	4.2	6.76	3.8	5.92	3.02	2.65
-1.0	0.4	154	236	217.5	8.5	11.30	6.1	7.95	5.20	3.65
-1.0	0.5	123	232	201.2	14.3	17.59	11.0	13.84	8.74	6.88
-1.0	0.6	123	222	176.8	13.5	16.70	12.3	14.96	9.45	8.46
-1.0	0.7	111	222	172.3	13.1	16.26	13.2	16.35	9.44	9.49

THROAT PITOT STATIC PROBE DATA FOR BASE 10 DEGREE BASE

PIT60T.DAT X=0.00IN Y=0.00IN F=0.00IN
TEMP(F)= 82.0 Density(Lbs2/ft4)=0.002180 P(mm Hg) = 728
CLmach#=0.1992 Vc.l.(ft/s) = 227.253 Vavg(ft/s)=207.93
M(LB/m)= 82.05 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY HEAD (FT/S)
0.0	-0.7	11.7	11.8	11.7	0.00	5.1	5.3	5.2	0.04	6.55	176.75
0.0	-0.6	11.7	11.8	11.7	0.00	3.2	3.4	3.3	0.07	8.45	200.77
0.0	-0.5	11.7	11.8	11.7	0.01	1.7	2.1	1.8	0.10	9.90	217.34
0.0	-0.4	11.1	11.8	11.5	0.16	1.2	1.5	1.3	0.08	10.21	220.72
0.0	-0.3	11.1	11.6	11.3	0.10	0.6	0.8	0.7	0.06	10.66	225.57
0.0	-0.2	10.8	11.5	11.2	0.15	0.1	0.3	0.2	0.05	10.96	228.69
0.0	-0.1	10.6	11.2	11.0	0.14	0.0	0.1	0.1	0.02	10.92	228.26
0.0	0.0	10.6	11.3	11.0	0.17	0.0	0.1	0.0	0.02	10.94	228.50
0.0	0.1	10.2	11.0	10.6	0.16	-0.1	0.0	-0.0	0.02	10.61	225.03
0.0	0.2	10.1	11.1	10.7	0.21	0.1	0.3	0.2	0.03	10.58	224.74
0.0	0.3	10.1	11.0	10.6	0.18	0.0	0.2	0.1	0.02	10.51	223.95
0.0	0.4	9.8	11.1	10.6	0.31	0.4	0.6	0.5	0.03	10.13	219.88
0.0	0.5	9.9	11.2	10.6	0.29	1.2	1.5	1.4	0.07	9.26	210.21
0.0	0.6	9.6	11.7	10.7	0.51	2.6	2.8	2.7	0.05	8.02	195.59
0.0	0.7	9.8	11.8	11.1	0.64	5.0	5.2	5.1	0.04	6.01	169.35

THROAT HOT WIRE DATA (V3:HW60T.TEXT)
X=0.00IN Y=0.00IN F=0.00IN S=0.00% BASE GEOMETRY
CALIBRATION USED : A=0.5193 B=6.1802 n=0.320
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
0.0	-0.5	154	242	210.4	13.7	16.29	9.9	12.22	7.74	5.81
0.0	-0.4	168	234	220.5	3.6	5.43	3.4	4.67	2.46	2.12
0.0	-0.3	179	234	220.1	3.7	5.23	2.1	2.84	2.38	1.29
0.0	-0.2	189	231	220.2	2.5	3.40	2.5	3.93	1.55	1.78
0.0	-0.1	173	241	223.5	2.5	3.47	2.7	3.82	1.56	1.71
0.0	0.0	197	232	220.2	2.7	3.55	2.9	3.72	1.61	1.69
0.0	0.1	182	230	218.2	3.1	4.69	2.4	3.31	2.15	1.52
0.0	0.2	154	233	217.6	4.7	7.23	7.0	9.27	3.32	4.26
0.0	0.3	140	234	211.9	9.9	13.54	6.8	9.16	6.39	4.32
0.0	0.4	131	236	207.7	13.2	16.76	4.6	6.22	8.07	2.99
0.0	0.5	106	232	193.3	16.5	20.26	11.8	14.55	10.48	7.53
0.0	0.6	88	231	179.7	17.9	22.45	18.0	22.53	12.50	12.54
0.0	0.7	34	203	139.1	18.3	23.56	19.1	24.31	16.93	17.48

EXIT PITOT STATIC PROBE DATA FOR BASE 10 DEGREE DIFFUSER
PIT60E.DAT X=0.00IN Y=0.00IN F=0.00IN
TEMP(F)= 82.5 Density(Lbs2/ft4)=0.002178 P(mm Hg) = 728
CLmach#=0.2003 Vc.l.(ft/s) = 228.661 Vavg(ft/s)=209.21
M(LB/m)= 82.48 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.0	-1.3	8.1	8.3	8.1	0.04	6.6	6.8	6.7	0.02	1.48	84.11
3.0	-1.2	8.0	8.6	8.2	0.11	4.7	5.0	4.8	0.07	3.40	127.49
3.0	-1.1	8.1	8.5	8.3	0.07	3.5	3.7	3.6	0.06	4.67	149.36
3.0	-1.0	8.1	8.4	8.2	0.05	2.4	2.7	2.5	0.06	5.69	164.80
3.0	-0.9	8.1	8.6	8.4	0.10	1.6	2.2	1.8	0.16	6.58	177.29
3.0	-0.8	8.2	8.5	8.3	0.05	1.2	1.4	1.3	0.04	7.01	182.95
3.0	-0.7	8.1	8.5	8.3	0.08	0.8	1.0	0.9	0.03	7.35	187.43
3.0	-0.6	8.2	8.5	8.3	0.04	0.6	1.0	0.8	0.11	7.49	189.11
3.0	-0.5	8.1	8.4	8.2	0.04	0.3	0.6	0.4	0.05	7.83	193.37
3.0	-0.4	8.2	8.6	8.4	0.07	0.5	0.9	0.7	0.08	7.64	191.07
3.0	-0.3	8.1	8.4	8.2	0.07	0.4	0.7	0.5	0.06	7.72	192.04
3.0	-0.2	8.0	8.5	8.3	0.08	0.6	0.9	0.7	0.05	7.53	189.61
3.0	-0.1	8.0	8.5	8.2	0.09	1.2	1.7	1.5	0.13	6.73	179.31
3.0	0.0	8.2	8.6	8.3	0.08	1.6	2.1	1.8	0.13	6.50	176.23
3.0	0.1	8.0	8.5	8.2	0.11	2.1	3.2	2.5	0.29	5.68	164.77
3.0	0.2	8.1	8.6	8.3	0.10	2.4	2.9	2.6	0.12	5.67	164.63
3.0	0.3	8.0	8.5	8.2	0.08	2.8	3.5	3.2	0.20	5.05	155.28
3.0	0.4	8.0	8.5	8.2	0.09	4.8	5.2	5.0	0.09	3.28	125.17
3.0	0.5	8.1	8.6	8.3	0.11	5.3	6.0	5.6	0.15	2.62	111.84
3.0	0.6	8.0	8.4	8.2	0.10	6.0	6.8	6.5	0.19	1.68	89.53
3.0	0.7	8.0	8.5	8.2	0.08	6.7	7.2	6.9	0.12	1.36	80.52
3.0	0.8	7.9	8.3	8.2	0.08	7.4	7.6	7.5	0.04	0.65	55.60
3.0	0.9	8.0	8.3	8.1	0.06	7.9	8.1	8.0	0.04	0.16	27.60
3.0	1.0	8.0	8.3	8.1	0.06	8.0	8.2	8.1	0.03	0.04	13.84
3.0	1.1	7.9	8.5	8.1	0.10	8.1	8.3	8.2	0.03	-0.10	-21.70
3.0	1.2	8.0	8.4	8.1	0.08	8.1	8.3	8.2	0.02	-0.08	-18.93
3.0	1.3	8.0	8.3	8.1	0.07	8.1	8.3	8.2	0.02	-0.06	-16.85

EXIT HOT WIRE DATA (V3:HW60E.TEXT)
X=0.00IN Y=0.00IN F=0.00IN S=0.00% BASE GEMOTRY
CALIBRATION USED : A=0.5193 B=6.1802 n=0.320
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
3.0	-1.1	78	216	167.7	16.0	19.59	18.5	23.01	11.68	13.71
3.0	-1.0	113	222	175.2	13.9	16.68	17.1	20.70	9.52	11.82
3.0	-0.9	105	231	182.2	12.0	15.19	17.8	21.55	8.34	11.83
3.0	-0.8	81	231	189.1	8.9	11.96	9.2	13.19	6.33	6.98
3.0	-0.7	95	233	192.0	7.2	10.23	8.7	11.19	5.33	5.83
3.0	-0.6	46	236	192.9	7.3	12.16	5.1	6.73	6.30	3.49
3.0	-0.5	62	231	194.1	6.2	9.98	8.0	11.61	5.14	5.98
3.0	-0.4	33	235	191.3	10.0	18.58	4.6	7.03	9.71	3.67
3.0	-0.3	33	231	190.2	11.0	19.57	3.4	4.30	10.29	2.26
3.0	-0.2	19	223	183.5	17.2	28.18	5.1	7.69	15.36	4.19
3.0	-0.1	12	231	162.4	37.1	46.24	33.2	48.59	28.48	29.93
3.0	0.0	15	231	162.5	39.9	48.67	20.2	31.83	29.95	19.58
3.0	0.1	12	242	161.8	38.2	47.17	9.5	21.59	29.15	13.35
3.0	0.2	10	231	154.7	41.7	50.27	66.0	77.41	32.49	50.04
3.0	0.3	9	225	127.9	48.5	55.35	49.3	63.31	43.26	49.48
3.0	0.4	11	211	125.5	40.8	48.30	62.5	73.12	38.48	58.26
3.0	0.5	8	218	96.7	46.3	52.91	49.0	57.53	54.74	59.52
3.0	0.6	7	207	91.4	40.8	47.27	33.4	42.11	51.73	46.08
3.0	0.7	7	204	58.3	30.5	38.01	33.3	39.43	65.15	67.58
3.0	0.8	7	176	44.0	18.4	25.30	16.5	21.10	57.52	47.97
3.0	0.9	7	194	41.9	17.0	23.26	14.8	18.62	55.51	44.44
3.0	1.0	7	154	37.5	12.3	17.00	8.9	11.69	45.34	31.19
3.0	1.1	6	137	33.5	9.8	12.79	9.7	12.22	38.23	36.53
3.0	1.2	7	132	37.2	11.2	13.81	10.3	12.92	37.15	34.75
3.0	1.3	6	140	36.9	11.7	14.61	11.1	14.27	39.62	38.69

GEOMETRY #1 : X=0.10IN Y=0.05IN F=0.00IN PROBE(-1.00,0.00)

TEMP(F)= 77.5 DENSITY(Lbs2/ft4)=0.002198 P(mmHg) = 728
C.L.M#=0.1995 Vc.l.(ft/s)=226.67 Vavg(ft/s)=205.59
M(LB/m)=81.80 S(%)=0.0 S(ind)=0.00 S(act) = 0.00
PTS=3000/3.02 P("H2O)=-2.03419+1.49391*V HEADavg= 8.931

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	10.90	11.20	11.04	0.063	0.053	0.000
2	0.00	0.000	-0.04	0.16	0.07	0.044	0.038	0.000
3	-8.00	-5.333	10.22	10.64	10.44	0.091	0.079	0.046
5	-5.00	-3.333	10.15	10.53	10.37	0.071	0.057	0.054
7	-2.50	-1.667	10.38	10.98	10.64	0.107	0.086	0.023
9	-1.00	-0.667	10.82	11.21	11.02	0.067	0.055	-0.019
11	0.43	0.140	10.67	11.68	11.16	0.175	0.142	-0.035
13	0.85	0.280	10.05	10.73	10.38	0.101	0.079	0.053
15	1.28	0.420	9.58	10.22	9.90	0.105	0.084	0.106
17	1.71	0.560	9.43	9.90	9.68	0.071	0.055	0.131
19	2.13	0.700	9.09	9.21	9.15	0.015	0.012	0.191
21	2.56	0.840	9.00	9.11	9.06	0.014	0.011	0.201
23	2.98	0.980	8.99	9.44	9.25	0.070	0.055	0.179
4	-8.00	-5.333	10.17	10.65	10.41	0.092	0.077	0.050
6	-5.00	-3.333	10.25	10.52	10.40	0.052	0.042	0.050
8	-2.50	-1.667	10.39	10.71	10.54	0.062	0.052	0.034
10	-1.00	-0.667	10.30	10.94	10.68	0.103	0.082	0.019
12	0.43	0.140	11.07	11.19	11.13	0.014	0.012	-0.031
14	0.85	0.280	9.11	9.83	9.44	0.118	0.092	0.158
16	1.28	0.420	9.80	9.90	9.84	0.015	0.012	0.112
18	1.71	0.560	9.01	9.53	9.25	0.094	0.076	0.179
20	2.13	0.700	8.90	9.61	9.20	0.114	0.092	0.184
22	2.56	0.840	8.83	9.48	9.17	0.099	0.079	0.188
24	2.98	0.980	8.99	9.67	9.25	0.104	0.083	0.179

UPSTREAM PITOT STATIC PROBE DATA FOR GEOMETRY # 1
PIT10U.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 78.0 DENSITY(Lbs2/ft4)=0.002202 P(mm Hg) = 730
CLMach#=0.2002 Vcenterline(ft/s)= 227.64 Vavg(ft/s)=207.156
M(LB/m)=82.578 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/2.03s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY HEAD (FT/S)
-1.0	-0.7	10.8	11.2	11.0	0.08	4.3	4.7	4.5	0.11	6.50	175.28
-1.0	-0.6	10.7	11.0	10.8	0.08	4.0	4.4	4.2	0.10	6.65	177.22
-1.0	-0.5	10.6	11.0	10.8	0.06	2.2	2.4	2.3	0.04	8.50	200.37
-1.0	-0.4	10.7	11.0	10.8	0.07	1.3	1.6	1.4	0.05	9.47	211.54
-1.0	-0.3	10.8	11.0	10.9	0.05	0.5	0.8	0.7	0.06	10.24	219.89
-1.0	-0.2	10.8	11.2	11.0	0.09	0.1	0.3	0.2	0.05	10.80	225.87
-1.0	-0.1	10.8	11.2	11.0	0.09	0.1	0.2	0.1	0.02	10.87	226.63
-1.0	0.0	10.9	11.3	11.1	0.08	0.0	0.1	0.1	0.02	11.02	228.17
-1.0	0.1	11.0	11.3	11.1	0.05	0.0	0.1	0.0	0.02	11.09	228.86
-1.0	0.2	11.1	11.4	11.2	0.05	0.0	0.1	0.0	0.02	11.19	229.94
-1.0	0.3	11.1	11.4	11.3	0.06	0.0	0.1	0.1	0.03	11.19	229.89
-1.0	0.4	11.1	11.4	11.3	0.05	0.2	0.5	0.3	0.05	10.93	227.23
-1.0	0.5	11.2	11.5	11.3	0.05	0.9	1.1	1.0	0.04	10.35	221.16
-1.0	0.6	11.2	11.6	11.4	0.06	2.7	3.0	2.8	0.05	8.57	201.18
-1.0	0.7	11.2	11.5	11.4	0.06	4.3	4.6	4.4	0.07	6.97	181.47

V3:HW10U.TEXT X=0.00IN Y=0.00IN F=0.00IN S=0.00%
CALIBRATION USED : A=1.7834 B=5.2847 n=0.340
AVERAGING 2500 POINTS OVER 0.05 SECONDS
CH1 UNCONDITIONED X 1 CH2 WAS D.C. STRIPPED X 8

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
-1.0	-0.6	108	215	174.4	12.8	15.88	13.0	16.30	9.10	9.35
-1.0	-0.5	124	225	201.6	9.7	12.00	11.1	13.96	5.95	6.92
-1.0	-0.4	112	230	213.0	5.4	7.67	5.7	7.86	3.60	3.69
-1.0	-0.3	129	225	218.0	1.5	2.83	1.5	2.05	1.30	0.94
-1.0	-0.2	136	230	219.6	2.2	3.52	2.6	3.45	1.60	1.57
-1.0	-0.1	132	229	219.4	1.8	3.11	2.2	3.32	1.42	1.51
-1.0	0.0	130	233	219.6	2.4	4.03	1.8	2.36	1.83	1.08
-1.0	0.1	136	230	221.3	2.5	3.80	1.3	1.99	1.72	0.90
-1.0	0.2	135	229	222.4	2.5	3.50	1.3	1.83	1.57	0.82
-1.0	0.3	136	234	222.4	3.1	4.74	2.9	4.26	2.13	1.92
-1.0	0.4	135	231	219.2	5.1	7.32	1.3	1.99	3.34	0.91
-1.0	0.5	132	233	216.2	7.6	10.24	8.5	10.49	4.73	4.85
-1.0	0.6	112	230	201.1	11.3	13.96	10.5	13.00	6.94	6.46
-1.0	0.7	103	209	158.5	12.2	14.98	14.3	17.48	9.45	11.03

THROAT PITOT STATIC PROBE DATA FOR GEOMETRY #1
PIT10T.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 77.0 DENSITY(Lbs2/ft4)=0.002200 P(mm Hg) = 728
CLMach#=0.1996 Vcenterline(ft/s)= 226.75 Vavg(ft/s)=205.656
M(LB/m)=81.907 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN (" H2O)	STAGNATION PORT MAX (" H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY HEAD (FT/S)
0.0	-0.7	9.6	10.0	9.8	0.06	5.4	5.6	5.5	0.03	4.31	142.74
0.0	-0.6	9.8	10.1	9.9	0.04	3.4	3.7	3.5	0.09	6.44	174.49
0.0	-0.5	9.9	10.2	10.0	0.07	2.1	2.5	2.3	0.10	7.72	191.08
0.0	-0.4	10.0	10.3	10.1	0.07	1.4	1.6	1.5	0.04	8.62	201.85
0.0	-0.3	10.2	10.5	10.3	0.06	0.7	0.9	0.8	0.03	9.49	211.78
0.0	-0.2	10.3	10.5	10.4	0.03	0.6	1.0	0.8	0.11	9.57	212.75
0.0	-0.1	10.4	10.7	10.5	0.07	0.0	0.2	0.1	0.02	10.43	222.06
0.0	0.0	10.6	11.0	10.8	0.07	0.0	0.1	0.0	0.02	10.77	225.65
0.0	0.1	10.8	11.0	10.9	0.05	0.0	0.2	0.1	0.03	10.81	226.04
0.0	0.2	10.9	11.2	11.0	0.05	0.0	0.2	0.1	0.02	10.97	227.79
0.0	0.3	11.1	11.4	11.2	0.07	0.1	0.3	0.2	0.03	11.04	228.46
0.0	0.4	11.5	11.7	11.6	0.05	0.2	0.3	0.2	0.03	11.34	231.51
0.0	0.5	11.6	11.7	11.7	0.02	1.1	1.4	1.3	0.09	10.43	222.11
0.0	0.6	11.7	11.7	11.7	0.00	2.8	2.9	2.9	0.03	8.86	204.64
0.0	0.7	11.7	11.7	11.7	0.00	5.8	5.9	5.8	0.02	5.89	166.82

V3:HW10T.TEXT X=0.10IN Y=0.05IN FENCE=0.00IN S=0%
CALIBRATION USED : A=1.7834 B=5.2847 n=0.340
AVERAGING 4000 POINTS OVER 0.10 SECONDS
CH1 WAS UNCONDITIONED X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
0.0	-0.7	87	206	143.3	14.8	18.25	15.8	19.40	12.74	13.54
0.0	-0.6	123	229	182.6	16.5	20.25	12.6	15.33	11.09	8.40
0.0	-0.5	149	229	201.1	11.0	13.59	10.7	13.29	6.76	6.61
0.0	-0.4	150	230	203.6	11.9	14.50	12.0	14.96	7.12	7.35
0.0	-0.3	166	230	216.1	4.9	7.45	5.0	7.23	3.45	3.35
0.0	-0.2	188	233	221.2	2.4	3.57	4.2	6.02	1.61	2.72
0.0	-0.1	201	236	223.7	2.4	2.76	2.5	3.72	1.26	1.19
0.0	0.1	200	237	227.1	1.7	2.32	2.2	3.07	1.02	1.35
0.0	0.2	201	237	228.39	1.5	2.16	1.7	2.33	0.95	1.02
0.0	0.3	204	239	229.9	1.9	2.70	2.4	3.19	1.18	1.39
0.0	0.4	187	242	229.4	4.76	6.90	4.7	6.96	3.01	3.03
0.0	0.5	161	249	220.6	12.3	14.87	12.1	15.13	6.74	6.86
0.0	0.6	166	247	206.5	11.7	14.35	14.8	17.85	6.95	8.64
0.0	0.7	145	240	190.4	11.4	14.19	11.0	13.30	7.45	6.99

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #1

PIT10E.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 77.0 DENSITY(Lbs2/ft4)=0.002200 P(mm Hg) = 728
CLMach#=0.2002 Vcenterline(ft/s)= 227.39 Vavg(ft/s)=206.244
M(LB/m)=82.142 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN (" H2O)	STAGNATION PORT MAX (" H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	8.9	9.2	9.1	0.05	9.2	9.3	9.3	0.02	-0.19	-29.86
3.1	-1.2	8.9	9.3	9.1	0.07	9.1	9.3	9.2	0.02	-0.11	-22.60
3.1	-1.1	9.0	9.3	9.1	0.05	9.1	9.2	9.2	0.02	-0.06	-16.49
3.1	-1.0	8.9	9.3	9.1	0.05	9.1	9.3	9.2	0.02	-0.11	-22.94
3.1	-0.9	9.0	9.3	9.1	0.05	9.1	9.3	9.2	0.02	-0.06	-17.42
3.1	-0.8	9.0	9.3	9.2	0.04	9.1	9.2	9.1	0.02	0.01	5.07
3.1	-0.7	9.0	9.3	9.2	0.05	9.0	9.1	9.0	0.02	0.12	23.80
3.1	-0.6	9.1	9.5	9.3	0.07	8.7	8.8	8.8	0.02	0.52	49.66
3.1	-0.5	9.1	9.4	9.3	0.05	8.2	8.4	8.3	0.03	0.97	67.66
3.1	-0.4	9.2	9.5	9.3	0.06	7.3	7.5	7.4	0.03	1.96	96.25
3.1	-0.3	9.2	9.5	9.3	0.06	6.0	6.2	6.1	0.06	3.17	122.45
3.1	-0.2	9.2	9.4	9.3	0.04	5.0	5.3	5.2	0.06	4.13	139.78
3.1	-0.1	9.1	9.4	9.3	0.05	3.5	3.9	3.7	0.06	5.57	162.33
3.1	0.0	9.0	9.5	9.3	0.09	2.2	2.7	2.4	0.10	6.90	180.59
3.1	0.1	9.0	9.4	9.2	0.08	1.6	1.9	1.7	0.06	7.48	188.04
3.1	0.2	9.1	9.4	9.2	0.05	0.9	1.2	1.1	0.06	8.14	196.18
3.1	0.3	9.2	9.5	9.3	0.06	0.5	0.8	0.6	0.06	8.66	202.38
3.1	0.4	8.4	8.7	8.5	0.05	0.2	0.3	0.3	0.02	8.25	197.48
3.1	0.5	8.5	8.7	8.6	0.04	0.2	0.4	0.3	0.02	8.27	197.75
3.1	0.6	8.3	8.5	8.4	0.03	0.2	0.3	0.3	0.02	8.14	196.18
3.1	0.7	8.5	8.7	8.6	0.04	0.4	0.6	0.5	0.04	8.12	195.91
3.1	0.8	8.2	8.5	8.4	0.04	0.2	0.4	0.3	0.02	8.11	195.78
3.1	0.9	8.4	8.6	8.5	0.04	0.4	0.5	0.4	0.02	8.03	194.85
3.1	1.0	8.3	8.6	8.4	0.04	0.8	1.2	1.0	0.10	7.48	188.08
3.1	1.1	8.4	8.6	8.5	0.04	1.6	1.9	1.7	0.06	6.78	179.02
3.1	1.2	8.3	8.5	8.4	0.04	3.6	3.8	3.7	0.04	4.73	33.53
3.1	1.3	8.3	8.6	8.4	0.04	5.4	5.6	5.5	0.03	2.95	26.46

V3:HW10E.TEXT X=0.10IN Y=0.05IN FENCE=0.00 S=0%
CALIBRATION USED : A=1.7834 B=5.2847 n=0.340
AVERAGING 4000 POINTS OVER 0.10 SECONDS
CH1 SIGNAL X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X	Y	MIN	MAX	AVG	MEAN1	RMS1	MEAN2	RMS2	RMS1	RMS2
(in)	(in)	FT/S		FT/S	FT/S	FT/S	FT/S	FT/S	(%)	(%)
3.1	-1.3	7	59	30.2	5.8	7.67	6.3	8.76	25.39	28.99
3.1	-1.2	13	59	33.3	6.7	8.13	7.1	8.81	24.38	26.42
3.1	-1.1	6	67	29.2	6.7	8.53	5.5	7.13	29.23	24.42
3.1	-1.0	5	137	26.9	8.6	11.74	7.9	9.78	43.57	36.29
3.1	-0.9	6	74	26.4	7.1	9.27	8.2	10.42	35.07	39.43
3.1	-0.8	6	139	31.2	12.1	16.47	12.5	15.74	52.82	50.50
3.1	-0.7	5	147	31.0	13.3	18.07	16.3	20.08	58.20	64.67
3.1	-0.6	6	147	37.4	16.9	22.57	17.0	20.96	60.36	56.05
3.1	-0.5	9	191	72.6	27.9	33.92	30.7	37.20	46.74	51.26
3.1	-0.4	12	192	85.3	29.3	34.97	32.9	40.90	40.99	47.93
3.1	-0.3	23	225	120.1	32.3	39.02	39.4	48.84	32.48	40.65
3.1	-0.2	25	214	134.9	29.3	35.61	35.4	44.53	26.40	33.02
3.1	-0.1	24	241	152.0	30.1	36.71	27.6	36.51	24.15	24.02
3.1	0.0	70	225	182.4	16.4	20.42	8.1	11.03	11.19	6.04
3.1	0.1	57	232	185.7	18.1	22.89	6.8	9.16	12.32	4.93
3.1	0.2	70	234	189.2	19.0	25.00	23.1	33.88	13.22	17.91
3.1	0.3	155	236	206.1	5.7	7.85	5.3	6.82	3.81	3.31
3.1	0.4	171	214	200.0	3.2	4.26	3.5	4.86	2.13	2.43
3.1	0.5	165	215	198.7	4.0	5.18	3.2	3.89	2.61	1.96
3.1	0.6	174	209	198.6	2.7	3.32	2.4	3.05	1.67	1.53
3.1	0.7	176	211	198.5	2.7	3.40	2.8	3.40	1.71	1.71
3.1	0.8	147	216	197.3	6.2	9.04	4.1	5.89	4.58	2.98
3.1	0.9	148	210	195.0	5.4	7.18	8.7	10.85	3.68	5.56
3.1	1.0	125	209	184.7	12.4	14.52	3.3	4.41	7.86	2.39
3.1	1.1	124	209	173.2	11.8	14.31	11.9	14.87	8.27	8.59
3.1	1.2	89	202	157.0	14.1	17.81	15.4	19.39	11.35	12.36
3.1	1.3	62	176	112.0	14.9	18.46	14.6	18.20	16.48	16.25

GEOMETRY #1 : X=0.10IN Y=0.05IN F=0.00IN   PROBE(-1.00,0.00)

TEMP(F)= 81.0 DENSITY(Lbs2/ft4)=0.002196 P(mmHg) = 732
C.L.M#=0.2000 Vcenterline(ft/s)= 228.02 Vavg(ft/s)=206.63
M(LB/m)=82.14 S(%)=1.0 S(ind)= 0.43 S(act) = 0.41
PTS=3000/2.96 P("H2O)=-2.03419+1.49391*V HEADavg = 9.012

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	10.84	11.22	11.02	0.067	0.056	0.000
2	0.00	0.000	0.07	0.34	0.21	0.056	0.049	0.000
3	-8.00	-5.333	10.23	10.71	10.46	0.091	0.075	0.052
5	-5.00	-3.333	10.04	10.67	10.36	0.102	0.081	0.064
7	-2.50	-1.667	10.20	10.93	10.56	0.123	0.097	0.042
9	-1.00	-0.667	10.58	11.06	10.85	0.112	0.094	0.009
11	0.43	0.140	7.15	8.63	8.18	0.244	0.185	0.305
13	0.85	0.280	6.84	7.94	7.39	0.186	0.143	0.393
15	1.28	0.420	6.44	7.37	6.94	0.135	0.105	0.443
17	1.71	0.560	6.39	7.03	6.68	0.100	0.079	0.472
19	2.13	0.700	6.99	7.13	7.06	0.019	0.015	0.430
21	2.56	0.840	6.71	6.86	6.78	0.019	0.014	0.461
23	2.98	0.980	6.18	6.65	6.40	0.077	0.062	0.503
4	-8.00	-5.333	10.13	10.78	10.44	0.137	0.115	0.055
6	-5.00	-3.333	10.22	10.65	10.47	0.082	0.069	0.051
8	-2.50	-1.667	10.45	10.95	10.67	0.082	0.066	0.030
10	-1.00	-0.667	10.67	11.34	11.02	0.105	0.084	-0.009
12	0.43	0.140	7.92	8.06	7.99	0.020	0.015	0.327
14	0.85	0.280	8.08	8.73	8.38	0.117	0.096	0.283
16	1.28	0.420	6.79	6.93	6.85	0.019	0.015	0.453
18	1.71	0.560	7.03	7.56	7.30	0.089	0.071	0.403
20	2.13	0.700	6.75	7.17	6.98	0.068	0.054	0.438
22	2.56	0.840	6.54	6.98	6.77	0.071	0.057	0.462
24	2.98	0.980	6.35	6.85	6.60	0.081	0.065	0.481

UPSTREAM PITOT STATIC DATA FOR GEOMETRY #1

PIT11U.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 79.0 DENSITY(Lbs2/ft4)=0.002204 P(mm Hg) = 732
CLMach#=0.2005 Vcenterline(ft/s)= 228.11 Vavg(ft/s)=207.579
M(LB/m)=82.819 S(%)=1.0 S(ind)= 0.43 S(act) = 0.41
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	(FT/S)
-1.0	-0.7	10.7	11.3	11.0	0.10	4.2	4.4	4.3	0.04	6.75	178.49
-1.0	-0.6	10.5	11.3	10.9	0.22	3.6	4.0	3.8	0.11	7.12	183.31
-1.0	-0.5	10.5	11.3	11.0	0.17	2.1	2.4	2.3	0.05	8.70	202.70
-1.0	-0.4	11.0	11.4	11.2	0.08	1.2	1.5	1.4	0.05	9.81	215.19
-1.0	-0.3	10.9	11.3	11.1	0.07	0.5	0.8	0.6	0.05	10.48	222.44
-1.0	-0.2	10.8	11.3	11.1	0.09	0.2	0.4	0.3	0.06	10.76	225.35
-1.0	-0.1	10.9	11.2	11.1	0.06	0.0	0.3	0.2	0.04	10.88	226.63
-1.0	0.0	10.9	11.3	11.1	0.06	0.0	0.1	0.0	0.02	11.06	228.43
-1.0	0.1	10.9	11.3	11.1	0.08	0.0	0.2	0.1	0.03	10.99	227.72
-1.0	0.2	10.8	11.2	11.0	0.08	0.0	0.1	0.0	0.02	10.99	227.72
-1.0	0.3	10.7	11.2	11.0	0.09	0.0	0.2	0.1	0.03	10.95	227.35
-1.0	0.4	10.8	11.2	11.1	0.07	0.1	0.4	0.2	0.04	10.82	226.01
-1.0	0.5	10.9	11.3	11.1	0.07	0.8	1.0	0.9	0.03	10.23	219.78
-1.0	0.6	11.0	11.3	11.1	0.05	2.4	2.7	2.6	0.06	8.54	200.82
-1.0	0.7	10.9	11.3	11.1	0.08	4.2	4.5	4.4	0.07	6.73	178.19

