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SINGLE STAGE EXPERIMENTAL EVALUATION OF SLOTTED ROTOR AND STATOR BLADING

PART IV - DATA AND PERFORMANCE FOR SLOTTED ROTOR 2

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Pratt & Whitney Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION
FLORIDA RESEARCH AND DEVELOPMENT CENTER

Printed in the United States of America

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ABSTRACT

A single-stage investigation of a slotted rotor was conducted as part of an overall program to evaluate the effect of slots on the performance of highly loaded compressor rotor and stator blade rows. The test rotor blades were 65-series airfoils having a calculated unslotted D-factor loading of 0.51 and an inlet relative Mach number of 0.833 at a radial station 10% of the span from the blade tip. For design equivalent rotor speed, the slotted rotor achieved a maximum adiabatic efficiency of 88.5% and a corresponding pressure ratio of 1.29.

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SECTION I
SUMMARY

A single-stage investigation of a slotted rotor was conducted as part of an overall program to evaluate the effect of slots on the performance of highly loaded compressor rotor and stator blade rows. The test rotor blades were 65-series airfoils and had a calculated unslotted blade D-factor loading of 0.512 and an inlet relative Mach number of 0.833 at a radial station 10% of the span from the blade tip. The rotor blades were slotted at approximately 50% chord; the slots extended from 5% to 45% span from the tip and from 50 to 90% span in each blade. The single-stage rig had a hub/tip ratio of 0.8, and the rotor tip diameter was about 40 in. The rotor blades had a constant chord length of 2.21 in., an aspect ratio of 1.71 and solidity of 1.15 at the mean radius. Design rotor tip velocity was 935 fps.

For design equivalent rotor speed the slotted rotor achieved a maximum adiabatic efficiency of 88.5% and a corresponding pressure ratio of 1.29. The measured D-factor values corresponding to maximum efficiency flow conditions were approximately 0.48 at the root and tip and 0.40 at midspan. Measured deviation angles were essentially the same as the predicted unslotted blade deviation angles in the midspan and tip regions, and approximately 6 degrees greater than the predicted deviation angle at the hub. Measured loss coefficient was comparable to the predicted unslotted blade loss coefficient at 30, 50, and 70% span locations, and was greater than the predicted loss at 10 and 90% span.

Comparison of the slotted rotor loss and D-factor loading characteristics for high incidence conditions with correlated NASA rotating cascade minimum loss incidence data indicates that the slot configuration for this investigation was effective in the achievement of loss levels equal to or less than those indicated by the NASA design curves for D-factor loading from 0.50 to 0.70.

SECTION II
INTRODUCTION

Pratt & Whitney Aircraft is engaged in a program under NASA Contract NAS3-7603 to investigate the application of slots to rotors and stators. A systematic investigation is being conducted to establish the feasibility and extent to which slotted blade concepts can be used to increase allowable blade loadings and the stable operating range of compressor stages. To accomplish this objective, three stator blade rows and three rotor blade rows have been built for test. Tests with stators use a representative state-of-the-art rotor to generate the stator inlet flow.

An aerodynamic analysis and design of the test blading and associated hardware were accomplished under the design phase of the program (Reference 1).* All rotors and stators were designed with the same rotor exit and stator inlet absolute velocities and air angle distributions to permit testing of any combination of rotor and stator. It was assumed, for design purposes, that the flow deviation angles for slotted rotors and stators would be approximately one-half the values normally used for unslotted blades. As part of the design effort, a series of annular cascade tests with slotted stators was conducted to establish preliminary criteria for the design of slotted rotors and stators for the rotating stage test program (Reference 2). Data and performance results obtained with the first slotted rotor configuration of the series are presented in Reference 3.

This report presents the data and performance results obtained with the second slotted rotor configuration (Rotor 2) which has a higher loading level than Rotor 1. Rotor 2 blading was designed with 65-series airfoil sections and had calculated design tip values of D-factor loading and inlet relative Mach number (without slots) of 0.512 and 0.833, respectively. The rotor blades were slotted at approximately 50% chord; the slots extended from 5 to 45% span, and from 50 to 90% span (from the tip) in each blade. A set of inlet guide vanes was used to establish the whirl

*References are given in Appendix C.

distribution into the test rotor. One of the test stator configurations, prior to slotting, was employed to remove some of the exit swirl. A set of exit guide vanes was used to remove the remaining exit swirl.

Overall performance and blade element data were obtained at 50, 70, and 100% of the design equivalent rotor speed. Blade element data were obtained at five radial locations behind each of the three blade rows, and rotating stall measurements were obtained at each of the three rotor speed conditions. Rotor wake surveys at five spanwise locations, using a hot-film anemometer, were obtained at choke, near-stall, and approximately maximum efficiency flow conditions at each rotor speed.

Details of the test equipment, procedures, and test results for the slotted Rotor 2 test configuration are presented in this report. Some design details are also included herein for convenience. Reference 1 gives further aerodynamic and mechanical design information.

SECTION III
TEST EQUIPMENT

A. FACILITY

The compressor test facility is shown schematically in figure III-1*. The compressor rotor is powered by a single-stage drive turbine using exhaust gases from a J75 slave engine. The drive turbine speed is regulated by a hydraulically actuated inlet flow control valve. The slave engine exhaust is also used to drive a two-stage exhaust-ejector system.

Air entered the compressor test rig through a 103-ft combined inlet duct, plenum, and bellmouth inlet, and exhausted through an exit diffuser to the atmosphere. A 7-degree diffuser in front of the inlet plenum ensured uniform flow conditions across the plenum, and an area contraction ratio from plenum to compressor inlet of approximately 10:1 provided essentially stagnation conditions in the plenum. The inlet duct and plenum were mounted on a track and could be rolled away from the compressor rig inlet to facilitate configuration changes. The plenum was sealed to the compressor rig inlet section with an inflatable rubber tube seal.

B. COMPRESSOR TEST RIG

The compressor rig, shown in figure III-2, comprises bellmouth inlet, test section, and exhaust section. The test section has a hub/tip ratio of 0.8 and a rotor tip diameter of approximately 40 in. The rotor assembly and shaft are supported on two bearings that transmit loads to the outer case through struts located in the inlet and exhaust case assemblies. The test section has a split outer case that permits guide vane, rotor, and stator assembly changes without removing the rig from the test stand. A set of motor-driven throttle vanes is located in the exhaust case to vary flow rate.

A section view of the flow path is shown in figure III-3. Flow is accelerated through the inlet strut station and guide vanes in a convergent passage to the rotor inlet. Thereafter, the inner wall diameter remains constant at 32.85 in. while the outer wall converges further through the rotor blade and stator vane rows to a diameter of

*All illustrations will be found in Section VII.

40 in. In general, the flow path is designed to simulate the middle-stage environment of a state-of-the-art multistage compressor.

Provisions were made for end wall bleed at the rotor tip and stator root and tip, as shown in figure III-4. Bleed air flowed through perforated plate shrouds, shroud manifolds, and 24 approximately equally spaced tubes to individual main collector manifolds for the rotor and stator. The collector manifolds exhausted through the facilities ejector system. Rotor and stator bleed flow rates were controlled and measured separately.

C. STAGE BLADING DESIGN

To expedite this research program, the aerodynamic and mechanical design of the blading was completed and fabrication initiated prior to the completion of the annular cascade program. Final slot configurations were based on the results of the cascade tests.

1. Inlet Guide Vane

The inlet guide vanes were designed to provide a rotor prewhirl distribution of 16.6 deg at the root (90% span) to 18.2 deg at the tip (10% span). NACA series-400 blade sections were chosen for this purpose. Details of the guide vane design are presented in table III-1.

2. Rotor 2

a. Blade Design

Slotted Rotor 2 blading was designed with a camber distribution of 36.0 deg at the root (90% span) to 18.1 deg at the tip (10% span). NACA series-65 blade sections were selected for the rotor blades because this series of airfoil has adequate thickness for slots, suitable loading distribution, and is capable of operating in the required Mach number range ($M_{tip} = 0.8$). It was assumed, for design purposes, that slots would reduce the flow deviation angle approximately one-half the normal values. Slotted rotor blade trailing edge metal angles were established in accordance with this assumption. Design D-factor loading at the rotor tip was 0.590 for the slotted blading and 0.512 for the same blading without slots (i.e., with full deviation).

Table III-1. Geometry Design Data

INLET GUIDE VANE 2

Airfoil Series: 400
No. of Blades: 50
Aspect Ratio: 1.777

Percent Span (From Tip)	κ_1	κ_2	ϕ	γ°	c	σ	t/c	δ°
90	0.00	24.04	-24.04	14.36	2.204	1.044	0.060	7.46
50	0.00	24.84	-24.84	14.92	2.204	0.956	0.060	8.30
10	0.00	28.88	-28.88	17.21	2.204	0.880	0.060	10.73

ROTOR 2

Airfoil Series: 65
No. of Blades: 60
Aspect Ratio: 1.707

Percent Span (From Tip)	κ_1	κ_2	ϕ	γ°	i_m	0/0*	c	σ	t/c	δ°	$\bar{\omega}$
90	52.16	16.15	36.01	34.21	0.42	1.247	2.210	1.250	0.075	11.43	0.062
50	55.03	29.24	25.79	42.10	0.70	1.253	2.210	1.149	0.059	8.05	0.053
10	56.79	38.65	18.14	47.75	1.26	1.250	2.210	1.071	0.044	5.97	0.047

STATOR 1

Airfoil Series: 65
No. of Blades: 58
Aspect Ratio: 1.663

Percent Span (From Tip)	κ_1	κ_2	ϕ	* γ°	i_m	0/0*	c	σ	t/c	δ°	$\bar{\omega}$
90	52.15	22.14	30.01	37.20	-1.68	1.187	2.182	1.192	0.090	10.14	0.040
50	52.15	22.14	30.01	37.20	-0.22	1.273	2.182	1.099	0.090	9.46	0.036
10	52.15	22.14	30.01	37.20	0.61	1.355	2.182	1.026	0.090	9.93	0.034

*Stators were actually installed at a blade-chord angle of 32.0 deg.

Solidity, thickness ratios, and aspect ratios for the selected series airfoils were representative of the middle stage of a state-of-the-art compressor. Details of the rotor design are presented in table III-1.

b. Slot Design

Rotor 2 slot geometry and location were based on the results of preliminary annular cascade tests of slotted stator vanes and an analysis of Rotor 2 suction surface boundary layer separation (References 1 and 2).

The selected slot geometry was similar to a preferred slot geometry determined in the annular cascade program. Blade thickness at the intersection of slot centerline and blade meanline was selected as an approximate scaling parameter to scale the slot size from the oversize (6.5-in. chord) annular cascade vanes to the 2.21 in. chord Rotor 2 blading. The angle between slot centerline and blade meanline was held constant over the Rotor 2 blade span; that is, the slot followed the twist of the blade. The slot spanwise position and geometry variables with corresponding dimensions at root, mean, and tip sections are presented in figure III-5.

The slot centerline intersected the blade suction surface at 50% chord, approximately halfway between the minimum pressure point and the calculated separation point. This slot location was determined under the annular cascade tests to be superior to an alternative location near the separation point.

The resulting slotted blade configuration is shown in figure III-6.

3. Stator

Three stators having unslotted root D-factor loading levels of 0.52, 0.60, and 0.70 were designed for evaluation of slotted stators under the contract program (Reference 1). The stators are 65-series airfoil sections. The stator having the lowest of the three loading levels (Stator 1, D = 0.52) was selected for use behind the slotted rotors. Even though this stator was unslotted for these tests, it was considered to have an incidence range that would not limit slotted rotor evaluation. The selected stator had a constant equivalent circular arc camber of 30 deg and was untwisted. Because the annular cascade test results (Reference 2) indicated that slots did not produce the assumed decrease in deviation angle, the stator was installed behind slotted Rotor 2 with a blade chord

angle of 32 deg instead of the original design blade chord angle of 37.2 deg. This stagger angle was so selected to ensure that stator minimum loss incidence would occur within the expected range of rotor exit angle. Additional details of the stator design are presented in table III-1.

D. INSTRUMENTATION

Instrumentation was provided for overall and blade element performance measurements for each blade row. Axial locations of instrumentation stations are indicated in figure III-3, and schematics showing the detailed instrumentation at each axial location are presented in figures III-7 through III-10.

1. Rig Inlet Conditions

Weight flow was measured with an ASME standard thin plate orifice located in the inlet duct.

Six static pressure taps and six temperature probes were located in the plenum chamber for measurement of inlet total pressure and temperature.

Six equally spaced static pressure taps were located on both the inner and outer walls upstream of the inlet guide vanes (Station 0). From a rig calibration over a wide range of weight flows, a calibration between these static pressures was derived and used to check subsequent weight flow measurements.

2. Guide Vane Exit/Rotor Inlet - Station 1

A sectional view of the flow path at Station 1 showing the circumferential and radial location of instrumentation is presented in figure III-7. Rotor inlet air angle measurements were obtained at two circumferential locations with 20-deg wedge traverse probes. A 20-tube wake traverse probe, approximately aligned with the average guide vane exit air angle, was installed to measure guide vane wake total pressure distribution. Four static pressure taps were located on both the inner and outer wall. An 8-deg wedge traverse probe was used for measurement of radial static pressure distribution. The wedge probes and static

pressure taps were located approximately along extensions of guide vane midchannel lines. The guide vane trailing edge was oriented to keep the instrumentation locations used for Rotor 1 testing along midchannel streamlines. Redundant static and mid-passage total pressure data were available from the 20-deg wedge probe.

3. Rotor Exit/Stator Inlet - Station 2

A sectional view of the flow path showing the circumferential and radial location of instrumentation at Station 2 is presented in figure III-8. Two 20-deg wedge traverse probes were used for air angle, total pressure, and total temperature measurements. Three sets of Kiel head total pressure probes were located at radial positions corresponding to 30 and 50%. Two sets of Kiel probes were located at 10, 70, and 90% span. The probes were circumferentially located so that each set approximately averaged the pressures across a guide vane wake. A set of Kiel head temperature probes were located at 10, 30, 50, 70, and 90% span positions to provide a check against the 20-deg wedge probe temperature measurement. Four static pressure taps were located on both the inner and outer wall. An 8-deg wedge traverse probe was used for radial static pressure measurement.

4. Stator Exit - Station 2A

A sectional view of the flow path showing circumferential and radial location of instrumentation at Station 2A is presented in figure III-9. Stator exit air angle was measured with a 20-deg wedge traverse probe. A 20-tube rake traverse probe was used for measurement of stator vane wake total pressure distribution. Four static pressure taps were located on both the inner and outer wall, and an 8-deg wedge traverse probe was provided for radial static pressure measurement.

5. Station 3

Station 3 is one chord-length farther from the stator exit plane than Station 2A. Instrumentation at this station (figure III-10) included two 20-deg wedge traverse probes, one 8-deg wedge traverse probe, four sets of Kiel head total pressure probes at 10, 30, 50, 70, and 90% span location, three sets of Kiel head temperature probes at the same five span locations, and four static pressure taps on both the inner and outer wall.

Stage exit total temperature was based on the Kiel head probe temperature measurements at Station 3. Data obtained from the other instrumentation at this station were generally used for comparison with the Station 2A data.

6. Description of Probes

Details of the 20-deg and 8-deg probes, wake probe, and Kiel pressure and temperature probes are shown in figure III-11. The wedge probe contained side pressure pickups for air angle measurement, a total pressure pickup and a total temperature pickup.

The wake probe contained 20 total pressure pickups formed by 0.042 inch OD hypo tubing and spaced as shown in the figure.

7. Instrumentation Readout

Traverse probe data (total pressure, static pressure, air angle, total temperature, and radial travel) were recorded on magnetic tape at the rate of 60 samples (2.5-in. probe travel) per minute. Steady-state pressure measurements were obtained using a scannivalve multichannel pressure transducer system that includes automatic data recording on IBM cards. Kiel probe temperatures were indicated on a precision potentiometer, and manually recorded.

Plenum pressures, three OD static pressures at Station 0, primary and bleed system flow-measuring-orifice pressures, and three Station 3 midspan Kiel probe pressures were recorded on manometer tubes in the test stand control room to permit setting the desired flow conditions.

8. Special Instrumentation

a. Rotating Stall Instrumentation

Three Kistler (601A) pressure transducers were installed at Station 2 for rotating stall measurement (figure III-8). Transducer output was recorded on a CEC VR-2800 tape recorder.

b. Rotor Wake Instrumentation

Rotor wake surveys were obtained with DISA 55479 hot-film anemometer probe, located as shown in figure III-8. Anemometer output voltage was recorded on a VR-2800 tape recorder. The hot-film probe is shown in figure III-12.

c. Rotor Exit Boundary Layer Instrumentation

Rotor exit end wall boundary layer total pressure profiles were measured to set bleed flow rates using a three-hole cylindrical yaw probe having a 3/4-in. tip (dimension between sensing ports and probe tip) and a diameter of 3/8 in. Total pressure and radial travel were recorded on an x-y plotter.

d. Rotor Speed

Rotor rpm was measured with an electromagnetic pickup mounted adjacent to a 60-tooth gear on the rotor shaft. Gear tooth passing frequency was displayed as rpm on an Anadex digital readout system. A closed loop control system maintained rotor speed within approximately ± 1%.

e. Stress Measurements

Five rotor blades and five stator vanes were instrumented with strain gages to monitor and record torsional and bending stresses. Strain gage locations on a typical instrumented rotor blade are shown in figure III-13.

f. Vibration

Displacement pickups were mounted on forward and rear sections of the compressor rig outer case to monitor rig vibration.

g. Bleed Flow Rate

End wall bleed flow from the rotor and stator blade rows was measured by means of standard ASME thin plate orifices located in the respective bleed manifold exhaust ducts.

SECTION IV
PROCEDURES

A. TEST PROCEDURE

1. End Wall Bleed Flow Rate Selection

a. Rotor Bleed

With the compressor operating at design speed and flow conditions, the three-hole yaw probe was traversed between 0 and 20% span at Station 2 behind the rotor for each of three bleed flow settings. The three settings corresponded to near-zero, half of maximum, and maximum bleed flow rates. The bleed flow rate selected was that which produced the most significant improvement in total pressure profile as indicated on the x-y plotter. The valve setting for this bleed flow rate was not changed at other rotor speed and flow conditions.

b. Stator Bleed

With the rotor end wall bleed set at the selected rate, the procedure described above was repeated for the stator. The 20-tube wake probe was positioned at 10 and 90% span locations, and the effect of boundary layer bleed on the stator wake pressures was monitored on manometers. The valve setting corresponding to the bleed flow rate that produced the most significant improvement at either span location at design speed and flow conditions was selected for the test program.

2. Stress Survey and Rotating Stall Tests

A stress survey program was conducted to define the stress and vibration characteristics of the slotted rotor over the operating range and in the stall regions. Blade stresses were monitored and recorded along the choke line, along an assumed operating line, and into the stall region at five rotor speed conditions. Fixed instrumentation was recorded at a sufficient number of speed and flow conditions to define the overall operating range between choke and stall and between 50 and 110% design speed.

Kistler transducer data were recorded during the excursions into stall along each speed line to define rotating stall patterns.

3. Overall and Blade Element Performance Tests

Overall and blade element performance data were obtained at three rotor speed conditions (50, 70, and 100% of design speed) and a sufficient number of points per speed line to define rotor and stage performance between choke and stall. The near-stall test point was determined on the basis of strain gage output and stage exit total pressures indicated on manometers. At each speed and flow set point, the fixed pressure and temperature instrumentation data were recorded five times, corresponding to five discrete radial locations of the inlet guide vane and stator vane wake probes. Traverse data were usually recorded during the last recording of fixed instrumentation. In this manner, representative average values of flow and pressures could be determined for the time period (approximately 45 min) of data recording at each point.

4. Rotor Wake Surveys

Rotor wake surveys were obtained following the recording of blade element and overall performance data at choke, approximately maximum efficiency, and near-stall conditions on each of the three speed lines. Hot-film anemometer output was recorded as the probe was traversed from the inner to the outer wall behind the rotor.

B. DATA REDUCTION PROCEDURES

1. Preliminary Data Reduction

Data reduction was accomplished in three steps using three computer programs. The first step involved conversion of raw data to engineering units. Traverse data (total pressure, static pressure, total temperature, and air angle), obtained at approximately 0.04-in. increments across the span, were automatically plotted (as well as tabulated). The plotted and tabulated data were reviewed to identify and eliminate any obviously questionable data prior to the subsequent data reduction step.

The second data reduction step accomplished the following:

1. Mach number corrections to temperature data
2. Mass average of wake probe data
3. Circumferential arithmetic average of fixed and traverse instrumentation data

4. Correction of all pressure and temperature data to NASA standard day ambient conditions

5. Selection by interpolation of total and static pressure, total temperature, and air angle values at specified radial locations for input for the final data reduction step.

All corrected data were available for further inspection in the printed results from this computer program, which included individual data values as well as averaged quantities. The third step in the data reduction procedure involved calculation of overall and blade element performance parameters, which are defined in the following paragraphs.

2. Parameter Calculation

The following overall and blade element performance parameters were calculated for the analysis of test data and the evaluation of slotted Rotor 2 performance. Symbols are defined in Appendix A.

a. Overall Performance

(1) Weight Flow

Weight flow is presented in terms of corrected weight flow, defined as

$$\frac{w\sqrt{\theta}}{\delta}$$

where:

w = actual (orifice) weight flow

θ = ratio of total temperature (plenum) to NASA standard sea level temperature

δ = ratio of total pressure (plenum) to NASA standard sea level pressure.

Values of corrected weight flow presented in the figures and tables include rotor and stator bleed flow rates. Percentage bleed flow rates for the respective blade rows are tabulated separately (table B-1).

(2) Pressure Ratio

Pressure ratios were calculated for the rotor, guide vane-rotor, and guide vane-rotor-stator blade row combinations. Behind the rotor, fixed Kiel head and traverse probe total pressure data were arithmetically averaged at each span location and the profile thus defined was mass-flow averaged across the span.

Behind the guide vane and stator, the wake probe pressures were first mass-flow integrated at each span location, and the resulting average pressures were than mass-flow averaged in the radial direction.

(3) Adiabatic Efficiency

Adiabatic efficiency across the rotor is defined as

$$\eta_{ad} = \frac{\left(\frac{\bar{P}_2}{\bar{P}_1}\right)^{\frac{\gamma - 1}{\gamma}} - 1}{\frac{\bar{T}_3}{T_1} - 1}$$

where:

$\bar{P}_1$ = mass averaged pressure behind the guide vane
T_1 = 518.7°R
$\bar{P}_2$ = mass averaged pressure behind the rotor
$\bar{T}_3$ = mass averaged temperature behind the stator.

To obtain adiabatic efficiencies for the guide vane-rotor combination or for the entire stage, appropriate average pressures were used.

b. Blade Element Performance

(1) Diffusion Factor

Diffusion factor for the rotor is defined as

$$D = 1 - \frac{V_2'}{V_1'} + \frac{\Delta V_\theta' (1 - 2)}{2\sigma V_1'}$$

Diffusion factor for the stator is defined as

$$D = 1 - \frac{V_{2A}}{V_2} + \frac{\Delta V_\theta (2 - 2A)}{2\sigma V_2}$$

(2) Deviation

Rotor blade deviation is defined as

$$\overset{\circ}{\delta}_2 = \beta_2' - \kappa_2'$$

Stator deviation is defined as

$$\overset{\circ}{\delta}_{2A} = \beta_{2A} - \kappa_{2A}$$

where κ_2' and κ_{2A} are the rotor blade and stator vane trailing edge metal angles based on equivalent circular arc camber lines for the 65-series airfoil.

(3) Incidence Angle

Rotor incidence angle is defined as

$$i_{m1} = \beta_1' - \kappa_1'$$

Stator incidence angle is defined as

$$i_{m2} = \beta_2 - \kappa_2$$

where κ_1' and κ_2 are the rotor blade and stator vane leading edge metal angles based on the equivalent circular arc camber lines for the 65-series airfoil.

(4) Total Pressure Loss Coefficient

Total pressure loss coefficient for the rotor is defined as

$$\bar{\omega}'_{(1-2)} = \frac{\bar{P}_1' - P_2'}{\bar{P}_1' - p_1}$$

where (—) refers to mass-averaged wake total pressure.

For the inlet guide vanes, total pressure loss coefficient is defined as

$$\bar{\omega}_{(0-1)} = \frac{14.69 - \bar{P}_1}{q_o}$$

where q_o is obtained from isentropic flow relationships using orifice weight flow and the annular area at the guide vane inlet.

Total pressure loss coefficient for the stator is defined as

$$\bar{\omega}_{(2 - 2A)} = \frac{P_2 - \bar{P}_{2A}}{P_2 - p_2}$$

(5) Loss Parameter

Rotor total pressure loss is also presented in terms of the loss parameter,

$$\frac{\bar{\omega}'_{(1 - 2)} \cos \beta_2'}{2\sigma}$$

SECTION V
RESULTS AND DISCUSSION

Slotted Rotor 2 performance was evaluated on the basis of pressure rise and efficiency characteristics as functions of rotative speed and weight flow, as well as blade element diffusion factor, deviation, and loss coefficient as functions of incidence angle. Slotted rotor performance results are compared with (1) predicted unslotted rotor performance and (2) available NASA rotating cascade performance results. Guide vane exit and stator inlet air angles are compared with the respective calculated design radial distributions. Overall and blade element experimental performance parameters and bleed flows as well as blade element vector diagram data for the guide vane, rotor, and stator are tabulated in Appendix B. The results of stress surveys, rotating stall measurements, and rotor wake surveys are included under the discussion of rotor performance.

A. OVERALL PERFORMANCE

Overall performance is presented in terms of efficiency and pressure ratio versus corrected main orifice weight flow, $w\sqrt{\theta}/\delta$, and corrected specific weight flow, $w\sqrt{\theta}/\delta A_A$, in figure V-1, V-2, and V-3, for rotor, guide vane-rotor, and guide vane-rotor-stator combinations. Each figure contains the performance results obtained at the three test rotor speed conditions. Values of corrected airflow obtained from integration of flow profiles downstream of the rotor and stator are compared with the main orifice measured values minus bleed flow in figure V-4. The figure shows that agreement within 0 to -7% was obtained for the majority of data points.

As reported in Reference 1, the design efficiency and pressure ratio for Rotor 2 are 90% and 1.35, respectively, without slots (normal deviation angles) and 91% and 1.42, respectively, with slots (reduced deviation angles) at a design flow of 99 lb/sec. Because it was learned from the annular cascade test results (Reference 2) and the test results obtained with slotted Rotor 1 (Reference 3) that the selected slot design does not produce the assumed reduction in deviation angle, the test results reported herein are compared with the calculated design performance without slots.

For the design equivalent rotor speed, a maximum efficiency of 88.5% was obtained with a corresponding pressure ratio of 1.29, at a flow rate slightly higher than the design flow rate of 99 lb/sec. At design flow conditions the efficiency and pressure ratio were 86% and 1.30, respectively, compared with the predicted values of 90% and 1.35.

The guide vane-rotor performance characteristics in figure V-2 indicate that guide vane total pressure loss had a negligible effect when compared with rotor performance in figure V-1. The stage performance (guide vane-rotor-stator) in figure V-3 shows the effect of stator loss on stage efficiency and pressure ratio when compared with the guide vane-rotor performance in figure V-2. The design rotor speed maximum efficiency was decreased from 88.5% to 83.5% and the pressure ratio corresponding to maximum efficiency decreased from 1.29 to 1.27.

B. BLADE ELEMENT PERFORMANCE

1. Inlet Guide Vane

Inlet guide vane exit air angle distributions are presented in figure V-5 for representative design speed line test data. Air angle data obtained with each of the two 20-deg wedge probes are identified by symbol, and the design air angle distribution is shown for comparison. The average measured air angle is within about 1.0 degree of the predicted value over the entire span.

Inlet guide vane vector diagram and blade element data are presented in table B-2.

2. Rotor

a. Rotor Inlet Conditions

Rotor inlet relative Mach number and air angle radial distributions for the design speed data points are presented in figure V-6. Calculated design point distributions are shown for comparison. The design Mach number distribution is within the range of measured values from choke to stall.

At the weight flow corresponding to maximum efficiency ($w\sqrt{\theta}/\delta$ = 101.31 lb/sec), the inlet relative air angle distribution is within 1 or 2 degrees of the design distribution. Design incidence would be attained at a flow of about 98 lb/sec.

b. Loss Coefficient; Deviation; D-factor

Blade element performance data obtained at rotor design equivalent speed are presented in terms of loss coefficient, deviation, and D-factor versus incidence in figures V-7 through V-11. Each figure corresponds to one spanwise location. Calculated design values of loss coefficient, deviation, and D-factor (without slots) are shown in the figures for comparison with the slotted rotor data. The measured D-factor loading levels are generally lower than the corresponding predicted values in the middle of the blade (30, 50, and 70% span positions). The measured D-factor is slightly higher than the predicted value at 90% span from the tip, and equal to the predicted value 10% span from the tip. Slotted Rotor 2 deviation values are approximately the same as the predicted values at 10, 30, 50, and 70% span locations and six degrees greater than the predicted values at 90% span. Measured loss coefficients are approximately the same as the predicted values in the middle of the blade, and significantly higher than the predicted values at the hub and tip. The corresponding hub and tip efficiencies are low compared to the midspan value, as seen in table B-2.

Blade element parameters for the three speed lines are combined in figures V-12 through V-16 to show the general consistencey of the data. Rotor tip inlet relative Mach number varied between about 0.37 and 0.84 over the rotor speed and flow range. An apparent Mach number effect on loss coefficient can be seen at all five span locations. The 50 and 70% speed values are consistently lower than the 100% speed values. Furthermore, the 100% design rotor speed loss coefficient data exhibit a narrower incidence angle range than that formed by the data corresponding to 50 or 70% speed data.

Deviation angle does not appear to be affected by Mach number with the possible exception of the 90% span data in figure V-12. The data in this figure indicate a systematic trend of increasing deviation/incidence angle rate with increasing rotor speed (Mach number). The D-factor values corresponding to design rotor speed are consistently higher than those corresponding to 50 and 70% design speed.

c. Loss Parameter

Loss parameter, $\overline{\omega}'_{1-2} \cos \beta'_2/2\sigma$, is presented as a function of D-factor in figures V-17a, b, and c. NASA correlation curves (reproduced from Reference 3) for NASA 65-series and circular arc series rotating cascade minimum loss (reference incidence) data are shown for comparison. The data are separated in figures V-17a, b, and c according to 70 and 50% span, 90 and 30% span, and 10% span, respectively.

In general, the minimum loss data appear to be consistent with the respective NASA correlation curves for minimum-loss data. The 70 and 50% span data that correspond to incidence angles greater than minimum loss incidence indicate D-factor loading level values up to 0.51 at loss parameter levels that are equivalent to the NASA minimum-loss correlation curve. D-factor values as high as 0.64 at loss levels below the NASA curve are indicated for the blade tip (10% span) data. Although the 90 and 30% span data are slightly above the NASA correlation curve that includes data for these span locations, they extend the loading level range to approximately D = 0.70 without a sharp rise in loss. The results of these comparisons are very similar to the results obtained with slotted Rotor 1, reported in Reference 3. The present results tend to support the indication reported therein that the present slot design and location may be more effective at high incidence angles than at design incidence.

d. Stress Survey Results

A brief stress survey program was performed with slotted Rotor 2 to define the bending and torsion stress characteristics over the planned operating range. Transient recordings of strain gage data as shown in figure III-13 were obtained at each rotor speed condition as the throttle vanes were actuated to reduce flow rate, and along the choke and an approximate operating line as shown in figure V-18.

Bending stress levels were less than 5000 psi along the choke and assumed operating lines as well as the major portions of the constant speed lines. Stall stresses ranged from 13,100 psi at 50% design speed to 45,000 psi at 100% design speed.

First bending and torsion vibration frequencies at design rotor speed were 465 to 490 cps and 1160 to 1250 cps, respectively, which are in good agreement with the calculated values given in Reference 1.

e. Rotating Stall Results

Rotating stall measurements were obtained with three Kistler pressure transducers during the stress survey program as the stall region was approached along each speed line. A typical recording of rotating stall is presented in figure V-19. Rotating stall at each speed condition was characterized by a single stall zone that covered half the annulus and rotated at approximately 20% of the rotor speed. The stall characteristic for this rotor was abrupt at design rotor speed and relatively abrupt at 70% of design speed. Steady-state data in the stall region were not obtained at 70 and 100% of design speed due to prohibitive blade stresses. Stall was relatively gradual at 50% design speed, and two steady-state data points were recorded, as shown on the overall performance map in figure V-3.

f. Rotor Wake Survey Results

Rotor wake surveys were obtained at three flow conditions along each speed line: choke, approximately maximum efficiency, and near stall. A hot-film anemometer probe (figure III-12) was traversed behind the rotor from the inner to the outer wall to obtain blade wake definition at several span locations. A sample of the anemometer output on either side of each desired radial location was displayed on an oscilloscope so that from 10 to 15 consecutive wake traces for an isolated blade were superimposed. The oscilloscope display thus established is presented in figures V-20 through V-22. Major scale division of these figures represent 1/2 in. in the horizontal direction and 60 ft/sec in the vertical direction.

The large blade wakes in the root region (90% span) at all rotor speed conditions reflect the relatively high loss coefficients for this span location. The wake shapes at the other span locations indicate the velocity deterioration on the suction surface side of the wake (left side of the wakes in the figures) as stall conditions are approached.

3. Stator

Stator inlet Mach number and air angle distribution for design rotor speed data are presented in figure V-23. Calculated design values of these two parameters are shown for comparison. The design Mach number distribution is closest to the measured distribution at stall flow conditions. The inlet air angle comparison shows that the stator was not very well matched to the rotor. The midspan region operated with 2 to 14 deg less than design incidence over the flow range. At near design flow conditions the stator was operating 1 deg above design incidence at the tip (10% span), 4 deg less than design incidence at midspan, and about 2 deg above design incidence at the root (90% span). This incidence distribution is not considered to have adversely affected the rotor evaluation near design flow operating conditions. Vector diagrams and blade element data as obtained with unslotted Stator 1 behind slotted Rotor 2 are included in table B-2 for general information. An analysis of unslotted Stator 1 data will be presented in a subsequent report under this program as appropriate for comparison with slotted stator test results.

SECTION VI
CONCLUDING DISCUSSION

Blade element data at five radial locations and overall performance data were obtained for a slotted rotor configuration at several flow conditions, including choke and near-stall, along three rotor speed lines, 50, 70, and 100% of the design speed. Measured slotted rotor pressure ratio and efficiency were lower than the design values predicted for the same rotor without slots. Maximum efficiency for the slotted rotor at design equivalent speed was 88.5% compared with a calculated design efficiency of 0.90, and the corresponding measured pressure ratio was 1.29 compared with a design value of 1.35. At design flow conditions, the measured efficiency was 86%, and the pressure ratio was 1.30. These results reflect the relatively high deviation angle and loss coefficient in the blade root region and the high loss coefficient in the tip region. An apparent flow shift toward the midspan region (particularly from the root region) is suggested by the relatively low values of efficiency at the 10 and 90% span positions in table B-2. Stator losses resulted in a stage maximum efficiency of 83.5% and a stage pressure ratio of 1.27.

The loading levels achieved, as indicated by D-factor, were approximately equal to the predicted values based on normal deviation angles in the root and tip regions, and slightly lower than similarly predicted values at the 30, 50, and 70% span locations. Measured deviation angles for the slotted rotor were within 1 deg of the predicted values at all span locations except at 90% span from the tip. At 90% span the measured deviation angle was about 6 deg more than the predicted value. Measured loss coefficients for the slotted rotor were comparable to the predicted values in the middle of the blade, and considerably higher than predicted values at the root and the tip.