UPSTREAM HOT WIRE DATA (V3:HW11U.TEXT)
X=0.10IN Y=0.05IN FENCE=0.00IN S=1.0%
CALIBRATION USED : A=1.6126 B=5.6714 n=0.330
AVERAGING 5000 POINTS OVER 0.20 SECONDS
CH1 SIGNAL WAS UNCONDITIONED X 1 CH2 SIGNAL WAS D.C. STRIPPED X

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
-1.0	-0.7	111	214	162.2	15.2	18.44	14.6	18.06	11.36	11.13
-1.0	-0.6	132	230	188.5	12.8	15.77	14.6	17.92	8.37	9.50
-1.0	-0.5	153	230	196.2	10.7	13.26	16.7	19.95	6.76	10.16
-1.0	-0.4	160	234	213.0	9.1	11.59	10.9	13.48	5.44	6.33
-1.0	-0.3	174	236	217.6	5.5	7.83	4.1	7.14	3.60	3.28
-1.0	-0.2	178	235	221.8	3.3	5.11	2.6	3.58	2.30	1.61
-1.0	-0.1	188	232	221.4	2.4	3.62	4.4	6.98	1.64	3.15
-1.0	0.0	199	231	222.5	1.6	2.22	2.1	2.76	1.00	1.24
-1.0	0.1	210	236	222.3	2.0	2.66	1.6	2.22	1.20	1.00
-1.0	0.2	214	230	222.3	1.6	2.12	2.3	2.84	0.95	1.28
-1.0	0.3	186	230	220.3	2.0	2.97	4.2	6.24	1.35	2.83
-1.0	0.4	174	229	216.5	4.3	6.53	2.7	4.86	3.02	2.24
-1.0	0.5	161	230	216.4	5.8	8.26	11.5	14.42	3.82	6.66
-1.0	0.6	121	231	178.6	17.2	20.84	10.0	12.54	11.67	7.02
-1.0	0.7	109	213	159.0	14.0	17.09	12.8	15.71	10.75	9.88

THROAT PITOT STATIC PROBE DATA FOR GEOMETRY #1

PIT11T.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 81.5 DENSITY(Lbs2/ft4)=0.002194 P(mm Hg) = 732
CLMach#=0.2003 Vcenterline(ft/s)= 228.41 Vavg(ft/s)=206.979
M(LB/m)=82.198 S(%)=1.0 S(ind)= 0.43 S(act) = 0.41
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN/MAX (" H2O)		STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	(FT/S)
0.0	-0.7	9.9	10.8	10.4	0.19	5.3	5.5	5.4	0.02	5.04	154.54
0.0	-0.6	9.9	10.3	10.1	0.10	2.9	3.6	3.3	0.19	6.81	179.64
0.0	-0.5	9.7	10.3	10.0	0.13	2.1	2.3	2.2	0.04	7.76	191.87
0.0	-0.4	9.6	10.1	9.9	0.11	1.5	1.9	1.7	0.09	8.17	196.88
0.0	-0.3	9.7	10.0	9.9	0.06	0.6	0.9	0.7	0.04	9.12	207.93
0.0	-0.2	9.4	10.0	9.8	0.12	0.2	0.4	0.3	0.03	9.45	211.74
0.0	-0.1	9.7	10.0	9.8	0.05	0.1	0.3	0.2	0.06	9.63	213.68
0.0	0.0	9.7	10.1	9.9	0.07	0.0	0.2	0.1	0.04	9.81	215.69
0.0	0.1	9.7	10.1	9.9	0.08	-0.1	0.1	0.0	0.02	9.84	215.96
0.0	0.2	9.6	10.1	9.9	0.11	-0.1	0.1	0.0	0.02	9.82	215.78
0.0	0.3	9.8	10.2	10.0	0.07	0.1	0.3	0.2	0.04	9.85	216.07
0.0	0.4	10.0	10.3	10.1	0.08	0.3	0.5	0.4	0.02	9.73	214.75
0.0	0.5	9.9	10.4	10.2	0.12	0.8	1.0	0.9	0.03	9.27	209.66
0.0	0.6	9.9	10.5	10.2	0.12	2.4	2.6	2.5	0.03	7.70	191.04
0.0	0.7	9.9	10.5	10.2	0.14	4.6	4.8	4.7	0.03	5.50	161.51

THROAT HOT WIRE DATA (V3:HW11T.TEXT)
X=0.10IN Y=0.05IN FENCE=0.00IN S=1.0%
CALIBRATION USED : A=1.6126 B=5.6714 n=0.330
AVERAGING 5000 POINTS OVER 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
0.0	-0.7	139	232	181.4	12.1	14.89	12.0	15.00	8.21	8.27
0.0	-0.6	146	230	192.8	11.1	13.67	11.5	14.26	7.09	7.39
0.0	-0.5	140	228	193.6	13.1	15.79	9.8	12.24	8.16	6.33
0.0	-0.4	151	223	205.3	6.9	9.45	10.2	12.75	4.60	6.21
0.0	-0.3	151	219	206.0	3.5	5.50	7.1	9.70	2.67	4.71
0.0	-0.2	185	218	207.2	2.4	3.11	1.9	2.53	1.50	1.22
0.0	-0.1	177	219	207.9	2.4	3.38	7.3	10.44	1.62	5.02
0.0	0.0	196	218	210.0	1.9	2.52	1.8	2.47	1.20	1.18
0.0	0.1	178	225	209.3	1.9	2.76	2.1	3.14	1.32	1.50
0.0	0.2	190	218	208.6	1.8	2.49	4.2	6.15	1.19	2.95
0.0	0.3	195	218	207.6	2.2	2.81	3.4	5.33	1.36	2.57
0.0	0.4	158	223	201.2	9.7	11.92	5.3	7.51	5.92	3.73
0.0	0.5	143	230	198.5	10.8	13.74	10.2	12.75	6.92	6.42
0.0	0.6	140	226	197.7	12.7	15.30	8.6	10.50	7.74	5.31
0.0	0.7	126	219	174.5	12.3	15.09	11.0	13.45	8.65	7.71

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #1

PIT11E.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 80.0 DENSITY(Lbs2/ft4)=0.002194 P(mm Hg) = 730
CLMach#=0.1998 Vcenterline(ft/s)= 227.61 Vavg(ft/s)=206.254
M(LB/m)=81.913 S(%)=1.0 S(ind)= 0.43 S(act) = 0.41
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	6.4	6.7	6.5	0.04	5.1	5.4	5.2	0.05	1.32	79.19
3.1	-1.2	6.4	6.6	6.5	0.04	4.1	4.4	4.2	0.04	2.30	104.45
3.1	-1.1	6.5	6.7	6.6	0.05	3.3	4.0	3.7	0.18	2.87	116.72
3.1	-1.0	6.5	6.7	6.6	0.04	2.7	3.1	2.9	0.06	3.72	132.79
3.1	-0.9	6.6	6.9	6.7	0.06	1.5	1.9	1.7	0.09	5.05	154.68
3.1	-0.8	6.5	6.8	6.7	0.05	1.2	1.5	1.3	0.05	5.33	158.93
3.1	-0.7	6.5	6.7	6.6	0.03	0.9	1.3	1.1	0.07	5.51	161.56
3.1	-0.6	6.5	6.8	6.6	0.06	0.6	0.9	0.7	0.05	5.95	167.90
3.1	-0.5	6.4	6.7	6.6	0.04	0.3	0.6	0.5	0.04	6.10	170.07
3.1	-0.4	6.4	6.7	6.6	0.04	0.2	0.5	0.3	0.06	6.22	171.71
3.1	-0.3	6.5	6.7	6.6	0.05	0.2	0.4	0.3	0.03	6.31	172.99
3.1	-0.2	6.4	6.6	6.5	0.04	0.1	0.3	0.2	0.03	6.29	172.75
3.1	-0.1	6.5	6.8	6.6	0.06	0.2	0.5	0.3	0.08	6.27	172.36
3.1	0.0	6.4	6.8	6.6	0.06	0.3	0.5	0.3	0.03	6.26	172.32
3.1	0.1	6.5	6.9	6.6	0.11	0.5	0.7	0.6	0.06	6.05	169.34
3.1	0.2	6.3	6.7	6.5	0.06	0.5	0.9	0.7	0.10	5.82	166.07
3.1	0.3	6.3	6.6	6.4	0.05	0.9	1.3	1.1	0.09	5.37	159.57
3.1	0.4	6.3	6.9	6.5	0.13	1.7	2.1	1.8	0.09	4.68	148.94
3.1	0.5	6.2	6.6	6.4	0.07	1.4	2.0	1.8	0.15	4.60	147.67
3.1	0.6	6.3	6.7	6.5	0.07	3.1	3.6	3.4	0.09	3.13	121.80
3.1	0.7	6.2	6.6	6.4	0.05	3.7	4.0	3.8	0.08	2.57	110.42
3.1	0.8	6.3	6.7	6.5	0.06	4.6	5.1	4.8	0.10	1.64	88.28
3.1	0.9	6.3	6.7	6.5	0.06	5.5	5.7	5.6	0.04	0.89	64.90
3.1	1.0	6.3	6.7	6.5	0.06	5.9	6.2	6.0	0.05	0.44	45.90
3.1	1.1	6.3	6.6	6.4	0.05	6.3	6.4	6.3	0.03	0.08	19.09
3.1	1.2	6.2	6.5	6.3	0.04	6.3	6.4	6.3	0.02	-0.01	-6.58
3.1	1.3	6.2	6.5	6.4	0.05	6.4	6.5	6.4	0.02	-0.07	-18.32

EXIT HOT WIRE DATA (V3:HW11E.TEXT)
X=0.10IN Y=0.05IN FENCE=0.00IN
CALIBRATION USED : A=1.6126 B=5.6714 n=0.330
AVERAGING 5000 POINTS OVER 0.20 SECONDS
CH1 SIGNAL WAS UNCONDITIONED X 1 CH2 SIGNAL WAS D.C. STRIPPED X

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X	Y	MIN	MAX	AVG	MEAN1	RMS1	MEAN2	RMS2	RMS1	RMS2
(in)	(in)	FT/S		FT/S	FT/S	FT/S	FT/S	FT/S	(%)	(%)
3.1	-1.3	15	134	67.7	16.0	19.73	26.2	32.87	29.13	48.54
3.1	-1.2	25	153	82.2	17.0	21.05	27.4	34.40	25.62	41.87
3.1	-1.1	49	159	106.8	13.9	17.22	19.9	25.33	16.13	23.71
3.1	-1.0	66	181	138.0	13.7	16.91	18.8	23.46	12.26	17.01
3.1	-0.9	65	181	151.8	14.1	17.34	18.4	23.71	11.42	15.62
3.1	-0.8	100	179	154.3	11.1	13.41	18.4	22.11	8.69	14.33
3.1	-0.7	95	182	160.7	9.9	12.52	4.0	5.96	7.79	3.71
3.1	-0.6	125	189	165.0	5.7	7.84	11.3	13.86	4.75	8.40
3.1	-0.5	139	195	169.1	3.6	5.04	3.2	4.49	2.98	2.65
3.1	-0.4	150	181	170.5	2.3	2.94	8.9	11.31	1.73	6.64
3.1	-0.3	153	184	170.9	1.9	2.56	5.2	7.18	1.50	4.20
3.1	-0.2	118	186	168.5	3.4	5.23	5.0	7.82	3.10	4.64
3.1	-0.1	104	191	166.6	5.4	8.39	6.3	9.41	5.03	5.65
3.1	0.0	82	193	165.3	7.0	11.05	4.3	10.37	6.68	6.27
3.1	0.1	25	197	166.1	7.8	14.60	3.2	4.44	8.79	2.68
3.1	0.2	26	189	152.0	19.2	26.33	25.2	35.56	17.32	23.39
3.1	0.3	24	182	145.1	22.2	29.06	24.1	30.86	20.02	21.27
3.1	0.4	23	189	142.9	21.4	26.75	30.7	45.45	18.72	31.81
3.1	0.5	17	207	140.4	27.8	35.41	43.9	59.07	25.23	42.08
3.1	0.6	15	185	133.9	22.7	29.74	33.4	43.56	22.20	32.52
3.1	0.7	12	177	90.0	30.4	35.93	38.9	46.88	39.91	52.08
3.1	0.8	7	169	71.0	29.0	34.39	37.5	44.97	48.41	63.31
3.1	0.9	5	132	51.2	22.8	26.75	25.2	29.91	52.28	58.46
3.1	1.0	5	118	33.6	15.5	19.71	15.7	18.78	58.66	55.88
3.1	1.1	5	95	28.5	11.7	15.35	12.8	16.04	53.76	56.18
3.1	1.2	6	143	30.3	13.0	18.26	12.3	15.07	60.31	49.79
3.1	1.3	6	52	21.5	6.1	7.53	6.9	8.52	35.06	39.67

GEOMETRY #1 : X=0.10IN Y=0.05IN F=0.00IN PROBE(0.00,0.00)

```
TEMP(F)=  76.0   DENSITY(Lbs2/ft4)=0.002201   P(mmHg)    =   727
C.L.M# =0.1998   Vcenterline(ft/s)=  226.76   Vavg(ft/s)=206.23
M(LB/m)=82.175   S(%)=2.0    S(ind)=    0.86   S(act)     =  0.82
PTS=3000/2.96s   P("H2O)=-2.03419+1.49391*V   HEADavg    = 8.999
```

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	8.83	9.61	9.28	0.162	0.134	0.000
2	0.00	0.000	-0.01	0.28	0.13	0.047	0.039	0.000
3	-8.00	-5.333	9.66	10.50	10.21	0.200	0.164	0.077
5	-5.00	-3.333	9.83	10.76	10.30	0.150	0.119	0.066
7	-2.50	-1.667	10.25	11.08	10.59	0.141	0.114	0.034
9	-1.00	-0.667	10.65	11.26	10.93	0.104	0.083	-0.004
11	0.43	0.140	8.06	8.74	8.44	0.107	0.086	0.273
13	0.85	0.280	7.25	8.08	7.69	0.118	0.092	0.356
15	1.28	0.420	6.00	6.78	6.39	0.171	0.146	0.501
17	1.71	0.560	5.92	6.99	6.58	0.299	0.275	0.480
19	2.13	0.700	5.71	5.90	5.79	0.027	0.022	0.568
21	2.56	0.840	5.74	5.93	5.84	0.028	0.023	0.562
23	2.98	0.980	5.95	6.23	6.09	0.038	0.030	0.535
4	-8.00	-5.333	9.49	10.63	10.20	0.188	0.144	0.077
6	-5.00	-3.333	9.93	10.52	10.28	0.141	0.118	0.069
8	-2.50	-1.667	10.14	10.88	10.47	0.160	0.135	0.048
10	-1.00	-0.667	10.22	11.27	10.87	0.190	0.153	0.004
12	0.43	0.140	7.75	7.94	7.84	0.026	0.021	0.340
14	0.85	0.280	6.26	7.96	7.34	0.293	0.227	0.396
16	1.28	0.420	6.25	6.43	6.35	0.026	0.021	0.506
18	1.71	0.560	5.82	6.72	6.24	0.152	0.122	0.517
20	2.13	0.700	6.12	6.73	6.41	0.083	0.067	0.499
22	2.56	0.840	5.86	6.55	6.20	0.091	0.071	0.522
24	2.98	0.980	5.43	6.23	5.81	0.123	0.098	0.566

UPTREAM PITOT STATIC PROBE DATA FOR GEOMETRY #1
TEMP(F)= 77.0 DENSITY(Lbs2/ft4)=0.002206 P(mm Hg) = 730
CLMach#=0.2003 Vcenterline(ft/s)= 227.50 Vavg(ft/s)=206.156
M(LB/m)=82.332 S(%)=2.0 S(ind)= 0.86 S(act) = 0.82
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
-1.0	-0.6	10.9	11.4	11.1	0.10	3.0	3.3	3.2	0.04	7.95	193.56
-1.0	-0.5	10.6	11.4	11.1	0.16	1.9	2.2	2.0	0.05	9.09	206.99
-1.0	-0.4	10.6	11.4	11.0	0.17	0.9	1.4	1.1	0.09	9.91	216.16
-1.0	-0.3	10.5	11.3	10.9	0.16	0.3	0.6	0.5	0.04	10.46	222.05
-1.0	-0.2	10.7	11.3	11.1	0.11	0.1	0.4	0.3	0.04	10.81	225.75
-1.0	-0.1	10.8	11.2	11.0	0.07	0.0	0.3	0.1	0.04	10.89	226.56
-1.0	0.0	10.8	11.3	11.0	0.08	-0.1	0.1	0.0	0.03	11.02	227.96
-1.0	0.1	10.8	11.3	11.1	0.11	-0.1	0.1	0.0	0.03	11.06	228.35
-1.0	0.2	10.7	11.4	11.1	0.11	0.0	0.2	0.1	0.04	11.00	227.76
-1.0	0.3	10.8	11.4	11.1	0.10	0.2	0.5	0.3	0.03	10.80	225.62
-1.0	0.4	10.7	11.2	10.9	0.10	0.0	0.3	0.1	0.04	10.78	225.48
-1.0	0.5	10.9	11.4	11.1	0.10	1.0	1.4	1.2	0.08	9.93	216.42
-1.0	0.6	10.8	11.3	11.1	0.08	2.7	2.9	2.8	0.04	8.29	197.66
-1.0	0.7	10.8	11.3	11.1	0.13	4.3	4.6	4.4	0.06	6.66	177.26

UPSTREAM HOT WIRE DATA (V3:HW12U.TEXT)
X=0.10IN Y=0.05IN FENCE=0.00IN S=2.0%
CALIBRATION USED : A=1.6126 B=5.6714 n=0.330
AVERAGING 5000 POINTS OVER 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
-1.0	-0.7	123	234	176.8	14.0	17.30	14.7	18.10	9.78	10.24
-1.0	-0.6	147	242	201.3	13.1	16.07	13.4	16.60	7.98	8.25
-1.0	-0.5	157	244	209.4	13.4	16.09	13.6	17.22	7.69	8.22
-1.0	-0.4	154	248	220.9	12.7	15.51	11.7	14.38	7.02	6.51
-1.0	-0.3	177	242	229.1	4.0	6.24	6.2	8.77	2.73	3.83
-1.0	-0.2	204	244	231.0	2.5	3.26	1.9	2.50	1.41	1.08
-1.0	-0.1	223	240	231.7	1.8	2.44	2.2	3.19	1.05	1.38
-1.0	0.0	218	239	231.2	2.2	2.83	1.8	2.40	1.22	1.04
-1.0	0.1	218	240	230.0	1.8	2.49	9.5	12.48	1.08	5.42
-1.0	0.2	220	236	228.8	1.8	2.35	5.7	8.81	1.03	3.85
-1.0	0.3	215	239	228.2	2.0	2.68	2.2	2.88	1.17	1.26
-1.0	0.4	167	244	225.7	6.3	8.43	4.3	6.07	3.73	2.69
-1.0	0.5	170	241	223.1	7.9	10.25	6.7	8.67	4.59	3.89
-1.0	0.6	130	236	184.2	14.5	17.86	13.0	16.36	9.70	8.88
-1.0	0.7	124	223	174.3	13.4	16.42	16.9	20.84	9.42	11.95

THROAT PITOT STATIC PROBE DATA FOR GEOMETRY #1

```
PIT12T.DAT        X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)=  77.0    DENSITY(Lbs2/ft4)=0.002194   P(mm Hg)  =    726
CLMach#=0.2005    Vcenterline(ft/s)=  227.78   Vavg(ft/s)=207.152
M(LB/m)=82.277    S(%)=2.0    S(ind)=    0.86  S(act)    =   0.82
PTS=3000/1.97s    P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
0.0	-0.7	8.1	9.7	9.3	0.38	4.4	4.6	4.5	0.04	4.80	150.83
0.0	-0.6	7.9	9.3	8.6	0.35	2.5	2.9	2.7	0.08	5.92	167.48
0.0	-0.5	9.3	9.8	9.5	0.10	1.6	1.9	1.7	0.05	7.78	192.08
0.0	-0.4	9.1	9.7	9.5	0.09	1.1	1.3	1.2	0.04	8.31	198.46
0.0	-0.3	8.5	9.6	9.3	0.24	0.3	0.6	0.5	0.06	8.80	204.27
0.0	-0.2	8.8	9.7	9.4	0.15	0.1	0.4	0.3	0.05	9.11	207.78
0.0	-0.1	9.2	9.7	9.4	0.08	0.1	0.4	0.2	0.04	9.19	208.76
0.0	0.0	8.8	9.6	9.4	0.15	0.0	0.2	0.1	0.03	9.28	209.74
0.0	0.1	9.1	9.6	9.4	0.09	-0.1	0.1	0.0	0.03	9.37	210.74
0.0	0.2	9.1	9.7	9.4	0.14	0.0	0.2	0.1	0.04	9.30	209.96
0.0	0.3	9.2	9.7	9.5	0.08	0.1	0.4	0.2	0.06	9.26	209.55
0.0	0.4	9.2	9.7	9.5	0.10	0.3	0.6	0.4	0.03	9.02	206.84
0.0	0.5	9.3	9.8	9.5	0.09	0.9	1.3	1.1	0.10	8.42	199.79
0.0	0.6	9.0	9.6	9.3	0.10	2.5	2.7	2.6	0.04	6.73	178.60
0.0	0.7	8.5	10.1	9.4	0.39	4.7	5.0	4.9	0.05	4.53	146.55

THROAT HOT WIRE DATA (V3:HW12T.TEXT)