It is difficult to assess the absolute effectiveness of slots on the basis of comparison of measured performance with the calculated performance derived from coventional loss and deviation correlations. On the basis of these comparisons, at design incidence, it might be concluded that the slot had little, if any, favorable effect on rotor performance. On the basis of the comparison of measured D-factor and loss parameter with NASA

design curves from Reference 3, it is concluded that the slots produced a favorable effect on blade profile loss at incidence angles above the minimum loss incidence, particularly in the tip region. The fact that slotted Rotor 2 did not achieve the design pressure ratio calculated for the rotor without slots is attributed to the flow deterioration in the blade root region, although the specific cause of this deterioration has not yet been determined.

Further analysis of the results is in progress to fully evaluate the possible interaction effects between the slotted rotor and the unslotted stator. The results of this analysis as they are pertinent to the overall program objectives will be published in the final report under this program.

SECTION VII
ILLUSTRATIONS

This section contains the illustrations that have been referenced in the preceding sections.

FD 10891B

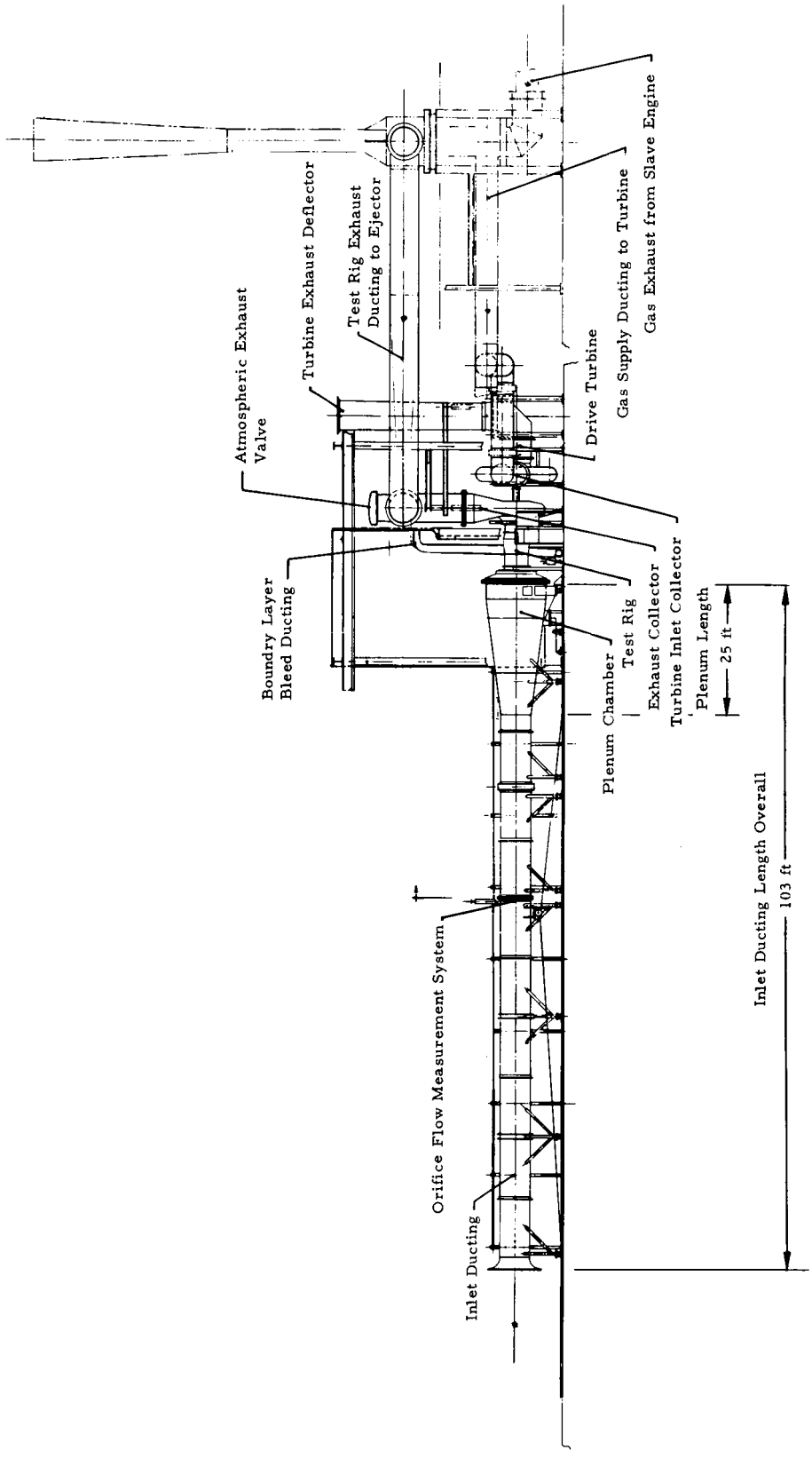


Figure III-1. Compressor Research Facility

FD 14681A

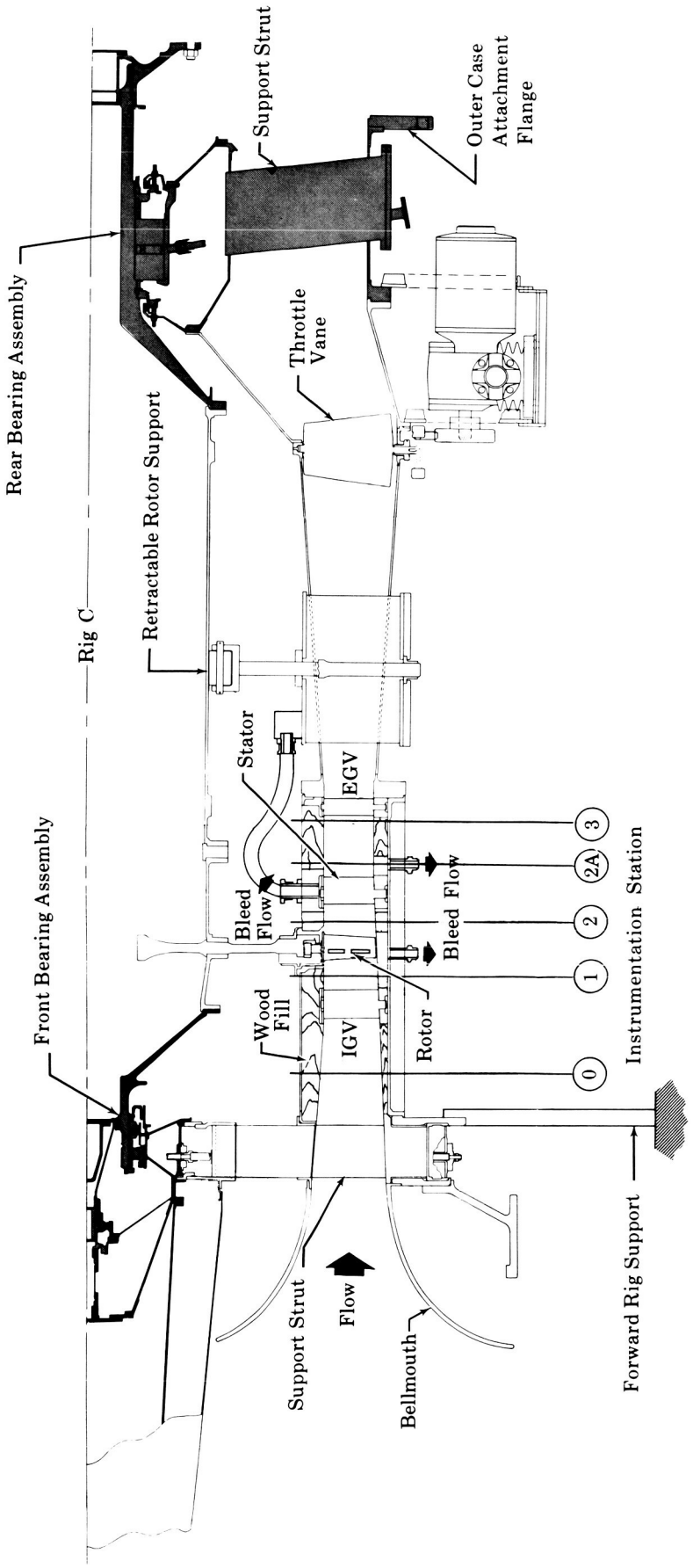


Figure III-2. Rotating Axial Flow Cascade Test Rig

FD 14685

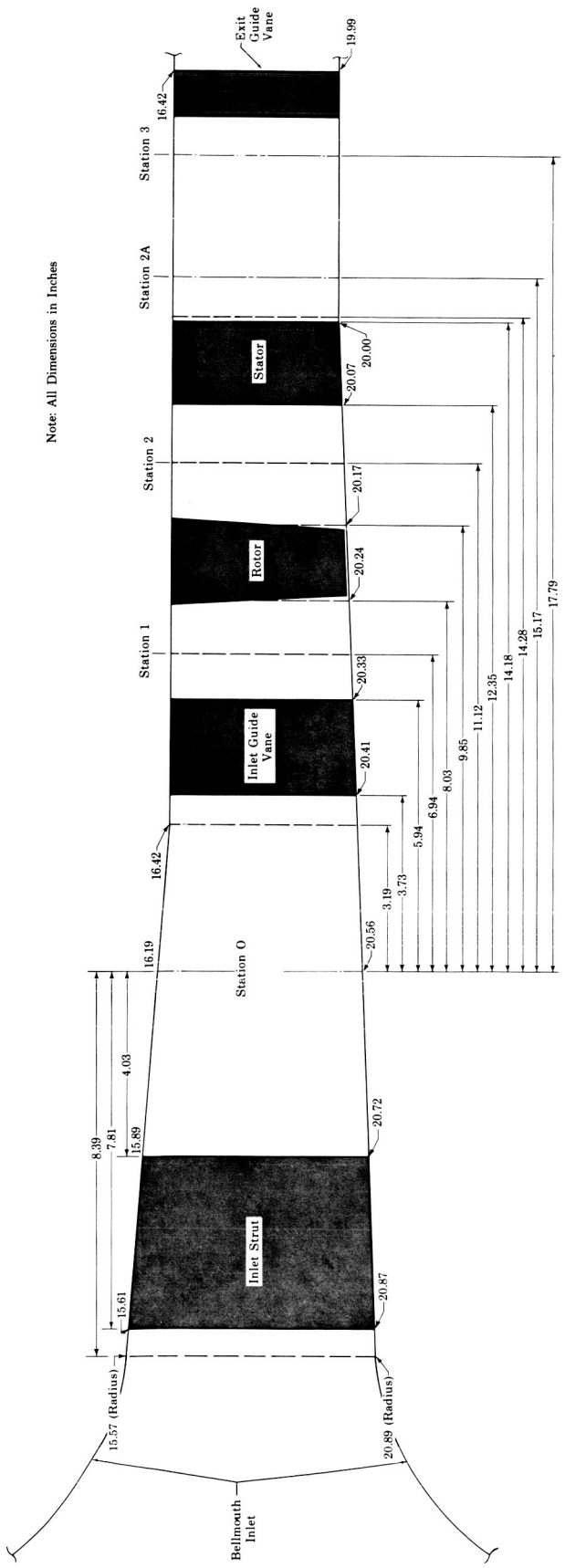


Figure III-3. Flow Path

FD 14683

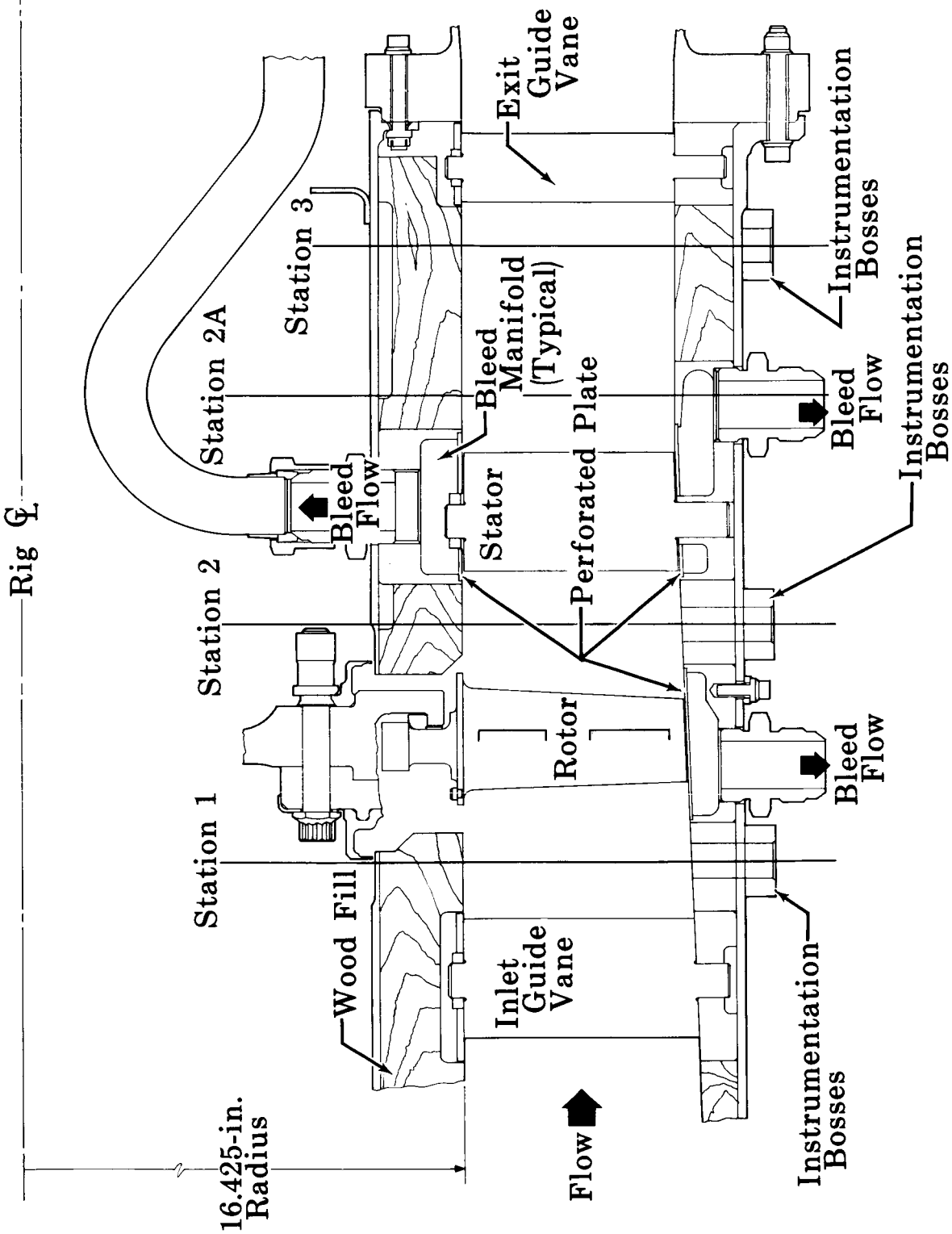


Figure III-4. Rotating Cascade Rig Bleed System

	Root	Mean	Tip
Y_2	0.050	0.050	0.050
t	0.167	0.133	0.098
R	0.105	0.105	0.105
r_1	0.013	0.013	0.013
Y_1	0.092	0.075	0.058
r_2	0.005	0.005	0.005
R_p	0.230	0.230	0.230
ψ	30°	30°	30°