```
X=0.10IN Y=0.05IN FENCE=0.00IN S=2.0%
CALIBRATION USED :  A=2.1941  B=5.4643 n=0.330
AVERAGING  5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1   CH2 SIGNAL WAS D.C. STRIPPED X 8
```

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
0.0	-0.7	119	234	186.9	12.8	16.06	11.7	14.51	8.59	7.76
0.0	-0.6	136	230	188.1	12.5	15.42	12.8	15.60	8.20	8.29
0.0	-0.5	133	226	192.4	12.0	14.84	11.9	14.54	7.71	7.56
0.0	-0.4	143	221	198.6	10.5	12.86	13.0	15.56	6.48	7.84
0.0	-0.3	129	220	202.0	6.5	9.54	5.2	7.72	4.72	3.82
0.0	-0.2	144	217	203.6	5.0	7.69	2.7	3.56	3.78	1.75
0.0	-0.1	156	218	204.5	3.2	4.96	2.0	2.59	2.42	1.27
0.0	0.0	174	216	205.5	2.5	3.42	2.8	3.53	1.66	1.72
0.0	0.1	155	216	205.5	2.7	4.06	3.0	4.29	1.97	2.09
0.0	0.2	168	216	205.7	2.7	3.67	2.0	2.63	1.78	1.28
0.0	0.3	148	222	206.4	4.1	6.59	5.0	7.64	3.19	3.70
0.0	0.4	143	222	204.0	8.8	11.65	6.6	8.88	5.71	4.35
0.0	0.5	130	223	198.3	12.1	14.88	11.6	14.18	7.50	7.15
0.0	0.6	148	243	192.3	12.2	15.19	10.5	13.04	7.90	6.71
0.0	0.7	119	226	183.5	15.9	19.44	11.0	13.49	10.60	7.35

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #1

PIT12E.DAT X=0.10IN Y=0.05IN F=0.00IN
TEMP(F)= 78.5 DENSITY(Lbs2/ft4)=0.002188 P(mm Hg) = 726
CLMach#=0.2001 Vcenterline(ft/s)= 227.63 Vavg(ft/s)=207.017
M(LB/m)=81.994 S(%)=2.0 S(ind)= 0.86 S(act) = 0.82
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE		STATIC PORT				STAGNATION PORT				VELOCITY	
X	Y	MIN	MAX	AVG	RMS	MIN/MAX		AVG	RMS	HEAD	
(in)	(in)	("H2O)		("H2O)		(" H2O)		("H2O)		("H2O)	(FT/S)
3.1	-1.3	5.7	6.2	6.0	0.09	5.7	5.9	5.8	0.03	0.17	28.07
3.1	-1.2	5.8	6.1	5.9	0.06	5.4	5.7	5.6	0.05	0.38	42.59
3.1	-1.1	5.8	6.3	6.1	0.08	5.1	5.4	5.3	0.06	0.78	61.08
3.1	-1.0	5.9	6.3	6.1	0.06	4.4	4.7	4.5	0.06	1.54	85.49
3.1	-0.9	5.8	6.3	6.0	0.09	3.5	3.8	3.7	0.04	2.34	105.43
3.1	-0.8	5.8	6.3	6.0	0.11	3.1	4.0	3.5	0.20	2.49	108.81
3.1	-0.7	5.9	6.3	6.1	0.07	3.0	3.4	3.2	0.06	2.89	117.17
3.1	-0.6	5.8	6.3	6.0	0.07	2.6	3.2	2.9	0.14	3.16	122.51
3.1	-0.5	5.9	6.3	6.1	0.05	1.7	2.1	2.0	0.06	4.09	139.46
3.1	-0.4	5.8	6.4	6.1	0.11	1.2	1.6	1.4	0.10	4.65	148.71
3.1	-0.3	5.8	6.3	6.0	0.08	0.6	0.9	0.8	0.06	5.21	157.40
3.1	-0.2	5.9	6.4	6.1	0.09	0.3	1.4	0.8	0.32	5.33	159.21
3.1	-0.1	5.8	6.1	6.0	0.06	0.3	0.8	0.5	0.14	5.43	160.62
3.1	0.0	5.9	6.4	6.1	0.10	0.1	1.1	0.6	0.29	5.46	161.10
3.1	0.1	5.8	6.2	6.0	0.05	0.2	0.4	0.3	0.04	5.70	164.58
3.1	0.2	5.9	6.3	6.1	0.08	0.3	0.6	0.4	0.08	5.68	164.29
3.1	0.3	5.9	6.3	6.1	0.05	0.3	0.7	0.5	0.06	5.57	162.76
3.1	0.4	5.9	6.3	6.0	0.06	0.3	0.6	0.5	0.07	5.55	162.49
3.1	0.5	6.0	6.3	6.1	0.04	0.4	0.7	0.6	0.08	5.52	162.07
3.1	0.6	5.7	6.1	6.0	0.04	0.3	0.7	0.5	0.05	5.48	161.45
3.1	0.7	5.9	6.5	6.2	0.09	0.5	0.9	0.7	0.06	5.44	160.81
3.1	0.8	6.0	6.3	6.1	0.04	1.0	1.5	1.3	0.12	4.84	151.75
3.1	0.9	5.9	6.4	6.1	0.07	1.6	2.0	1.8	0.08	4.32	143.27
3.1	1.0	6.0	6.3	6.1	0.05	2.4	2.8	2.6	0.09	3.51	129.27
3.1	1.1	5.8	6.3	6.1	0.11	3.7	4.3	4.0	0.10	2.07	99.10
3.1	1.2	6.0	6.4	6.2	0.06	4.5	5.0	4.8	0.10	1.41	81.90
3.1	1.3	6.0	6.3	6.1	0.04	5.0	5.3	5.1	0.06	1.03	70.08

EXIT HOT WIRE DATA (V3:HW12E.TEXT)

X=0.10IN Y=0.05IN FENCE=0.00IN S=2.0%
CALIBRATION USED : A=2.1941 B=5.4643 n=0.330
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 WAS UNCONDITIONED X 1 CH2 WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.1	-1.3	4	142	29.0	13.5	18.07	9.4	11.91	62.29	41.04
3.1	-1.2	4	139	35.5	17.1	22.02	15.8	19.57	62.01	55.12
3.1	-1.1	5	162	56.7	29.2	34.36	24.6	30.50	60.63	53.82
3.1	-1.0	4	185	64.1	32.4	38.26	28.8	35.32	59.64	55.06
3.1	-0.9	4	172	65.0	35.4	41.28	28.3	34.96	63.55	53.81
3.1	-0.8	5	161	69.6	29.2	34.34	29.7	36.36	49.35	52.26
3.1	-0.7	5	197	112.7	31.5	38.64	27.4	37.20	34.29	33.01
3.1	-0.6	6	188	118.3	29.0	36.25	38.6	49.98	30.65	42.26
3.1	-0.5	6	178	124.5	36.2	44.11	58.7	68.93	35.43	55.36
3.1	-0.4	8	190	137.3	25.5	34.00	27.4	35.61	24.76	25.93
3.1	-0.3	7	194	137.5	24.6	32.92	2.5	3.05	23.95	2.22
3.1	-0.2	8	188	148.9	18.0	28.02	9.8	13.51	18.82	9.07
3.1	-0.1	14	197	150.5	16.1	24.51	28.6	40.94	16.28	27.20
3.1	0.0	10	199	155.3	10.8	19.25	3.6	6.30	12.39	4.06
3.1	0.1	17	190	157.0	8.9	16.00	7.8	16.45	10.19	10.47
3.1	0.2	19	200	159.9	6.1	12.45	4.2	6.38	7.79	3.99
3.1	0.3	22	196	159.6	5.8	10.98	2.9	4.20	6.88	2.63
3.1	0.4	20	197	158.5	7.6	14.26	17.8	25.78	9.00	16.27
3.1	0.5	25	189	155.6	11.1	17.58	11.5	14.53	11.30	9.33
3.1	0.6	12	189	154.3	12.2	17.06	43.6	57.46	11.06	37.23
3.1	0.7	16	183	154.8	12.3	18.28	19.2	25.26	11.81	16.32
3.1	0.8	10	188	141.2	21.3	27.80	22.4	29.73	19.68	21.05
3.1	0.9	8	182	136.3	21.9	28.09	16.5	20.45	20.61	15.01
3.1	1.0	5	175	108.0	30.5	37.91	47.5	57.73	35.10	53.45
3.1	1.1	9	173	103.4	24.0	30.29	25.9	33.12	29.29	32.03
3.1	1.2	5	167	66.1	31.0	36.39	15.7	18.69	55.07	28.28
3.1	1.3	4	122	44.1	18.8	22.70	17.1	21.77	51.49	49.39

GEOMETRY 2 : X=0.10IN Y=0.00IN F=0.00IN PROBE(-1.00,0.00)

TEMP(F)= 78.7 DENSITY(Lbs2/ft4)=0.002208 P(mmHg) = 733
C.L.M#=0.1996 Vcenterline(ft/s)= 227.11 Vavg(ft/s)=206.31
M(LB/m)=82.471 S(%)=0.0 S(ind)= 0.00 S(act) = 0.00
PTS=3000/2.96s P("H2O)=-2.03419+1.49391*V HEADavg = 9.035

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	10.87	11.22	11.05	0.062	0.050	0.000
2	0.00	0.000	-0.07	0.03	-0.03	0.015	0.012	0.000
3	-8.00	-5.333	10.22	10.82	10.52	0.112	0.090	0.047
5	-5.00	-3.333	10.01	10.73	10.41	0.114	0.086	0.059
7	-2.50	-1.667	10.33	11.01	10.71	0.121	0.094	0.026
9	-1.00	-0.667	10.83	11.27	11.07	0.073	0.059	-0.013
11	0.43	0.140	10.87	11.64	11.27	0.126	0.100	-0.036
13	0.85	0.280	10.02	10.26	10.15	0.052	0.045	0.088
15	1.28	0.420	9.30	9.92	9.59	0.100	0.079	0.150
17	1.71	0.560	8.94	9.48	9.18	0.096	0.080	0.196
19	2.13	0.700	8.20	8.30	8.24	0.015	0.012	0.299
21	2.56	0.840	8.18	8.30	8.24	0.015	0.012	0.300
23	2.98	0.980	8.35	8.47	8.42	0.015	0.012	0.280
4	-8.00	-5.333	10.21	10.76	10.47	0.100	0.081	0.053
6	-5.00	-3.333	10.37	10.64	10.50	0.047	0.038	0.049
8	-2.50	-1.667	10.54	10.85	10.71	0.066	0.056	0.026
10	-1.00	-0.667	10.47	11.17	10.83	0.117	0.093	0.013
12	0.43	0.140	9.06	9.61	9.35	0.103	0.084	0.177
14	0.85	0.280	8.44	9.25	8.82	0.121	0.094	0.236
16	1.28	0.420	9.38	9.49	9.43	0.014	0.011	0.168
18	1.71	0.560	8.16	8.84	8.52	0.111	0.089	0.269
20	2.13	0.700	8.05	8.85	8.37	0.128	0.104	0.286
22	2.56	0.840	7.97	8.57	8.28	0.107	0.086	0.296
24	2.98	0.980	8.00	8.72	8.35	0.115	0.092	0.288

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #2

PIT20E.DAT	X=0.10IN Y=0.00IN F=0.00IN	
TEMP(F)= 80.0	DENSITY(Lbs2/ft4)=0.002203	P(mm Hg) = 733
CLMach#=0.2005	Vcenterline(ft/s)= 228.31	Vavg(ft/s)=207.407
M(LB/m)=82.710	S(%)=0.0 S(ind)= 0.00	S(act) = 0.00
PTS=3000/1.97s	P("H2O)=-2.03419+1.49391*V	

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	8.1	8.4	8.2	0.05	8.3	8.4	8.3	0.02	-0.11	-22.46
3.1	-1.2	8.1	8.4	8.2	0.04	8.3	8.4	8.3	0.02	-0.07	-18.59
3.1	-1.1	8.1	8.4	8.3	0.05	8.3	8.4	8.3	0.01	-0.04	-13.87
3.1	-1.0	8.2	8.4	8.3	0.05	8.2	8.3	8.2	0.02	0.04	13.28
3.1	-0.9	8.2	8.4	8.3	0.04	8.1	8.2	8.2	0.02	0.12	24.22
3.1	-0.8	8.3	8.5	8.4	0.05	7.9	8.0	7.9	0.02	0.46	46.49
3.1	-0.7	8.2	8.5	8.4	0.05	7.3	7.4	7.4	0.03	0.99	68.42
3.1	-0.6	8.3	8.5	8.4	0.05	6.5	6.7	6.6	0.05	1.79	92.00
3.1	-0.5	8.3	8.6	8.4	0.04	6.1	6.3	6.2	0.04	2.17	101.30
3.1	-0.4	8.2	8.6	8.4	0.05	4.9	5.2	5.0	0.06	3.38	126.26
3.1	-0.3	8.3	8.6	8.4	0.05	3.9	4.3	4.1	0.10	4.35	143.25
3.1	-0.2	8.2	8.6	8.4	0.08	3.0	3.4	3.2	0.11	5.24	157.38
3.1	-0.1	8.2	8.5	8.3	0.05	2.4	2.9	2.6	0.12	5.73	164.50
3.1	0.0	8.3	8.6	8.4	0.06	1.1	1.3	1.2	0.02	7.24	184.96
3.1	0.1	8.3	8.6	8.5	0.06	0.5	0.8	0.6	0.06	7.87	192.76
3.1	0.2	8.3	8.6	8.4	0.05	0.4	0.6	0.5	0.04	7.91	193.31
3.1	0.3	8.3	8.6	8.5	0.05	0.3	0.6	0.4	0.06	8.09	195.40
3.1	0.4	8.3	8.7	8.4	0.08	0.2	0.3	0.2	0.02	8.22	196.98
3.1	0.5	8.4	8.7	8.5	0.05	0.2	0.4	0.3	0.02	8.25	197.41
3.1	0.6	8.4	8.6	8.5	0.03	0.2	0.4	0.3	0.02	8.28	197.70
3.1	0.7	8.4	8.7	8.6	0.06	0.2	0.4	0.3	0.03	8.26	197.55
3.1	0.8	8.4	8.7	8.6	0.05	0.3	0.5	0.4	0.02	8.15	196.15
3.1	0.9	8.4	8.7	8.6	0.06	0.9	1.2	1.1	0.07	7.51	188.33
3.1	1.0	8.4	8.8	8.6	0.05	2.3	2.7	2.5	0.10	6.10	169.75
3.1	1.1	8.4	8.7	8.6	0.05	4.5	4.7	4.6	0.05	3.99	137.25
3.1	1.2	8.4	8.6	8.5	0.04	6.1	6.4	6.3	0.05	2.28	103.67
3.1	1.3	8.3	8.6	8.5	0.05	8.4	8.5	8.4	0.02	0.05	15.73

EXIT HOT WIRE DATA (V3:HW20E.TEXT)

X=0.10IN Y=0.00IN FENCE=0.00IN S=0.0%
CALIBRATION USED : A=1.7421 B=5.4909 n=0.330
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
3.1	-1.3	5	90	26.4	6.6	8.38	5.9	7.73	31.77	29.32
3.1	-1.2	5	99	25.0	6.7	8.90	7.0	9.46	35.63	37.88
3.1	-1.1	4	110	24.5	7.8	10.84	7.2	9.28	44.24	37.87
3.1	-1.0	5	153	26.9	10.6	15.10	9.9	12.51	56.18	46.54
3.1	-0.9	4	156	35.0	16.6	22.28	17.5	20.95	63.60	59.79
3.1	-0.8	5	161	44.3	20.9	26.28	20.9	25.50	59.34	57.58
3.1	-0.7	6	173	59.7	26.1	31.79	29.9	36.15	53.22	60.53
3.1	-0.6	7	194	79.6	31.9	37.95	29.8	36.21	47.67	45.50
3.1	-0.5	7	195	94.2	32.0	38.28	35.8	43.65	40.62	46.32
3.1	-0.4	11	197	111.7	32.7	39.03	38.5	48.22	34.93	43.16
3.1	-0.3	14	203	128.0	31.7	38.39	26.5	37.23	29.99	29.08
3.1	-0.2	20	211	148.9	24.3	31.18	17.1	23.26	20.93	15.62
3.1	-0.1	24	206	161.8	18.8	25.18	24.9	34.63	15.57	21.41
3.1	0.0	30	206	170.6	12.6	17.25	5.1	7.55	10.11	4.43
3.1	0.1	44	203	174.0	10.8	15.31	13.9	19.09	8.80	10.97
3.1	0.2	75	206	178.9	6.0	8.94	3.9	5.79	5.00	3.23
3.1	0.3	113	199	180.6	4.2	6.69	3.0	3.62	3.70	2.00
3.1	0.4	135	198	181.0	3.5	5.49	2.6	3.37	3.03	1.86
3.1	0.5	124	199	182.4	3.5	5.00	2.9	3.71	2.74	2.04
3.0	0.6	158	194	182.6	2.9	3.88	4.3	6.41	2.13	3.51
3.1	0.7	147	193	183.0	2.9	4.01	3.2	4.26	2.19	2.33
3.1	0.8	129	195	177.9	6.6	9.12	7.3	9.57	5.13	5.38
3.1	0.9	109	194	170.9	11.8	14.38	11.8	14.22	8.41	8.32
3.1	1.0	64	195	148.9	14.4	17.93	11.7	14.72	12.04	9.88
3.1	1.1	48	190	123.3	18.7	23.03	14.0	17.73	18.67	14.38
3.1	1.2	18	163	85.5	17.6	21.91	13.9	17.34	25.63	20.28
3.1	1.3	4	28	8.6	2.1	2.77	2.3	2.82	32.07	32.66

GEOMETRY 2 : X=0.10IN Y=0.00IN F=0.00IN PROBE(3.10,0.00)

TEMP(F)= 75.0 DENSITY(Lbs2/ft4)=0.002229 P(mmHg) = 735
C.L.M# =0.1978 Vcenterline(ft/s)= 224.22 Vavg(ft/s)=204.04
M(LB/m)=82.351 S(%)=1.0 S(ind)= 0.43 S(act) = 0.41
PTS=3000/2.96s P("H2O)=-2.03419+1.49391*V HEADavg = 8.923

TAP#	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	7.01	7.43	7.19	0.085	0.072	0.000
2	0.00	0.000	0.59	1.11	0.75	0.113	0.089	0.000
3	-8.00	-5.333	10.02	10.52	10.30	0.086	0.069	0.054
5	-5.00	-3.333	9.97	10.49	10.28	0.088	0.070	0.057
7	-2.50	-1.667	10.13	10.79	10.49	0.101	0.078	0.034
9	-1.00	-0.667	10.49	10.90	10.72	0.080	0.067	0.007
11	0.43	0.140	7.82	9.54	8.63	0.313	0.253	0.242
13	0.85	0.280	7.70	7.85	7.77	0.022	0.018	0.339
15	1.28	0.420	7.12	7.95	7.47	0.140	0.111	0.372
17	1.71	0.560	7.06	7.77	7.32	0.106	0.084	0.389
19	2.13	0.700	7.89	8.02	7.96	0.018	0.014	0.317
21	2.56	0.840	7.63	7.76	7.69	0.019	0.015	0.347
23	2.98	0.980	7.17	7.30	7.23	0.018	0.015	0.398
4	-8.00	-5.333	9.93	10.54	10.27	0.103	0.082	0.058
6	-5.00	-3.333	10.11	10.38	10.25	0.048	0.038	0.061
8	-2.50	-1.667	10.25	10.64	10.47	0.069	0.056	0.036
10	-1.00	-0.667	10.55	11.16	10.86	0.111	0.089	-0.007
12	0.43	0.140	9.60	10.33	9.99	0.149	0.123	0.089
14	0.85	0.280	8.77	9.45	9.12	0.119	0.098	0.187
16	1.28	0.420	7.47	7.61	7.54	0.019	0.015	0.365
18	1.71	0.560	7.68	8.26	7.93	0.088	0.071	0.321
20	2.13	0.700	7.36	7.89	7.66	0.090	0.072	0.351
22	2.56	0.840	7.12	7.74	7.42	0.088	0.070	0.378
24	2.98	0.980	6.92	7.48	7.23	0.084	0.068	0.399

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #2

PIT21E.DAT X=0.10IN Y=0.00IN F=0.00IN
TEMP(F)= 75.0 DENSITY(Lbs2/ft4)=0.002229 P(mm Hg) = 735
CLMach#=0.1974 Vcenterline(ft/s)= 223.84 Vavg(ft/s)=203.693
M(LB/m)=82.212 S(%)=1.0 S(ind)= 0.43 S(act) = 0.41
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE		STATIC PORT				STAGNATION PORT				VELOCITY	
X	Y	MIN	MAX	AVG	RMS	MIN/MAX		AVG	RMS	HEAD	
(in)	(in)	("H2O)		("H2O)		(" H2O)		("H2O)		("H2O)	(FT/S)
3.1	-1.3	7.0	7.3	7.2	0.04	5.4	5.7	5.6	0.09	1.60	86.36
3.1	-1.2	7.0	7.3	7.2	0.06	3.4	3.9	3.6	0.11	3.52	128.19
3.1	-1.1	7.1	7.3	7.2	0.04	2.9	3.3	3.1	0.07	4.05	137.52
3.1	-1.0	7.1	7.4	7.2	0.05	2.0	2.5	2.2	0.10	4.94	151.76
3.1	-0.9	7.1	7.4	7.2	0.04	1.4	1.9	1.7	0.15	5.56	160.99
3.1	-0.8	7.1	7.4	7.3	0.05	1.0	1.3	1.2	0.07	6.11	168.90
3.1	-0.7	7.1	7.4	7.3	0.06	0.8	1.1	0.9	0.06	6.37	172.35
3.1	-0.6	7.1	7.3	7.2	0.04	0.3	0.6	0.4	0.06	6.78	177.89
3.1	-0.5	7.0	7.5	7.3	0.09	0.3	0.5	0.4	0.04	6.87	178.99
3.1	-0.4	7.1	7.5	7.2	0.07	0.1	0.4	0.2	0.04	6.99	180.55
3.1	-0.3	7.0	7.3	7.2	0.04	0.2	0.5	0.3	0.05	6.88	179.11
3.1	-0.2	7.0	7.5	7.2	0.09	0.2	0.5	0.4	0.06	6.85	178.81
3.1	-0.1	7.0	7.5	7.2	0.10	0.4	0.7	0.5	0.07	6.63	175.86
3.1	0.0	6.9	7.3	7.1	0.08	0.6	0.8	0.7	0.05	6.44	173.28
3.1	0.1	7.0	7.3	7.1	0.05	0.9	1.6	1.2	0.17	5.89	165.80
3.1	0.2	7.0	7.4	7.2	0.06	1.5	1.9	1.6	0.08	5.54	160.71
3.1	0.3	6.9	7.2	7.1	0.06	2.0	2.9	2.4	0.27	4.61	146.63
3.1	0.4	7.0	7.3	7.1	0.07	2.5	3.3	2.8	0.23	4.35	142.49
3.1	0.5	6.9	7.4	7.1	0.11	3.5	4.1	3.8	0.15	3.33	124.58
3.1	0.6	7.0	7.3	7.1	0.04	4.4	4.8	4.6	0.11	2.53	108.63
3.1	0.7	7.0	7.3	7.1	0.04	5.3	5.8	5.5	0.12	1.67	88.20
3.1	0.8	7.0	7.4	7.1	0.07	6.2	6.5	6.3	0.06	0.82	61.96
3.1	0.9	6.9	7.4	7.1	0.08	6.7	6.9	6.8	0.06	0.29	36.74
3.1	1.0	6.9	7.3	7.1	0.06	7.0	7.1	7.0	0.02	0.08	18.77
3.1	1.1	6.9	7.2	7.0	0.06	7.0	7.2	7.1	0.02	-0.10	-21.56
3.1	1.2	6.9	7.2	7.0	0.04	7.0	7.2	7.1	0.02	-0.09	-20.02
3.1	1.3	6.8	7.1	7.0	0.05	7.1	7.2	7.1	0.02	-0.15	-26.52

EXIT HOT WIRE DATA (V3:HW21E.TEXT)

X=0.10IN Y=0.00IN FENCE=0.00IN S=1.0%
CALIBRATION USED : A=2.6141 B=4.7892 n=0.350
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.1	-1.3	22	184	90.7	18.6	23.36	16.3	20.20	25.75	22.27
3.1	-1.2	43	196	121.2	18.4	23.04	15.5	19.75	19.00	16.29
3.1	-1.1	53	194	147.1	21.1	25.72	18.6	23.32	17.48	15.85
3.1	-1.0	75	197	148.9	21.3	25.15	16.6	20.50	16.89	13.76
3.1	-0.9	97	197	164.3	14.5	17.52	15.8	18.96	10.66	11.54
3.1	-0.8	105	209	169.0	13.6	16.71	12.1	15.00	9.89	8.88
3.1	-0.7	101	204	176.9	9.4	12.42	3.4	4.67	7.02	2.64
3.1	-0.6	21	210	178.7	8.9	14.67	5.0	8.51	8.21	4.77
3.1	-0.5	113	204	179.7	6.8	9.95	7.3	10.67	5.54	5.94
3.1	-0.4	55	213	181.0	5.1	10.40	8.2	10.56	5.75	5.83
3.1	-0.3	59	217	181.2	5.4	9.21	4.1	5.95	5.08	3.28
3.1	-0.2	18	214	182.0	4.4	8.28	6.2	12.01	4.55	6.60
3.1	-0.1	21	214	176.0	11.4	20.05	13.2	22.61	11.39	12.84
3.1	0.0	19	223	168.5	19.4	29.18	22.3	39.57	17.32	23.49
3.1	0.1	23	212	166.5	20.2	28.26	51.0	64.26	16.97	38.60
3.1	0.2	10	221	155.4	28.0	36.18	35.2	47.82	23.27	30.77
3.1	0.3	9	217	148.6	33.0	41.28	49.7	61.86	27.79	41.63
3.1	0.4	8	208	124.2	39.3	46.33	22.6	30.54	37.31	24.60
3.1	0.5	8	231	120.5	45.4	52.02	60.1	69.99	43.18	58.09
3.1	0.6	6	205	96.8	41.6	48.39	37.7	47.39	49.99	48.95
3.1	0.7	5	182	60.5	30.1	36.31	30.0	35.52	60.06	58.75
3.1	0.8	6	201	54.9	31.6	39.52	30.0	35.71	71.95	65.01
3.1	0.9	5	173	40.4	19.7	25.66	19.8	23.63	63.59	58.57
3.1	1.0	5	153	32.0	13.7	18.78	12.7	16.41	58.73	51.31
3.1	1.1	5	116	27.0	8.8	12.12	7.2	9.15	44.89	33.90
3.1	1.2	4	82	26.3	7.8	9.89	8.7	10.79	37.56	41.00
3.1	1.3	5	75	26.3	7.8	9.71	8.4	10.67	36.96	40.62

PRESSURE RECOVERY DATA GEOMETRY #2

CP22.DAT	X=0.10IN Y=0.00IN F=0.00IN		PROBE(3.10,0.00)
TEMP(F)= 79.0	Density(Lbs2/ft4)=0.002210		P(mm Hg) = 734
C.L.M#=0.2006	Vc.l.(ft/s) = 228.212		Vavg(ft/s)=208.04
M(LB/m)=83.23	S(%)=2.0	S(ind)= 0.87	S(act) = 0.83
PTS=3000/3.02	P("H2O)=-2.03419+1.49391*V		HEADavg = 9.195

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	6.74	7.17	6.93	0.080	0.066	0.000
2	0.00	0.000	0.41	0.73	0.53	0.066	0.054	0.000
3	-8.00	-5.333	10.38	10.88	10.64	0.092	0.073	0.049
5	-5.00	-3.333	10.27	10.85	10.60	0.098	0.078	0.054
7	-2.50	-1.667	10.30	11.10	10.78	0.130	0.106	0.034
9	-1.00	-0.667	10.54	11.33	11.03	0.135	0.104	0.006
11	0.43	0.140	7.37	9.65	8.76	0.360	0.275	0.253
13	0.85	0.280	9.36	9.51	9.43	0.023	0.019	0.180
15	1.28	0.420	6.98	7.87	7.38	0.154	0.124	0.403
17	1.71	0.560	6.86	7.48	7.14	0.094	0.075	0.429
19	2.13	0.700	7.82	7.98	7.89	0.024	0.019	0.347
21	2.56	0.840	7.41	7.58	7.49	0.024	0.019	0.392
23	2.98	0.980	7.21	7.40	7.31	0.025	0.019	0.411
4	-8.00	-5.333	10.22	10.85	10.54	0.110	0.089	0.059
6	-5.00	-3.333	10.25	10.72	10.47	0.089	0.073	0.068
8	-2.50	-1.667	10.54	10.99	10.76	0.071	0.059	0.035
10	-1.00	-0.667	10.69	11.49	11.15	0.133	0.109	-0.006
12	0.43	0.140	9.64	10.30	9.98	0.130	0.106	0.120
14	0.85	0.280	8.68	9.48	9.08	0.133	0.106	0.219
16	1.28	0.420	7.40	7.56	7.48	0.023	0.019	0.393
18	1.71	0.560	7.50	8.08	7.82	0.092	0.073	0.356
20	2.13	0.700	7.21	7.77	7.47	0.095	0.076	0.394
22	2.56	0.840	6.97	7.53	7.24	0.089	0.071	0.418
24	2.98	0.980	6.77	7.29	7.03	0.087	0.069	0.442

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #2

```
PIT22E.DAT         X=0.10IN Y=0.00IN F=0.00IN
TEMP(F)=   80.0    Density(Lbs2/ft4)=0.002206   P(mm Hg)   =   734
CLmach#=0.2009     Vc.l.(ft/s)       = 228.840  Vavg(ft/s)=208.61
M(LB/m)= 83.30     S(%)=2.0    S(ind)=    0.87  S(act)     =  0.83
PTS=3000/1.970s    P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN (" H2O)	STAGNATION PORT MAX (" H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	6.9	7.1	7.0	0.04	4.4	5.2	4.8	0.22	2.25	103.09
3.1	-1.2	6.9	7.1	7.0	0.04	3.5	3.9	3.7	0.09	3.33	125.23
3.1	-1.1	6.9	7.2	7.0	0.07	2.8	3.5	3.1	0.14	3.96	136.69
3.1	-1.0	6.9	7.2	7.0	0.07	1.7	2.4	2.0	0.17	5.04	154.11
3.1	-0.9	6.9	7.2	7.0	0.05	1.5	2.2	1.8	0.18	5.22	156.95
3.1	-0.8	6.9	7.2	7.0	0.07	0.9	1.6	1.3	0.20	5.72	164.25
3.1	-0.7	6.9	7.2	7.0	0.05	0.7	1.0	0.8	0.07	6.23	171.44
3.1	-0.6	7.0	7.3	7.1	0.05	0.6	0.8	0.7	0.03	6.42	173.95
3.1	-0.5	6.8	7.3	7.0	0.09	0.3	0.8	0.5	0.11	6.51	175.17
3.1	-0.4	6.8	7.1	7.0	0.05	0.3	0.6	0.4	0.04	6.54	175.56
3.1	-0.3	6.8	7.2	7.0	0.07	0.3	0.6	0.5	0.06	6.55	175.72
3.1	-0.2	6.9	7.2	7.0	0.07	0.3	0.5	0.4	0.03	6.66	177.16
3.1	-0.1	6.8	7.1	6.9	0.06	0.2	0.4	0.3	0.04	6.63	176.86
3.1	0.0	6.7	7.1	6.9	0.07	0.7	1.0	0.8	0.06	6.06	169.02
3.1	0.1	6.7	7.1	6.9	0.06	0.8	1.6	1.2	0.20	5.73	164.33
3.1	0.2	6.7	7.2	6.9	0.08	1.2	1.9	1.5	0.21	5.42	159.91
3.1	0.3	6.8	7.2	6.9	0.08	1.9	2.5	2.1	0.10	4.83	150.98
3.1	0.4	6.7	7.0	6.9	0.05	2.8	3.5	3.1	0.14	3.73	132.62
3.1	0.5	6.6	7.3	6.9	0.13	3.1	4.1	3.6	0.28	3.36	125.94
3.1	0.6	6.7	7.0	6.8	0.06	4.4	5.3	4.9	0.24	1.94	95.73
3.1	0.7	6.7	7.1	6.9	0.08	4.7	5.3	5.0	0.16	1.82	92.72
3.1	0.8	6.7	7.1	6.9	0.07	5.4	6.0	5.7	0.16	1.23	76.03
3.1	0.9	6.7	7.1	6.9	0.08	5.9	6.2	6.0	0.06	0.91	65.36
3.1	1.0	6.7	7.1	6.9	0.07	6.6	6.9	6.7	0.05	0.18	28.82
3.1	1.1	6.7	7.0	6.9	0.04	6.8	7.0	6.9	0.03	0.00	-2.47
3.1	1.2	6.6	6.9	6.8	0.04	6.8	7.0	6.9	0.03	-0.16	-27.35
3.1	1.3	6.7	7.0	6.8	0.05	6.8	7.0	6.9	0.03	-0.10	-21.75

EXIT HOT WIRE DATA (V3:HW22E.TEXT)

X=0.10IN Y=0.00IN FENCE=0.00IN S=2%
CALIBRATION USED : A=3.9353 B=3.8675 n=0.380
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.1	-1.3	10	186	96.4	20.7	25.95	19.8	24.48	26.92	25.40
3.1	-1.2	33	195	129.8	21.9	27.04	28.7	36.66	20.84	28.25
3.1	-1.1	47	195	142.3	20.1	24.73	13.5	16.84	17.38	11.83
3.1	-1.0	73	198	155.6	16.6	20.49	11.5	13.89	13.17	8.92
3.1	-0.9	69	200	162.5	16.4	19.90	17.8	22.14	12.25	13.63
3.1	-0.8	92	221	169.5	15.3	18.46	18.0	21.83	10.89	12.88
3.1	-0.7	83	206	176.2	11.8	15.10	9.7	13.24	8.57	7.51
3.1	-0.6	56	209	181.7	6.5	10.26	10.1	12.44	5.64	6.84
3.1	-0.5	35	216	182.5	5.9	9.58	13.7	16.81	5.25	9.21
3.1	-0.4	66	215	182.3	5.7	9.42	5.7	7.84	5.17	4.30
3.1	-0.3	63	206	182.4	5.8	10.54	2.1	2.82	5.78	1.55
3.1	-0.2	21	220	181.1	6.8	10.87	4.6	6.90	6.00	3.81
3.1	-0.1	30	206	177.6	11.2	19.50	3.8	6.18	10.98	3.48
3.1	0.0	17	215	177.7	11.7	20.39	2.4	3.05	11.47	1.72
3.1	0.1	16	224	168.0	20.9	30.20	19.2	28.60	17.97	17.02
3.1	0.2	8	223	160.2	30.4	40.33	20.7	28.88	25.18	18.03
3.1	0.3	11	211	149.9	32.7	41.77	9.9	16.99	27.87	11.34
3.1	0.4	10	210	138.3	37.5	45.79	60.5	71.00	33.10	51.32
3.1	0.5	7	211	108.9	43.6	50.23	43.1	53.77	46.11	49.36
3.1	0.6	5	211	98.9	46.6	53.32	34.7	43.50	53.90	43.98
3.1	0.7	6	195	84.3	38.4	44.61	45.5	52.31	52.93	62.06
3.1	0.8	7	207	61.7	31.4	38.30	30.6	36.58	62.06	59.26
3.1	0.9	5	187	49.3	25.0	31.09	19.4	24.30	63.01	49.24
3.1	1.0	6	155	35.2	15.0	20.38	12.6	16.28	57.87	46.25
3.1	1.1	5	136	31.6	12.0	16.33	12.4	16.34	51.62	51.66
3.1	1.2	5	127	28.0	9.3	12.20	8.6	11.30	43.54	40.32
3.1	1.3	4	97	23.7	7.6	9.49	9.1	11.23	40.10	47.46

PRESSURE RECOVERY DATA GEOMETRY #3

CP30.DAT	X=0.10IN Y=0.10IN F=0.00IN		PROBE(3.10, 0.00)
TEMP(F)= 83.3	Density(Lbs2/ft4)=0.002195		P(mm Hg) = 735
C.L.M#=0.1997	Vc.l.(ft/s) = 228.131		Vavg(ft/s)=208.06
M(LB/m)=82.69	S(%)=0.0	S(ind)= 0.00	S(act) = 0.00
PTS=3000/3.02	P("H2O)=-2.03419+1.49391*V		HEADavg = 9.136

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	9.83	10.14	10.00	0.065	0.053	0.000
2	0.00	0.000	2.73	3.27	2.95	0.159	0.142	0.000
3	-8.00	-5.333	10.33	10.74	10.54	0.071	0.057	0.049
5	-5.00	-3.333	10.25	10.69	10.50	0.078	0.063	0.054
7	-2.50	-1.667	10.40	10.99	10.69	0.094	0.076	0.033
9	-1.00	-0.667	10.99	11.37	11.19	0.073	0.060	-0.022
11	0.43	0.140	11.77	11.78	11.77	0.004	0.003	-0.085
13	0.85	0.280	10.90	11.66	11.35	0.123	0.100	-0.039
15	1.28	0.420	10.11	10.66	10.37	0.092	0.076	0.068
17	1.71	0.560	9.71	10.33	10.05	0.100	0.081	0.103
19	2.13	0.700	9.81	9.91	9.86	0.014	0.011	0.124
21	2.56	0.840	9.73	9.82	9.77	0.013	0.010	0.134
23	2.98	0.980	9.71	9.82	9.77	0.014	0.011	0.134
4	-8.00	-5.333	10.20	10.74	10.49	0.080	0.064	0.055
6	-5.00	-3.333	10.43	10.60	10.51	0.027	0.022	0.053
8	-2.50	-1.667	10.56	10.87	10.71	0.046	0.036	0.031
10	-1.00	-0.667	10.57	11.08	10.79	0.084	0.068	0.022
12	0.43	0.140	9.63	10.20	9.94	0.081	0.062	0.116
14	0.85	0.280	9.61	10.19	9.88	0.105	0.085	0.122
16	1.28	0.420	10.32	10.41	10.37	0.014	0.011	0.068
18	1.71	0.560	9.58	10.17	9.89	0.092	0.075	0.121
20	2.13	0.700	9.56	10.20	9.84	0.096	0.074	0.126
22	2.56	0.840	9.52	10.07	9.82	0.096	0.077	0.129
24	2.98	0.980	9.62	10.26	9.93	0.103	0.083	0.116

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #3

```
PIT30E.DAT        X=0.10IN Y=0.10IN F=0.00IN
TEMP(F)=  83.5    Density(Lbs2/ft4)=0.002194  P(mm Hg)   =    735
CLmach#=0.1993    Vc.l.(ft/s)       = 227.786  Vavg(ft/s)=207.75
M(LB/m)= 82.54    S(%)=0.0    S(ind)=    0.00  S(act)     =   0.00
PTS=3000/2.030s   P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	9.7	9.9	9.8	0.03	9.9	9.9	9.9	0.01	-0.16	-27.87
3.1	-1.2	9.7	9.9	9.8	0.04	9.9	9.9	9.9	0.01	-0.16	-27.24
3.1	-1.1	9.6	9.9	9.8	0.05	9.8	9.9	9.9	0.01	-0.09	-20.99
3.1	-1.0	9.6	9.9	9.7	0.04	9.8	9.9	9.9	0.02	-0.12	-23.64
3.1	-0.9	9.7	9.9	9.8	0.04	9.8	9.9	9.9	0.01	-0.10	-21.54
3.1	-0.8	9.6	9.9	9.8	0.05	9.8	9.9	9.8	0.01	-0.03	-11.71
3.1	-0.7	9.7	10.0	9.8	0.05	9.6	9.8	9.7	0.01	0.14	25.85
3.1	-0.6	9.7	10.0	9.9	0.04	9.3	9.5	9.4	0.02	0.46	46.64
3.1	-0.5	9.8	10.0	9.9	0.04	8.6	8.8	8.7	0.03	1.25	76.96
3.1	-0.4	9.8	10.1	10.0	0.06	7.5	7.8	7.7	0.07	2.30	104.43
3.1	-0.3	9.9	10.1	10.0	0.04	6.3	6.8	6.6	0.13	3.39	126.81
3.1	-0.2	9.9	10.1	10.0	0.03	4.9	5.4	5.1	0.13	4.86	151.83
3.1	-0.1	9.8	10.1	9.9	0.05	3.0	3.5	3.3	0.11	6.61	176.99
3.1	0.0	9.8	10.0	10.0	0.04	2.6	3.3	3.0	0.16	6.96	181.62
3.1	0.1	9.8	10.1	10.0	0.05	1.3	1.8	1.5	0.12	8.45	200.12
3.1	0.2	9.9	10.1	10.0	0.04	0.9	1.5	1.1	0.16	8.90	205.34
3.1	0.3	9.9	10.2	10.0	0.06	0.9	1.1	1.0	0.05	9.02	206.77
3.1	0.4	9.9	10.2	10.1	0.06	0.3	0.5	0.4	0.05	9.65	213.91
3.1	0.5	9.9	10.2	10.1	0.05	0.2	0.3	0.3	0.02	9.78	215.35
3.1	0.6	9.9	10.2	10.1	0.05	0.2	0.3	0.3	0.02	9.80	215.50
3.1	0.7	10.0	10.3	10.1	0.06	0.3	0.4	0.3	0.02	9.85	216.03
3.1	0.8	9.9	10.2	10.1	0.05	0.3	0.4	0.4	0.02	9.69	214.34
3.1	0.9	10.0	10.2	10.1	0.04	0.7	0.9	0.8	0.04	9.29	209.84
3.1	1.0	10.0	10.3	10.1	0.06	1.8	2.1	2.0	0.05	8.13	196.31
3.1	1.1	10.0	10.3	10.1	0.04	3.7	4.1	3.9	0.10	6.21	171.55
3.1	1.2	9.9	10.2	10.0	0.05	5.9	6.1	6.0	0.06	4.02	138.07
3.1	1.3	9.8	10.0	9.9	0.04	7.4	7.6	7.5	0.05	2.47	108.20

EXIT HOT WIRE DATA (V3:HW30E.TEXT)

X=0.10IN Y=0.10IN F=0.00IN S=0.0%
CALIBRATION USED : A=3.3609 B=4.3096 n=0.370
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE X (in)	PROBE Y (in)	VELOCITIES MIN FT/S	VELOCITIES MAX FT/S	VELOCITIES AVG FT/S	FLUCTUATIONS MEAN1 FT/S	FLUCTUATIONS RMS1 FT/S	FLUCTUATIONS MEAN2 FT/S	FLUCTUATIONS RMS2 FT/S	INTENSITY RMS1 (%)	INTENSITY RMS2 (%)
3.1	-1.3	11	63	32.2	5.1	6.43	4.9	6.09	19.99	18.94
3.1	-1.2	10	55	29.9	4.6	5.79	5.1	6.99	19.40	23.39
3.1	-1.1	5	92	28.1	4.9	6.40	5.0	6.42	22.77	22.83
3.1	-1.0	5	86	26.8	5.8	7.67	6.0	7.70	28.64	28.74
3.1	-0.9	5	100	25.5	7.3	9.73	7.7	9.98	38.19	39.18
3.1	-0.8	4	109	26.5	9.5	12.93	9.4	11.85	48.84	44.76
3.1	-0.7	5	156	34.5	15.3	20.14	12.7	16.33	58.38	47.33
3.1	-0.6	5	168	45.1	19.9	24.80	20.3	24.76	54.98	54.88
3.1	-0.5	9	172	63.5	25.2	30.84	27.4	33.23	48.57	52.34
3.1	-0.4	7	201	82.4	29.1	35.61	26.4	33.28	43.19	40.36
3.0	-0.3	14	220	116.0	32.6	39.35	31.0	38.73	33.91	33.37
3.1	-0.2	31	237	138.9	30.4	36.98	31.2	39.60	26.63	28.51
3.1	-0.1	22	235	159.2	26.2	32.56	36.9	45.58	20.45	28.63
3.1	0.0	47	228	180.4	19.2	24.54	11.3	15.58	13.60	8.64
3.1	0.1	60	223	181.2	17.5	23.01	16.2	22.78	12.70	12.57
3.1	0.2	57	222	192.9	12.2	17.19	15.9	20.10	8.91	10.42
3.1	0.3	137	220	200.9	5.2	7.94	4.6	6.36	3.95	3.16
3.1	0.4	132	220	201.1	5.0	7.21	18.1	23.05	3.59	11.46
3.1	0.5	162	220	202.8	3.3	4.65	4.7	6.39	2.29	3.15
3.1	0.6	155	216	202.8	3.3	4.92	2.4	3.05	2.43	1.51
3.1	0.7	171	216	202.8	3.1	4.28	2.4	3.03	2.11	1.49
3.1	0.8	164	215	202.3	3.3	4.74	6.4	8.48	2.34	4.19
3.1	0.9	155	220	200.3	5.0	6.86	3.3	4.34	3.43	2.17
3.1	1.0	124	221	193.0	9.3	11.94	6.3	8.82	6.19	4.57
3.1	1.1	87	221	172.2	15.1	19.29	16.5	20.79	11.20	12.07
3.1	1.2	67	208	138.4	17.8	22.11	17.4	21.56	15.97	15.57
3.1	1.3	61	184	114.6	15.6	19.49	15.2	18.63	17.02	16.26

PRESSURE RECOVERY DATA GEOMETRY #3

CP31.DAT	X=0.10IN Y=0.10IN F=0.00IN		PROBE(3.10, 0.00)
TEMP(F)= 79.5	Density(Lbs2/ft4)=0.002214		P(mm Hg) = 736
C.L.M#=0.2009	Vc.l.(ft/s) = 228.707		Vavg(ft/s)=208.17
M(LB/m)=83.43	S(%)=1.0	S(ind)= 0.44	S(act) = 0.42
PTS=3000/3.07	P("H2O)=-2.03419+1.49391*V		HEADavg = 9.223

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	8.26	8.57	8.40	0.050	0.039	0.000
2	0.00	0.000	1.25	1.51	1.38	0.050	0.041	0.000
3	-8.00	-5.333	10.56	10.93	10.72	0.061	0.049	0.043
5	-5.00	-3.333	10.50	10.90	10.71	0.072	0.058	0.045
7	-2.50	-1.667	10.63	11.26	10.91	0.112	0.090	0.022
9	-1.00	-0.667	11.08	11.50	11.27	0.066	0.051	-0.017
11	0.43	0.140	11.18	11.74	11.68	0.095	0.065	-0.061
13	0.85	0.280	9.37	10.39	9.93	0.178	0.145	0.129
15	1.28	0.420	8.89	9.48	9.17	0.101	0.081	0.211
17	1.71	0.560	8.45	9.16	8.83	0.117	0.093	0.248
19	2.13	0.700	8.47	8.59	8.54	0.017	0.013	0.280
21	2.56	0.840	8.28	8.43	8.36	0.017	0.014	0.299
23	2.98	0.980	8.23	8.35	8.30	0.018	0.015	0.306
4	-8.00	-5.333	10.37	10.97	10.63	0.095	0.075	0.053
6	-5.00	-3.333	10.56	10.77	10.67	0.032	0.026	0.049
8	-2.50	-1.667	10.69	11.10	10.87	0.067	0.054	0.027
10	-1.00	-0.667	10.70	11.23	10.96	0.086	0.068	0.017
12	0.43	0.140	9.36	10.38	9.84	0.150	0.120	0.139
14	0.85	0.280	8.69	9.77	9.17	0.153	0.119	0.212
16	1.28	0.420	9.15	9.27	9.22	0.017	0.014	0.206
18	1.71	0.560	8.21	8.98	8.63	0.130	0.105	0.270
20	2.13	0.700	7.99	8.79	8.43	0.126	0.100	0.292
22	2.56	0.840	7.92	8.72	8.31	0.120	0.096	0.305
24	2.98	0.980	8.04	8.77	8.40	0.124	0.100	0.294

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #3

```
PIT31E.DAT        X=0.10IN Y=0.10IN F=0.00IN
TEMP(F)=  79.7    Density(Lbs2/ft4)=0.002210 P(mm Hg)  =   735
CLmach#=0.2010    Vc.l.(ft/s)      = 228.858 Vavg(ft/s)=208.31
M(LB/m)= 83.34    S(%)=1.0   S(ind)=    0.44 S(act)    =  0.42
PTS=3000/1.97s    P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	8.1	8.4	8.3	0.05	8.4	8.5	8.4	0.02	-0.15	-26.79
3.1	-1.2	8.1	8.5	8.3	0.08	8.3	8.5	8.4	0.02	-0.12	-23.35
3.1	-1.1	8.2	8.5	8.3	0.06	8.3	8.4	8.4	0.02	-0.03	-10.94
3.1	-1.0	8.2	8.5	8.4	0.06	8.3	8.4	8.3	0.02	0.01	6.91
3.1	-0.9	8.2	8.6	8.4	0.07	8.1	8.3	8.2	0.02	0.20	30.77
3.1	-0.8	8.3	8.6	8.4	0.05	7.9	8.0	7.9	0.02	0.47	47.18
3.1	-0.7	8.3	8.6	8.4	0.05	7.5	7.7	7.5	0.04	0.90	65.20
3.1	-0.6	8.4	8.7	8.5	0.05	6.8	7.0	6.9	0.02	1.57	86.09
3.1	-0.5	8.4	8.6	8.5	0.04	6.0	6.2	6.1	0.03	2.37	105.55
3.1	-0.4	8.4	8.6	8.5	0.05	5.0	5.3	5.2	0.04	3.32	125.07
3.1	-0.3	8.2	8.7	8.5	0.08	3.8	4.1	3.9	0.07	4.54	146.12
3.1	-0.2	8.3	8.7	8.5	0.06	2.7	3.3	3.1	0.11	5.39	159.25
3.1	-0.1	8.3	8.6	8.4	0.04	1.8	2.2	1.9	0.08	6.49	174.74
3.1	0.0	8.2	8.6	8.4	0.05	1.3	2.0	1.6	0.17	6.83	179.35
3.1	0.1	8.3	8.6	8.4	0.05	0.6	0.8	0.7	0.04	7.72	190.60
3.1	0.2	8.2	8.6	8.4	0.06	0.3	0.6	0.4	0.06	7.97	193.64
3.1	0.3	8.2	8.6	8.4	0.06	0.4	0.9	0.7	0.10	7.72	190.64
3.1	0.4	8.3	8.6	8.4	0.04	0.3	0.6	0.4	0.06	8.01	194.21
3.1	0.5	8.3	8.6	8.4	0.05	0.2	0.3	0.2	0.02	8.21	196.56
3.1	0.6	8.3	8.6	8.4	0.04	0.2	0.4	0.3	0.04	8.11	195.36
3.1	0.7	8.4	8.6	8.5	0.05	0.2	0.4	0.3	0.03	8.16	195.99
3.1	0.8	8.3	8.6	8.5	0.06	0.6	0.8	0.7	0.03	7.82	191.87
3.1	0.9	8.3	8.7	8.5	0.06	1.2	1.4	1.3	0.03	7.22	184.36
3.1	1.0	8.3	8.7	8.5	0.07	2.5	3.1	2.7	0.14	5.84	165.82
3.1	1.1	8.3	8.7	8.5	0.06	4.5	4.8	4.7	0.08	3.85	134.54
3.1	1.2	8.3	8.7	8.5	0.06	6.0	6.2	6.1	0.03	2.41	106.53
3.1	1.3	8.3	8.5	8.4	0.04	6.6	6.9	6.7	0.04	1.68	88.93

EXIT HOT WIRE DATA (V3:HW31E.TEXT)

X=0.10IN Y=0.10IN F=0.00IN S=1.0%
CALIBRATION USED : A=3.3609 B=4.3096 n=0.370
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.1	-1.3	5	131	33.3	9.4	11.92	8.9	11.19	35.80	33.61
3.1	-1.2	5	125	32.3	9.3	12.24	10.6	14.37	37.82	44.42
3.1	-1.1	6	187	33.7	12.3	17.29	12.0	15.63	51.30	46.37
3.1	-1.0	5	164	34.6	13.8	18.96	14.1	18.13	54.74	52.37
3.1	-0.9	6	178	41.4	18.6	24.56	18.6	23.30	59.32	56.27
3.1	-0.8	5	183	50.9	23.4	29.45	22.9	28.12	57.87	55.25
3.1	-0.7	6	205	62.4	28.4	35.18	27.7	33.92	56.41	54.40
3.1	-0.6	9	202	80.6	32.3	38.92	30.7	37.94	48.27	47.05
3.1	-0.5	10	222	100.5	33.9	40.76	38.5	48.10	40.54	47.84
3.1	-0.4	11	222	111.6	34.8	41.48	35.6	44.17	37.18	39.58
3.1	-0.3	12	227	131.6	36.1	43.09	40.8	50.50	32.74	38.38
3.1	-0.2	18	224	152.5	30.0	37.16	37.9	48.39	24.37	31.74
3.1	-0.1	21	227	169.7	25.0	32.32	9.7	16.15	19.04	9.51
3.1	0.0	16	243	170.6	23.8	30.93	29.2	40.40	18.13	23.68
3.1	0.1	40	234	181.1	17.7	24.03	10.3	17.09	13.27	9.43
3.1	0.2	27	233	189.3	12.9	18.86	5.9	7.79	9.97	4.12
3.1	0.3	93	223	195.5	6.9	10.56	4.5	5.55	5.40	2.84
3.1	0.4	96	227	195.7	6.7	10.00	5.9	8.00	5.11	4.09
3.1	0.5	153	221	197.8	4.5	5.95	3.9	5.06	3.01	2.56
3.1	0.6	147	215	197.3	4.7	6.77	3.9	4.91	3.43	2.49
3.1	0.7	133	216	197.3	4.9	7.10	6.2	8.97	3.60	4.55
3.1	0.8	104	218	194.5	6.8	9.72	5.1	6.95	5.00	3.58
3.1	0.9	99	220	184.8	12.4	16.06	13.8	16.87	8.69	9.13
3.1	1.0	78	220	169.7	17.7	22.18	18.1	23.80	13.07	14.02
3.1	1.1	50	210	144.3	21.6	26.49	20.3	25.69	18.36	17.80
3.1	1.2	42	199	118.5	21.6	26.50	21.0	26.19	22.36	22.11
3.1	1.3	27	176	95.6	17.8	22.29	19.4	24.90	23.31	26.04

PRESSURE RECOVERY DATA GEOMETRY #3

CP32.DAT	X=0.10IN Y=0.10IN F=0.00IN		PROBE(3.10, 0.00)
TEMP(F)= 83.5	Density(Lbs2/ft4)=0.002189		P(mm Hg) = 733
C.L.M#=0.2001	Vc.l.(ft/s) = 228.653		Vavg(ft/s)=206.95
M(LB/m)=82.00	S(%)=2.0	S(ind)= 0.86	S(act) = 0.82
PTS=3000/2.96	P("H2O)=-2.03419+1.49391*V		HEADavg = 9.011

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	6.10	6.37	6.23	0.046	0.037	0.000
2	0.00	0.000	0.78	1.39	1.06	0.149	0.130	0.000
3	-8.00	-5.333	10.25	10.84	10.53	0.103	0.084	0.053
5	-5.00	-3.333	10.31	10.89	10.59	0.116	0.096	0.046
7	-2.50	-1.667	10.37	11.17	10.78	0.146	0.123	0.024
9	-1.00	-0.667	10.78	11.33	11.09	0.113	0.089	-0.009
11	0.43	0.140	8.03	8.91	8.46	0.165	0.136	0.282
13	0.85	0.280	7.33	8.09	7.77	0.110	0.086	0.359
15	1.28	0.420	6.87	7.56	7.31	0.110	0.085	0.410
17	1.71	0.560	6.04	7.03	6.53	0.163	0.129	0.496
19	2.13	0.700	6.70	6.85	6.77	0.022	0.018	0.469
21	2.56	0.840	6.48	6.64	6.56	0.021	0.017	0.493
23	2.98	0.980	6.16	6.35	6.25	0.022	0.018	0.527
4	-8.00	-5.333	10.26	10.88	10.58	0.108	0.089	0.047
6	-5.00	-3.333	10.53	10.88	10.69	0.056	0.045	0.035
8	-2.50	-1.667	10.61	11.03	10.80	0.074	0.058	0.023
10	-1.00	-0.667	10.18	11.25	10.92	0.166	0.124	0.009
12	0.43	0.140	6.86	8.30	7.61	0.272	0.221	0.377
14	0.85	0.280	6.51	7.79	7.14	0.231	0.187	0.428
16	1.28	0.420	7.15	7.29	7.22	0.023	0.019	0.420
18	1.71	0.560	6.69	7.21	6.94	0.081	0.064	0.451
20	2.13	0.700	6.39	6.97	6.67	0.096	0.077	0.481
22	2.56	0.840	5.85	6.85	6.24	0.173	0.139	0.528
24	2.98	0.980	5.78	6.74	6.16	0.157	0.124	0.537

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #3

```
PIT32E.DAT       X=0.10IN Y=0.10IN F=0.00IN
TEMP(F)=  83.3   Density(Lbs2/ft4)=0.002189 P(mm Hg)  =    733
CLmach#=0.1995   Vc.l.(ft/s)       = 227.884 Vavg(ft/s)=206.26
M(LB/m)= 81.75   S(%)=2.0    S(ind)=    0.86 S(act)    =  0.82
PTS=3000/2.03s   P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.1	-1.3	6.0	6.4	6.1	0.09	5.9	6.2	6.1	0.03	0.08	19.40
3.1	-1.2	5.9	6.3	6.1	0.08	5.8	6.0	5.9	0.04	0.23	33.39
3.1	-1.1	6.0	6.4	6.2	0.06	5.6	6.0	5.8	0.06	0.38	42.39
3.1	-1.0	6.0	6.3	6.1	0.06	5.1	5.5	5.3	0.06	0.86	63.86
3.1	-0.9	6.1	6.4	6.2	0.07	5.2	5.4	5.3	0.05	0.88	64.83
3.1	-0.8	6.0	6.4	6.2	0.07	4.6	4.9	4.7	0.06	1.48	83.88
3.1	-0.7	6.1	6.5	6.3	0.08	3.5	4.2	3.8	0.15	2.50	108.91
3.1	-0.6	6.0	6.5	6.2	0.09	2.6	3.5	3.1	0.21	3.04	120.25
3.1	-0.5	6.1	6.6	6.2	0.09	2.5	3.8	3.1	0.39	3.11	121.64
3.1	-0.4	6.1	6.5	6.3	0.07	1.8	2.5	2.2	0.21	4.12	139.89
3.1	-0.3	6.0	6.3	6.2	0.05	0.7	1.6	1.2	0.24	4.98	153.84
3.1	-0.2	6.1	6.4	6.2	0.06	0.6	1.7	1.1	0.33	5.12	156.01
3.1	-0.1	6.1	6.4	6.2	0.05	0.8	1.4	1.1	0.16	5.14	156.29
3.1	0.0	6.1	6.5	6.2	0.08	0.8	1.2	1.0	0.10	5.27	158.21
3.1	0.1	6.1	6.3	6.2	0.04	0.5	1.0	0.8	0.09	5.46	161.11
3.1	0.2	6.1	6.5	6.3	0.07	0.4	0.9	0.6	0.10	5.66	163.94
3.1	0.3	6.2	6.6	6.3	0.06	0.1	0.4	0.2	0.04	6.07	169.89
3.1	0.4	6.2	6.4	6.3	0.04	0.1	0.3	0.2	0.03	6.12	170.47
3.1	0.5	6.2	6.4	6.3	0.05	0.2	0.5	0.3	0.05	5.97	168.42
3.1	0.6	6.2	6.5	6.4	0.07	0.3	0.5	0.4	0.03	5.95	168.17
3.1	0.7	6.2	6.5	6.4	0.05	0.7	1.0	0.9	0.05	5.50	161.59
3.1	0.8	6.3	6.6	6.4	0.04	1.4	2.0	1.7	0.13	4.72	149.73
3.1	0.9	6.3	6.6	6.4	0.04	2.0	2.6	2.3	0.14	4.11	139.79
3.1	1.0	6.3	6.6	6.4	0.04	3.3	3.8	3.5	0.12	2.91	117.64
3.1	1.1	6.0	6.3	6.1	0.05	5.9	6.1	6.0	0.03	0.10	21.80
3.1	1.2	6.3	6.5	6.4	0.04	4.6	5.4	5.0	0.25	1.42	82.12
3.1	1.3	6.1	6.5	6.3	0.05	5.4	5.6	5.5	0.03	0.78	60.85

EXIT HOT WIRE DATA (V3:HW32E.TEXT)

X=0.10IN Y=0.10IN F=0.00IN S=2.0%
CALIBRATION USED : A=3.1391 B=4.5627 n=0.360
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X	Y	MIN	MAX	AVG	MEAN1	RMS1	MEAN2	RMS2	RMS1	RMS2
(in)	(in)	FT/S		FT/S	FT/S	FT/S	FT/S	FT/S	(%)	(%)
3.1	-1.3	5	122	31.5	13.0	17.00	15.4	18.71	54.00	59.44
3.1	-1.2	4	147	35.4	16.1	20.91	16.2	19.56	59.03	55.21
3.1	-1.1	4	170	44.9	20.8	25.88	18.6	22.71	57.58	50.52
3.1	-1.0	5	160	54.0	24.2	29.19	26.4	31.83	54.03	58.93
3.1	-0.9	7	172	60.2	28.3	34.02	24.1	30.09	56.53	50.00
3.1	-0.8	6	180	79.6	31.4	37.30	23.0	29.39	46.87	36.94
3.1	-0.7	7	185	92.1	33.5	39.71	45.1	52.81	43.10	57.31
3.1	-0.6	7	190	106.0	36.0	42.49	34.6	43.08	40.10	40.66
3.1	-0.5	7	191	116.7	35.3	42.18	55.3	64.08	36.15	54.92
3.1	-0.4	10	188	142.3	23.6	31.25	46.0	57.63	21.96	40.50
3.1	-0.3	9	198	144.9	24.2	32.50	5.2	7.68	22.44	5.30
3.1	-0.2	11	191	150.4	22.3	31.83	19.8	27.89	21.17	18.55
3.1	-0.1	14	214	151.2	20.8	30.43	24.6	33.45	20.13	22.12
3.1	0.0	15	190	159.6	12.6	20.32	2.5	3.33	12.73	2.09
3.1	0.1	17	194	162.1	10.1	16.97	27.6	40.89	10.47	25.22
3.1	0.2	15	197	166.4	5.4	10.97	55.2	68.50	6.59	41.16
3.1	0.3	48	189	166.6	5.6	8.75	7.3	9.81	5.25	5.89
3.1	0.4	32	191	163.5	9.2	14.41	3.4	4.68	8.82	2.86
3.1	0.5	22	188	163.3	8.9	14.27	5.4	7.93	8.74	4.86
3.1	0.6	26	210	161.7	11.4	17.13	2.4	3.00	10.59	1.85
3.1	0.7	38	189	157.3	13.9	18.54	3.4	4.38	11.78	2.79
3.1	0.8	39	191	153.1	17.4	22.91	21.0	27.27	14.97	17.82
3.1	0.9	15	199	140.6	25.5	30.94	8.8	13.36	22.00	9.50
3.1	1.0	6	190	112.5	31.7	38.51	21.3	26.99	34.23	23.99
3.1	1.1	8	185	93.9	27.3	33.66	37.4	45.43	35.84	48.37
3.1	1.2	7	171	79.4	22.3	28.07	22.1	27.88	35.35	35.11
3.1	1.3	5	159	58.2	24.1	29.58	20.1	25.68	50.82	44.11

PRESSURE RECOVERY DATA GEOMETRY #4

CP40.DAT	X=0.00IN Y=0.05IN F=0.00IN	PROBE(3.05, 0.00)
TEMP(F)= 83.0	Density(Lbs2/ft4)=0.002188	P(mm Hg) = 732
C.L.M#=0.1987	Vc.l.(ft/s) = 226.985	Vavg(ft/s)=205.80
M(LB/m)=81.50	S(%)=0.0 S(ind)= 0.00	S(act) = 0.00
PTS=3000/2.96	P("H2O)=-2.03419+1.49391*V	HEADavg = 8.908

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	9.36	9.69	9.53	0.059	0.048	0.000
2	0.00	0.000	1.06	1.43	1.27	0.087	0.073	0.000
3	-8.00	-5.333	10.12	10.56	10.36	0.083	0.067	0.055
5	-5.00	-3.333	10.11	10.54	10.33	0.090	0.076	0.058
7	-2.50	-1.667	10.29	10.91	10.57	0.092	0.073	0.031
9	-1.00	-0.667	10.86	11.23	11.04	0.059	0.048	-0.021
11	0.43	0.140	11.68	11.75	11.74	0.003	0.001	-0.100
13	0.85	0.280	10.13	10.95	10.56	0.123	0.099	0.034
15	1.28	0.420	9.76	10.36	10.06	0.103	0.083	0.090
17	1.71	0.560	9.46	10.23	9.82	0.106	0.084	0.117
19	2.13	0.700	9.36	9.45	9.41	0.013	0.010	0.162
21	2.56	0.840	9.24	9.36	9.30	0.015	0.012	0.174
23	2.98	0.980	9.39	9.48	9.43	0.016	0.013	0.160
4	-8.00	-5.333	10.09	10.56	10.31	0.074	0.059	0.061
6	-5.00	-3.333	10.26	10.51	10.38	0.043	0.034	0.054
8	-2.50	-1.667	10.37	10.73	10.55	0.060	0.051	0.034
10	-1.00	-0.667	10.39	10.85	10.67	0.080	0.066	0.021
12	0.43	0.140	9.48	10.11	9.80	0.101	0.081	0.118
14	0.85	0.280	9.18	9.88	9.57	0.107	0.084	0.144
16	1.28	0.420	9.10	9.79	9.47	0.110	0.085	0.155
18	1.71	0.560	9.09	9.77	9.47	0.115	0.093	0.156
20	2.13	0.700	9.32	9.43	9.38	0.017	0.013	0.166
22	2.56	0.840	9.03	9.63	9.36	0.102	0.084	0.168
24	2.98	0.980	9.16	9.81	9.48	0.108	0.087	0.154

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #4

```
PIT40E.DAT        X=0.00IN Y=0.05IN F=0.00IN
TEMP(F)=  83.0    Density(Lbs2/ft4)=0.002188 P(mm Hg)  =   732
CLmach#=0.1984    Vc.l.(ft/s)      = 226.568 Vavg(ft/s)=205.42
M(LB/m)= 81.36    S(%)=0.0   S(ind)=    0.00 S(act)    =  0.00
PTS=3000/1.97s    P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.0	-1.3	9.3	9.4	9.3	0.03	9.5	9.6	9.5	0.02	-0.18	-29.11
3.0	-1.2	9.2	9.5	9.3	0.04	9.4	9.6	9.5	0.02	-0.15	-26.50
3.0	-1.1	9.2	9.5	9.3	0.05	9.4	9.5	9.5	0.01	-0.11	-22.74
3.0	-1.0	9.2	9.5	9.3	0.06	9.4	9.5	9.5	0.01	-0.13	-24.38
3.0	-0.9	9.2	9.5	9.4	0.05	9.3	9.5	9.4	0.02	-0.04	-13.11
3.0	-0.8	9.3	9.6	9.4	0.05	9.3	9.4	9.3	0.02	0.10	22.27
3.0	-0.7	9.3	9.6	9.5	0.05	9.0	9.1	9.0	0.02	0.43	45.01
3.0	-0.6	9.4	9.6	9.5	0.04	8.3	8.5	8.4	0.04	1.08	71.64
3.0	-0.5	9.4	9.7	9.5	0.05	7.6	7.8	7.7	0.03	1.81	92.89
3.0	-0.4	9.3	9.7	9.5	0.06	6.0	6.4	6.2	0.09	3.31	125.37
3.0	-0.3	9.4	9.6	9.5	0.05	5.0	5.5	5.3	0.14	4.24	141.97
3.0	-0.2	9.4	9.7	9.5	0.05	2.9	3.4	3.1	0.13	6.40	174.50
3.0	-0.1	9.4	9.7	9.5	0.06	2.4	2.9	2.7	0.12	6.84	180.30
3.0	0.0	9.3	9.6	9.5	0.05	1.3	1.8	1.5	0.12	8.01	195.16
3.0	0.1	9.4	9.6	9.5	0.04	0.6	1.0	0.8	0.09	8.74	203.84
3.0	0.2	9.3	9.7	9.5	0.07	0.5	1.0	0.7	0.13	8.78	204.38
3.0	0.3	9.3	9.6	9.5	0.06	0.5	0.8	0.6	0.09	8.87	205.39
3.0	0.4	9.3	9.7	9.5	0.05	0.2	0.4	0.3	0.03	9.27	210.00
3.0	0.5	9.4	9.7	9.6	0.06	0.2	0.3	0.3	0.03	9.32	210.48
3.0	0.6	9.5	9.8	9.6	0.06	0.3	0.4	0.4	0.02	9.22	209.41
3.0	0.7	9.3	9.7	9.5	0.06	0.2	0.5	0.4	0.08	9.16	208.67
3.0	0.8	9.4	9.7	9.6	0.06	0.4	0.6	0.5	0.03	9.06	207.54
3.0	0.9	9.5	9.8	9.6	0.05	0.9	1.3	1.1	0.11	8.53	201.41
3.0	1.0	9.5	9.8	9.6	0.04	2.5	3.0	2.8	0.15	6.89	181.04
3.0	1.1	9.5	9.7	9.6	0.04	4.6	4.9	4.7	0.05	4.85	151.83
3.0	1.2	9.3	9.6	9.5	0.05	6.7	6.9	6.8	0.04	2.70	113.31
3.0	1.3	9.3	9.6	9.5	0.05	7.0	7.2	7.1	0.04	2.41	106.96

EXIT HOT WIRE DATA (V3:HW40E.TEXT)

X=0.00 Y=0.05 F=0.00 S=0.0%
CALIBRATION USED : A=3.1391 B=4.5627 n=0.360
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.0	-1.3	9	79	35.5	6.0	7.67	6.5	8.17	21.60	23.02
3.0	-1.2	7	68	33.1	6.2	7.89	6.3	8.21	23.88	24.85
3.0	-1.1	6	93	30.8	6.9	8.97	6.1	8.16	29.08	26.45
3.0	-1.0	5	121	28.6	7.9	10.66	8.6	11.03	37.28	38.57
3.0	-0.9	6	153	28.9	10.0	13.60	9.4	11.93	47.07	41.28
3.0	-0.8	5	172	35.3	15.4	21.08	15.4	19.46	59.77	55.18
3.0	-0.7	6	185	48.1	22.3	28.29	21.1	26.15	58.84	54.39
3.0	-0.6	7	202	66.2	27.6	33.93	33.7	40.67	51.22	61.40
3.0	-0.5	11	226	91.6	32.8	39.93	35.2	43.65	43.61	47.67
3.0	-0.4	11	240	122.0	35.5	42.86	38.2	48.06	35.14	39.41
3.0	-0.3	15	243	140.8	38.0	45.43	36.8	45.95	32.27	32.64
3.0	-0.2	32	243	172.9	28.5	35.78	27.1	36.10	20.70	20.88
3.0	-0.1	49	266	193.0	21.2	28.27	17.4	25.40	14.65	13.16
3.0	0.0	52	245	193.9	21.3	27.27	19.6	26.32	14.06	13.58
3.0	0.1	83	248	207.4	16.0	21.80	9.3	12.97	10.51	6.25
3.0	0.2	140	243	217.2	7.3	10.59	4.2	5.75	4.87	2.65
3.0	0.3	136	245	218.1	6.2	9.12	13.9	17.28	4.18	7.92
3.0	0.4	170	239	220.3	4.2	6.04	2.9	3.82	2.74	1.74
3.0	0.5	167	236	220.8	3.9	5.39	3.2	3.94	2.44	1.79
3.0	0.6	184	240	221.3	3.4	4.97	2.4	3.10	2.24	1.40
3.0	0.7	174	236	221.4	3.3	4.75	2.9	3.63	2.14	1.64
3.0	0.8	154	234	216.6	7.5	10.44	10.9	13.42	4.82	6.20
3.0	0.9	157	234	210.1	10.2	12.44	7.9	9.88	5.92	4.70
3.0	1.0	110	234	197.8	12.7	15.92	9.2	12.09	8.05	6.11
3.0	1.1	99	229	165.4	17.1	21.17	17.0	21.71	12.80	13.12
3.0	1.2	69	205	133.8	15.9	19.76	15.6	19.49	14.77	14.56
3.0	1.3	54	198	114.6	14.8	18.59	14.6	17.86	16.22	15.58