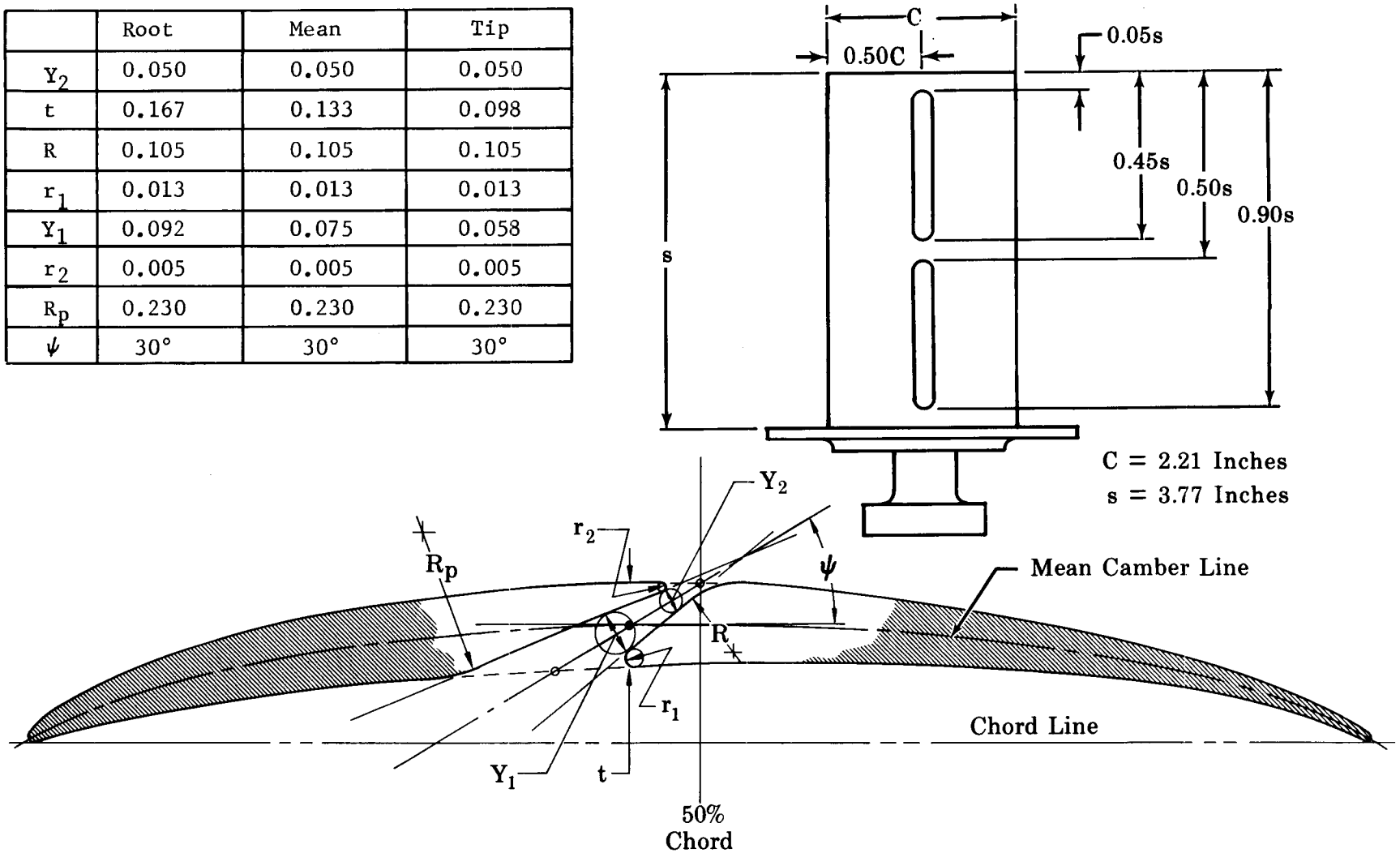
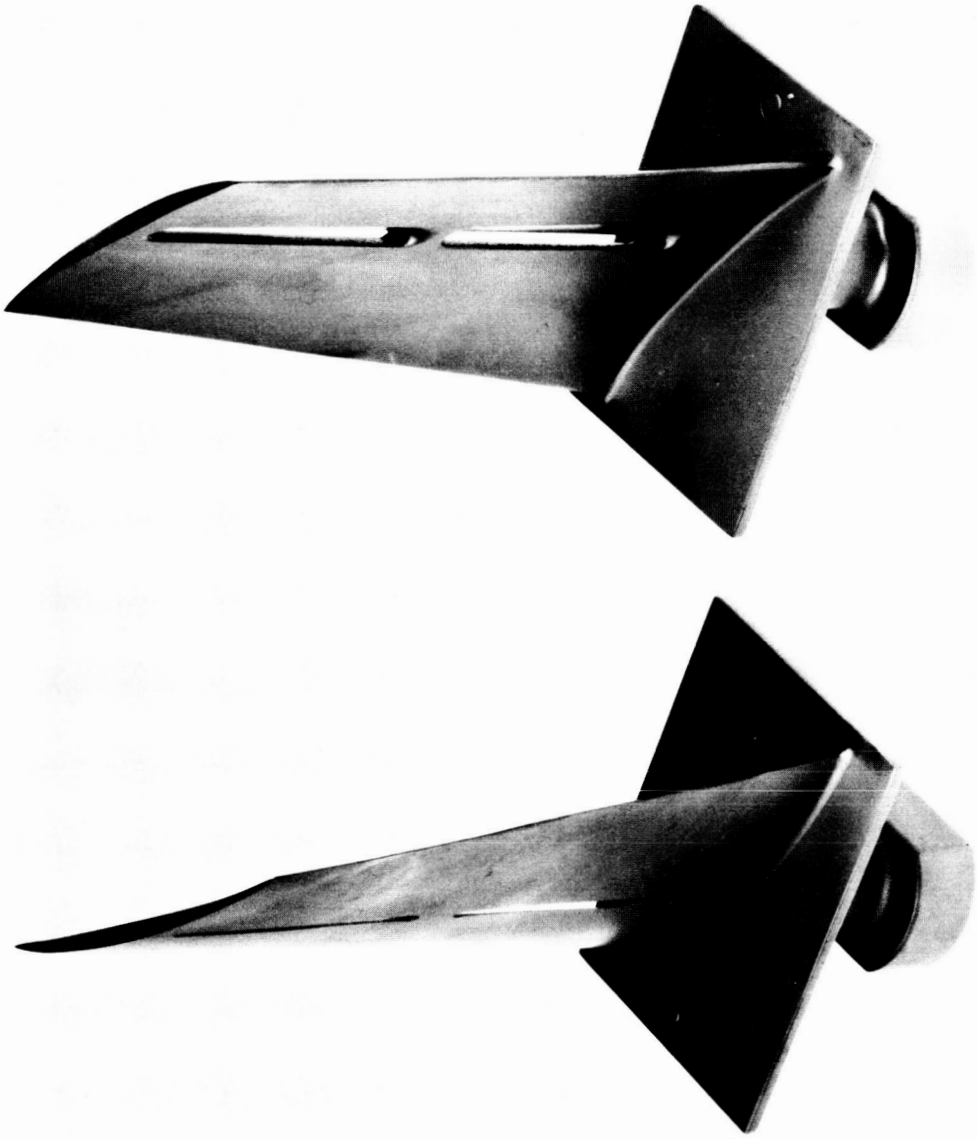


Figure III-5. Slot Geometry and Location

FD 14679C

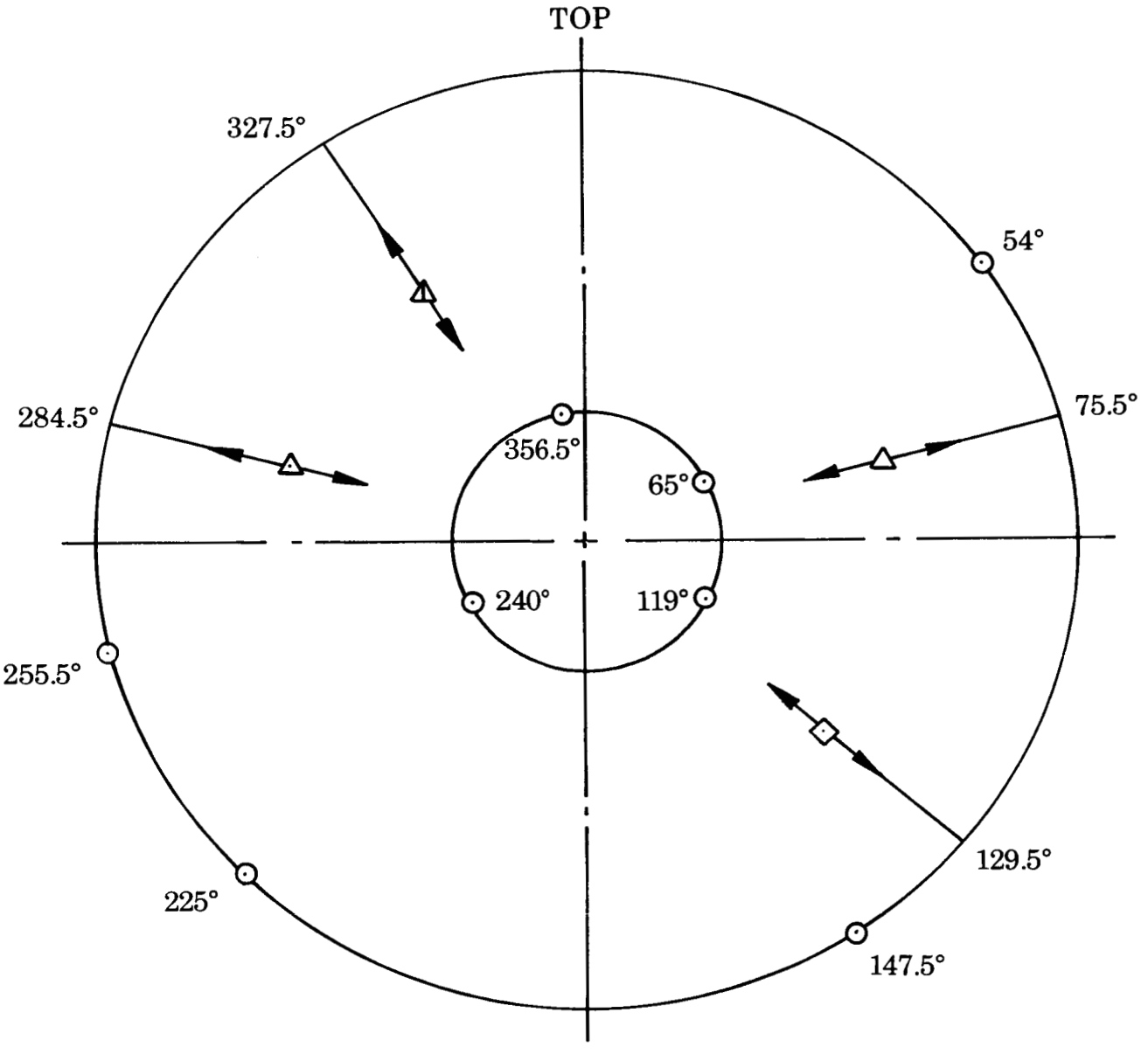
FD 19357



a. Suction Surface

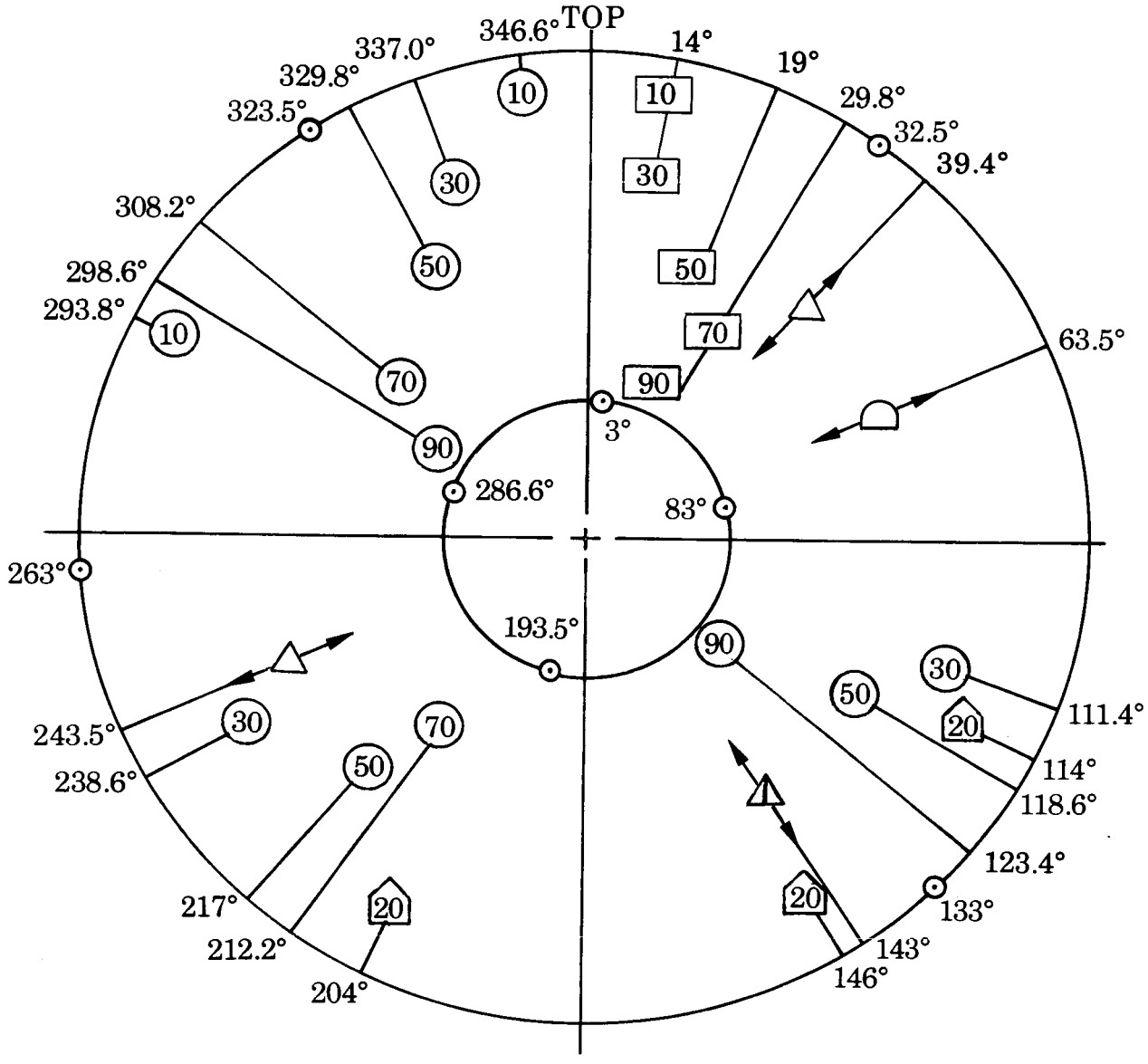
b. Pressure Surface

Figure III-6. Typical Slotted Rotor 2 Blade



⊙ Wall Static Pressure
△ Traverse Wedge Probe, 20°
◭ Traverse Wedge Probe, 8°
◇ Traverse Wake Probe
Probe angular position is measured clockwise from the top.

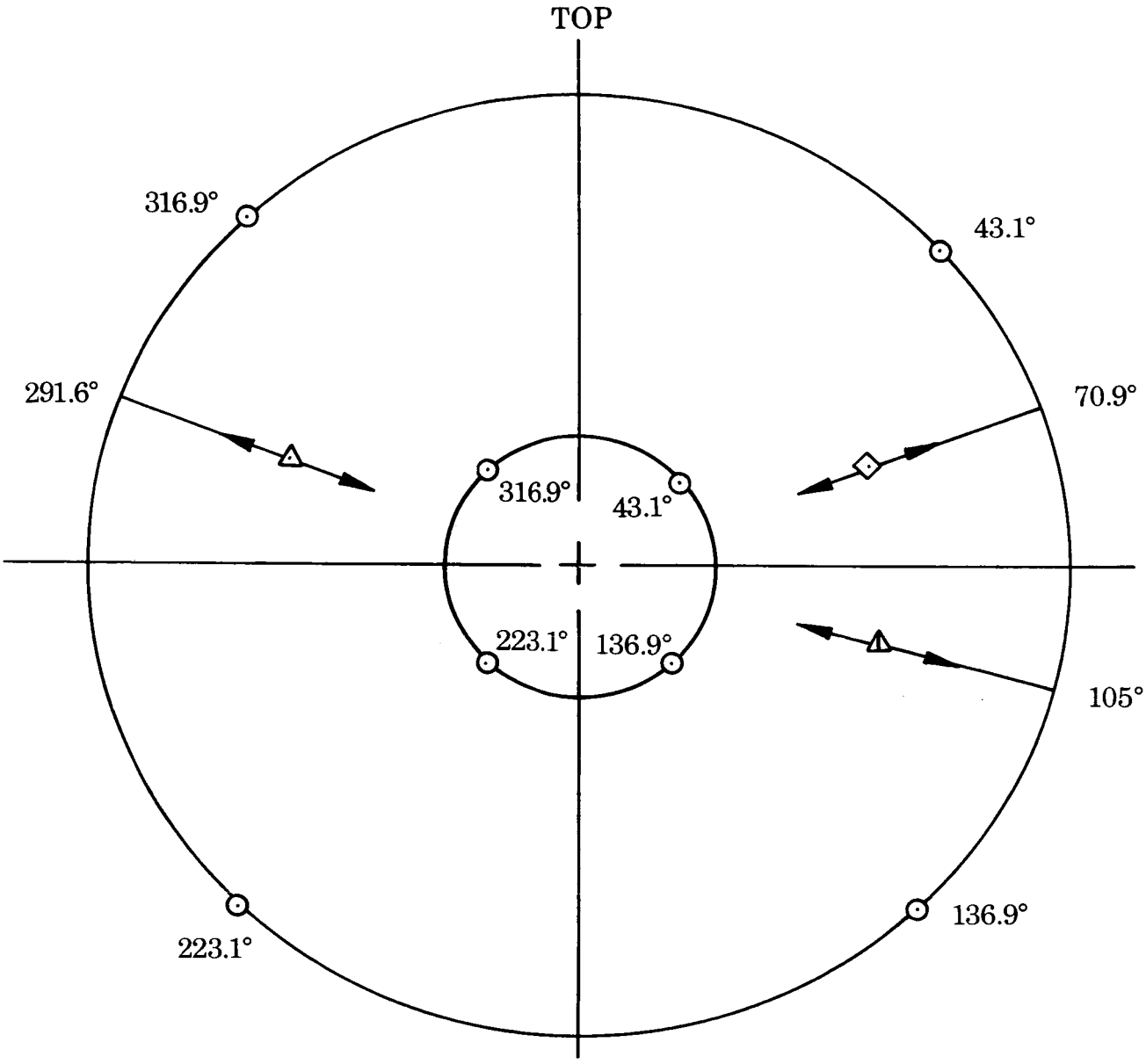
Figure III-7. Instrumentation, Station 1 (View Looking Downstream) FD 18596B



○ Keil Probe *
⊙ Wall Static Pressure
△ Traverse Wedge Probe, 20°
⊿ Traverse Wedge Probe, 8°
Traverse Hot Film Probe
□ Kiel Temperature Probe
Kistler Probe *

Probe angular position is measured clockwise from the top.
*Radial location as a percent of span from tip is denoted by the number within the symbol

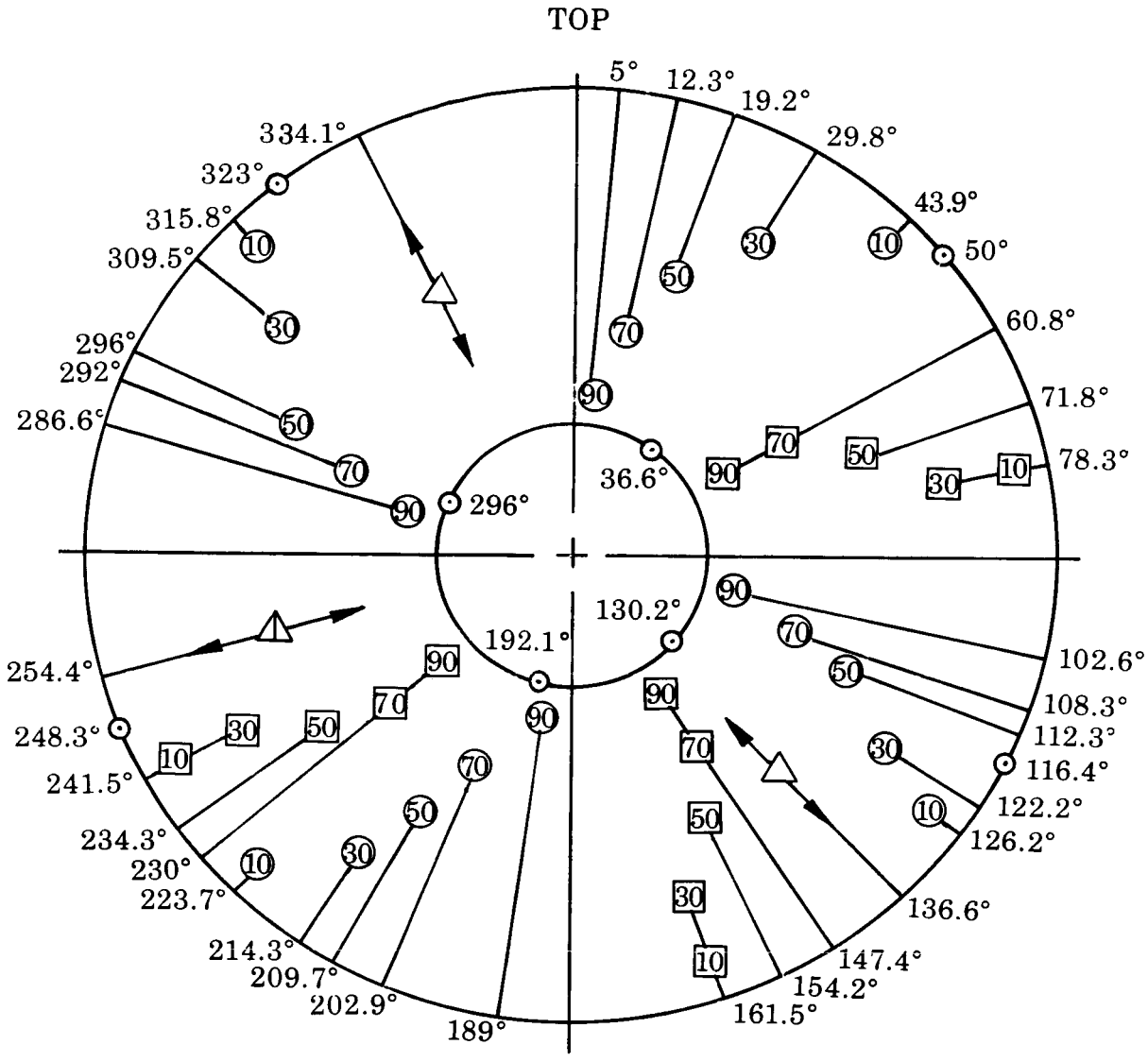
Figure III-8. Instrumentation, Station 2 (View Looking Downstream) FD 18595C



⊙ Wall Static Pressure
△ Traverse Wedge Probe, 20°
◭ Traverse Wedge Probe, 8°
◇ Traverse Wake Probe

Probe angular position is measured clockwise from the top.