PRESSURE RECOVERY DATA GEOMETRY #4

CP41.DAT	X=0.00IN Y=0.05IN F=0.00IN	PROBE(3.00, 0.00)
TEMP(F)= 89.0	Density(Lbs2/ft4)=0.002158	P(mm Hg) = 730
C.L.M#=0.1996	Vc.l.(ft/s) = 229.220	Vavg(ft/s)=207.65
M(LB/m)=81.11	S(%)=1.0 S(ind)= 0.43	S(act) = 0.41
PTS=3000/2.96	P("H2O)=-2.03419+1.49391*V	HEADavg = 8.944

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	6.52	6.93	6.71	0.078	0.064	0.000
2	0.00	0.000	0.65	0.99	0.85	0.075	0.062	0.000
3	-8.00	-5.333	10.21	10.57	10.38	0.065	0.054	0.059
5	-5.00	-3.333	10.08	10.63	10.40	0.107	0.091	0.057
7	-2.50	-1.667	10.19	11.02	10.62	0.143	0.118	0.032
9	-1.00	-0.667	10.60	11.12	10.92	0.105	0.081	-0.001
11	0.43	0.140	8.50	9.24	8.92	0.119	0.094	0.222
13	0.85	0.280	7.82	8.68	8.34	0.129	0.097	0.288
15	1.28	0.420	7.57	8.10	7.83	0.079	0.063	0.344
17	1.71	0.560	7.23	7.72	7.45	0.077	0.061	0.387
19	2.13	0.700	6.77	6.90	6.84	0.019	0.015	0.455
21	2.56	0.840	6.66	6.79	6.73	0.019	0.015	0.468
23	2.98	0.980	6.70	6.83	6.77	0.020	0.016	0.463
4	-8.00	-5.333	10.17	10.64	10.42	0.077	0.062	0.055
6	-5.00	-3.333	10.24	10.54	10.40	0.048	0.038	0.057
8	-2.50	-1.667	10.26	10.87	10.62	0.109	0.089	0.032
10	-1.00	-0.667	10.32	11.25	10.90	0.148	0.115	0.001
12	0.43	0.140	7.48	8.65	8.15	0.208	0.167	0.308
14	0.85	0.280	6.67	7.93	7.46	0.237	0.187	0.386
16	1.28	0.420	6.64	7.53	7.03	0.148	0.115	0.434
18	1.71	0.560	6.50	7.16	6.82	0.112	0.091	0.457
20	2.13	0.700	6.47	7.13	6.69	0.087	0.067	0.472
22	2.56	0.840	6.35	7.16	6.66	0.121	0.096	0.475
24	2.98	0.980	6.29	7.13	6.59	0.145	0.114	0.483

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #4

```
PIT41E.DAT       X=0.00IN Y=0.05IN F=0.00IN
TEMP(F)=  88.5   Density(Lbs2/ft4)=0.002160 P(mm Hg)   =    730
CLmach#=0.1997   Vc.l.(ft/s)        = 229.213 Vavg(ft/s)=207.64
M(LB/m)= 81.18   S(%)=1.0   S(ind)=    0.43 S(act)     =  0.41
PTS=3000/1.97s   P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN (" H2O)	STAGNATION PORT MAX (" H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY HEAD (FT/S)
3.0	-1.3	6.4	6.7	6.5	0.05	6.6	6.7	6.6	0.03	-0.09	-21.10
3.0	-1.2	6.5	6.8	6.6	0.05	6.6	6.7	6.6	0.03	-0.03	-11.47
3.0	-1.1	6.5	6.8	6.6	0.08	6.2	6.5	6.4	0.07	0.24	34.01
3.0	-1.0	6.4	6.8	6.6	0.08	6.1	6.4	6.2	0.03	0.39	43.43
3.0	-0.9	6.5	6.8	6.6	0.06	5.9	6.2	6.0	0.06	0.60	53.72
3.0	-0.8	6.6	6.9	6.7	0.06	4.9	5.4	5.0	0.13	1.67	89.62
3.0	-0.7	6.5	7.0	6.7	0.08	4.5	4.9	4.7	0.08	1.96	97.17
3.0	-0.6	6.5	7.0	6.8	0.09	3.4	4.3	3.8	0.23	2.96	119.35
3.0	-0.5	6.6	6.9	6.8	0.06	3.0	3.6	3.4	0.14	3.35	127.05
3.0	-0.4	6.5	7.0	6.8	0.12	2.2	3.3	2.8	0.38	3.98	138.46
3.0	-0.3	6.5	6.9	6.7	0.08	1.3	1.8	1.5	0.09	5.20	158.23
3.0	-0.2	6.5	7.0	6.7	0.10	1.2	2.0	1.5	0.23	5.23	158.64
3.0	-0.1	6.6	7.0	6.7	0.08	1.1	1.6	1.3	0.16	5.38	161.01
3.0	0.0	6.5	6.8	6.6	0.05	0.7	1.3	0.9	0.16	5.73	166.11
3.0	0.1	6.5	6.9	6.7	0.06	0.3	0.6	0.5	0.06	6.20	172.85
3.0	0.2	6.6	6.9	6.7	0.05	0.3	0.6	0.4	0.05	6.30	174.15
3.0	0.3	6.6	7.0	6.7	0.07	0.2	0.5	0.3	0.05	6.45	176.21
3.0	0.4	6.6	7.0	6.8	0.09	0.2	0.4	0.3	0.05	6.52	177.19
3.0	0.5	6.6	6.9	6.7	0.04	0.2	0.4	0.3	0.06	6.45	176.21
3.0	0.6	6.6	6.9	6.8	0.04	0.3	0.6	0.4	0.06	6.33	174.63
3.0	0.7	6.7	7.1	6.8	0.06	0.6	0.9	0.8	0.07	6.08	171.07
3.0	0.8	6.7	6.9	6.8	0.03	0.7	1.1	0.9	0.10	5.88	168.31
3.0	0.9	6.7	7.0	6.8	0.04	1.5	2.4	2.1	0.23	4.75	151.24
3.0	1.0	6.7	6.9	6.8	0.03	2.9	3.4	3.2	0.11	3.64	132.37
3.0	1.1	6.7	6.9	6.8	0.04	2.8	3.6	3.2	0.22	3.59	131.48
3.0	1.2	6.7	6.9	6.8	0.04	4.9	5.4	5.2	0.09	1.61	88.01
3.0	1.3	6.7	6.9	6.8	0.03	5.8	6.0	5.9	0.04	0.92	66.44

EXIT HOT WIRE DATA (V3:HW41E.TEXT)

X=0.00IN Y=0.05IN F=0.00IN S=1.0%
CALIBRATION USED : A=0.5193 B=6.1802 n=0.320
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.0	-1.3	5	94	24.3	8.4	10.88	6.8	8.61	44.82	35.45
3.0	-1.2	6	109	28.5	9.1	11.81	8.7	10.95	41.36	38.34
3.0	-1.1	5	135	33.7	13.8	18.19	13.5	16.94	53.96	50.24
3.0	-1.0	5	158	37.9	16.6	21.44	18.7	22.52	56.50	59.37
3.0	-0.9	5	154	43.4	21.1	26.69	19.2	23.19	61.52	53.45
3.0	-0.8	5	183	48.2	24.2	31.14	22.7	27.37	64.54	56.74
3.0	-0.7	6	177	78.1	35.3	41.08	38.6	46.15	52.59	59.09
3.0	-0.6	9	189	94.7	38.0	44.33	42.3	52.08	46.80	54.99
3.0	-0.5	8	190	113.4	35.8	42.69	19.9	26.97	37.64	23.79
3.0	-0.4	7	200	120.4	35.5	42.22	57.5	68.40	35.08	56.83
3.0	-0.3	8	199	141.6	27.4	35.84	17.9	30.45	25.30	21.50
3.0	-0.2	10	203	142.1	27.2	35.04	10.8	19.13	24.66	13.47
3.0	-0.1	14	202	151.0	24.1	32.78	2.0	2.56	21.70	1.69
3.0	0.0	13	195	153.2	19.7	28.30	21.2	33.34	18.47	21.77
3.0	0.1	12	193	154.1	19.1	27.74	13.4	26.78	18.01	17.38
3.0	0.2	12	200	155.5	18.9	28.86	35.5	46.76	18.56	30.08
3.0	0.3	42	201	165.4	7.9	13.62	3.0	4.28	8.24	2.59
3.0	0.4	45	202	167.1	5.2	9.34	3.0	3.73	5.59	2.23
3.0	0.5	78	193	167.3	5.3	8.53	19.8	26.69	5.10	15.95
3.0	0.6	50	199	166.2	6.7	10.71	2.9	4.78	6.45	2.88
3.0	0.7	46	186	163.2	9.5	13.83	7.8	10.08	8.48	6.18
3.0	0.8	67	189	159.1	12.6	15.96	2.9	3.81	10.03	2.39
3.0	0.9	59	187	155.4	14.7	18.23	11.2	17.43	11.73	11.22
3.0	1.0	12	185	129.8	20.6	25.64	21.9	26.05	19.76	20.07
3.0	1.1	7	176	100.0	24.2	30.34	16.6	21.05	30.35	21.05
3.0	1.2	8	164	84.5	23.2	28.89	16.9	21.45	34.17	25.37
3.0	1.3	6	166	63.8	20.6	25.85	17.2	21.47	40.55	33.69

PRESSURE RECOVERY DATA GEOMETRY #4

CP42.DAT	X=0.00IN Y=0.05IN F=0.00IN	PROBE(3.00, 0.00)
TEMP(F)= 83.7	Density(Lbs2/ft4)=0.002173	P(mm Hg) = 728
C.L.M#=0.2003	Vc.l.(ft/s) = 228.908	Vavg(ft/s)=210.00
M(LB/m)=82.61	S(%)=2.0 S(ind)= 0.87	S(act) = 0.83
PTS=3000/2.96	P("H2O)=-2.03419+1.49391*V	HEADavg = 9.212

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	6.23	6.52	6.37	0.055	0.047	0.000
2	0.00	0.000	0.25	0.74	0.42	0.091	0.071	0.000
3	-8.00	-5.333	10.13	10.79	10.53	0.107	0.079	0.034
5	-5.00	-3.333	10.18	10.72	10.48	0.096	0.077	0.039
7	-2.50	-1.667	10.30	11.05	10.70	0.139	0.113	0.016
9	-1.00	-0.667	10.12	11.31	10.81	0.222	0.177	0.003
11	0.43	0.140	8.45	9.03	8.78	0.104	0.084	0.224
13	0.85	0.280	7.59	8.39	8.09	0.121	0.095	0.298
15	1.28	0.420	6.97	7.89	7.55	0.161	0.129	0.358
17	1.71	0.560	6.93	7.45	7.21	0.084	0.066	0.394
19	2.13	0.700	6.56	6.72	6.64	0.022	0.017	0.456
21	2.56	0.840	6.53	6.69	6.61	0.023	0.018	0.459
23	2.98	0.980	6.29	6.44	6.37	0.022	0.017	0.485
4	-8.00	-5.333	10.23	10.82	10.53	0.113	0.092	0.034
6	-5.00	-3.333	10.20	10.76	10.51	0.122	0.107	0.037
8	-2.50	-1.667	10.34	10.96	10.70	0.103	0.083	0.015
10	-1.00	-0.667	10.19	11.21	10.87	0.200	0.153	-0.003
12	0.43	0.140	7.05	8.70	8.01	0.331	0.271	0.308
14	0.85	0.280	6.47	8.04	7.34	0.314	0.258	0.380
16	1.28	0.420	6.38	7.35	6.80	0.153	0.120	0.439
18	1.71	0.560	6.24	7.20	6.61	0.144	0.111	0.459
20	2.13	0.700	6.29	6.66	6.43	0.056	0.043	0.479
22	2.56	0.840	5.98	6.85	6.35	0.118	0.089	0.487
24	2.98	0.980	6.00	6.84	6.25	0.137	0.108	0.498

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #4

PIT42E.DAT X=0.00IN Y=0.05IN F=0.00IN
TEMP(F)= 84.0 Density(Lbs2/ft4)=0.002172 P(mm Hg) = 728
CLmach#=0.2011 Vc.l.(ft/s) = 229.923 Vavg(ft/s)=210.94
M(LB/m)= 82.93 S(%)=2.0 S(ind)= 0.87 S(act) = 0.83
PTS=3000/1.97s P("H2O)=-2.03419+1.49391*V

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN (" H2O)	STAGNATION PORT MAX (" H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.0	-1.3	6.1	6.4	6.3	0.05	6.2	6.4	6.3	0.02	-0.04	-13.83
3.0	-1.2	6.1	6.5	6.3	0.05	6.2	6.4	6.3	0.05	0.02	10.09
3.0	-1.1	6.2	6.5	6.3	0.06	5.9	6.1	6.0	0.04	0.30	37.88
3.0	-1.0	6.2	6.7	6.4	0.10	5.5	5.9	5.7	0.07	0.69	57.58
3.0	-0.9	6.4	7.0	6.6	0.12	2.4	2.8	2.6	0.07	3.97	137.86
3.0	-0.8	6.3	6.6	6.4	0.06	4.2	5.1	4.5	0.25	1.85	94.15
3.0	-0.7	6.2	6.5	6.3	0.04	3.2	3.6	3.4	0.10	2.91	118.16
3.0	-0.6	6.2	6.5	6.3	0.05	2.4	3.3	2.9	0.23	3.48	129.15
3.0	-0.5	6.2	6.5	6.3	0.06	1.8	2.3	2.0	0.10	4.33	143.93
3.0	-0.4	6.3	6.6	6.4	0.07	1.7	2.5	2.0	0.21	4.40	145.18
3.0	-0.3	6.3	6.7	6.4	0.07	1.1	1.6	1.3	0.13	5.13	156.78
3.0	-0.2	6.3	6.6	6.4	0.05	0.2	0.6	0.4	0.13	6.07	170.53
3.0	-0.1	6.3	6.7	6.4	0.08	0.1	0.3	0.2	0.03	6.20	172.32
3.0	0.0	6.3	6.6	6.4	0.06	0.3	0.7	0.5	0.11	5.98	169.24
3.0	0.1	6.3	6.7	6.4	0.06	0.4	0.7	0.5	0.06	5.91	168.29
3.0	0.2	6.2	6.6	6.4	0.07	0.4	0.9	0.6	0.11	5.79	166.58
3.0	0.3	6.3	6.6	6.4	0.05	0.5	1.0	0.8	0.08	5.62	164.13
3.0	0.4	6.2	6.5	6.3	0.05	1.1	2.1	1.5	0.25	4.79	151.44
3.0	0.5	6.2	6.5	6.3	0.05	2.6	3.1	2.8	0.12	3.45	128.47
3.0	0.6	6.2	6.6	6.4	0.07	3.6	4.0	3.8	0.08	2.59	111.43
3.0	0.7	6.2	6.5	6.3	0.06	3.4	4.1	3.8	0.19	2.56	110.74
3.0	0.8	6.2	6.6	6.4	0.08	4.2	4.6	4.3	0.08	2.03	98.58
3.0	0.9	6.4	6.6	6.5	0.04	1.6	2.3	1.9	0.18	4.66	149.42
3.0	1.0	6.4	6.6	6.5	0.04	2.8	3.6	3.1	0.19	3.36	126.94
3.0	1.1	6.4	6.7	6.6	0.05	4.1	4.6	4.3	0.11	2.22	103.08
3.0	1.2	6.4	6.7	6.5	0.05	4.7	4.9	4.8	0.04	1.72	90.86
3.0	1.3	6.3	6.6	6.4	0.04	5.3	5.6	5.4	0.06	1.00	69.14

EXIT HOT WIRE DATA (V3:HW42E.TEXT)

X=0.00IN Y=0.05IN F=0.00IN S=2.0%
CALIBRATION USED : A=0.5193 B=6.1802 n=0.320
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X	Y	MIN	MAX	AVG	MEAN1	RMS1	MEAN2	RMS2	RMS1	RMS2
(in)	(in)	FT/S		FT/S	FT/S	FT/S	FT/S	FT/S	(%)	(%)
3.0	-1.3	5	106	25.7	10.4	13.51	10.0	12.36	52.58	48.11
3.0	-1.2	5	143	30.9	12.3	16.51	11.9	15.09	53.35	48.74
3.0	-1.1	6	153	43.7	20.4	24.98	15.1	19.25	57.10	44.01
3.0	-1.0	6	160	51.1	24.2	29.42	5.5	7.14	57.54	13.96
3.0	-0.9	15	219	144.4	23.2	28.70	14.5	17.95	19.88	12.43
3.0	-0.8	10	207	152.0	19.9	25.77	65.6	78.47	16.95	51.61
3.0	-0.7	7	191	75.1	38.7	44.87	35.1	42.23	59.74	56.22
3.0	-0.6	8	199	112.4	34.9	41.91	38.1	47.10	37.30	41.91
3.0	-0.5	11	195	127.7	33.4	40.88	14.8	20.50	32.00	16.05
3.0	-0.4	14	211	135.0	30.1	37.44	1.9	2.58	27.73	1.91
3.0	-0.3	10	198	144.0	32.6	41.98	8.6	12.12	29.15	8.42
3.0	-0.2	11	226	158.6	21.5	31.30	29.8	40.76	19.73	25.70
3.0	-0.1	13	218	163.4	16.2	24.45	22.7	36.39	14.96	22.27
3.0	0.0	21	211	169.3	10.3	18.87	2.5	3.60	11.15	2.13
3.0	0.1	67	196	171.9	6.8	10.52	6.3	10.15	6.12	5.90
3.0	0.2	20	201	173.1	5.9	11.30	33.8	48.03	6.53	27.75
3.0	0.3	12	213	164.4	17.2	27.32	3.1	4.16	16.62	2.53
3.0	0.4	9	198	137.4	35.9	43.54	18.5	25.42	31.69	18.50
3.0	0.5	8	194	134.0	35.4	43.99	28.7	37.91	32.83	28.30
3.0	0.6	8	201	127.6	37.3	44.85	51.0	63.40	35.15	49.69
3.0	0.7	6	191	94.2	41.8	48.18	28.8	36.93	51.14	39.20
3.0	0.8	7	196	80.0	35.3	41.58	38.6	45.28	51.99	56.61
3.0	0.9	13	209	146.9	24.7	30.31	19.0	23.72	20.63	16.15
3.0	1.0	11	207	133.3	22.8	28.53	17.6	22.39	21.40	16.79
3.0	1.1	8	188	113.1	25.2	31.61	34.1	43.65	27.94	38.58
3.0	1.2	13	168	94.0	21.5	26.65	20.1	26.73	28.33	28.42
3.0	1.3	9	172	80.3	22.2	27.75	22.3	28.78	34.56	35.85

PRESSURE RECOVERY DATA GEOMETRY #5

CP50.DAT	X=0.20IN Y=0.05IN F=0.00IN	PROBE(3.20, 0.00)	
TEMP(F)= 87.0	Density(Lbs2/ft4)=0.002160	P(mm Hg) =	728
C.L.M#=0.2013	Vc.l.(ft/s) = 230.802	Vavg(ft/s)=210.46	
M(LB/m)=82.29	S(%)=0.0 S(ind)= 0.00	S(act) =	0.00
PTS=3000/2.96	P("H2O)=-2.03419+1.49391*V	HEADavg =	9.197

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	8.65	8.97	8.83	0.047	0.035	0.000
2	0.00	0.000	1.25	1.52	1.35	0.060	0.049	0.000
3	-8.00	-5.333	10.35	10.91	10.62	0.089	0.070	0.048
5	-5.00	-3.333	10.37	10.87	10.61	0.082	0.066	0.049
7	-2.50	-1.667	10.45	11.05	10.77	0.103	0.082	0.032
9	-1.00	-0.667	11.00	11.45	11.21	0.076	0.061	-0.015
11	0.43	0.140	10.36	11.01	10.64	0.126	0.105	0.046
13	0.85	0.280	9.80	10.33	10.05	0.098	0.079	0.110
15	1.28	0.420	9.36	9.92	9.65	0.092	0.074	0.154
17	1.71	0.560	8.98	9.63	9.36	0.099	0.079	0.185
19	2.13	0.700	8.79	8.88	8.83	0.014	0.011	0.243
21	2.56	0.840	8.74	8.84	8.79	0.013	0.011	0.247
23	2.98	0.980	8.67	8.76	8.71	0.013	0.011	0.256
4	-8.00	-5.333	10.35	10.79	10.55	0.071	0.056	0.056
6	-5.00	-3.333	10.45	10.69	10.57	0.040	0.033	0.054
8	-2.50	-1.667	10.51	10.96	10.74	0.077	0.062	0.036
10	-1.00	-0.667	10.67	11.17	10.92	0.081	0.065	0.015
12	0.43	0.140	8.91	9.51	9.18	0.107	0.086	0.205
14	0.85	0.280	8.65	9.24	8.96	0.097	0.079	0.229
16	1.28	0.420	8.51	9.17	8.86	0.097	0.076	0.240
18	1.71	0.560	8.44	9.11	8.81	0.098	0.076	0.245
20	2.13	0.700	8.45	9.16	8.76	0.099	0.080	0.251
22	2.56	0.840	8.44	8.98	8.72	0.090	0.073	0.255
24	2.98	0.980	8.53	9.11	8.84	0.096	0.076	0.242

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #5

```
PIT50E.DAT        X=0.20IN Y=0.05IN F=0.00IN
TEMP(F)=  82.0    Density(Lbs2/ft4)=0.002183 P(mm Hg)  =   729
CLmach#=0.2012    Vc.l.(ft/s)      = 229.548 Vavg(ft/s)=209.32
M(LB/m)= 82.71    S(%)=0.0   S(ind)=    0.00 S(act)    =  0.00
PTS=3000/1.97s    P("H2O)=-2.03419+1.49391*V
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PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY HEAD (FT/S)
3.2	-1.3	8.7	9.0	8.8	0.06	8.7	8.8	8.8	0.01	0.04	14.03
3.2	-1.2	8.6	9.0	8.8	0.05	8.8	8.9	8.8	0.01	-0.05	-15.12
3.2	-1.1	8.6	8.9	8.7	0.05	8.8	8.9	8.8	0.01	-0.09	-20.72
3.2	-1.0	8.6	8.9	8.7	0.05	8.8	8.9	8.8	0.01	-0.10	-22.01
3.2	-0.9	8.6	8.9	8.8	0.04	8.8	8.9	8.8	0.02	-0.04	-13.64
3.2	-0.8	8.6	8.9	8.7	0.04	8.6	8.7	8.6	0.02	0.11	22.47
3.2	-0.7	8.7	8.9	8.8	0.04	8.3	8.4	8.4	0.02	0.45	46.36
3.2	-0.6	8.7	8.9	8.8	0.04	7.6	7.8	7.7	0.03	1.08	71.80
3.2	-0.5	8.7	9.0	8.8	0.04	6.5	6.7	6.6	0.03	2.20	102.50
3.2	-0.4	8.7	8.9	8.8	0.05	5.4	5.7	5.6	0.05	3.25	124.46
3.2	-0.3	8.7	8.9	8.8	0.05	4.1	4.4	4.2	0.07	4.56	147.44
3.2	-0.2	8.7	8.9	8.8	0.04	2.4	2.6	2.5	0.06	6.29	173.20
3.2	-0.1	8.7	8.9	8.8	0.04	1.7	2.1	1.9	0.09	6.93	181.67
3.2	0.0	8.7	8.9	8.8	0.03	1.0	1.4	1.1	0.09	7.65	190.91
3.2	0.1	8.7	8.9	8.8	0.04	0.9	1.1	1.0	0.05	7.81	192.88
3.2	0.2	8.7	9.0	8.8	0.04	0.3	0.6	0.4	0.04	8.39	200.00
3.2	0.3	8.7	9.0	8.8	0.04	0.3	0.6	0.4	0.11	8.41	200.24
3.2	0.4	8.7	9.0	8.8	0.04	0.3	0.5	0.3	0.04	8.50	201.23
3.2	0.5	8.8	9.1	8.9	0.07	0.2	0.3	0.2	0.03	8.68	203.36
3.2	0.6	8.8	9.1	8.9	0.06	0.2	0.3	0.2	0.02	8.67	203.24
3.2	0.7	8.8	9.0	8.9	0.04	0.3	0.4	0.3	0.04	8.57	202.05
3.2	0.8	8.8	9.1	9.0	0.06	0.5	0.6	0.5	0.02	8.46	200.83
3.2	0.9	8.8	9.1	8.9	0.05	0.8	1.0	0.9	0.05	8.03	195.60
3.2	1.0	8.8	9.1	9.0	0.04	2.0	2.2	2.1	0.03	6.84	180.61
3.2	1.1	8.8	9.1	8.9	0.04	3.5	3.8	3.7	0.07	5.24	158.04
3.2	1.2	8.8	9.0	8.9	0.03	6.1	6.2	6.1	0.03	2.73	114.11
3.2	1.3	8.8	9.0	8.9	0.04	7.1	7.3	7.2	0.03	1.74	91.13

EXIT HOT WIRE DATA (V3:HW50E.TEXT)

X=0.20IN Y=0.05IN F=0.00IN S=0.0%
CALIBRATION USED : A=1.8083 B=5.2559 n=0.340
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.2	-1.3	6	76	33.6	8.1	10.15	8.5	10.76	30.17	31.99
3.2	-1.2	6	66	31.5	6.7	8.55	6.2	8.29	27.17	26.35
3.2	-1.1	6	112	29.7	7.2	9.38	6.2	8.06	31.57	27.14
3.2	-1.0	6	103	27.9	7.9	10.37	8.3	10.40	37.17	37.28
3.2	-0.9	6	117	28.7	10.1	13.64	9.5	12.35	47.56	43.04
3.2	-0.8	5	144	34.7	14.9	19.84	15.3	18.96	57.21	54.69
3.2	-0.7	7	172	47.2	21.3	26.85	21.9	26.69	56.84	56.51
3.2	-0.6	7	194	62.8	26.2	32.15	25.8	31.13	51.20	49.58
3.2	-0.5	9	192	82.8	30.0	36.29	30.0	37.01	43.85	44.72
3.2	-0.4	12	210	113.7	33.1	39.81	34.3	43.27	35.01	38.06
3.2	-0.3	14	224	141.2	31.4	38.30	34.3	43.55	27.12	30.84
3.2	-0.2	28	221	154.7	27.2	33.88	31.6	43.00	21.90	27.80
3.2	-0.1	41	221	170.9	23.2	29.77	15.3	20.53	17.42	12.01
3.2	0.0	60	223	184.5	15.5	20.49	12.0	16.13	11.11	8.75
3.2	0.1	52	230	188.5	14.0	18.86	14.9	19.87	10.01	10.54
3.2	0.2	120	218	197.4	7.1	10.50	8.5	11.39	5.32	5.77
3.2	0.3	119	216	198.3	5.6	8.59	4.3	6.00	4.33	3.03
3.2	0.4	144	217	201.3	4.0	5.77	3.2	4.09	2.87	2.03
3.2	0.5	150	217	201.8	3.6	5.09	3.7	4.58	2.52	2.27
3.2	0.6	159	214	201.1	3.5	5.11	5.2	7.32	2.54	3.64
3.0	0.7	156	214	201.3	3.6	5.58	2.7	3.32	2.77	1.65
3.2	0.8	156	216	199.9	5.0	7.49	3.6	4.85	3.75	2.43
3.2	0.9	139	214	192.0	10.8	13.49	5.3	7.64	7.03	3.98
3.2	1.0	128	215	190.1	11.2	13.98	8.0	9.96	7.35	5.24
3.2	1.1	108	212	169.2	14.7	18.07	13.0	16.29	10.68	9.63
3.2	1.2	62	195	134.0	15.4	19.03	14.6	18.11	14.20	13.52
3.2	1.3	52	168	100.6	13.9	17.19	12.6	16.00	17.09	15.91

PRESSURE RECOVERY DATA GEOMETRY #5

```
CP51.DAT         X=0.20IN Y=0.05IN F=0.00IN   PROBE(3.20,0.00)
TEMP(F)= 84.0    Density(Lbs2/ft4)=0.002172   P(mm Hg)   =    728
C.L.M#=0.2010    Vc.l.(ft/s)        = 229.786  Vavg(ft/s)=209.93
M(LB/m)=82.53    S(%)=1.0    S(ind)=    0.43  S(act)     =  0.41
PTS=3000/3.02    P("H2O)=-2.03419+1.49391*V   HEADavg    = 9.201
```

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	6.43	6.68	6.55	0.047	0.039	0.000
2	0.00	0.000	0.40	0.69	0.57	0.066	0.057	0.000
3	-8.00	-5.333	10.39	10.78	10.58	0.077	0.064	0.054
5	-5.00	-3.333	10.26	10.75	10.52	0.082	0.067	0.060
7	-2.50	-1.667	10.49	11.07	10.79	0.092	0.071	0.031
9	-1.00	-0.667	10.90	11.35	11.15	0.080	0.065	-0.007
11	0.43	0.140	8.53	9.32	9.00	0.121	0.092	0.226
13	0.85	0.280	8.07	8.57	8.32	0.085	0.069	0.300
15	1.28	0.420	7.36	8.06	7.70	0.112	0.087	0.367
17	1.71	0.560	7.08	7.59	7.34	0.083	0.064	0.406
19	2.13	0.700	6.62	6.76	6.69	0.019	0.015	0.477
21	2.56	0.840	6.56	6.69	6.63	0.018	0.015	0.484
23	2.98	0.980	6.44	6.59	6.52	0.018	0.014	0.495
4	-8.00	-5.333	10.42	10.78	10.60	0.073	0.061	0.052
6	-5.00	-3.333	10.34	10.69	10.50	0.066	0.055	0.063
8	-2.50	-1.667	10.56	10.98	10.75	0.068	0.054	0.036
10	-1.00	-0.667	10.73	11.24	11.01	0.091	0.072	0.007
12	0.43	0.140	7.62	8.64	8.17	0.175	0.137	0.316
14	0.85	0.280	6.78	7.71	7.36	0.163	0.128	0.404
16	1.28	0.420	6.55	7.28	6.96	0.105	0.082	0.448
18	1.71	0.560	6.43	7.02	6.70	0.095	0.077	0.476
20	2.13	0.700	6.35	6.95	6.61	0.090	0.073	0.486
22	2.56	0.840	6.17	6.93	6.47	0.095	0.071	0.501
24	2.98	0.980	6.14	6.64	6.39	0.086	0.071	0.509

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #5

```
PIT51E.DAT        X=0.20IN Y=0.05IN F=0.00IN
TEMP(F)=  84.5    Density(Lbs2/ft4)=0.002170  P(mm Hg)   =   728
CLmach#=0.2014    Vc.l.(ft/s)        = 230.330  Vavg(ft/s)=210.43
M(LB/m)= 82.65    S(%)=1.0    S(ind)=     0.44  S(act)     =  0.41
PTS=3000/1.97s    P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.2	-1.3	6.3	6.6	6.5	0.05	6.4	6.6	6.5	0.02	-0.01	-7.29
3.2	-1.2	6.4	6.6	6.5	0.05	6.4	6.5	6.5	0.02	0.00	3.68
3.2	-1.1	6.3	6.6	6.5	0.04	6.3	6.5	6.4	0.03	0.08	19.29
3.2	-1.0	6.4	6.6	6.5	0.04	6.0	6.3	6.1	0.05	0.40	43.55
3.2	-0.9	6.3	6.7	6.5	0.07	5.3	5.5	5.4	0.04	1.09	72.14
3.2	-0.8	6.4	6.7	6.5	0.05	4.5	4.8	4.6	0.07	1.86	94.40
3.2	-0.7	6.4	6.6	6.5	0.04	3.7	4.2	4.0	0.11	2.54	110.27
3.2	-0.6	6.3	6.7	6.5	0.07	2.5	3.0	2.7	0.15	3.87	136.28
3.2	-0.5	6.4	6.6	6.5	0.04	2.1	3.1	2.6	0.24	3.87	136.29
3.2	-0.4	6.4	6.7	6.5	0.07	2.0	2.5	2.3	0.10	4.25	142.70
3.2	-0.3	6.4	6.7	6.6	0.05	1.2	1.5	1.4	0.07	5.18	157.66
3.2	-0.2	6.4	6.9	6.6	0.10	0.7	1.3	1.0	0.17	5.60	163.83
3.2	-0.1	6.5	6.7	6.6	0.05	0.6	1.2	0.9	0.17	5.67	164.86
3.2	0.0	6.4	6.7	6.6	0.05	0.5	0.8	0.6	0.05	5.93	168.56
3.2	0.1	6.5	6.8	6.6	0.06	0.4	0.7	0.5	0.07	6.11	171.10
3.2	0.2	6.5	6.8	6.6	0.06	0.1	0.3	0.2	0.03	6.45	175.87
3.2	0.3	6.5	6.8	6.7	0.04	0.1	0.4	0.3	0.06	6.41	175.28
3.2	0.4	6.5	6.8	6.7	0.04	0.1	0.4	0.3	0.05	6.41	175.33
3.2	0.5	6.6	6.8	6.7	0.04	0.2	0.4	0.3	0.04	6.42	175.41
3.2	0.6	6.5	6.9	6.7	0.06	0.2	0.4	0.2	0.03	6.46	175.94
3.2	0.7	6.6	6.8	6.7	0.03	0.5	0.7	0.6	0.04	6.13	171.44
3.2	0.8	6.6	6.8	6.8	0.03	1.0	1.6	1.2	0.14	5.55	163.19
3.2	0.9	6.6	6.9	6.7	0.05	1.8	2.3	2.0	0.09	4.72	150.45
3.2	1.0	6.6	6.9	6.7	0.05	2.9	3.3	3.1	0.09	3.64	132.07
3.2	1.1	6.6	6.9	6.7	0.04	4.1	4.6	4.4	0.14	2.28	104.53
3.2	1.2	6.6	6.8	6.7	0.03	5.4	5.7	5.5	0.07	1.12	73.25
3.2	1.3	6.5	6.7	6.6	0.03	6.2	6.3	6.2	0.02	0.40	43.54

EXIT HOT WIRE DATA (V3:HW51E.TEXT)

X=0.20IN Y=0.05IN F=0.00IN S=1.0%
CALIBRATION USED : A=1.8083 B=5.2559 n=0.340
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.2	-1.3	4	110	22.8	7.1	9.21	7.1	8.73	40.30	38.22
3.2	-1.2	5	110	26.6	10.3	13.91	9.3	11.75	52.32	44.20
3.2	-1.1	5	150	35.4	16.2	21.19	14.0	17.64	59.82	49.80
3.2	-1.0	5	162	49.8	22.6	27.52	18.5	22.97	55.31	46.17
3.2	-0.9	7	179	65.2	29.0	34.58	22.5	28.12	53.08	43.16
3.2	-0.8	7	177	76.9	32.6	38.40	32.0	39.43	49.91	51.26
3.2	-0.7	11	206	108.3	34.4	41.25	31.2	39.99	38.10	36.94
3.2	-0.6	10	197	119.8	32.6	39.82	19.5	26.64	33.25	22.24
3.2	-0.5	9	204	125.6	37.9	45.02	52.4	63.21	35.83	50.31
3.2	-0.4	17	204	154.7	27.5	34.66	11.3	15.84	22.40	10.24
3.2	-0.3	20	202	154.3	23.1	29.88	17.3	23.31	19.36	15.10
3.2	-0.2	16	212	166.9	21.8	29.34	2.5	3.61	17.58	2.16
3.2	-0.1	12	210	169.5	20.9	29.25	9.2	12.59	17.25	7.43
3.2	0.0	29	202	180.2	10.9	16.36	4.0	5.65	9.08	3.14
3.2	0.1	43	211	183.7	6.4	11.24	2.5	3.81	6.12	2.07
3.2	0.2	75	206	184.5	6.7	11.14	13.1	18.62	6.04	10.09
3.2	0.3	108	204	184.6	6.8	10.57	2.3	2.82	5.72	1.53
3.2	0.4	119	204	187.0	4.1	6.72	15.2	19.07	3.59	10.20
3.2	0.5	110	201	186.8	4.7	7.66	17.9	22.37	4.10	11.98
3.2	0.6	110	206	181.3	10.5	14.16	3.4	4.80	7.81	2.65
3.2	0.7	44	200	178.2	13.8	18.33	20.9	24.80	10.29	13.91
3.2	0.8	41	201	174.9	15.5	20.11	6.0	8.64	11.49	4.94
3.2	0.9	15	198	160.1	21.4	27.51	17.7	21.73	17.19	13.58
3.2	1.0	40	201	152.6	22.2	27.31	25.2	32.68	17.90	21.42
3.2	1.1	7	197	127.7	23.1	29.46	17.8	22.26	23.07	17.43
3.2	1.2	7	176	83.2	21.9	27.57	30.1	38.24	33.13	45.95
3.2	1.3	5	131	59.0	17.9	22.29	16.1	20.34	37.79	34.48

PRESSURE RECOVERY DATA GEOMETRY #5

CP52.DAT	X=0.20IN Y=0.05IN F=0.00IN	PROBE(3.20,0.00)
TEMP(F)= 86.5	Density(Lbs2/ft4)=0.002162	P(mm Hg) = 728
C.L.M#=0.2000	Vc.l.(ft/s) = 229.114	Vavg(ft/s)=208.02
M(LB/m)=81.41	S(%)=2.0 S(ind)= 0.86	S(act) = 0.81
PTS=3000/3.02	P("H2O)=-2.03419+1.49391*V	HEADavg = 8.993

TAP	AXIAL LOC	L/D LOC	MIN ("H2O)	MAX ("H2O)	AVG ("H2O)	RMSDEV ("H2O)	AVGDEV ("H2O)	Cp
1	0.00	0.000	5.96	6.31	6.11	0.069	0.058	0.000
2	0.00	0.000	0.34	0.79	0.59	0.105	0.092	0.000
3	-8.00	-5.333	10.02	10.57	10.33	0.099	0.081	0.060
5	-5.00	-3.333	10.05	10.60	10.33	0.115	0.097	0.061
7	-2.50	-1.667	10.23	11.11	10.57	0.143	0.113	0.034
9	-1.00	-0.667	10.59	11.11	10.85	0.086	0.071	0.003
11	0.43	0.140	8.23	8.96	8.57	0.112	0.087	0.256
13	0.85	0.280	7.25	8.13	7.79	0.121	0.092	0.343
15	1.28	0.420	6.93	7.51	7.27	0.078	0.060	0.401
17	1.71	0.560	6.58	7.19	6.87	0.090	0.072	0.445
19	2.13	0.700	6.23	6.37	6.30	0.023	0.019	0.508
21	2.56	0.840	5.99	6.16	6.07	0.024	0.020	0.534
23	2.98	0.980	5.98	6.14	6.06	0.024	0.020	0.535
4	-8.00	-5.333	10.17	10.71	10.42	0.087	0.068	0.050
6	-5.00	-3.333	10.08	10.48	10.30	0.067	0.052	0.064
8	-2.50	-1.667	10.28	10.81	10.57	0.096	0.078	0.033
10	-1.00	-0.667	10.62	11.15	10.90	0.094	0.074	-0.003
12	0.43	0.140	6.82	8.32	7.81	0.315	0.250	0.340
14	0.85	0.280	6.36	7.41	7.02	0.211	0.172	0.429
16	1.28	0.420	6.06	6.95	6.60	0.129	0.102	0.476
18	1.71	0.560	6.02	6.85	6.32	0.115	0.089	0.506
20	2.13	0.700	5.77	6.63	6.12	0.131	0.101	0.529
22	2.56	0.840	5.73	6.48	6.01	0.115	0.087	0.541
24	2.98	0.980	5.63	6.50	5.98	0.140	0.114	0.544

EXIT PITOT STATIC PROBE DATA FOR GEOMETRY #5

```
PIT52E.DAT        X=0.20IN Y=0.05IN F=0.00IN
TEMP(F)=  87.0    Density(Lbs2/ft4)=0.002160 P(mm Hg)   =    728
CLmach#=0.1999    Vc.l.(ft/s)       = 229.188 Vavg(ft/s)=208.09
M(LB/m)= 81.36    S(%)=2.0    S(ind)=    0.86 S(act)    =  0.81
PTS=3000/1.97s    P("H2O)=-2.03419+1.49391*V
```

PROBE X (in)	PROBE Y (in)	STATIC PORT MIN ("H2O)	STATIC PORT MAX ("H2O)	STATIC PORT AVG ("H2O)	STATIC PORT RMS ("H2O)	STAGNATION PORT MIN ("H2O)	STAGNATION PORT MAX ("H2O)	STAGNATION PORT AVG ("H2O)	STAGNATION PORT RMS ("H2O)	VELOCITY HEAD ("H2O)	VELOCITY (FT/S)
3.2	-1.3	5.8	6.0	5.9	0.05	5.9	6.0	5.9	0.03	-0.05	-15.81
3.2	-1.2	5.8	6.2	5.9	0.06	5.8	6.0	5.9	0.03	0.02	9.40
3.2	-1.1	5.8	6.2	6.0	0.06	5.7	5.9	5.8	0.03	0.24	33.65
3.2	-1.0	5.9	6.3	6.1	0.08	5.1	5.5	5.3	0.07	0.80	62.08
3.2	-0.9	5.8	6.2	6.0	0.08	4.6	5.1	4.8	0.10	1.18	75.44
3.2	-0.8	5.8	6.3	6.1	0.09	3.8	4.4	4.1	0.10	1.93	96.35
3.2	-0.7	5.8	6.3	6.0	0.09	3.4	4.2	3.8	0.21	2.17	102.16
3.2	-0.6	5.8	6.3	6.0	0.08	2.5	3.0	2.8	0.10	3.24	124.90
3.2	-0.5	5.9	6.1	6.0	0.04	1.8	2.4	2.2	0.14	3.79	135.02
3.2	-0.4	5.8	6.2	6.0	0.06	1.9	2.4	2.1	0.13	3.84	136.02
3.2	-0.3	5.9	6.2	6.0	0.05	1.3	2.3	1.9	0.27	4.13	141.03
3.2	-0.2	5.9	6.3	6.1	0.05	0.6	1.0	0.8	0.08	5.31	159.91
3.2	-0.1	5.9	6.3	6.1	0.09	0.6	0.9	0.7	0.06	5.35	160.49
3.2	0.0	6.0	6.2	6.1	0.04	0.3	0.7	0.5	0.08	5.61	164.36
3.2	0.1	6.0	6.3	6.1	0.06	0.3	0.6	0.5	0.05	5.63	164.64
3.2	0.2	5.9	6.4	6.1	0.09	0.2	0.6	0.3	0.08	5.77	166.71
3.2	0.3	6.0	6.3	6.1	0.05	0.2	0.4	0.3	0.05	5.85	167.84
3.2	0.4	6.0	6.3	6.2	0.05	0.1	0.3	0.2	0.03	5.96	169.45
3.2	0.5	6.0	6.3	6.1	0.05	0.1	0.4	0.2	0.04	5.88	168.22
3.2	0.6	6.0	6.3	6.2	0.04	0.3	0.7	0.5	0.07	5.67	165.26
3.2	0.7	6.1	6.4	6.2	0.05	0.5	0.9	0.7	0.06	5.52	162.99
3.2	0.8	5.8	6.3	6.0	0.09	3.2	4.1	3.5	0.28	2.49	109.46
3.2	0.9	6.0	6.3	6.2	0.04	4.8	5.1	5.0	0.05	1.17	75.20
3.2	1.0	5.8	6.2	6.0	0.07	4.7	5.2	5.0	0.08	1.04	70.64
3.2	1.1	5.7	6.1	6.0	0.07	5.2	5.6	5.4	0.08	0.57	52.27
3.2	1.2	6.0	6.2	6.1	0.05	5.5	5.8	5.7	0.04	0.45	46.33
3.2	1.3	5.8	6.1	6.0	0.05	5.6	5.9	5.7	0.05	0.25	34.95

EXIT HOT WIRE DATA (V3:HW52E.TEXT)

X=0.20IN Y=0.05IN F=0.00IN S=2.0%
CALIBRATION USED : A=1.8082 B=5.2559 n=0.340
AVERAGING 5000 POINTS OVER CH1= 5.00 CH2= 0.20 SECONDS
CH1 SIGNAL WAS X 1 CH2 SIGNAL WAS D.C. STRIPPED X 8

PROBE		VELOCITIES			FLUCTUATIONS				INTENSITY	
X (in)	Y (in)	MIN FT/S	MAX FT/S	AVG FT/S	MEAN1 FT/S	RMS1 FT/S	MEAN2 FT/S	RMS2 FT/S	RMS1 (%)	RMS2 (%)
3.2	-1.3	5	113	24.7	8.7	11.66	8.0	10.11	47.22	40.92
3.2	-1.2	6	126	29.4	11.4	15.13	12.7	15.26	51.49	51.93
3.2	-1.1	6	159	41.4	19.1	24.09	19.2	22.90	58.15	55.29
3.2	-1.0	7	166	53.0	24.3	29.24	23.3	28.46	55.14	53.68
3.2	-0.9	6	182	74.8	30.6	36.45	23.9	30.30	48.71	40.48
3.2	-0.8	7	185	90.1	35.3	41.28	33.4	40.93	45.79	45.41
3.2	-0.7	8	185	99.7	33.3	39.74	23.1	32.07	39.84	32.15
3.2	-0.6	11	191	118.8	38.3	45.30	28.3	37.96	38.12	31.94
3.2	-0.5	10	193	126.2	32.4	39.83	28.1	37.07	31.55	29.36
3.2	-0.4	9	193	138.9	31.1	39.69	16.7	21.32	28.58	15.35
3.2	-0.3	8	196	150.4	25.9	34.71	10.5	14.10	23.07	9.37
3.2	-0.2	14	200	161.4	17.3	26.06	2.1	2.70	16.14	1.67
3.2	-0.1	17	200	165.5	14.6	23.24	3.3	4.45	14.04	2.69
3.2	0.0	29	189	167.9	8.8	16.15	3.5	5.09	9.62	3.03
3.2	0.1	28	193	168.2	7.9	14.11	2.4	3.08	8.39	1.83
3.2	0.2	60	187	168.5	7.0	11.69	2.0	2.61	6.94	1.55
3.2	0.3	43	191	169.0	7.0	13.49	3.7	5.80	7.98	3.43
3.2	0.4	33	192	167.8	8.8	14.89	3.9	5.58	8.87	3.32
3.2	0.5	35	186	164.8	11.9	16.69	8.1	10.27	10.12	6.23
3.2	0.6	35	196	164.7	13.5	19.03	3.4	5.28	11.55	3.20
3.2	0.7	16	186	160.0	14.9	21.39	3.2	4.20	13.37	2.62
3.2	0.8	7	183	69.8	35.5	42.20	19.9	26.15	60.46	37.47
3.2	0.9	7	175	58.5	27.7	33.42	27.1	32.48	57.13	55.52
3.2	1.0	7	167	48.4	24.0	29.63	20.8	25.95	61.26	53.66
3.2	1.1	6	148	32.0	13.1	17.35	13.6	17.98	54.26	56.24
3.2	1.2	9	179	82.8	25.1	31.32	27.1	34.92	37.84	42.20
3.2	1.3	7	155	62.1	18.1	22.78	14.0	17.87	36.66	28.77

APPENDIX G

PRESSURE TRANSDUCER CALIBRATION PROGRAM

```
  AnalogWriteRegisterOffset        = $3000;

  BinaryControlRegisterOffset      = $0000;
  BinaryReadWriteRegisterOffset    = $2000;
  BinaryStatusRegisterOffset       = $0000;

  InterruptControlRegisterOffset   = $D000;
  IssacDeviceNoRegisterOffset      = $C000;

  AnalogDeviceCode                 = $0009;
  BinaryDeviceCode                 = $0008;
  DisableAllInterrupts             = $0000;
  EnableAnalogAD                   = $0001;
  DisableAnalogAD                  = $0000;

type
  R_ARRAY      = ARRAY[1..10000] OF REAL;
  R_PTR        = ^R_ARRAY;
  Str80        = string[80];
  STR60        = STRING[60];
  STR15        = STRING[15];
  IOtype       = (Analog,Binary);

Var
  DATA                                                   :R_PTR;
  CheckInteruptStatus,Chl,ErrorCode,I,POINTS,REPT:INTEGER;
  TEMP,DENSITY,PRESS,DELTAH,PACE,FREQ,
  TIME,MIN,MAX,AVG,DEV,RMS,PCT                           :REAL;
  InChar                                                 :CHAR;
  HOUR,MINUTE,SECOND,HUNDRETH,DLY                        :WORD;
  QUIT,FILEIT,PRINTIT                                    :BOOLEAN;
  FILENAME                                               :STRING;
  F                                                      :TEXT;

Procedure InitDevice(BASEADDRESS:integer;Mode:IOtype);
begin
case Mode of
  Analog : Port[BaseAddress+IssacDeviceNoRegisterOffset]
         := AnalogDeviceCode;
  Binary : Port[BaseAddress+IssacDeviceNoRegisterOffset]
         := BinaryDeviceCode;
end; { case }
Delay(1);
end; { InitDevice }


PROCEDURE SETCHANNEL(BASEADDRESS,CHL:INTEGER);
VAR TESTSTATUS:INTEGER;
BEGIN
  Port[BaseAddress+AnalogReadControlRegisterOffset]
                                :=DisableAnalogAD;
```

```
  Port[BaseAddress+AnalogReadControlRegisterOffset
                                 +SelectHighOrderByte]:=Chl;
  Delay(1);
  Port[BaseAddress+AnalogReadControlRegisterOffset]
                                  :=EnableAnalogAD;
  Port[BaseAddress+AnalogReadControlRegisterOffset
                                  +SelectHighOrderByte]:=Chl;
  Delay(1);
{****** Test for completion of A/D conversion ********}
repeat
   TestStatus:=Port[BaseAddress+AnalogStatusRegisterOffset];
   TestStatus:=TestStatus AND 1;
until TestStatus = 0;
{*****************************************************}
END;



PROCEDURE ReadAnalogData(VAR DATA:R_PTR;VAR POINTS:INTEGER;
                         VAR TIME:REAL;
                         CHL,REPT,DLY:INTEGER);

VAR LowByteData,HighByteData,I,J: integer;

Begin
POINTS:=0;
INITDEVICE(BASEADDRESS,ANALOG);
SETCHANNEL(BASEADDRESS,CHL);
SETTIME(0,0,0,0);

REPEAT
   FOR I:=0 TO DLY DO J:=1;
   Port[BaseAddress+AnalogReadControlRegisterOffset]
                                  :=DisableAnalogAD;
   Port[BaseAddress+AnalogReadControlRegisterOffset
                                  +SelectHighOrderByte]:=Chl;
   LowByteData :=Port[BaseAddress+AnalogReadRegisterOffset];
   HighByteData:=Port[BaseAddress+AnalogReadRegisterOffset
                                  +SelectHighOrderByte];

   Port[BaseAddress+AnalogReadControlRegisterOffset]
                                  :=EnableAnalogAD;
   Port[BaseAddress+AnalogReadControlRegisterOffset
                                  +SelectHighOrderByte]:=Chl;
   POINTS      :=POINTS+1;
   DATA^[POINTS]:= (HighByteData SHL 8) + LowByteData;
UNTIL((KEYPRESSED) OR (POINTS>=REPT));

GETTIME(HOUR,MINUTE,SECOND,HUNDRETH);
TIME:=HOUR*3600+MINUTE*60+SECOND+HUNDRETH/100;
end; { ReadAnalogData }
```

```
BEGIN
CLRSCR;
WRITELN('PRESSURE CALIBRATION MEASUREMENT');
WRITELN;
FILEIT:=FALSE;
INCHAR:='N';
WRITE('DO YOU WISH TO SAVE THIS DATA IN A FILE (Y/N):');
INCHAR:=READKEY;
WRITELN;
IF (INCHAR IN ['Y','y']) THEN BEGIN
   WRITE('ENTER THE NAME OF THE DATA FILE FOR THIS RUN:');
   READLN(FILENAME);
   ASSIGN(F,FILENAME);
   REWRITE(F);
   FILEIT:=TRUE;
END;

PRINTIT:=FALSE;
INCHAR:='N';
WRITE('DO YOU WISH TO PRINT OUT THE RESULTS:');
INCHAR:=READKEY;
WRITELN;
IF (INCHAR IN ['Y','y']) THEN PRINTIT:=TRUE;

WRITELN;
WRITE('ATMOSPHERIC PRESSURE (mm Hg) : ');
READLN(PRESS);
WRITELN;
WRITE('ATMOSPHERIC TEMPERATURE (F)  : ');
READLN(TEMP);
WRITELN;
DENSITY:=(2116.2*PRESS/760)/(1716.97*(TEMP+459.67));
WRITELN;
WRITE('FREQUENCY OF SAMPLING (1.1Hz-2024Hz):');
READLN(FREQ);
IF (FREQ>2024) THEN FREQ:=2024;
DLY:=ROUND(-17.4874+35592.8246/FREQ);
WRITELN;
WRITELN('SETTING DELAY LOOP # TO:',DLY:5);
WRITELN;
WRITE('NUMBER OF POINTS TO BE SAMPLED (1 - 10000): ');
READLN(REPT);

{*****************************************************}
IF FILEIT THEN BEGIN
 REWRITE(F);
 WRITELN(F,'FILE:',FILENAME:15,'   TEMP     = ',TEMP   :9:1,
           ' F            PRESSURE = ',PRESS:5:0,' mm Hg');
```

```
 WRITELN(F,'                              DENSITY = ',DENSITY:9:7,
              ' lb s2/ft4    SAMPLING   ',REPT:5 ,' POINTS');
 WRITELN(F);
 WRITELN(F,'PRESSURE   TIME    AVERAGE    MINIMUM',
             '     MAXIMUM    RMS DEV   AVG DEV   AVG DEV');
 WRITELN(F,'( " H2O)   (SEC)   (" H2O)    (" H2O)',
             '     (" H2O)    (" H2O)   (" H2O)      (%)   ');
 WRITELN(F,'------------------------------------',
             '------------------------------------------');
END;
{***********************************************************}

{***********************************************************}
IF PRINTIT THEN BEGIN
 WRITELN(LST,'FILE:',FILENAME:15,'   TEMP      = ',
 TEMP  :9:1,' F              PRESSURE = ',PRESS:5:0,' mm Hg');
 WRITELN(LST,'                           DENSITY  = ',
 DENSITY:9:7,' lb s2/ft4    SAMPLING   ',REPT:5 ,' POINTS');
 WRITELN(LST);
 WRITELN(LST,'PRESSURE   TIME    AVERAGE    MINIMUM    ',
                 'MAXIMUM    RMS DEV   AVG DEV   AVG DEV');
 WRITELN(LST,'( " H2O)   (SEC)   (" H2O)    (" H2O)    ',
                 '(" H2O)    (" H2O)   (" H2O)      (%)   ');
 WRITELN(LST,'------------------------------------------',
                 '--------------------------------------');
END;
{***********************************************************}

INITDEVICE(BASEADDRESS,ANALOG);
CHL:=0;
QUIT:=FALSE;

REPEAT
 CLRSCR;
 WRITE( 'ENTER THE PRESSURE (INCHES H2O) : ');
 READLN(DELTAH);
 NEW(DATA);
 READANALOGDATA(DATA,POINTS,TIME,CHL,REPT,DLY);
 AVG:=0;MIN:=11;MAX:=-11;
 FOR I:=1 TO POINTS DO BEGIN
     DATA^[I]:=DATA^[I]/409.5;
     AVG     :=AVG+DATA^[I];
     IF (DATA^[I]>MAX) THEN MAX:=DATA^[I];
     IF (DATA^[I]<MIN) THEN MIN:=DATA^[I];
 END;
 AVG:=AVG/POINTS;
 PCT:=0;DEV:=0;RMS:=0;

 FOR I:=1 TO POINTS DO BEGIN
     DEV:=DEV+ABS(DATA^[I]-AVG);
     RMS:=RMS+SQR(DATA^[I]    );
 END;
```

```
 IF ((DEV<>0) AND (RMS<>0) AND (AVG<>0)) THEN BEGIN
    DEV:=DEV/POINTS;
    RMS:=SQRT((RMS/POINTS)-SQR(AVG));
    PCT:=100*DEV/AVG;
 END;

 DISPOSE(DATA);

 CLRSCR;
 WRITELN('SAMPLING AT A INPUT PRESSURE:',DELTAH:8:2,'"H2O');
 WRITELN;
 WRITELN;
 WRITELN('NUMBER OF DATA POINTS TAKEN :',POINTS:8);
 WRITELN;
 WRITELN('DELAY                       :',DLY:8);
 WRITELN;
 WRITELN('TIME ELLAPSED               :',TIME:8:2,'SEC');
 WRITELN('----------------------------------------');
 WRITELN('MINIMUM OUTPUT              :',MIN:8:5,'"H20');
 WRITELN;
 WRITELN('MAXIMUM OUTPUT              :',MAX:8:5,'"H20');
 WRITELN;
 WRITELN('AVERAGE OUTPUT              :',AVG:8:5,'"H2O');
 WRITELN;
 WRITELN('RMS DEVIATION               :',RMS:8:5,'"H2O');
 WRITELN;
 WRITELN('AVERAGE DEVIATION           :',DEV:8:5,'"H2O');
 WRITELN;
 WRITELN('AVERAGE DEVIATION PERCENTAGE:',PCT:8:5,' % ');
 WRITELN;
 WRITELN;

 INCHAR:='N';
 WRITE('ACCEPT POINT (Y/N)');
 INCHAR:=READKEY;
 WRITELN;

 IF (INCHAR IN ['Y','y']) THEN BEGIN
   IF FILEIT  THEN WRITELN(F  ,DELTAH:7:2,TIME:9:2,
      AVG:10:5,MIN:11:5,MAX:11:5,RMS:11:5,DEV:11:5,PCT:8:4);
   IF PRINTIT THEN WRITELN(LST,DELTAH:7:2,TIME:9:2,
      AVG:10:5,MIN:11:5,MAX:11:5,RMS:11:5,DEV:11:5,PCT:8:4);
 END;

 INCHAR:='N';
 WRITE('REPEAT (Y/N)');
 INCHAR:=READKEY;
 WRITELN;
 IF (INCHAR IN ['N','n']) THEN QUIT:=TRUE;

UNTIL QUIT;
```

```
IF FILEIT THEN CLOSE(F);
END.
```

APPENDIX H

PRESSURE TAP SCANNING PROGRAM

```
Program Scanvalve;

USES CRT,DOS,PRINTER;
Const
BASEADDRESS                        =$02E2;
SelectHighOrderByte                =$0001;
AnalogReadControlRegisterOffset    =$0000;
AnalogReadRegisterOffset           =$2000;
AnalogStatusRegisterOffset         =$0000;
AnalogWriteControlRegisterOffset=$1000;
AnalogWriteRegisterOffset          =$3000;
BinaryControlRegisterOffset        =$0000;
BinaryReadWriteRegisterOffset      =$2000;
BinaryStatusRegisterOffset         =$0000;
InterruptControlRegisterOffset     =$D000;
IssacDeviceNoRegisterOffset        =$C000;
AnalogDeviceCode                   =$0009;
BinaryDeviceCode                   =$0008;
DisableAllInterrupts               =$0000;
EnableAnalogAD                     =$0001;
DisableAnalogAD                    =$0000;

type
 Str80        = string[80];
 STR60        = STRING[60];
 STR14        = STRING[14];
 IOtype       = (Analog,Binary);

Var
 MIN,MAX,AVG,DEV,RMS,X,XOD,CP : ARRAY [1..30] OF REAL;
 InChar                                                  :char;
 DLY                                                     :WORD;
 QUIT,FILEIT,PRINTIT,FIRST                               :BOOLEAN;
 NUMBERSTRING,GEOM                                       :STR80;
 FILENAME                                                :STRING;
 F                                                       :TEXT;
 CheckInteruptStatus,ErrorCode,I,
 POINTS,LOTAP,HITAP,lOC,REPT,E,O                         :INTEGER;
 TEMP,HEAD,CHEAD,WHEAD,MACH,CMACH,WMACH,DENSITY,
 PRESS,PACE,TIME,FREQ,A,B,QACT,QIND,QPCT,MFLOW,
 VAVG,VCL,VMULT,HEADAVG                                  : real;

Procedure InitDevice(BASEADDRESS:integer;Mode:IOtype);
 begin
 case Mode of
      Analog : Port[BaseAddress+IssacDeviceNoRegisterOffset]
             := AnalogDeviceCode;
      Binary : Port[BaseAddress+IssacDeviceNoRegisterOffset]
             := BinaryDeviceCode;
 end; { case }

 Delay(1);
end; { InitDevice }
```

```
Procedure WriteAnalogData(BASEADDRESS,CHL,VALUE:INTEGER);
begin
  Port[BaseAddress+AnalogWriteControlRegisterOffset
                +SelectHighOrderByte]:=Chl;
  Port[BaseAddress+AnalogWriteRegisterOffset]:=Lo(Value);
  Port[BaseAddress+AnalogWriteRegisterOffset
                +SelectHighOrderByte]:=Hi(Value);
end; { WriteAnalogData }

PROCEDURE STEP(BASEADDRESS:INTEGER);
BEGIN
  WRITEANALOGDATA(BASEADDRESS,0,0);    DELAY(50);
  WRITEANALOGDATA(BASEADDRESS,0,3700);DELAY(50);
  WRITEANALOGDATA(BASEADDRESS,0,0);    DELAY(200);
END; { main program }

PROCEDURE HOME(BASEADDRESS:INTEGER);
BEGIN
  WRITEANALOGDATA(BASEADDRESS,1,3700);DELAY(2000);
  WRITEANALOGDATA(BASEADDRESS,0,0);
  WRITEANALOGDATA(BASEADDRESS,1,0);
END; { main program }

PROCEDURE ReadAnalogData(A,B,FREQ:REAL;REPT:INTEGER;
                      VAR POINTS:INTEGER;
                      VAR AVG,MIN,MAX,DEV,RMS,TIME:REAL);

TYPE  R_ARRAY= ARRAY[1..10000] OF REAL;
      R_PTR  = ^R_ARRAY;

VAR DATA     : R_PTR;
    TESTSTATUS,LowByteData,HighByteData,CHL,DLY,I,J:integer;
    HOUR,MINUTE,SECOND,HUNDRETH                   : WORD;