Figure III-9. Instrumentation, Station 2A (View Looking Downstream) FD 18594B



⊙ Wall Static
△ Traverse Wedge Probe, 20°
⊿ Traverse Wedge Probe, 8°
○ Kiel Probe *
□ Temperature *

Probe angular position is measured clockwise from the top.
*Radial location as a percent of span from tip is denoted by the number within the symbol

Figure III-10. Instrumentation, Station 3 (View Looking Downstream) FD 18597C

Note: All Dimensions Are in Inches.

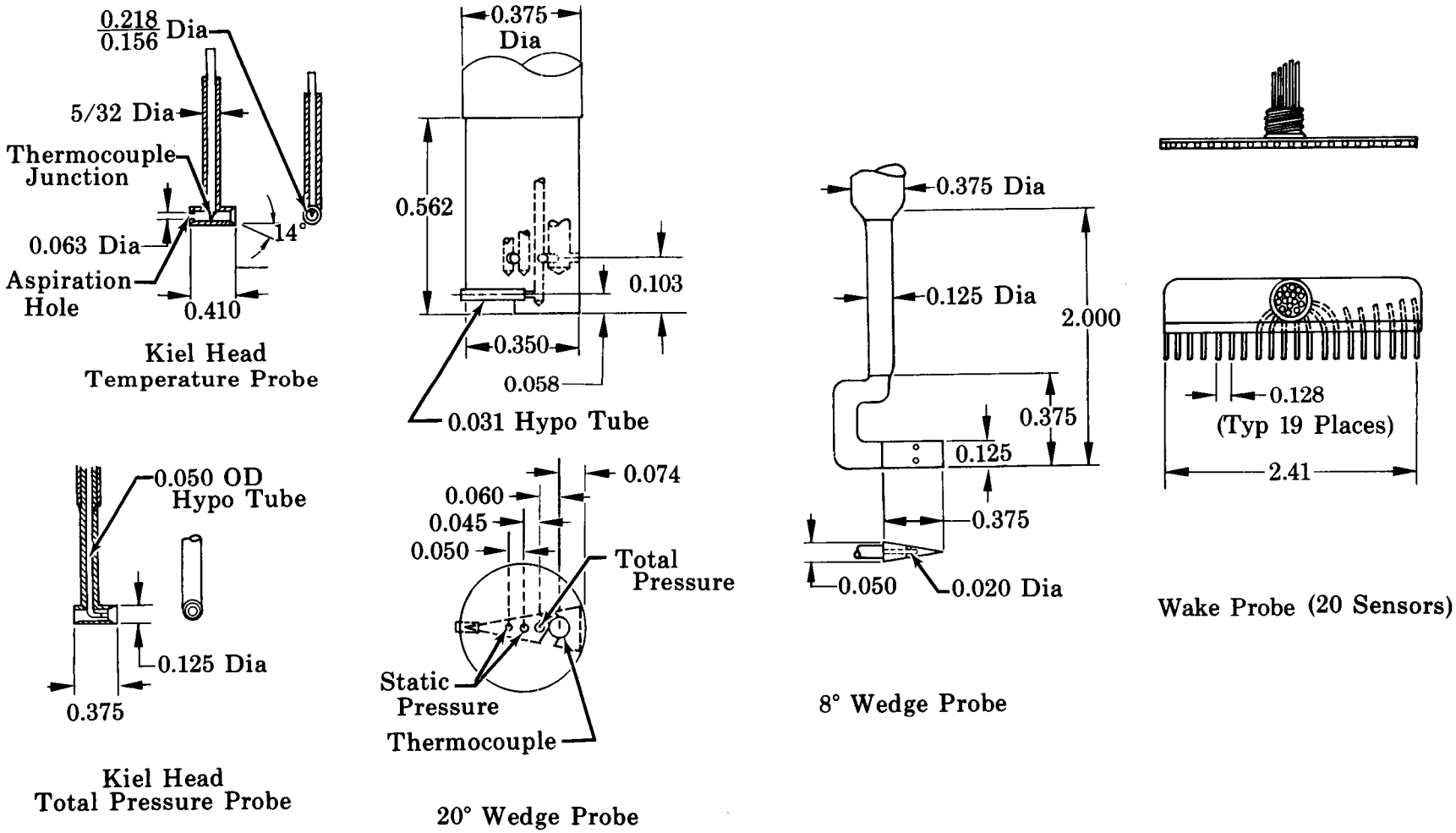


Figure III-11. Probe Configurations

FD 18483A

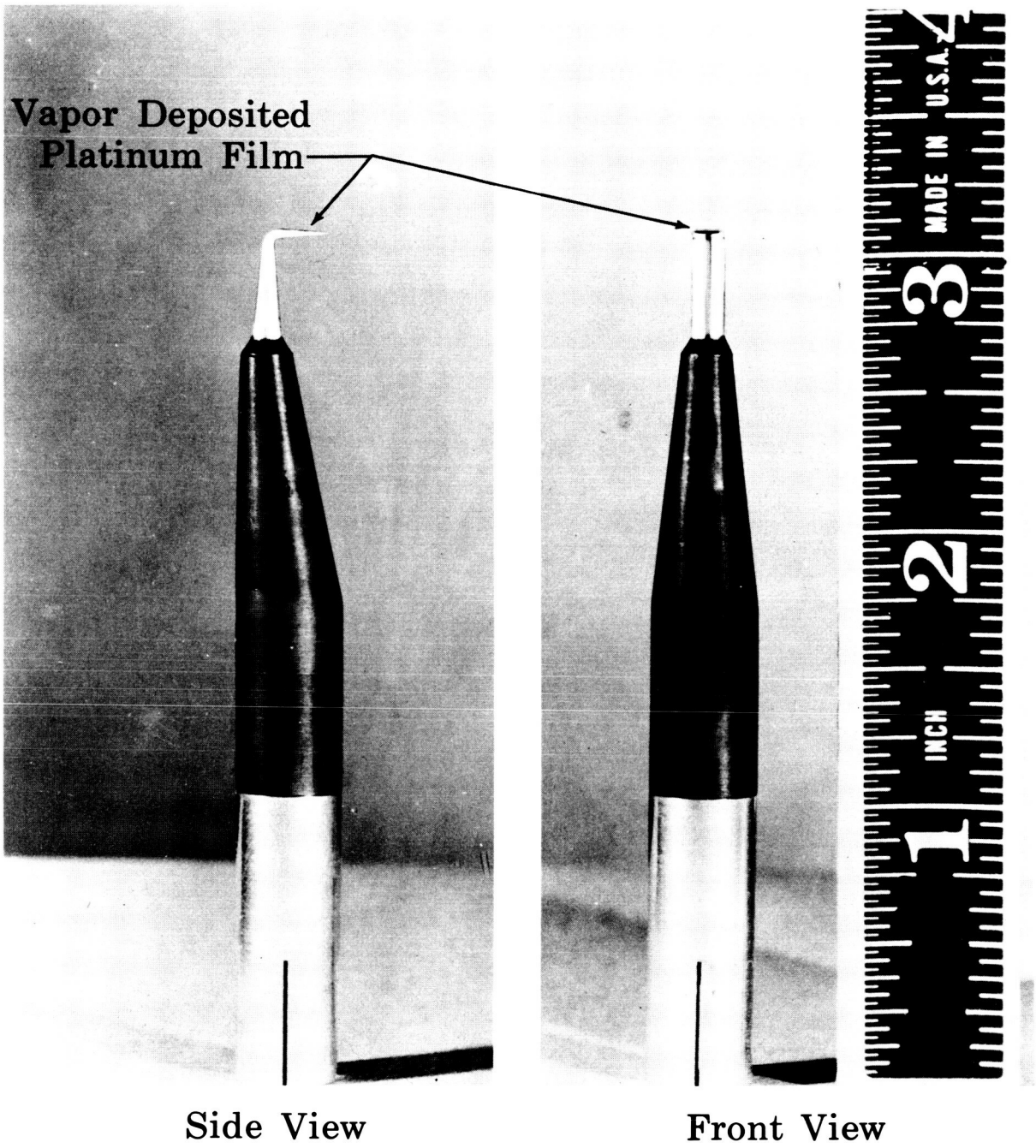


Figure III-12. Anemometer Probe

FD 18603

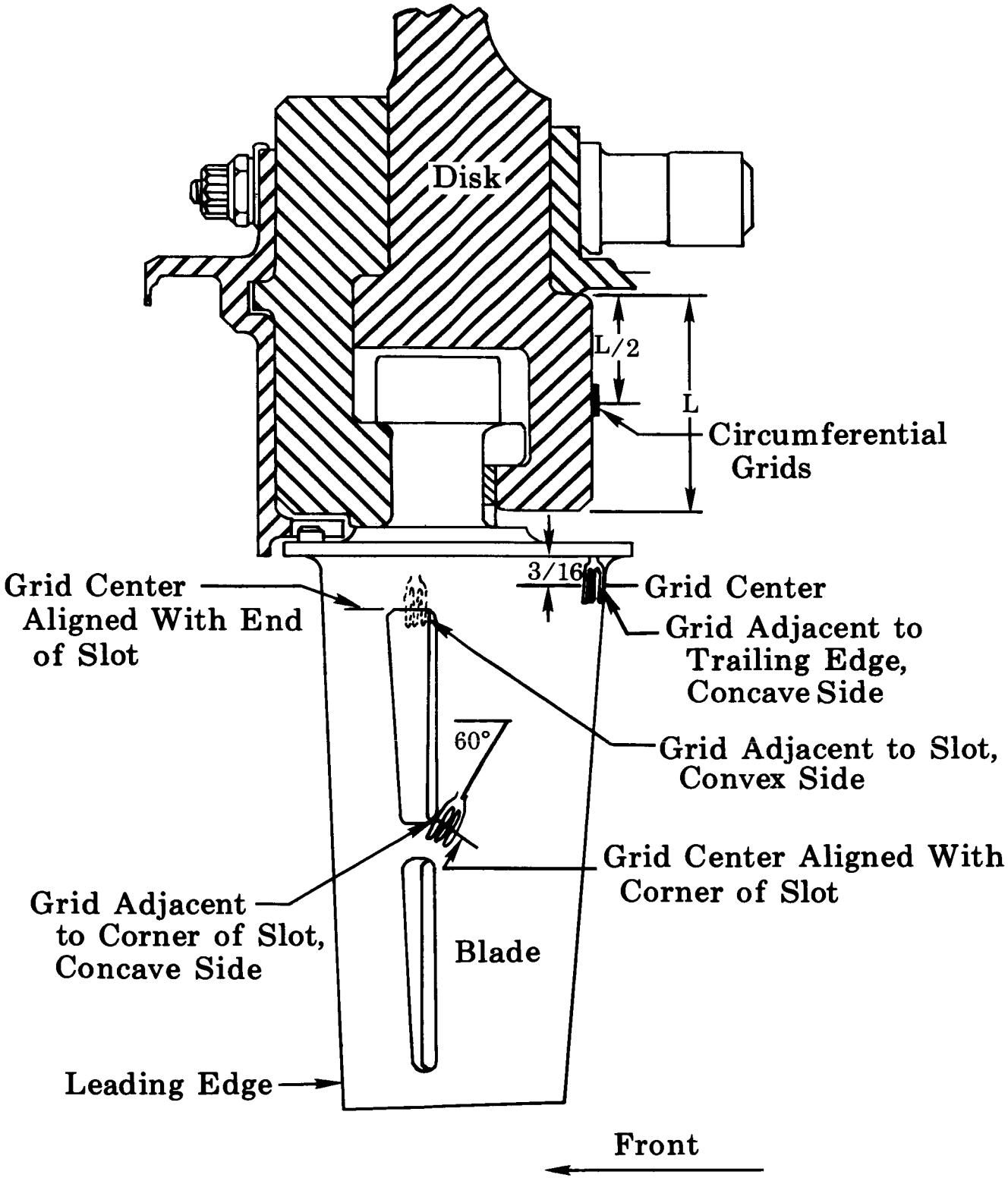


Figure III-13. Strain Gage Locations FD 18598

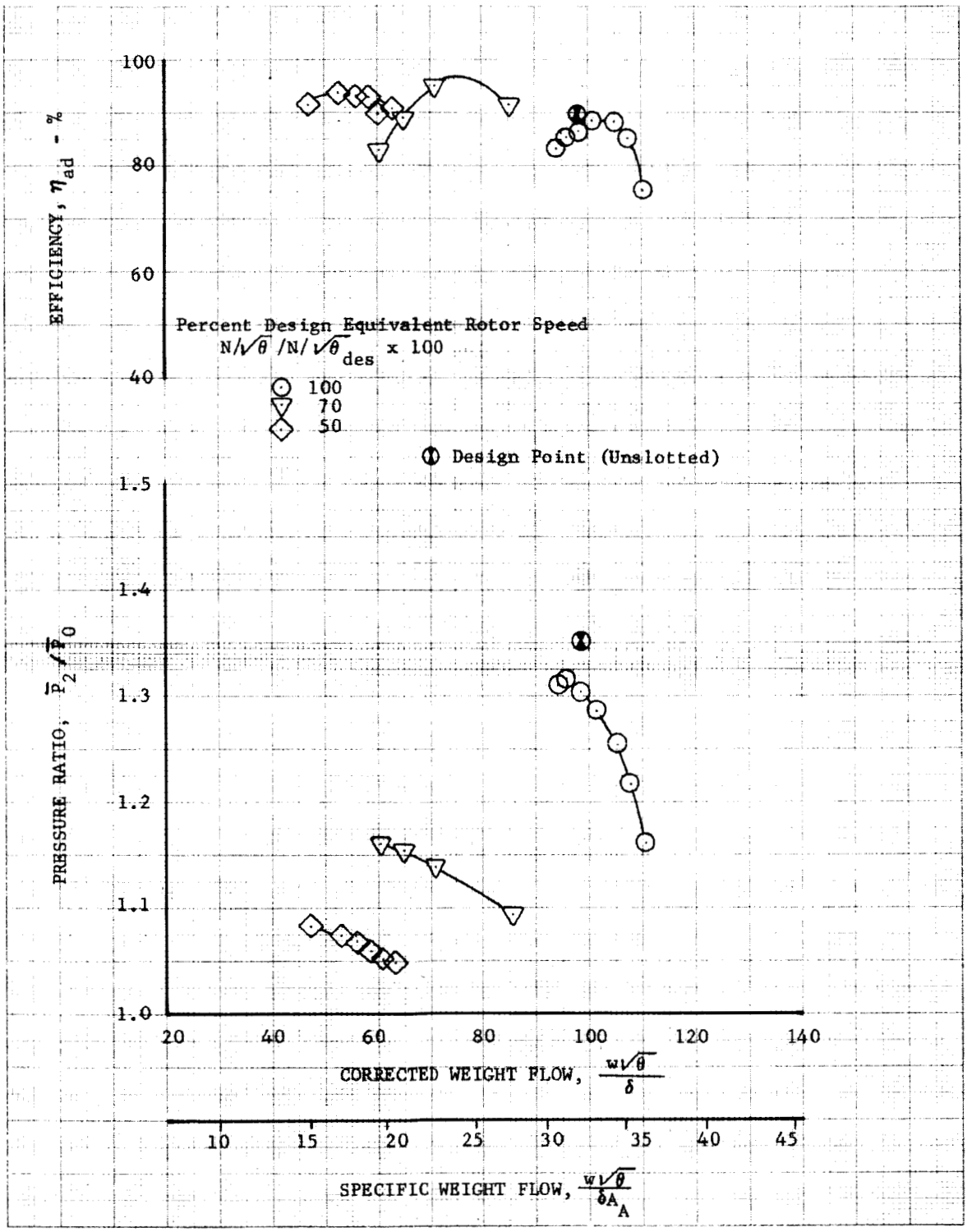