Begin
CHL   :=0;
POINTS:=0;
DLY:=ROUND(-17.4874+35592.8246/FREQ);
IF (DLY<0) THEN DLY:=0;
NEW(DATA);
INITDEVICE(BASEADDRESS,ANALOG);
Port[BaseAddress+AnalogReadControlRegisterOffset]:=
                                          DisableAnalogAD;
Port[BaseAddress+AnalogReadControlRegisterOffset
                               +SelectHighOrderByte]:=Chl;
Delay(1);
Port[BaseAddress+AnalogReadControlRegisterOffset]
                                         :=EnableAnalogAD;
Port[BaseAddress+AnalogReadControlRegisterOffset
                               +SelectHighOrderByte]:=Chl;
Delay(1);
```

```
repeat
  TestStatus:=Port[BaseAddress+AnalogStatusRegisterOffset];
  TestStatus:=TestStatus AND 1;
until TestStatus = 0;
SETTIME(0,0,0,0);
REPEAT
   FOR I:=0 TO DLY DO J:=1;
   Port[BaseAddress+AnalogReadControlRegisterOffset]:=
                                              DisableAnalogAD;
   Port[BaseAddress+AnalogReadControlRegisterOffset
                                   +SelectHighOrderByte]:=Chl;
   LowByteData:=Port[BaseAddress +AnalogReadRegisterOffset];
   HighByteData:=Port[BaseAddress+AnalogReadRegisterOffset
                                    +SelectHighOrderByte]
   Port[BaseAddress+AnalogReadControlRegisterOffset]
                                             :=EnableAnalogAD;
   Port[BaseAddress+AnalogReadControlRegisterOffset
                                    +SelectHighOrderByte]:=Chl;
   POINTS       := POINTS+1;
   DATA^[POINTS]:= (HighByteData SHL 8) + LowByteData;
UNTIL((KEYPRESSED) OR (POINTS>=REPT));

GETTIME(HOUR,MINUTE,SECOND,HUNDRETH);
TIME:=HOUR*3600+MINUTE*60+SECOND+HUNDRETH/100;
STEP(BASEADDRESS);

AVG:=0;MIN:=100;MAX:=-100;
FOR I:=1 TO POINTS DO BEGIN
    DATA^[I]:=A+(DATA^[I]*B/409.5);
    AVG     :=AVG+DATA^[I];
    IF (DATA^[I]>MAX) THEN MAX:=DATA^[I];
    IF (DATA^[I]<MIN) THEN MIN:=DATA^[I];
END;
AVG:=AVG/POINTS;
DEV:=0;RMS:=0;

FOR I:=1 TO POINTS DO BEGIN
    DEV:=DEV+ABS(DATA^[I]-AVG);
    RMS:=RMS+SQR(DATA^[I]-AVG);
END;

IF (AVG<>0) THEN BEGIN
   DEV:=DEV/POINTS;
   RMS:=SQRT(RMS/POINTS);
END;
DISPOSE(DATA);
end; { ReadAnalogData }
```

```
BEGIN
   X[ 1]:= 0.00;XOD[ 1]:= 0.000;
   X[ 2]:= 0.00;XOD[ 2]:= 0.000;
   X[ 3]:=-8.00;XOD[ 3]:=-5.333;
   X[ 4]:=-8.00;XOD[ 4]:=-5.333;
   X[ 5]:=-5.00;XOD[ 5]:=-3.333;
   X[ 6]:=-5.00;XOD[ 6]:=-3.333;
   X[ 7]:=-2.50;XOD[ 7]:=-1.667;
   X[ 8]:=-2.50;XOD[ 8]:=-1.667;
   X[ 9]:=-1.00;XOD[ 9]:=-0.667;
   X[10]:=-1.00;XOD[10]:=-0.667;
   X[11]:= 0.426;XOD[11]:= 0.14;
   X[12]:= 0.426;XOD[12]:= 0.14;
   X[13]:= 0.853;XOD[13]:= 0.28;
   X[14]:= 0.853;XOD[14]:= 0.28;
   X[15]:= 1.279;XOD[15]:= 0.42;
   X[16]:= 1.279;XOD[16]:= 0.42;
   X[17]:= 1.706;XOD[17]:= 0.56;
   X[18]:= 1.706;XOD[18]:= 0.56;
   X[19]:= 2.132;XOD[19]:= 0.70;
   X[20]:= 2.132;XOD[20]:= 0.70;
   X[21]:= 2.559;XOD[21]:= 0.84;
   X[22]:= 2.559;XOD[22]:= 0.84;
   X[23]:= 2.985;XOD[23]:= 0.98;
   X[24]:= 2.985;XOD[24]:= 0.98;

QUIT   :=FALSE;
FILEIT :=FALSE;
PRINTIT:=FALSE;
FIRST  :=TRUE;
A      :=-2.03419;
B      := 1.49391;

CLRSCR;
WRITELN('                              PRESSURE TAP MEASUREMENT  ');
WRITELN;
WRITE('DO YOU WISH TO SAVE THIS DATA IN A  (Y/N)       : ');
REPEAT
  INCHAR:=READKEY;
UNTIL (INCHAR IN ['Y','y','N','n']);
WRITELN;WRITELN;
IF (INCHAR IN ['Y','y']) THEN BEGIN;
 WRITE('ENTER THE NAME OF THE TEXT FILE FOR THIS RUN   : ');
 READLN(FILENAME);ASSIGN(F,FILENAME);REWRITE(F);WRITELN;
 FILEIT:=TRUE;
END;

WRITE('DO YOU WISH TO PRINT THIS DATA IN A  (Y/N)       :');
REPEAT
  INCHAR:=READKEY;
UNTIL (INCHAR IN ['Y','y','N','n']);
IF (INCHAR IN ['Y','y']) THEN PRINTIT:=TRUE;
```

```
WRITELN;WRITELN;
WRITE('ALTER CALIBRATION  A=',A:8:5,' B=',B:8:5,' (Y/N): ');
INCHAR:=READKEY;
WRITELN;
IF (INCHAR IN ['Y','y']) THEN BEGIN
   WRITELN;
   WRITE('CALIBRATION : PRESSURE = A + B*VOLTS   A : ');
   READLN(A);
   WRITE('                                       B : ');
   READLN(B);WRITELN;
END;

CLRSCR;
WRITE(  'GEOMETRY:');READLN(GEOM);
WRITELN;
WRITE('ATMOSPHERIC PRESSURE (mm Hg)       :');READLN(PRESS);
WRITELN;
WRITE('ATMOSPHERIC TEMPERATURE (F)        :');READLN(TEMP);
WRITELN;
WRITE('ENTER THE CENTER LINE MACH NUMBER WISHED :');
READLN(MACH);
WRITELN;
WRITE('Vaverage/Vcenterline MULTIPLIER    :');READLN(VMULT);
WRITELN;
WRITE('SUCTION RATE WISHED (% OF FLOW)    :');READLN(QPCT);
WRITELN;
DENSITY:=(2116.2*PRESS/760)/(1716.97*(TEMP+459.67));
HEAD:=MACH*MACH*231.095*DENSITY*(TEMP+459.67);
Vcl:=SQRT(10.4016*HEAD/DENSITY);
VAVG:=VMULT*Vcl;
MFLOW:=DENSITY*VAVG*181.041;
QACT:=QPCT*MFLOW/200;
QIND:=QACT/SQRT((PRESS*511.67)/(760*(TEMP+459.67)));

WRITELN('SET ROTAMETER TO (LBm/min)            :',QIND:4:2);
WRITELN;
WRITE('INPUT OR READ THE CENTER LINE MACH NUMBER (I/R):');
REPEAT INCHAR:=READKEY; UNTIL (INCHAR IN ['I','i','R','r']);
WRITELN;WRITELN;

IF (INCHAR IN ['I','i']) THEN BEGIN
   WRITE('ENTER THE CENTER LINE MACH NUMBER                :');
   READLN(MACH);
   HEAD:=MACH*MACH*231.095*DENSITY*(TEMP+459.67);
END;

IF (INCHAR IN ['R','r']) THEN BEGIN
WRITELN('PITOT     PITOT   PITOT  WALL     WALL    WALL ');
WRITELN('Static Stagnation  M#   STATIC9  STATIC10   M#  ');
WRITELN('------ ---------- ----- -------  -------- ------');

INITDEVICE(BASEADDRESS,ANALOG);
```

```
HOME(BASEADDRESS);
REPEAT
  ReadAnalogData(A,B,1000,3000,POINTS,AVG[1],MIN[1],MAX[1],
                 DEV[1],RMS[1],TIME);
  WRITE(AVG[1]:5:2,'+-',DEV[1]:5:3);
  DELAY(8000);
  ReadAnalogData(A,B,1000,3000,POINTS,AVG[2],MIN[2],MAX[2],
                 DEV[2],RMS[2],TIME);
  FOR I:=1 TO 6 DO STEP(BASEADDRESS);
  CHEAD:=ABS(AVG[1]-AVG[2]);
  CMACH:=SQRT(CHEAD/(231.095*DENSITY*(TEMP+459.67)));
  WRITE(AVG[2]:5:2,'+-',DEV[2]:5:3,CMACH:7:4);
  DELAY(1000);
  ReadAnalogData(A,B,1000,3000,POINTS,AVG[1],MIN[1],MAX[1],
                 DEV[1],RMS[1],TIME);
  WRITE(AVG[1]:8:2,'+-',DEV[1]:5:3);
  DELAY(1000);
  ReadAnalogData(A,B,1000,3000,POINTS,AVG[2],MIN[2],MAX[2],
                 DEV[2],RMS[2],TIME);
  HOME(BASEADDRESS);
  WHEAD:=ABS((AVG[1]+AVG[2])/2);
  WMACH:=SQRT(WHEAD/(231.095*DENSITY*(TEMP+459.67)));
  WRITE(AVG[2]:6:2,'+-',DEV[2]:5:3,WMACH:7:4,'REPEAT(Y/N)');

  REPEAT INCHAR:=READKEY;
  UNTIL (INCHAR IN ['Y','y','N','n']);
  WRITELN;
  until (INCHAR IN ['N','n']);
  WRITELN;
  WRITELN;

  WRITE('USE CL OR WALL AVERAGED MACH # (C/W)          :');
  REPEAT INCHAR:=READKEY;UNTIL(INCHAR IN ['C','c','W','w']);

  IF (INCHAR IN ['C','c']) THEN BEGIN MACH:=CMACH;
     HEAD:=CHEAD;END;

  IF (INCHAR IN ['W','w']) THEN BEGIN MACH:=WMACH;
     HEAD:=WHEAD;END;
     INCHAR:='N';
  END;

  Vcl  :=SQRT(10.4016*HEAD/DENSITY);
  VAVG :=VMULT*Vcl;
  MFLOW:=DENSITY*VAVG*181.041;
  QACT :=QPCT*MFLOW/200;
  QIND :=QACT/SQRT((PRESS*511.67)/(760*(TEMP+459.67)));

  WRITELN;WRITELN;
  WRITE('FREQUENCY OF SAMPLING (1.1Hz - 2024Hz) :');
  READLN(FREQ); DLY:=WRITELN;
  WRITELN('SETTING DELAY LOOP # TO                 :',DLY:5);
```

```
WRITELN;
WRITE('NUMBER OF POINTS TO BE SAMPLED (1 - 10000)    :');
READLN(REPT);
WRITELN;
WRITE('ENTER STARTING PRESSURE TAP TO SAMPLE (1 - 24) :');
READLN(LOTAP);WRITELN;
WRITE('ENTER LAST PRESSURE TAP TO SAMPLE     (1 - 24) :');
READLN(HITAP);WRITELN;

INITDEVICE(BASEADDRESS,ANALOG);

REPEAT
  HOME(BASEADDRESS);
  FOR I:=2 TO LOTAP DO BEGIN
      STEP(BASEADDRESS);DELAY(200);
  END;
  DELAY(4000);
  LOC :=LOTAP;
  QUIT:=FALSE;

  REPEAT
  READANALOGDATA(A,B,FREQ,REPT,POINTS,AVG[LOC],
            MIN[LOC],MAX[LOC],DEV[LOC],RMS[LOC],TIME);
  IF (POINTS<REPT) THEN QUIT:=TRUE;
  CLRSCR;
  WRITELN('PRESSURE SAMPLING OF TAP # ',LOC);
  WRITELN;WRITELN;
  WRITELN('NUMBER OF DATA POINTS TAKEN      : ',POINTS:8);
  WRITELN;WRITELN;
  WRITELN('TIME ELLAPSED                    : ',TIME:8:2,'SECONDS');
  WRITELN('-----------------------------------------------------');
  WRITELN('MINIMUM OUTPUT                   :',MIN[LOC]:8:5,'"H2O');
  WRITELN;
  WRITELN('MAXIMUM OUTPUT                   :',MAX[LOC]:8:5,'"H2O');
  WRITELN;
  WRITELN('AVERAGE OUTPUT                   :',AVG[LOC]:8:5,'"H2O');
  WRITELN;WRITELN;
  WRITELN('AVERAGE DEVIATION                :',DEV[LOC]:8:5,'"H2O');
  WRITELN;
  WRITELN('RMS DEVIATION                    :',RMS[LOC]:8:5,'"H2O');
  WRITELN;

  IF (LOC=1) THEN DELAY(8000);
  IF (LOC>=HITAP) THEN QUIT:=TRUE;
  IF (LOC< HITAP) THEN LOC:=LOC+1;
UNTIL QUIT;

HOME(BASEADDRESS);
HEADAVG:=DENSITY*VAVG*VAVG/10.4016;
FOR I:=1 TO 24 DO CP[I] :=0;

IF FIRST THEN BEGIN
```

```
  CLRSCR;
  WRITELN;
  WRITELN(GEOM);
  WRITELN;
  WRITELN('TEMP(F)=',TEMP:6:1,'  Density(Lbs2/ft4)=',
                   DENSITY:8:6,'  P(mm HG)=',PRESS:3:0);
  WRITELN('CLmach#=',MACH:6:4,'  Vc.l.(ft/s)      =',
                      VCL:8:3,'  Vavg(ft/s)=',VAVG:7:2);
  WRITELN('M(LB/m)=',MFLOW:6:2,S(%)=',QPCT :3:1,'  S(ind)=',
                     Qind:8:2,'  S(ACT)     =',SACT:7:2);
  WRITELN('PTS=',REPT:4,'/',TIME:5:3,'s  P("H2O)=',A:8:5,
                 '+',B:7:5,'*V  HEADavg   =',HEADAVG:7:3);
  WRITELN;
  WRITELN('TAP  AXIAL  L/D     MIN     MAX     AVG   ',
                              'RMSDEV AVGDEV   Cp    ');
  WRITELN('      LOC    LOC   ("H2O)  ("H2O)  ("H2O)  ',
                              '("H2O) ("H2O)         ');
  WRITELN('------------------------------------------',
                              '---------------------');

IF FILEIT THEN BEGIN
ASSIGN(F,FILENAME);
REWRITE(F);
WRITELN(F,FILENAME,':',GEOM);
WRITELN(F);
WRITELN(F,'TEMP(F)=',TEMP :6:1,'  Density(Lbs2/ft4)=',
                   DENSITY:8:6,'  P(mm Hg)=',PRESS:3:0);
WRITELN(F,'CLmach#=',MACH :6:4,'  Vc.l.(ft/s)      =',
                    VCL    :8:3,'  VAVG     =',VAVG:7:3);
WRITELN(F,'M(LB/m)=',MFLOW:6:2,'  S(%)=',QPCT :3:1,
              '  S(ind)=', Qind:8:2,'  S(ACT)=',SACT;7:2);
WRITELN(F,'PTS=',REPT:4,'/',TIME:5:3,'s  P("H2O)=',A:8:5,
                 '+',B:7:5,'*V  HEADAVG   =',HEADAVG:7:3);
WRITELN(F);
WRITELN(F,'TAP  AXIAL  L/D     MIN     MAX     AVG   ',
                               'RMSDEV AVGDEV   Cp   ');
WRITELN(F,'      LOC    LOC   ("H2O)  ("H2O)  ("H2O)  ',
                               '("H2O)  ("H2O)       ');
WRITELN(F,'------------------------------------------',
                               '--------------------');
END;

IF PRINTIT THEN BEGIN
   WRITELN(LST,FILENAME,':',GEOM);
WRITELN(LST);
WRITELN(LST,'TEMP(F)=',TEMP :6:1,'   Density(Lbs2/ft4)=',
DENSITY:8:6,'
WRITELN(LST,'CLmach#=',MACH :6:4,'   Vc.l.(ft/s)      =',
                        VCL    :8:3,'  VAVG=',VAVG:7:2);
WRITELN(LST,'M(LB/m)=',MFLOW:6:2,'   S(%)=',QPCT :3:1,
                 '    S(ind)=',Qind,'   S(ACT)=',QACT:7:2);
WRITELN(LST,'PTS=',REPT:4,'/',TIME:5:3,'s  P("H2O)=',A:8:5,
```

```
                    '+',B:7:5,'*V   HEADAVG=',HEADAVG:7:2);
WRITELN(LST);
WRITELN(LST,'TAP  AXIAL  L/D     MIN     MAX     AVG    ',
'RMSDEV AVGDEV   Cp  ');
WRITELN(LST,'      LOC   LOC   ("H2O)  ("H2O)  ("H2O)  ',
'("H2O) ("H2O)        ');
WRITELN(LST,'----------------------------------------',
'--------------------');

END;
FIRST:=FALSE;
END;

IF (POINTS<REPT) THEN LOC:=LOC-1;
IF (LOTAP=1) THEN BEGIN
FOR I:=1 TO 2 DO BEGIN
    WRITELN(I:9,X[I]:7:2,XOD[I]:6:3,MIN[I]:8:2,MAX[I]:8:2,
       AVG[I]:8:2,RMS[I]:8:2,DEV[I]:8:2,CP[I]:8:3);
    IF FILEIT THEN WRITELN(F,I:9,X[I]:7:2,XOD[I]:6:3,
       MIN[I]:8:2,MAX[I]:8:2,AVG[I]:8:2,RMS[I]::8:2,
       DEV[I]:8:2,CP[I]:8:3);
    IF PRINTIT THEN WRITELN(LST,I:9,X[I]:7:2,XOD[I]:6:3,
       MIN[I]:8:2,MAX[I]:8:2,AVG[I]:8:2,RMS[I]:8:2,
       DEV[I]:8:2,CP[I]:8:3);
END;
END;
WRITELN;
IF FILEIT  THEN WRITELN(F,  '  ');
IF PRINTIT THEN WRITELN(LST,'  ');

FOR I:=(LOTAP DIV 2+1) TO (LOC DIV 2-1) DO BEGIN
    O:=2*I+1;
    Cp[O]:=(0.5*AVG[9]+0.5*AVG[10]-AVG[O])/HEADAVG;
    WRITELN(O:9,X[O]:7:2,XOD[O]:6:3,MIN[O]:8:2,MAX[O]:8:2,
                AVG[O]:8:2,RMS[O]:8:2,DEV[O]:8:2,CP[O]:8:2);
    IF FILEIT THEN WRITELN(F,O:9,X[O]:7:2,XOD[O]:6:3,
                           MIN[O]:8:2,MAX[O]:8:2,AVG[O]:8:2,
                           RMS[O]:8:2,DEV[O]:8:2,CP[O]:8:2);
    IF PRINTIT THEN WRITELN(LST,O:9,X[O]:7:2,XOD[O]:6:3,
                           MIN[O]:8:2,MAX[O]:8:2,AVG[O]:8:2,
                           RMS[O]:8:2,DEV[O]:8:2,CP[O]:8:2);
END;

WRITELN;
IF FILEIT  THEN WRITELN(F,  '  ');
IF PRINTIT THEN WRITELN(LST,'  ');
FOR I:=(LOTAP DIV 2+1) TO (LOC DIV 2-1) DO BEGIN
    E:=2*I+2;
    Cp[E]:=(0.5*AVG[9]+0.5*AVG[10]-AVG[E])/HEADAVG;
    WRITELN(E:9,X[E]:7:2,XOD[E]:6:3,MIN[E]:8:2,MAX[E]:8:2,
                AVG[E]:8:2,RMS[E]:8:2,DEV[E]:8:2,CP[E]:8:2);
    IF FILEIT THEN WRITELN(F,E:9,X[E]:7:2,XOD[E]:6:3,
```

```
                              MIN[E]:8:2,MAX[E]:8:2,AVG[E]:8:2,
                              RMS[E]:8:2,DEV[E]:8:2,CP[E]:8:2);
    IF PRINTIT THEN WRITELN(LST,E:9,X[E]:7:2,XOD[E]:6:3,
                              MIN[E]:8:2,MAX[E]:8:2,AVG[E]:8:2,
                              RMS[E]:8:2,DEV[E]:8:2,CP[E]:8:2);
  END;
  WRITELN;
  WRITE('REPEAT (Y/N)');REPEAT INCHAR:=READKEY;
  UNTIL (INCHAR IN ['Y','y','N','n']);
UNTIL (INCHAR IN ['N','n']);
IF FILEIT THEN CLOSE(F);
END.
```

APPENDIX I

PITOT PROBE PRESSURE DATA AQUISITION PROGRAM

```
Program PITOT;
USES CRT,DOS,PRINTER;

Const
  BASEADDRESS                        = $02E2;
  SelectHighOrderByte                = $0001;
  AnalogReadControlRegisterOffset    = $0000;
  AnalogReadRegisterOffset           = $2000;
  AnalogStatusRegisterOffset         = $0000;
  AnalogWriteControlRegisterOffset   = $1000;
  AnalogWriteRegisterOffset          = $3000;
  BinaryControlRegisterOffset        = $0000;
  BinaryReadWriteRegisterOffset      = $2000;
  BinaryStatusRegisterOffset         = $0000;
  InterruptControlRegisterOffset     = $D000;
  IssacDeviceNoRegisterOffset        = $C000;
  AnalogDeviceCode                   = $0009;
  MinaryDeviceCode                   = $0008;
  DisableAllInterrupts               = $0000;
  EnableAnalogAD                     = $0001;
  DisableAnalogAD                    = $0000;

type
 STR80        = STRING[80];
 STR15        = STRING[15];
 IOtype       = (Analog,Binary);

 Var
   X,Y,STATMIN,STATMAX,STATAVG,STATDEV,STATRMS,
   PITSTAT,VEL,STAGMIN,STAGMAX,STAGAVG,STAGDEV,
   STAGRMS                          :ARRAY[0..50] OF REAL;
   TEMP,DENSITY,PRESS,MACH,CMACH,WMACH,HEAD,CHEAD,WHEAD,
   START,PACE,FREQ,A,B,MIN,MAX,DEV,RMS,TIME,VMULT,VCENT,
   S1,S2,QPCT,QIND,QACT,VAVG,VCL,VMEAN,VPOS,VNEG,MFLOW,
   SUM,SUMPOS,SUMNEG                                   :Real;
   DLY,I,POINTS,LOC,REPT                               :INTEGER;
   InChar                                              :char;
   QUIT,FILEIT,PRINTIT                                 :BOOLEAN;
   GEOM                                                :STR80;
   FILENAME                                            :STRING;
   F                                                   :TEXT;

Procedure InitDevice(BASEADDRESS:integer;Mode:IOtype);
begin
case Mode of
     Analog:Port[BaseAddress+IssacDeviceNoRegisterOffset]
                                    := AnalogDeviceCode;
     Binary:Port[BaseAddress+IssacDeviceNoRegisterOffset]
                                     :=BinaryDeviceCode;
end; { case }
Delay(1);
end; { InitDevice }
```

```
Procedure WriteAnalogData(BASEADDRESS,CHL,VALUE:INTEGER);
begin
  Port[BaseAddress+AnalogWriteControlRegisterOffset
                  +SelectHighOrderByte]:=Chl;
  Port[BaseAddress+AnalogWriteRegisterOffset]:=Lo(Value);
  Port[BaseAddress+AnalogWriteRegisterOffset
                  +SelectHighOrderByte]:=Hi(Value);
end; { WriteAnalogData }

PROCEDURE STEP(BASEADDRESS:INTEGER);
BEGIN
  WRITEANALOGDATA(BASEADDRESS,0,0);
  DELAY(50);
  WRITEANALOGDATA(BASEADDRESS,0,3700);
  DELAY(50);
  WRITEANALOGDATA(BASEADDRESS,0,0);
  DELAY(200);
END; { main program }

PROCEDURE HOME(BASEADDRESS:INTEGER);
BEGIN
  WRITEANALOGDATA(BASEADDRESS,1,3700);
  DELAY(2000);
  WRITEANALOGDATA(BASEADDRESS,1,0);
END; { main program }

PROCEDURE ReadAnalogData(A,B,FREQ:REAL;REPT:INTEGER;
                     VAR POINTS:INTEGER;
                     VAR AVG,MIN,MAX,DEV,RMS,TIME:REAL);

TYPE  R_ARRAY = ARRAY[1..10000] OF REAL;
      R_PTR   = ^R_ARRAY;

VAR DATA                                          : R_PTR;
    TESTSTATUS,LowByteData,HighByteData,CHL,DLY,I,J:integer;
    HOUR,MINUTE,SECOND,HUNDRETH                   : WORD;

Begin
 CHL   :=0;
 POINTS:=0;
 DLY:=ROUND(-17.4874+35592.8246/FREQ);
 IF (DLY<0) THEN DLY:=0;
 NEW(DATA);
 {********************************************************}
 INITDEVICE(BASEADDRESS,ANALOG);
 Port[BaseAddress+AnalogReadControlRegisterOffset]
                :=DisableAnalogAD;
 Port[BaseAddress+AnalogReadControlRegisterOffset
                +SelectHighOrderByte]:=Chl;
 Delay(1);
 Port[BaseAddress+AnalogReadControlRegisterOffset]
                                         :=EnableAnalogAD;
```

```
 Port[BaseAddress+AnalogReadControlRegisterOffset
                                +SelectHighOrderByte]:=Chl;
 Delay(1);
 repeat
  TestStatus:=Port[BaseAddress+AnalogStatusRegisterOffset];
  TestStatus:=TestStatus AND 1;
 until TestStatus = 0;
 {**********************************************************}

 SETTIME(0,0,0,0);

REPEAT
  FOR I:=0 TO DLY DO J:=1;
  Port[BaseAddress+AnalogReadControlRegisterOffset]
                                         :=DisableAnalogAD;
  Port[BaseAddress+AnalogReadControlRegisterOffset
                                +SelectHighOrderByte]:=Chl;
  LowByteData :=Port[BaseAddress+AnalogReadRegisterOffset];
  HighByteData:=Port[BaseAddress+AnalogReadRegisterOffset
                                     +SelectHighOrderByte];
  Port[BaseAddress+AnalogReadControlRegisterOffset]
                                          :=EnableAnalogAD;
  Port[BaseAddress+AnalogReadControlRegisterOffset
                                +SelectHighOrderByte]:=Chl;
  POINTS       := POINTS+1;
  DATA^[POINTS]:= (HighByteData SHL 8) + LowByteData;
UNTIL((KEYPRESSED) OR (POINTS>=REPT));

GETTIME(HOUR,MINUTE,SECOND,HUNDRETH);
TIME:=HOUR*3600+MINUTE*60+SECOND+HUNDRETH/100;
STEP(BASEADDRESS);
AVG:=0;MIN:=100;MAX:=-100;
FOR I:=1 TO POINTS DO BEGIN
    DATA^[I]:=A+(DATA^[I]*B/409.5);
    AVG     :=AVG+DATA^[I];
    IF (DATA^[I]>MAX) THEN MAX:=DATA^[I];
    IF (DATA^[I]<MIN) THEN MIN:=DATA^[I];
END;
AVG:=AVG/POINTS;
DEV:=0;RMS:=0;

FOR I:=1 TO POINTS DO BEGIN
    DEV:=DEV+ABS(DATA^[I]-AVG);RMS:=RMS+SQR(DATA^[I]);
END;

IF NOT(AVG=0) THEN BEGIN
   DEV:=DEV/POINTS;
   RMS:=SQRT(ABS((RMS/POINTS)-SQR(AVG)));
END;

DISPOSE(DATA);
end; { ReadAnalogData }
```

```
BEGIN
FILEIT :=FALSE;
PRINTIT:=FALSE;
A:=-2.03419;
B:= 1.49391;

CLRSCR;
WRITELN('PITOT PROBE MEASUREMENT');
WRITELN;
WRITE('DO YOU WISH TO SAVE THIS DATA IN A FILE (Y/N):');
REPEAT
  INCHAR:=READKEY;
UNTIL (INCHAR IN ['Y','y','N','n']);
WRITELN;
WRITELN;

IF (INCHAR IN ['Y','y']) THEN BEGIN;
   WRITE('ENTER THE NAME OF THE DATA FILE FOR THIS RUN:');
   READLN(FILENAME);
   FILEIT:=TRUE;
   ASSIGN(F,FILENAME);
   REWRITE(F);
END;

WRITELN;
WRITE('DO YOU WISH TO PRINT THIS DATA IN A (Y/N) :');
REPEAT
  INCHAR:=READKEY;
UNTIL (INCHAR IN ['Y','y','N','n']);
IF (INCHAR IN ['Y','y']) THEN PRINTIT:=TRUE;
WRITELN;
WRITELN;

WRITELN;
WRITE('ALTER CALIBRATION A=',A:8:5,' B=',B:8:5,' (Y/N):');
INCHAR:=READKEY;
WRITELN;
IF (INCHAR IN ['Y','y']) THEN BEGIN
   WRITELN;
   WRITE('CALIBRATION :    PRESSURE = A + B*VOLTS   A:');
   READLN(A);
   WRITE('                                          B :');
   READLN(B);
   WRITELN;
END;

CLRSCR;
WRITE(  'SLOT GEOMETRY:');
READLN(GEOM);
WRITELN;
WRITE('STARTING POINT IN THE SWEEP: ');
READLN(Y[0]);
```

```
WRITELN;
WRITE('ATMOSPHERIC PRESSURE (mm Hg):');
READLN(PRESS);
WRITELN;
WRITE('ATMOSPHERIC TEMPERATURE (F) :');
READLN(TEMP);
WRITELN;
WRITE('ENTER THE CENTER LINE MACH NUMBER WISHED:');
READLN(MACH);
WRITELN;
WRITE('Vaverage/Vcenterline MULTIPLIER:');
READLN(VMULT);
WRITELN;
WRITE('SUCTION RATE WISHED (% OF FLOW):');
READLN(QPCT);
WRITELN;

DENSITY:=(2116.2/760)*PRESS/((TEMP+459.67)*1716.97);
HEAD   :=MACH*MACH*231.095*DENSITY*(TEMP+459.67);
Vcl    :=SQRT(10.4016*HEAD/DENSITY);
VAVG   :=VMULT*Vcl;
MFLOW  :=DENSITY*VAVG*181.041;
QACT   :=QPCT*MFLOW/200;
QIND   :=QACT/SQRT((PRESS*511.67)/(760*(TEMP+459.67)));

WRITELN('SET ROTAMETER TO (LBm/min) :',QIND:4:2);
WRITELN;

WRITE('INPUT OR READ THE CENTER LINE MACH NUMBER (I/R):');
REPEAT
   INCHAR:=READKEY;
UNTIL (INCHAR IN ['I','i','R','r']);
WRITELN;
WRITELN;

IF (INCHAR IN ['I','i']) THEN BEGIN
   WRITE('ENTER THE CENTER LINE MACH NUMBER :');
   READLN(MACH);
   HEAD:=MACH*MACH*231.095*DENSITY*(TEMP+459.67);
END;