Figure V-1. Overall Performance; Slotted Rotor 2 Only DF 52283

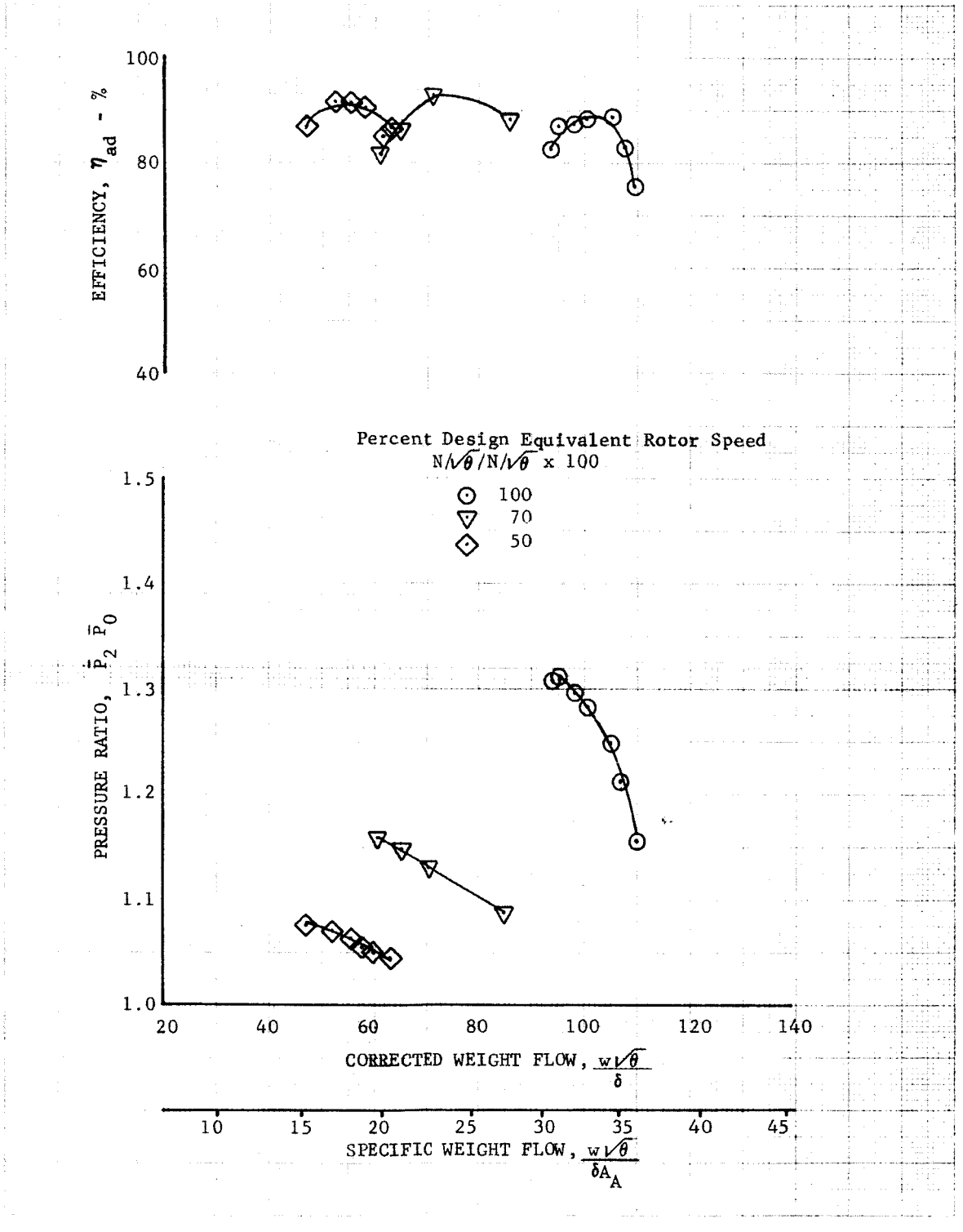


Figure V-2. Overall Performance; Inlet Guide Vane, Slotted Rotor 2

DF 52284

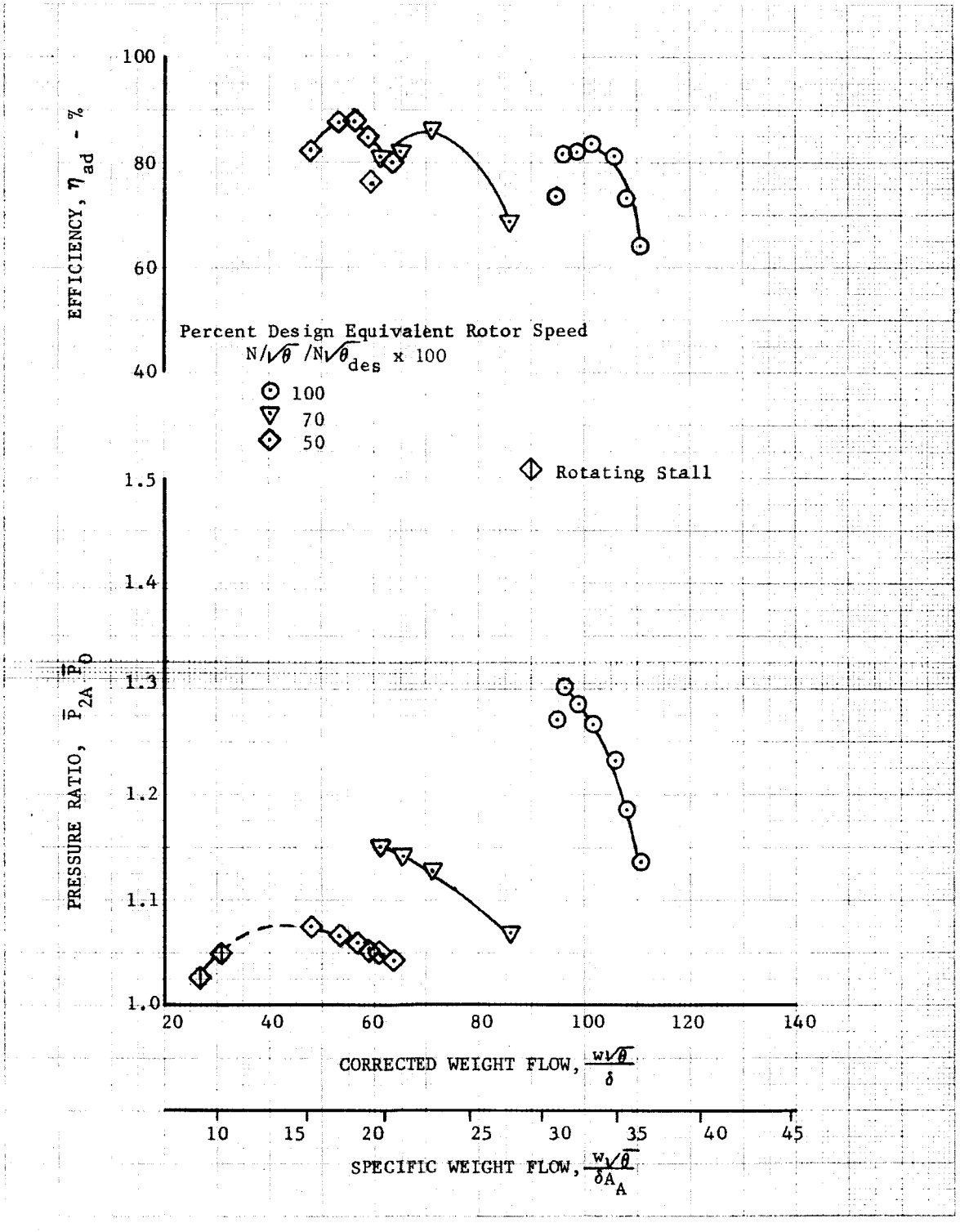


Figure V-3. Overall Performance; Inlet Guide Vane, Slotted Rotor 2, Unslotted Stator 1 DF 52285

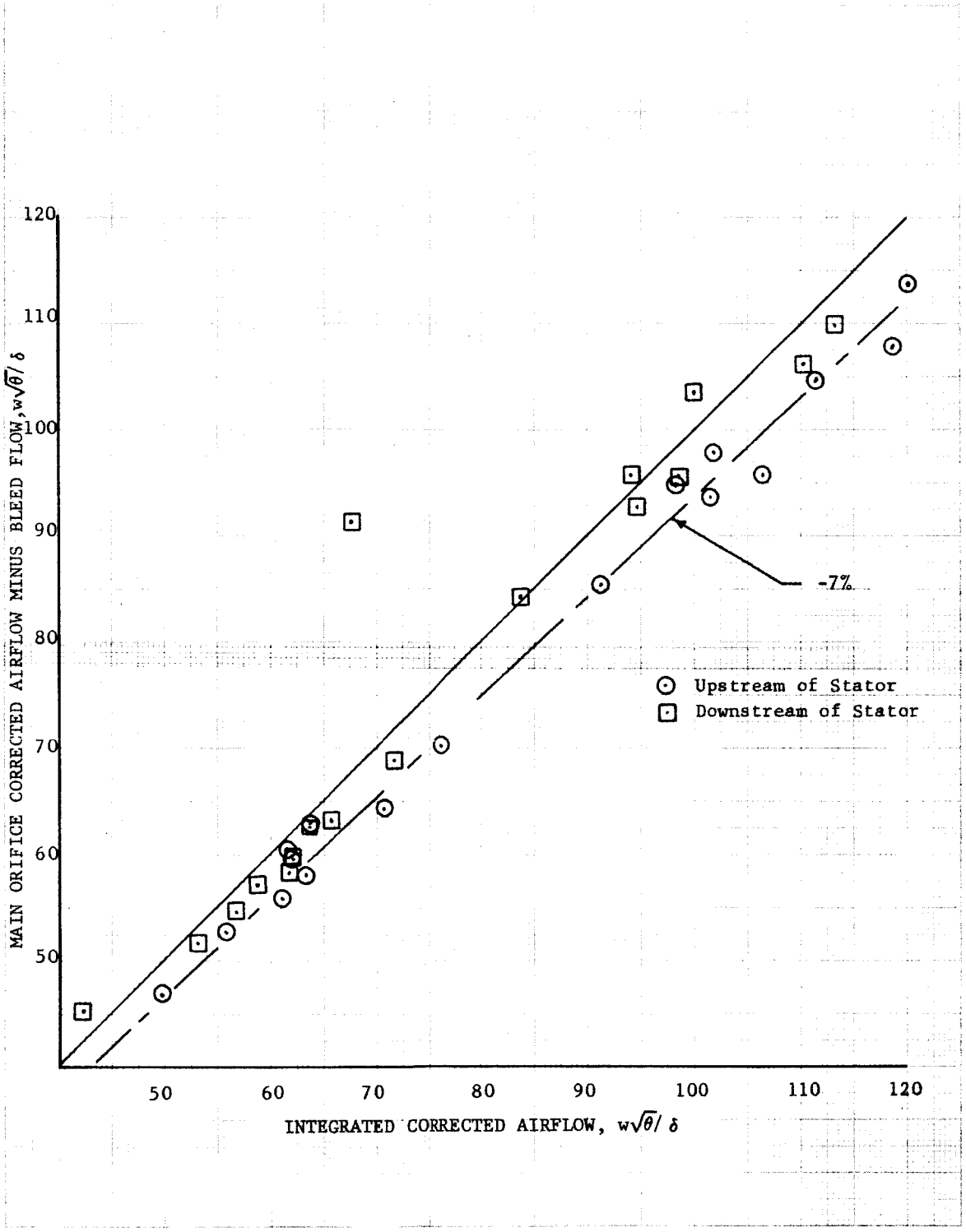


Figure V-4. Airflow Continuity Comparison

DF 52286

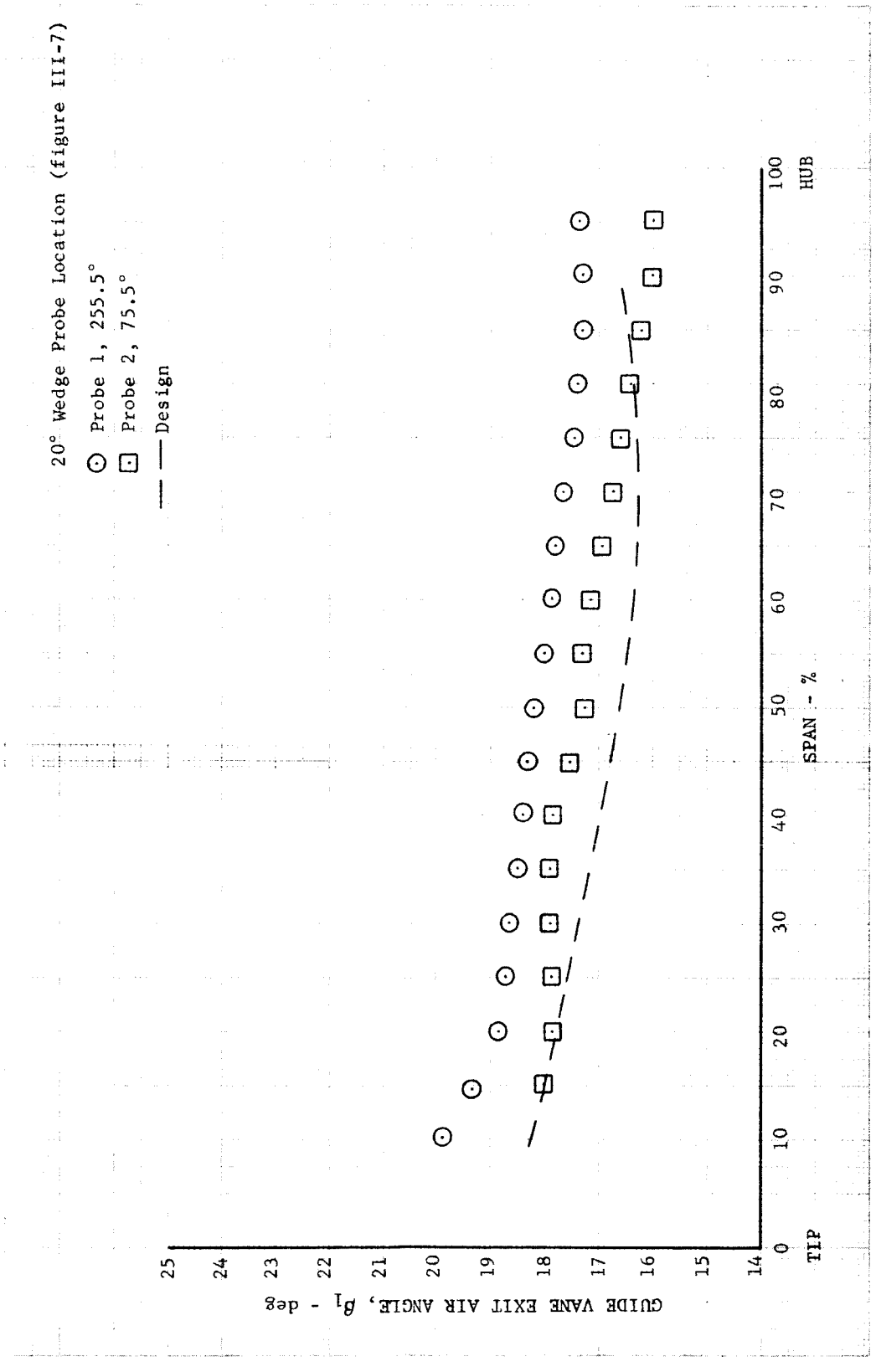


Figure V-5. Guide Vane Exit Air Angle Distribution - 100% Design Equivalent Rotor Speed

DF 52287

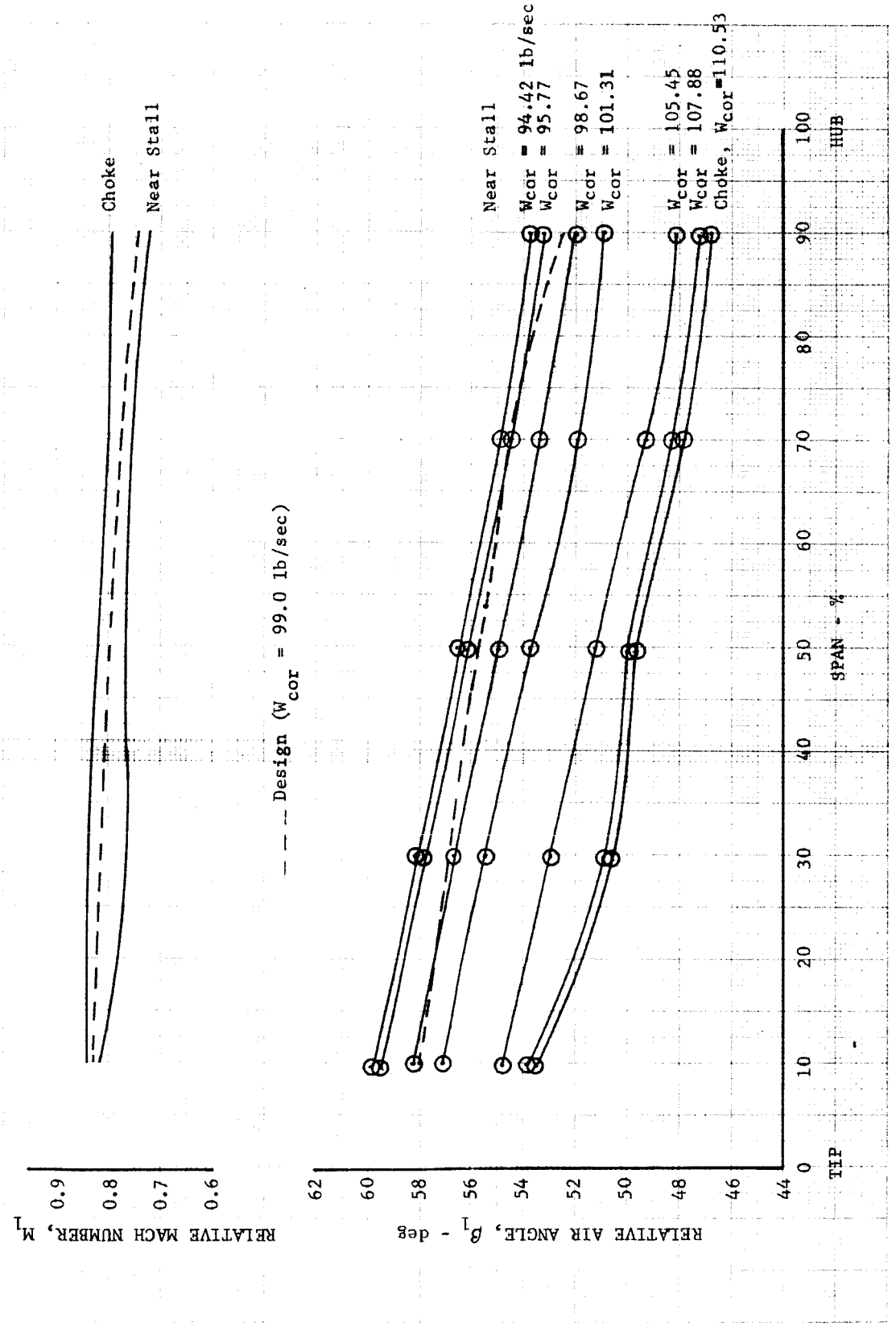


Figure V-6. Relative Air Angle and Mach Number Distribution Into Slotted Rotor 2 - 100% Design Equivalent Rotor Speed

DF 52289

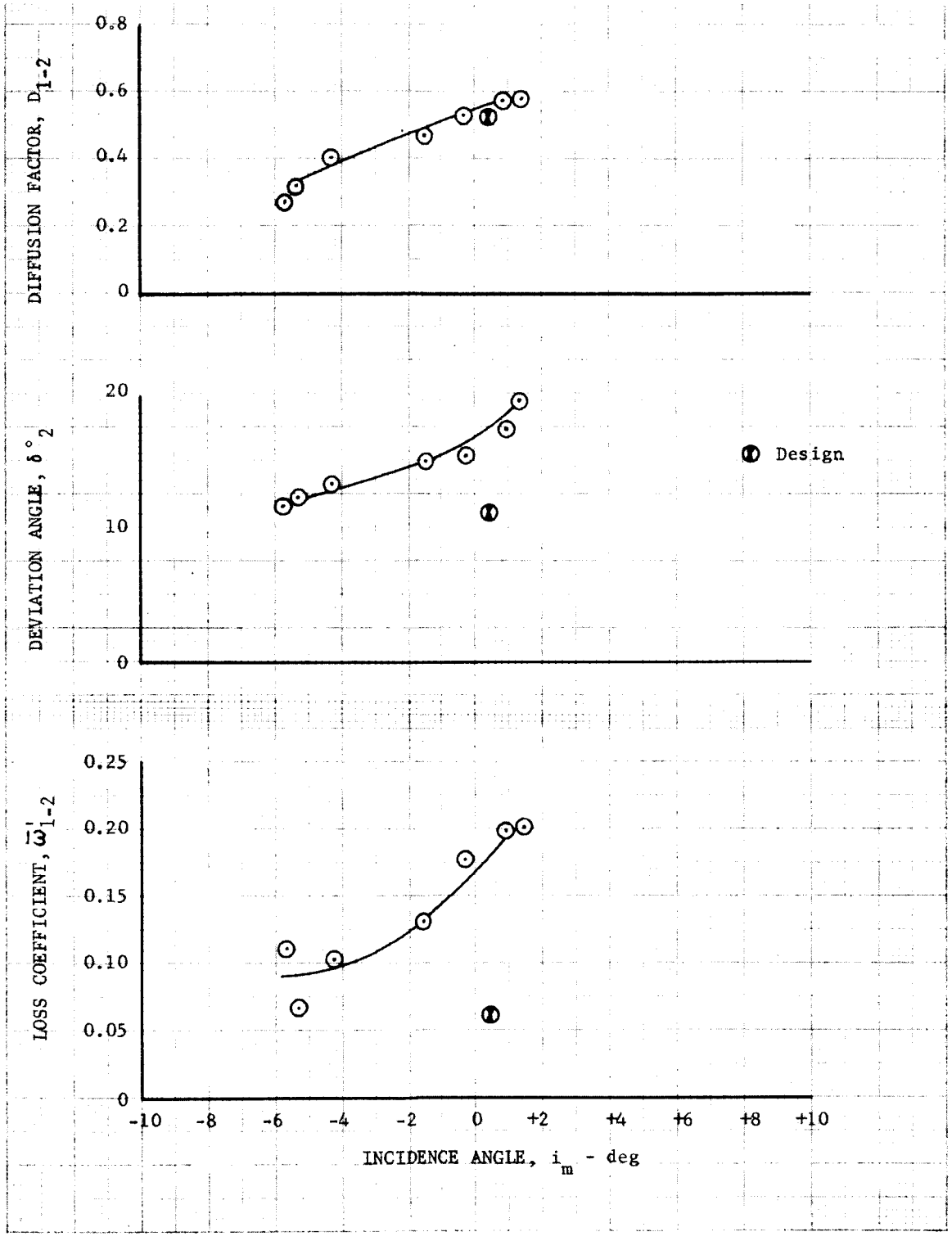


Figure V-7. Rotor Blade Element Performance - 100% Design Equivalent Rotor Speed, 90% Span From Tip DF 52290

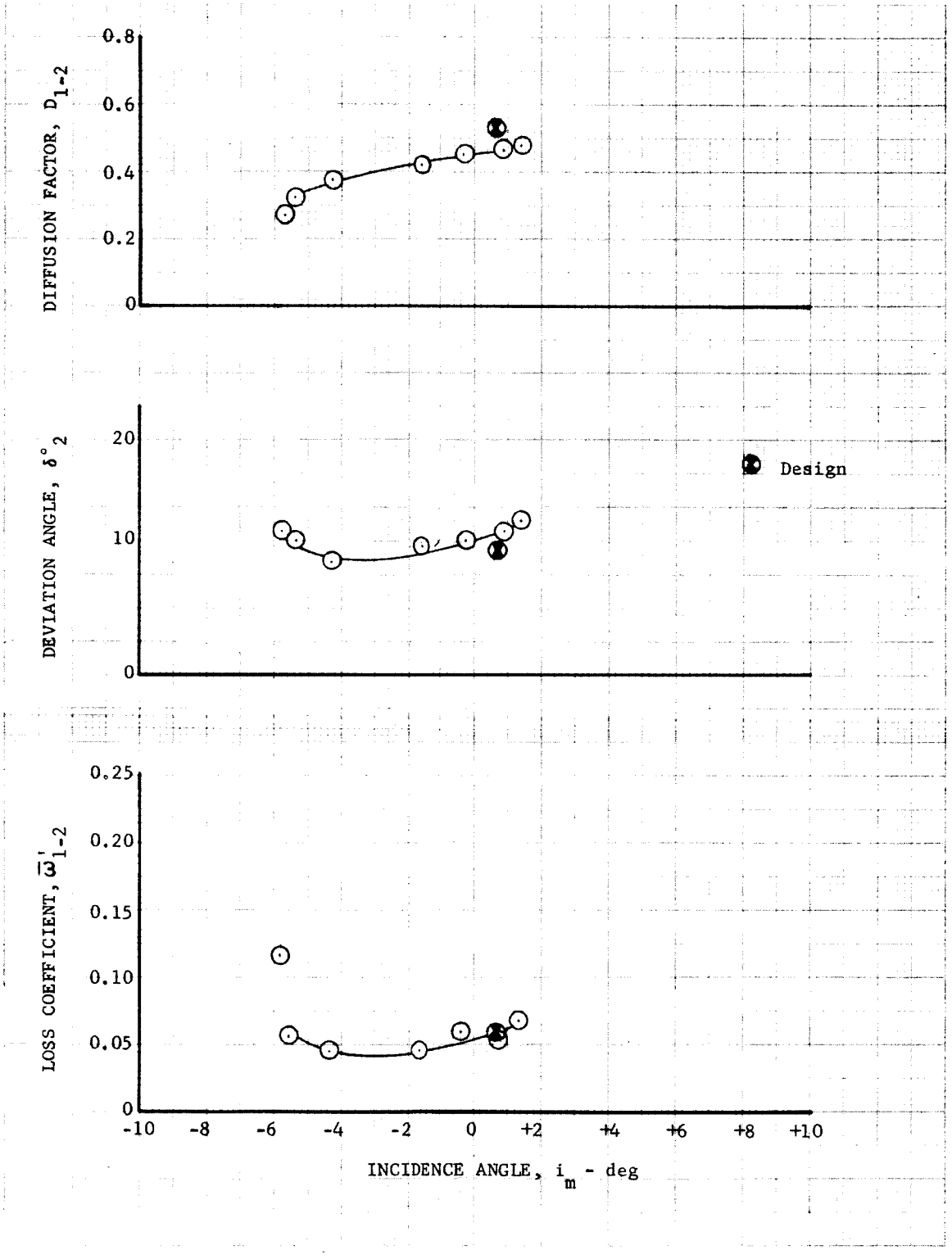


Figure V-8. Rotor Blade Element Performance - 100% Design Equivalent Rotor Speed, 70% Span From Tip DF 52291

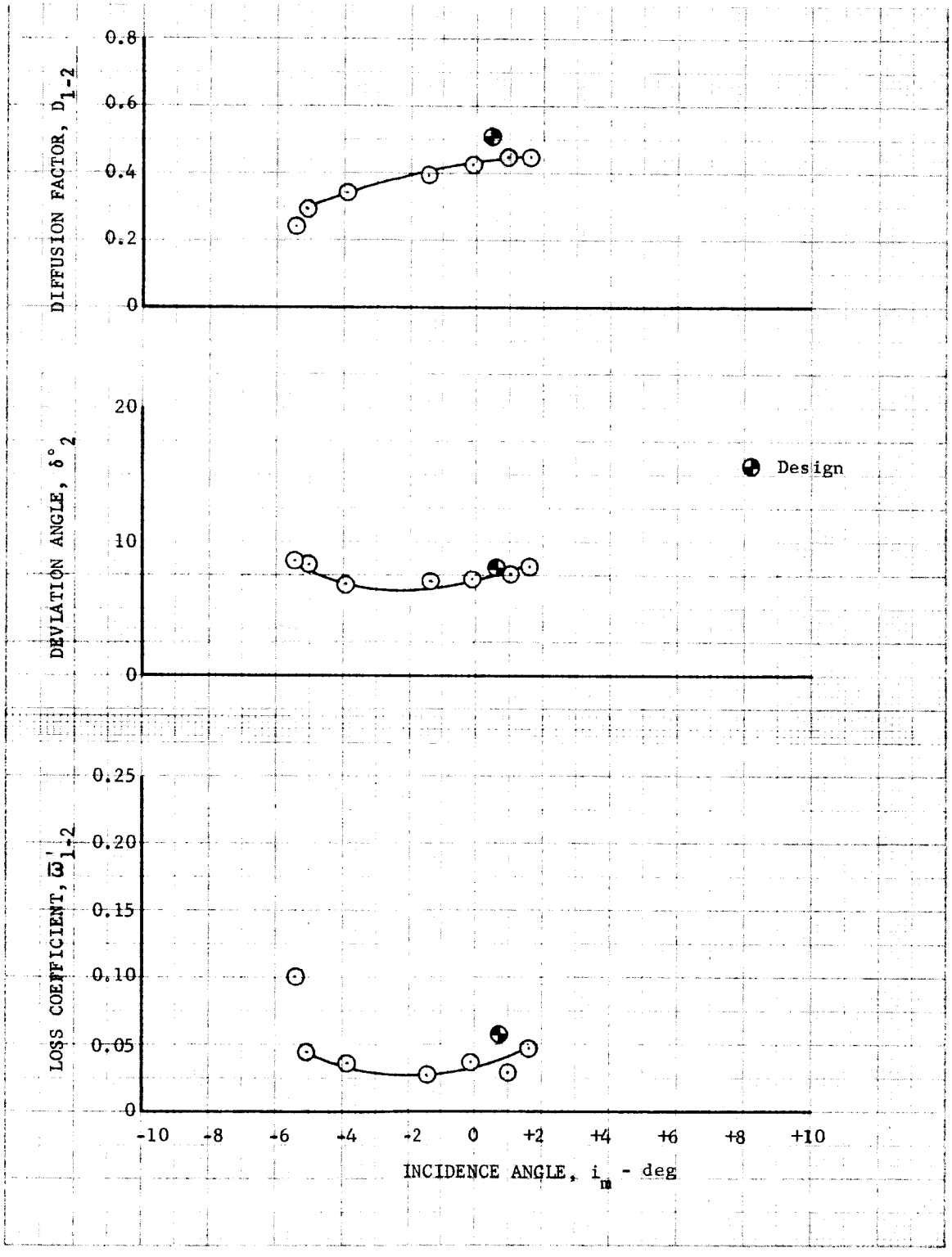


Figure V-9. Rotor Blade Element Performance - 100% Design Equivalent Rotor Speed, 50% Span From Tip DF 52292

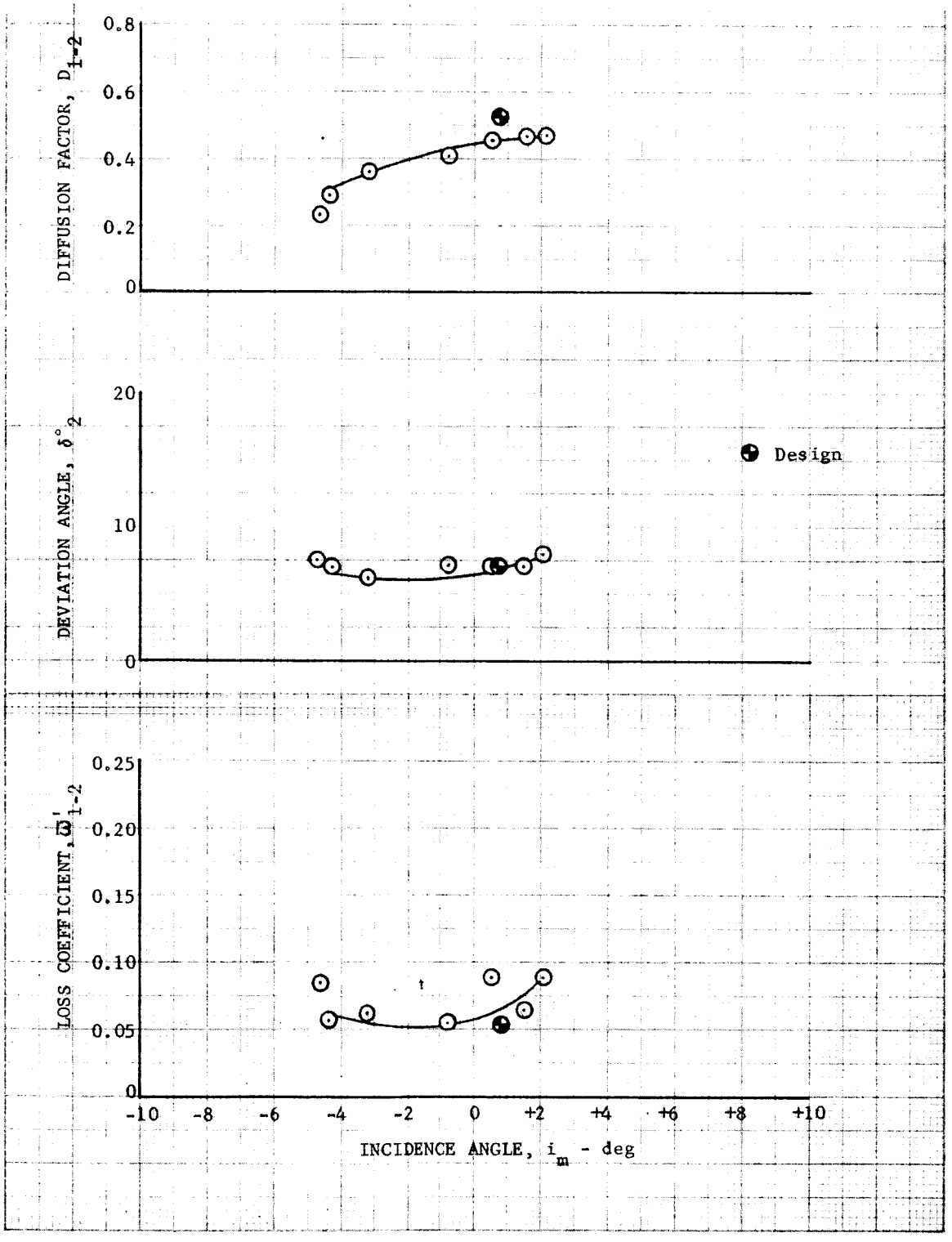


Figure V-10. Rotor Blade Element Performance - 100% Design Equivalent Rotor Speed, 30% Span From Tip DF 52293