IF (INCHAR IN ['R','r']) THEN BEGIN
   WRITELN('   PITOT       PITOT      PITOT       WALL    '
                               ,'    WALL        WALL ');
   WRITELN('   Static    Stagnation    M#       STATIC 9 '
                               ,'   STATIC 10    M#   ');
   WRITELN('----------- ----------- ------  -----------'
                               ,' ------------ ------');

   INITDEVICE(BASEADDRESS,ANALOG);
   HOME(BASEADDRESS);
```

```
    REPEAT
      ReadAnalogData(A,B,1000,2000,POINTS,STATAVG[1],
          STATMIN[1],STATMAX[1],STATDEV[1],STATRMS[1],TIME);

      WRITE(STATAVG[1]:5:2,'+-',STATDEV[1]:5:3);
      DELAY(8000);
      ReadAnalogData(A,B,1000,2000,POINTS,STAGAVG[1],
          STAGMIN[1],STAGMAX[1],STAGDEV[1],STAGRMS[1],TIME);

      FOR I:=1 TO 6 DO STEP(BASEADDRESS);
      CHEAD:=ABS(STATAVG[1]-STAGAVG[1]);
      CMACH:=SQRT(CHEAD/(231.095*DENSITY*(TEMP+459.67)));
      WRITE(STAGAVG[1]:5:2,'+-',STAGDEV[1]:5:3,CMACH:7:4);

      DELAY(1000);
      ReadAnalogData(A,B,1000,2000,POINTS,STATAVG[1],
          STATMIN[1],STATMAX[1],STATDEV[1],STATRMS[1],TIME);

      WRITE(STATAVG[1]:8:2,'+-',STATDEV[1]:5:3);
      DELAY(1000);
      ReadAnalogData(A,B,1000,2000,POINTS,STAGAVG[1],
          STAGMIN[1],STAGMAX[1],STAGDEV[1],STAGRMS[1],TIME);

      HOME(BASEADDRESS);
      WHEAD:=ABS((STATAVG[1]+STAGAVG[1])/2);
      WMACH:=SQRT(WHEAD/(231.095*DENSITY*(TEMP+459.67)));
      WRITE(STAGAVG[1]:6:2,'+-',STAGDEV[1]:5:3,WMACH:7:4,
           ' REPEAT(Y/N)');

      REPEAT
         INCHAR:=READKEY;
      UNTIL (INCHAR IN ['Y','y','N','n']);
      WRITELN;
    until (INCHAR IN ['N','n']);

 WRITELN;
 WRITELN;
 WRITE('USE CENTERLINE OR WALL AVERAGED MACH# (C/W)    :');
 REPEAT
   INCHAR:=READKEY;
UNTIL (INCHAR IN ['C','c','W','w']);

 IF (INCHAR IN ['C','c']) THEN BEGIN
    MACH:=CMACH;
    HEAD:=CHEAD;
 END;
 IF (INCHAR IN ['W','w']) THEN BEGIN
    MACH:=WMACH;
    HEAD:=WHEAD;
 END;
 INCHAR:='N';
 END;
```

```
Vcl   :=SQRT(10.4016*HEAD/DENSITY);
VAVG  :=VMULT*Vcl;
MFLOW:=DENSITY*VAVG*181.041;
QACT  :=QPCT*MFLOW/200;
QIND  :=QACT/SQRT((PRESS*511.67)/(760*(TEMP+459.67)));

WRITELN;
WRITE('FREQUENCY OF SAMPLING (1.1Hz - 2024Hz)       :');
      READLN(FREQ);
WRITELN;
WRITE('NUMBER OF POINTS TO BE SAMPLED (1 - 10000)   :');
      READLN(REPT);
WRITELN;
WRITELN;

{***********************************************************}
IF FILEIT THEN BEGIN
   ASSIGN(F,FILENAME);
   REWRITE(F);
   WRITELN(F,'FILENAME,':',GEOM);
   WRITELN(F);
   WRITELN(F,'TEMP(F)=',TEMP :6:1,'   Density(Lbs2/ft4)=',
                   DENSITY:8:6,'   P(mm Hg)  =',PRESS:7:0);
   WRITELN(F,'CLmach#=',MACH :6:4,'   Vc.l.(ft/s)      =',
                    VCL    :8:3,'   Vavg(ft/s)=',Vavg:7:2);
   WRITELN(F,'M(LB/m)=',MFLOW:6:2,'   S(%)=',QPCT :3:1,
           '   S(ind)=',Qind:8:2,'   S(act)    =',QACT:7:2);
   WRITELN(F,'PTS=',REPT:4,'/',TIME:5:3,'s  P("H2O)=',
                                 A:8:5,'+',B:7:5,'*V');
   WRITELN(F);
   WRITELN(F,'  PROBE         STATIC PORT     ',
                    '    STAGNATION PORT        VELOCITY  ');
   WRITELN(F,' X      Y     MIN/MAX   AVG    RMS',
                    ' MIN/MAX   AVG    RMS      HEAD     ');
   WRITELN(F,'(in)  (in)   (" H2O)    ( "H2O ) ',
                    '  (" H2O)   ( "H2O )  ("H2O) (FT/S)');
   WRITELN(F,'---------- --------------------',
                    ' ------------------- -------------');
   END;

IF PRINTIT THEN BEGIN
   WRITELN(LST,FILENAME,':',GEOM);
   WRITELN(LST);
   WRITELN(LST,'TEMP(F)=',TEMP :6:1,'  Density(Lbs2/ft4)='
                  ,DENSITY:8:6,'   P(mm Hg)  =',PRESS:7:0);
   WRITELN(LST,'CLmach#=',MACH :6:4,'  Vc.l.(ft/s)      ='
                   ,VCL    :8:3,'   Vavg(ft/s)=',Vavg:7:2);
   WRITELN(LST,'M(LB/m)=',MFLOW:6:2,'  S(%)=',QPCT :3:1,
           '   S(ind)=',Qind:8:2,'   S(act)    =',QACT:7:2);
   WRITELN(LST,'PTS=',REPT:4,'/',TIME:5:3,'  P("H2O)=',
                                 A:8:5,'+',B:7:5,'*V');
   WRITELN(LST);
```

```
    WRITELN(LST,'  PROBE          STATIC PORT     ',
                 '    STAGNATION PORT       VELOCITY  ');
    WRITELN(LST,' X      Y     MIN/MAX    AVG    RMS',
                 ' MIN/MAX    AVG    RMS        HEAD    ');
    WRITELN(LST,'(in)   (in)   (" H2O)    ( "H2O ) ',
                 '  (" H2O)   ( "H2O )  ("H2O) (FT/S)');
    WRITELN(LST,'---------- -------------------',
                 ' ------------------- ------------');
    END;

{*****************************************************}
INITDEVICE(BASEADDRESS,ANALOG);
HOME(BASEADDRESS);
LOC:=0;

REPEAT{**************** CYCLE ************************}
  QUIT:=FALSE;
  LOC:=LOC+1;
  WRITE('PROBE LOCATION    X = ');READLN(X[LOC]);
  WRITE('                  Y = ');READLN(Y[LOC]);

  ReadAnalogData(A,B,FREQ,REPT,POINTS,STATAVG[LOC],
                 STATMIN[LOC],STATMAX[LOC],STATDEV[LOC],
                 STATRMS[LOC],TIME);

  DLY:=17000-ROUND(4.8*POINTS);
  IF (DLY<0) THEN DLY:=0;
  DELAY(DLY);
  IF (POINTS<REPT) THEN QUIT:=TRUE;

  ReadAnalogData(A,B,FREQ,REPT,POINTS,STAGAVG[LOC],
                 STAGMIN[LOC],STAGMAX[LOC],
                 STAGDEV[LOC],STAGRMS[LOC],TIME);

  HOME(BASEADDRESS);
  IF (POINTS<REPT) THEN QUIT:=TRUE;
  PITSTAT[LOC]:=STATAVG[LOC]-STAGAVG[LOC];
  VEL[LOC]:=(PITSTAT[LOC]/ABS(PITSTAT[LOC]))
           *SQRT(ABS(10.4016*PITSTAT[LOC]/DENSITY));

  CLRSCR;
  WRITELN;
  WRITELN(GEOM);
  WRITELN('TEMP(F)=',TEMP :6:1,'  Density(Lbs2/ft4)=',
                 DENSITY:8:6,'   P(mm Hg)   =',PRESS:7:0);
  WRITELN('CLmach#=',MACH :6:4,'  Vc.l.(ft/s)       =',
                 VCL    :8:3,'   Vavg(ft/s)=',Vavg:7:2);
  WRITELN('M(LB/m)=',MFLOW:6:2,'  S(%)=',QPCT :3:1,
         '   S(ind)=',Qind:8:2,'   S(act)    =',QACT:7:2);
  WRITELN('PTS=',REPT:4,'/',TIME:5:3,'  P("H2O)=',
                                 A:8:5,'+',B:7:5,'*V');
  WRITELN;
```

```
  WRITELN('  PROBE          STATIC PORT     ',
                  '    STAGNATION PORT       VELOCITY  ');
  WRITELN(' X      Y    MIN/MAX   AVG   RMS',
                  '  MIN/MAX   AVG   RMS      HEAD    ');
  WRITELN('(in)  (in)  (" H2O)   ( "H2O ) ',
                  '  (" H2O)   ( "H2O )  ("H2O) (FT/S)');
  WRITELN('---------- --------------------',
                  ' -------------------- ------------');
  FOR I:=1 TO LOC DO WRITELN(X[I]:10:1,Y[I]:6:2,
  STATMIN[I]:5:1,STATMAX[I]:5:1,STATAVG[I]:6:2,
  STATRMS[I]:5:2,STAGMIN[I]:5:2,STAGMAX[I]:5:2,
  STAGAVG[I]:6:2,STAGRMS[I]:5:2,PITSTAT[I]:7:2,VEL[I]:7:2);
  WRITELN;

  WRITE('ACCEPT POINT (Y/N)  : ');
  REPEAT
    INCHAR:=READKEY;
  UNTIL (INCHAR IN ['Y','y','N','n']);
  WRITELN;

IF (INCHAR IN ['Y','y']) THEN BEGIN
IF FILEIT THEN WRITELN(F,  X[I]:10:1,Y[I]:6:2,
  STATMIN[I]:5:1,STATMAX[I]:5:1,STATAVG[I]:6:2,
  STATRMS[I]:5:2,STAGMIN[I]:5:2,STAGMAX[I]:5:2,
  STAGAVG[I]:6:2,STAGRMS[I]:5:2,PITSTAT[I]:7:2,VEL[I]:7:2);
IF PRINTIT THEN WRITELN(LST,X[I]:10:1,Y[I]:6:2,
  STATMIN[I]:5:1,STATMAX[I]:5:1,STATAVG[I]:6:2,
  STATRMS[I]:5:2,STAGMIN[I]:5:2,STAGMAX[I]:5:2,
  STAGAVG[I]:6:2,STAGRMS[I]:5:2,PITSTAT[I]:7:2,VEL[I]:7:2);
END;

IF (INCHAR IN ['N','n']) THEN LOC:=LOC-1;

WRITE('ANOTHER SEY (Y/N)   : ');
REPEAT
   INCHAR:=READKEY;
UNTIL (INCHAR IN ['Y','y','N','n']);
WRITELN;

UNTIL (INCHAR IN ['N','n']);

WRITELN;
IF FILEIT THEN CLOSE(F);
IF PRINTIT THEN WRITELN(LST);

Y[LOC+1]:=-Y[0];
VEL[0]:=0;
VEL[LOC+1]:=0;
SUM:=0;
FOR I:=0 TO LOC DO BEGIN
    SUM:=SUM+0.5*(VEL[I]+VEL[I+1])*ABS(Y[I+1]-Y[I]);
    IF I=(LOC DIV 2) THEN SUMNEG:=SUM;
```

```
    IF I=((LOC DIV 2)+1) THEN VCENT:=VEL[I];
END;
VMEAN:=SUM/(2*ABS(Y[0]));
SUMPOS:=SUM-SUMNEG;
VNEG  :=SUMNEG/SUM;
VPOS  :=SUMPOS/SUM;
MFLOW:=DENSITY*SUM*120.6375;

WRITELN;
WRITELN('Vavg(Ft/s)=',VMEAN:7:3,'  Vavg/Vset=',
            VMEAN/VCL:7:5,'   Vavg/Vmid=',VMEAN/VCENT:7:5);
WRITELN('Mflow(PPM)=',MFLOW:7:3,'  M(OUT/IN)=',
                                     VNEG:5:3,'/',VPOS:5:3);
IF PRINTIT THEN BEGIN
   WRITELN(LST,'Vavg(Ft/s)=',VMEAN:7:3,'  Vavg/Vset=',
            VMEAN/VCL:7:5,'   Vavg/Vmid=',VMEAN/VCENT:7:5);
   WRITELN(LST,'Mflow(PPM)=',MFLOW:7:3,'  M(OUT/IN)=',
                                     VNEG:5:3,'/',VPOS:5:3);
END;
END.
```

APPENDIX J

HOT WIRE CALIBRATION PROGRAM

```
program PAUL_CAL(input,output,listing);

{ This program performs a calibration of a single sensor }
{ hot-wire probe.  The program output provides the two   }
{ coefficients and the optimum exponent for a KING'S LAW }
{ calibration.                                           }

import iodeclarations;
import general_1;
import general_2;
import measurement_lib;

const
      name = 'ADC';
      model = '98640A';
select_code = 18;
      error = 'NO';
      units = 'STANDARD';
 multiplier = 1.0;
     offset = 0.0;
     p_size = 1;
     g_size = 1;
type
     r_array = ARRAY[1..3000] of real;
     r_ptr = ^r_array;
     i_array = ARRAY[1..7] of shortint;
     i_ptr = ^i_array;
     cal_array = ARRAY[1..50] of real;

var
     data,pace                                    :r_ptr;
     channel,gain                                 :i_ptr;
     c_size,d_size,rept,i,points                  :integer;
     time,pase,press,temp,density,velocity,
     residual,n,a,b,m,r                           :real;
     mean,rms,vel                                 :cal_array;
     date                                         :string[10];
     test2,test1,choice                           :char;
     f,listing                                    :text;

procedure least(mean,vel:cal_array;points:integer;
                var a,b,n,residual:real);
var x,y,sumx,sumy,sumxx,sumxy,det:real;
          i:integer;
      begin
      sumx :=0.0;sumxx:=0.0;sumxy:=0.0;sumy :=0.0;
      for i:=1 to points do begin
          x:=exp(n*ln(vel[i]));
          y:=mean[i]*mean[i];
          sumx:=sumx+x;sumxx:=sumxx+x*x;
          sumy:=sumy+y;sumxy:=sumxy+x*y;
      end;
```

```
      det:=(points*sumxx)-(sumx*sumx);
      a:=((sumy*sumxx)-(sumxy*sumx))/det;
      b:=((points*sumxy)-(sumx*sumy))/det;
      residual:=0.0;

      for i:=1 to points do begin
          det:=(mean[i]*mean[i]-a)/b;
          residual:=residual+sqr(exp(ln(det)/n)-vel[i]);
      end;

      residual:=sqrt(residual/points);
end;

begin {MAIN PROGRAM}
write(  'ENTER THE CALIBRATION DATE (12/21/90)       :');
readln(date);
write(  'ENTER THE FLUID BARAMETRIC PRESSURE IN mm Hg:');
readln(press);
write(  'ENTER THE FLUID TEMPERATURE IN DEGREES F    :');
readln(temp);
density:=(2116.2/760)*press/((temp+459.67)*1716.97);

writeln('THE FLUID DENSITY IN (lbf-s2/ft4)           :',
         density:9:7);
write(  'NUMBER OF POINTS TO SAMPLE (1 - 32760)      :');
readln(d_size);
write(  'DURATION OF SAMPLING (SEC)                  :');
readln(time);

c_size:=1;
pase:=time/(c_size*d_size);

if(pase < 0.0000180) then pase:=0.000018;
if(pase > 0.0393336) then pase:=0.0393336;

time:=pase*c_size*d_size;
rept:=round(d_size/c_size);
writeln('PASE WILL BE SET TO : ',PASE:10:8);

new(channel);
channel^[1]:=1;
new(pace);
pace^[1]:=pase;
new(gain);
write('ENTER THE DESIRED GAIN FOR CH1 (1,8,64,512):');
readln(gain^[1]);

meas_lib_init;
config_0(name,model,select_code,1,0.02,error,units,
         multiplier,offset);
init(name);
calibrate(name,3,0.0001,1000);
```

```
points:=1;

repeat
  new(data);
  writeln;
  write('MANOMETER PRESSURE IN INCHES OF WATER :');
  readln(velocity);
  vel[points]:=sqrt((10.4016*velocity)/density);

  random_scan(name,c_size,channel,d_size,data,rept,p_size,
              pace,g_size,gain);

  m:=0.0;
  for i:=1 to d_size do m:=m+data^[i];
  mean[points]:=m/d_size;
  r:=0.0;
  for i:=1 to d_size do r:=r+sqr(data^[i]-mean[points]);
  rms[points]:=sqrt(r/d_size);
  dispose(data);

  writeln('POINT     VELOCITY       MEAN          RMS  ');
  writeln('           (FT/S)       (VOLTS)      (VOLTS)');
  writeln('-----     --------      -------      --------');
  for i:=1 to points do writeln(i:4,vel[i]:13:3,
                              mean[i]:13:4,rms[i]:14:5);
  writeln;
  write('ACCEPT DATA POINT  ( y  or n ) : ');
  repeat
     readchar(1,test2);
  until(test2 in ['Y','y','N','n']);
  writeln;

  write('CALIBRATE MORE OR QUIT (C/Q)   : ');
  repeat
     readchar(1,test1);
  until( test1 in ['C','c','Q','q']);
  writeln;

  if ((test1 in ['C','c']) and (test2 in ['Y','y']))
                                  then points:=points+1;
  until (test1 in ['Q','q']);

rewrite(f,'PAUL:CALDAT.TEXT');
writeln(f,'CALIBRATION ',date,
         '      DENSITY(LBfs2/FT)=',density:9:7);
writeln(f,'PRESS(mm Hg)=',press:4:0,
         '       TEMP(F)=',temp:4:1);
writeln(f);
writeln(f,'POINT     VELOCITY       MEAN          RMS  ');
writeln(f,'           (ft/s)       (Volts)      (Volts)');
writeln(f,'-----     --------      -------      -------');
```

```
writeln(listing,'CALIBRATION ',date,
                '       DENSITY(LBfs2/FT)=',density:9:7);

writeln(listing,'PRESS(mm Hg)=',press:4:0,
                '        TEMP(F)=',temp:4:1);

writeln(listing);
writeln(listing,'POINT    VELOCITY      MEAN       RMS  ');
writeln(listing,'          (ft/s)     (Volts)   (Volts)');
writeln(listing,'-----    --------     -------   -------');

for i:=1 to points do begin
  writeln(listing,i:4,vel[i]:13:3,mean[i]:13:4,rms[i]:14:5);
  writeln(f,i:4,vel[i]:13:3,mean[i]:13:4,rms[i]:14:5);
end;
writeln;
writeln(listing);

  for i:=0 to 20 do begin
     n    :=0.30+0.01*i;
     least(mean,vel,points,a,b,n,residual);

     writeln('A=',a:8:5,'  B=',b:8:5,'  n=',n:5:2,
             '   RMS RESIDUAL (FT/S)=',residual:10);

     writeln(listing,'A=',a:8:5,'  B=',b:8:5,'  n=',n:5:2,
                    '   RMS RESIDUAL (FT/S)=',residual:10);

  end;
close(f,'SAVE');
end.
```

APPENDIX K

HOT WIRE VELOCITY AND TURBULENCE PROGRAM

```
PROGRAM SWEEP(INPUT,OUTPUT,LISTING);

{ This program samples A time varying voltage using the  }
{ HP-98640A at A user specified rate.  Up to two channels}
{ may be sampled and Using a User Specified Kings Law    }
{ Calibration the MEAN and RMS Velocities, And Local     }
{ Turbulence Intensity are Calculated for Each Pitot     }
{ Probe Location                                         }

import iodeclarations;
import general_2;
import measurement_lib;

const
       name = 'ADC';
      model = '98640A';
select_code = 18;
      error = 'NO';
      units = 'STANDARD';
 multiplier = 1.0;
     offset = 0.0;
     p_size = 1;
     g_size = 1;

type
     r_array = ARRAY[1..32766] of real;
     r_ptr   = ^r_array;
     i_array = ARRAY[1..7] of shortint;
     i_ptr   = ^i_array;
     l_array = ARRAY[1..60] of real;

var
    data,pace                                         :r_ptr;
    channel,gain                                      :i_ptr;
    g1,g2,c_size,d_size,rept,loc,i,j                  :integer;
    a,b,n,size,time1,time2,pase1,pase2,v1,v2,e,dvde:real;

    x,y,min,max,avg1,avg2,er1,er2,dev1,
    dev2,rms1,rms2,rmsi1,rmsi2                        :l_array;

    filename                                          :string[20];
    geometry                                          :string[70];
    accept,continue,con                               :char;
    listing,f                                         :text;

begin {MAIN PROGRAM}
writeln('MEASURES DC & RMS VELOCITIES FROM PROBE TRAVERSE');
writeln('  CHANNEL 1 = UNGAINED,UNCONDITIONED INPUT');
writeln('  CHANNEL 2 = DC STRIPPED INPUT TO BE AMPLIFIED');
writeln;
write(  'FILE NAME: ');
readln(filename);
```

```
write(  'CONTINUATION OR NEW FILE (C/N) : ');
repeat
   readln(con);
until (con in ['C','c','N','n']);

write(  'GEOMETRY :');
readln(geometry);
writeln;
write(  'KINGS LAW CALIBRATION COEFFICIENTS    A: ');
readln(a);
write(  '                                      B: ');
readln(b);
write(  '                                      n: ');
readln(n);
writeln;
writeln;
write(  'NUMBER OF POINTS TO SAMPLE (1 - 32766) : ');
readln(d_size);
write(  'DURATION OF SAMPLING FOR CHANNEL1 (SEC): ');
readln(time1);
write(  'DURATION OF SAMPLING FOR CHANNEL2 (SEC): ');
readln(time2);

c_size:=1;
pase1:=time1/(c_size*d_size);

if (pase1 < 0.0000180) then pase1:=0.0000180;
if (pase1 > 0.0393336) then pase1:=0.0393336;

time1:=pase1*c_size*d_size;
pase2:=time2/(c_size*d_size);

if (pase2 < 0.0000180) then pase2:=0.0000180;
if (pase2 > 0.0393336) then pase2:=0.0393336;

time2:=pase2*c_size*d_size;
rept:=round(d_size/c_size);
writeln;
writeln('PACE1 RATE WILL BE SET TO     : ',pase1:9:7);
writeln;
writeln('PACE2 RATE WILL BE SET TO     : ',pase2:9:7);
writeln;
write('DESIRED GAIN FOR UNSTRIPPED CH 1 (1,8,64,512x):');
readln(g1);
write('DESIRED GAIN FOR STRIPPED CH 2   (1,8,64,512x):');
readln(g2);
new(channel);
channel^[1]:=1;
new(pace);
pace^[1]:=pase1;
new(gain);
gain^[1]:=g1;
```

```
meas_lib_init;

config_0(name,model,select_code,1,0.02,error,units,
         multiplier,offset);

init(name);

calibrate(name,3,0.0001,1000);
new(data);

if (con in ['N','n']) then begin
   rewrite(f,filename);
   writeln(f,filename);
   writeln(f,geometry);
   writeln(f);
   writeln(f,'CALIBRATION USED :  A=',a:6:4,'  B=',b:6:4,
             ' n=',n:5:3);

   writeln(f,'AVERAGING ',d_size:5,' POINTS OVER CH1=',
             time1:5:2,' CH2=',time2:5:2,' SECONDS');

   writeln(f);
   writeln(f,'CH1 WAS UNCONDITIONED AND x ',g1:3);
   writeln(f,'CH2 WAS D.C. STRIPPED AND x ',g2:3);
   writeln(f);
   writeln(f,'PROBE LOC.    VELOCITIES          ',
          'FLUCTUATIONS        LSB ERROR     INTENSITY ');

   writeln(f,'  X     Y   MIN1 MAX1  AVG1  MEAN1 RMS1  ',
          'MEAN2  RMS2   CH1   CH2     RMS1  RMS2');

   writeln(f,' (in)  (in) ft/s ft/s  ft/s (ft/s)(ft/s)',
          '(ft/s) (ft/s) (ft/s)(ft/s)   (%)   (%) ');

   writeln(f,'----------- -------------- -------------',
          '-----------  -----------  -----------');

   close(f,'save');

   writeln(listing,filename);
   writeln(listing,geometry);
   writeln(listing);
   writeln(listing,'CALIBRATION USED :  A=',a:6:4,'  B=',
           b:6:4,' n=',n:5:3);

   writeln(listing,'AVERAGING',d_size:5,'POINTS OVER CH1=',
           time1:5:2,' CH2=',time2:5:2,' SECONDS');

   writeln(listing);
   writeln(listing,'CH1 WAS UNCONDITIONED AND x ',g1:3);
   writeln(listing,'CH2 WAS D.C. STRIPPED AND x ',g2:3);
   writeln(listing);
```

```
   writeln(listing,'PROBE LOC.     VELOCITIES          ',
           'FLUCTUATIONS         LSB ERROR     INTENSITY ');

   writeln(listing,'  X      Y   MIN1 MAX1  AVG1  MEAN1 ',
           'RMS1  MEAN2  RMS2   CH1   CH2     RMS1  RMS2');

   writeln(listing,' (in)  (in) ft/s ft/s  ft/s (ft/s)',
           '(ft/s)(ft/s) (ft/s) (ft/s)(ft/s)   (%)   (%) ');

   writeln(listing,'----------- -------------- --------',
           '---------------  ----------  ----------');

end;

loc:=1;

repeat
   writeln;
   write('ENTER PROBE LOCATION    X=');
   readln(x[loc]);
   write('                        Y=');
   readln(y[loc]);

   random_scan(name,c_size,channel,d_size,data,rept,
               p_size,pace,g_size,gain);

   avg1[loc]:=0.0;
   min[loc]:=999.0;
   max[loc]:=000.0;

   for i:=1 to d_size do begin
       v1:=(data^[i]*data^[i]-a)/b;
       v1:=exp(ln(v1)/n);
       avg1[loc]:=avg1[loc]+v1;
       if (v1<min[loc]) then min[loc]:=v1;
       if (v1>max[loc]) then max[loc]:=v1;
   end;

   avg1[loc]:=avg1[loc]/d_size;
   dev1[loc]:=0.0;
   rms1[loc]:=0.0;

   for i:=1 to d_size do begin
       v1:=(data^[i]*data^[i]-a)/b;
       v1:=exp(ln(v1)/n);
       dev1[loc]:=dev1[loc]+abs(v1-avg1[loc]);
       rms1[loc]:=rms1[loc]+sqr(v1-avg1[loc]);
   end;

   channel^[1]:=2;
   pace^[1]:=pase2;
   gain^[1]:=g2;
```

```
random_scan(name,c_size,channel,d_size,data,rept,
            p_size,pace,g_size,gain);

avg2[loc]:=0.0;
for i:=1 to d_size do avg2[loc]:=avg2[loc]+data^[i];
avg2[loc]:=avg2[loc]/d_size;

dev2[loc]:=0.0;
rms2[loc]:=0.0;

for i:=1 to d_size do begin
    dev2[loc]:=dev2[loc]+abs(data^[i]-avg2[loc]);
    rms2[loc]:=rms2[loc]+sqr(data^[i]-avg2[loc]);
end;

e:=sqrt(a+b*exp(n*ln(avg1[loc])));
dvde:=(e*e-a)/b;
dvde:=(2*e/(b*n))*exp((1/n-1)*ln(dvde));
er1[loc]:=dvde*10/(g1*4095);
er2[loc]:=dvde*10/(g2*4095);

dev1[loc]:=dev1[loc]/d_size;
rms1[loc]:=sqrt(rms1[loc]/d_size);
rmsi1[loc]:=rms1[loc]*100/avg1[loc];

dev2[loc]:=dvde*dev2[loc]/d_size;
rms2[loc]:=dvde*sqrt(rms2[loc]/d_size);
rmsi2[loc]:=rms2[loc]*100/avg1[loc];

channel^[1]:=1;
pace^[1]:=pase1;
gain^[1]:=g1;

writeln(filename);
writeln(geometry);
writel n;
writeln('CALIBRATION USED :  A=',a:6:4,'  B=',b:6:4,
        ' n=',n:5:3);

writeln('AVERAGING ',d_size:5,' POINTS OVER CH1=',
        time1:5:2,' CH2=',time2:5:2,' SECONDS');

writeln;
writeln('CH 1 WAS UNCONDITIONED x BY ',g1:3);
writeln('CH 2 WAS D.C. STRIPPED x BY ',g2:3);
writeln;
writeln('PROBE LOC.     VELOCITIES          FLUCTUATIONS'
        '        LSB ERROR     INTENSITY ');

writeln('  X     Y   MIN1 MAX1   AVG1   MEAN1 RMS1   MEAN2'
        '  RMS2   CH1    CH2      RMS1   RMS2');
```

```
    writeln(' (in)  (in) ft/s ft/s  ft/s (ft/s)(ft/s)(ft/s)'
           ' (ft/s) (ft/s)(ft/s)   (%)   (%) ');

    writeln('----------- -------------- -----------------'
           '-------  -----------  -----------');

    for i:=1 to loc do writeln(x[i]:5:2,y[i]:6:2,min[i]:5:0,
        max[i]:4:0,avg1[i]:7:2,dev1[i]:6:2,rms1[i]:6:2,
        dev2[i]:7:3,rms2[i]:7:3,er1[i]:7:3,er2[i]:6:3,
        rmsi1[i]:7:2,rmsi2[i]:6:2);

    writeln;
    write('ACCEPT(Y/N):');
    repeat
       readln(accept);
    until (accept in ['Y','y','N','n']);

    if (accept in ['Y','y']) then begin
      append(f,filename);

      writeln(f,x[loc]:5:2,y[loc]:6:2,min[loc]:5:0,
              max[loc]:4:0,avg1[loc]:7:2,dev1[loc]:6:2,
              rms1[loc]:6:2,dev2[loc]:7:3,rms2[loc]:7:3,
              er1[loc]:7:3,er2[loc]:6:3,rmsi1[loc]:7:2,
              rmsi2[loc]:6:2);

      close(f,'save');
      writeln(listing,x[loc]:5:2,y[loc]:6:2,min[loc]:5:0,
              max[loc]:4:0,avg1[loc]:7:2,dev1[loc]:6:2,
              rms1[loc]:6:2,dev2[loc]:7:3,rms2[loc]:7:3,
              er1[loc]:7:3,er2[loc]:6:3,rmsi1[loc]:7:2,
              rmsi2[loc]:6:2);
      end;

      write('CONTINUE(Y/N):');
      repeat
        readln(continue);
      until (continue in ['Y','y','N','n']);

      if((accept in ['Y','y']) and (continue in ['Y','y']))
         then loc:=loc+1;

until (continue in ['N','n']);
end.
```

VITA

Paul A. Williams

Candidate for the Degree of

Master of Science

Thesis: HOT-WIRE ANEMOMETER STUDIES OF A TWO DIMENSIONAL DIFFUSER THAT USES VARIABLE GEOMETRY SLOT SUCTION

Major Field: Mechanical Engineering

Biographical:

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