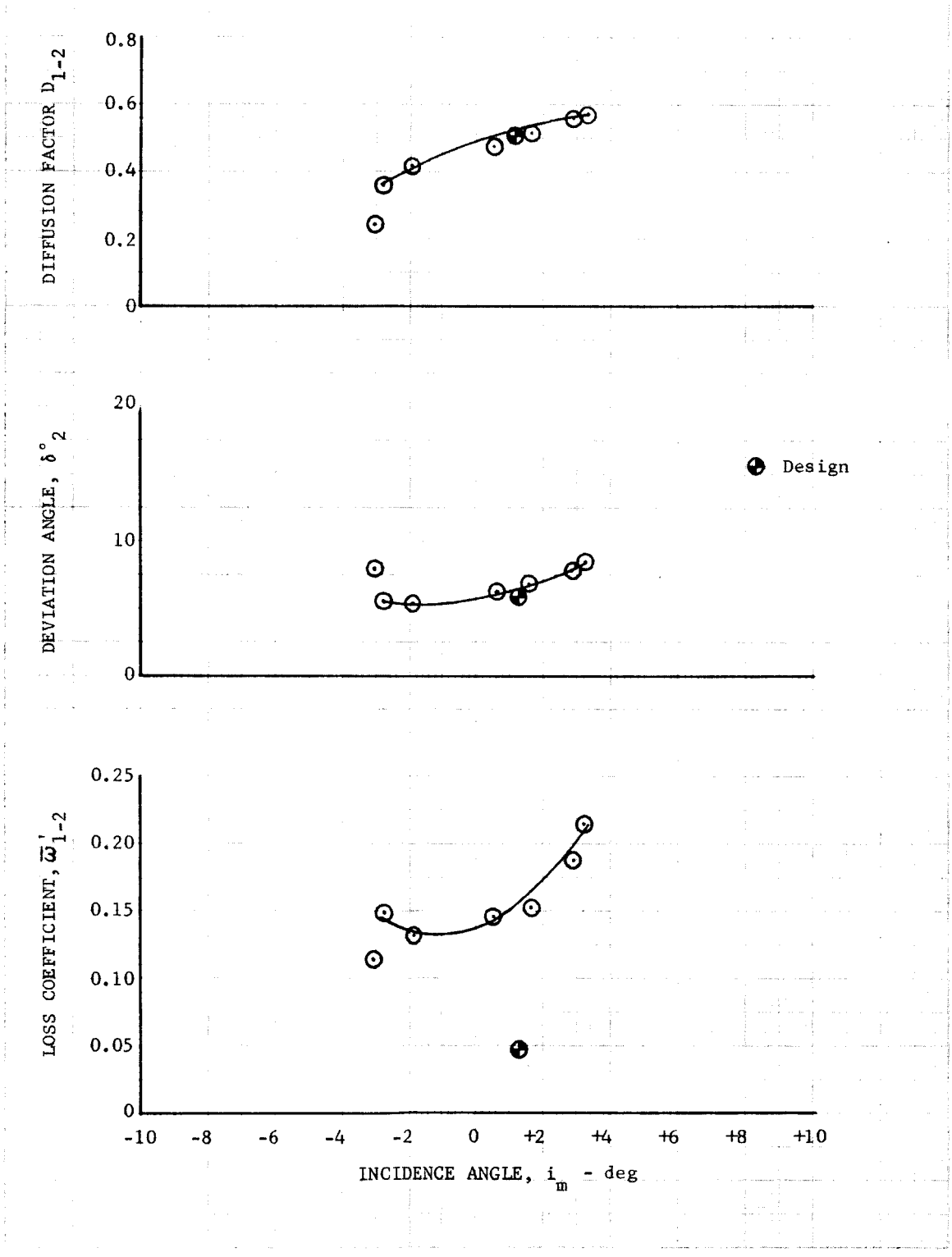


Figure V-11. Rotor Blade Element Performance - 100% Design Equivalent Rotor Speed, 10% Span From Tip DF 52294

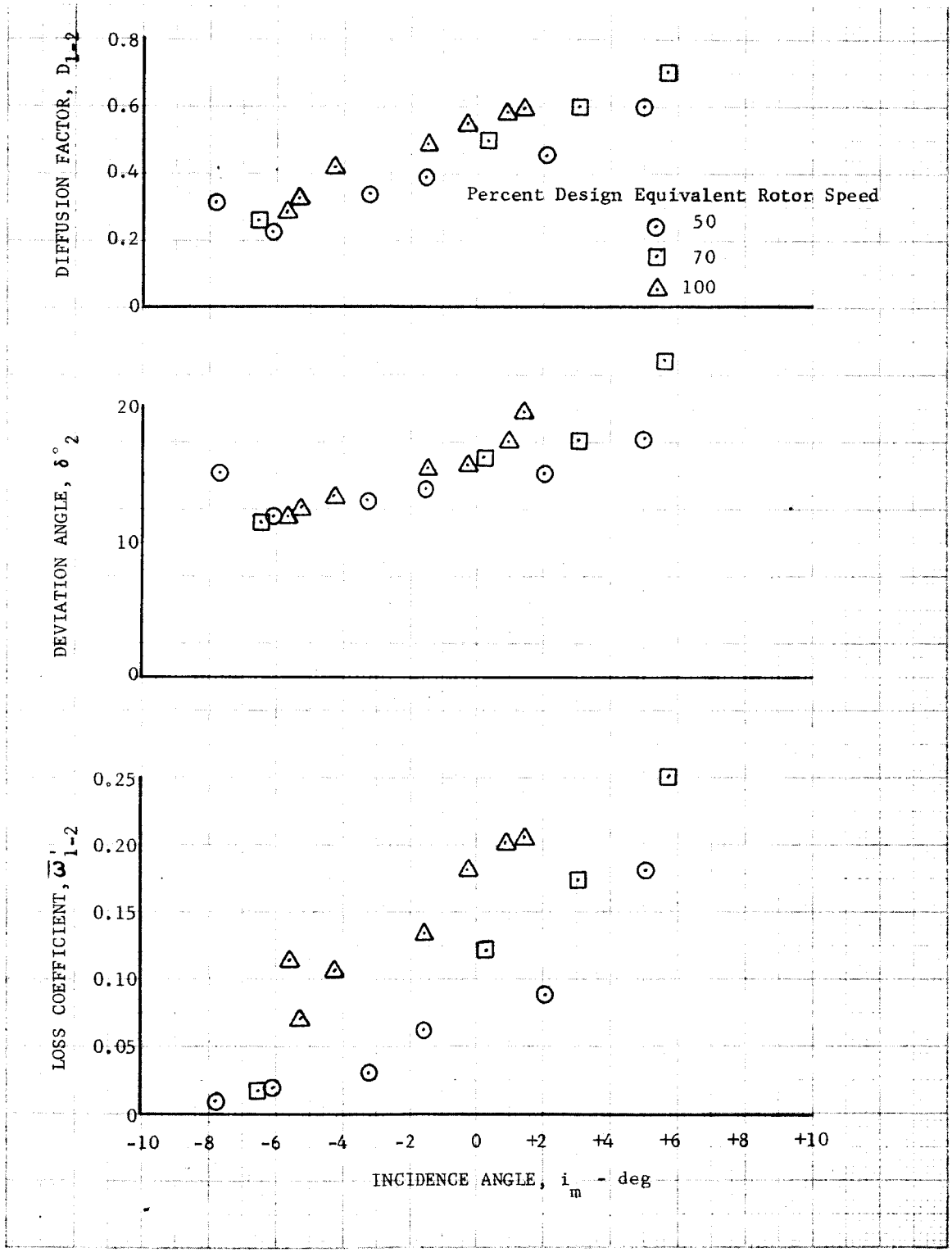


Figure V-12. Variation of Rotor Blade Element Parameters With Incidence, Slotted Rotor 2, 90% Span From Tip

DF 52295

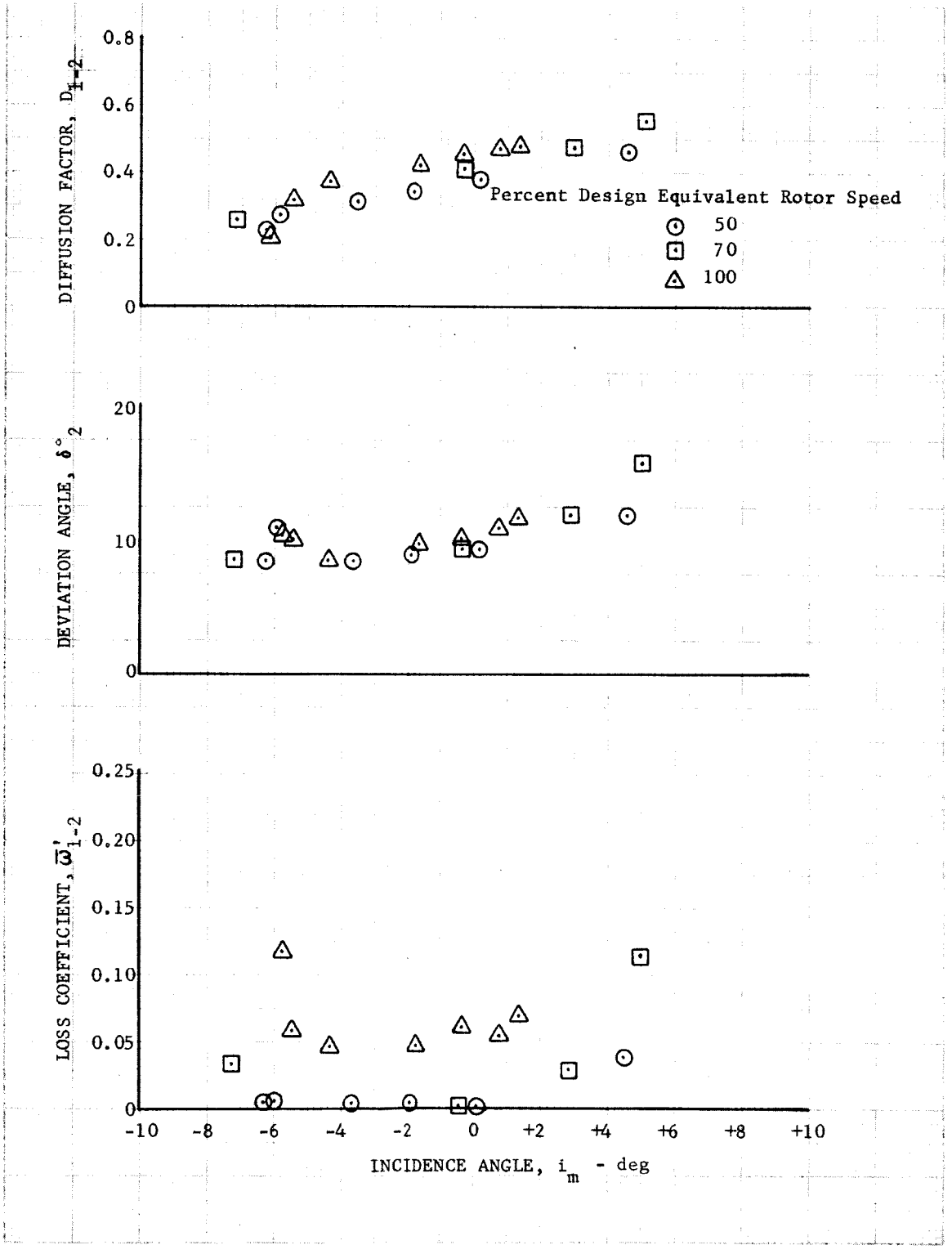


Figure V-13. Variation of Rotor Blade Element Parameters With Incidence, Slotted Rotor 2, 70% Span From Tip

DF 52296

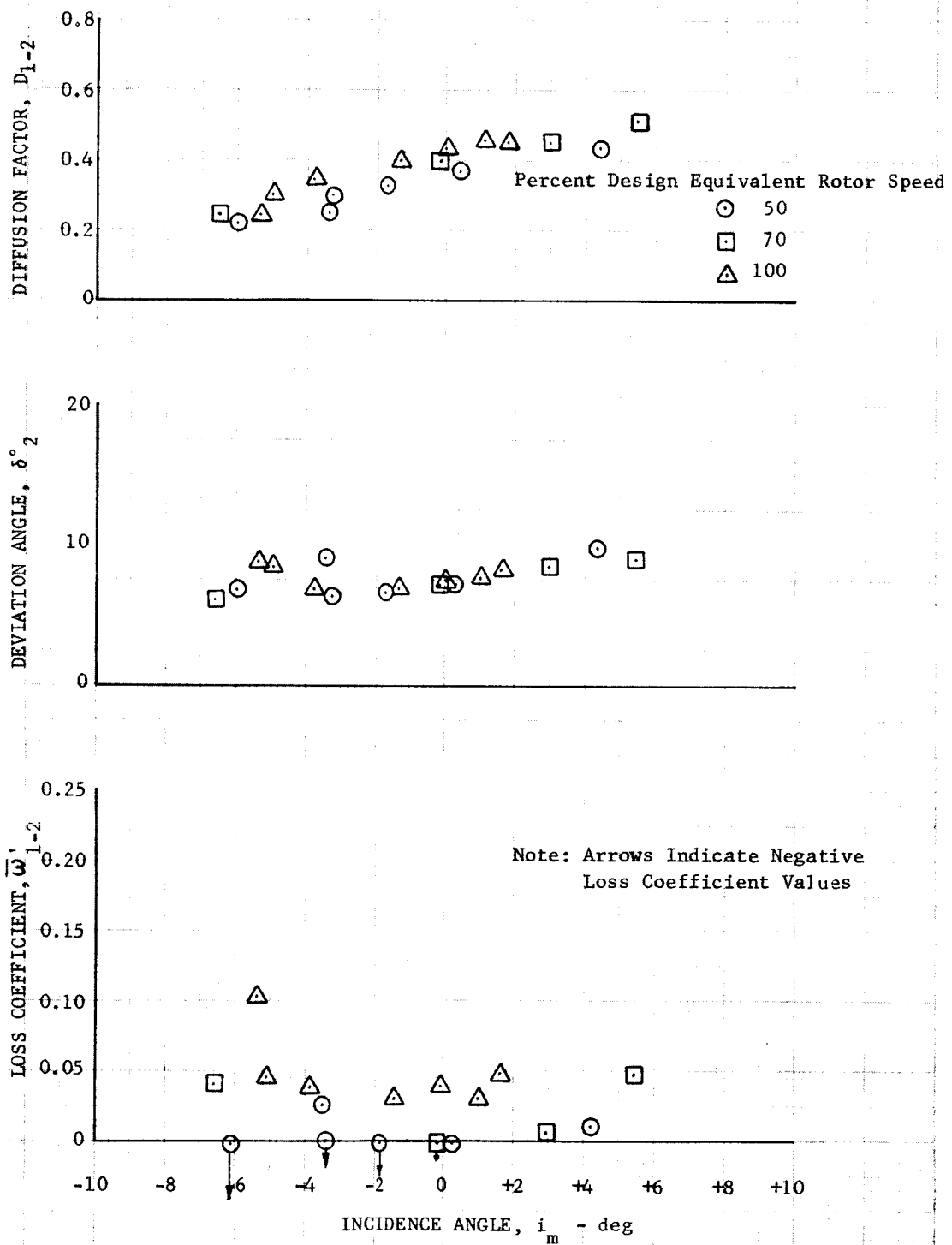


Figure V-14. Variation of Rotor Blade Element Parameters With Incidence, Slotted Rotor 2, 50% Span From Tip

DF 52297

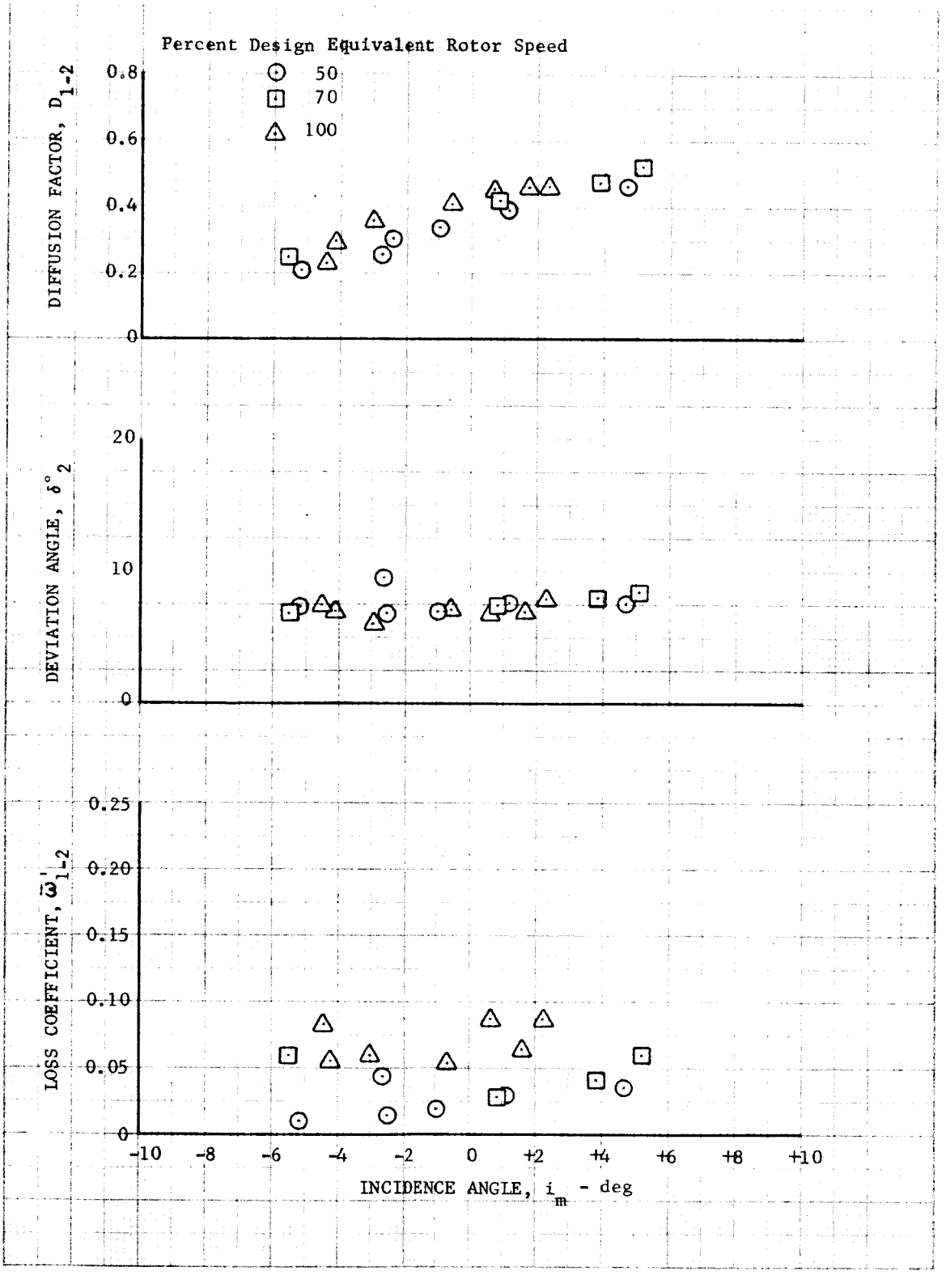


Figure V-15. Variation of Rotor Blade Element Parameters With Incidence, Slotted Rotor 2, 30% Span From Tip

DF 52298

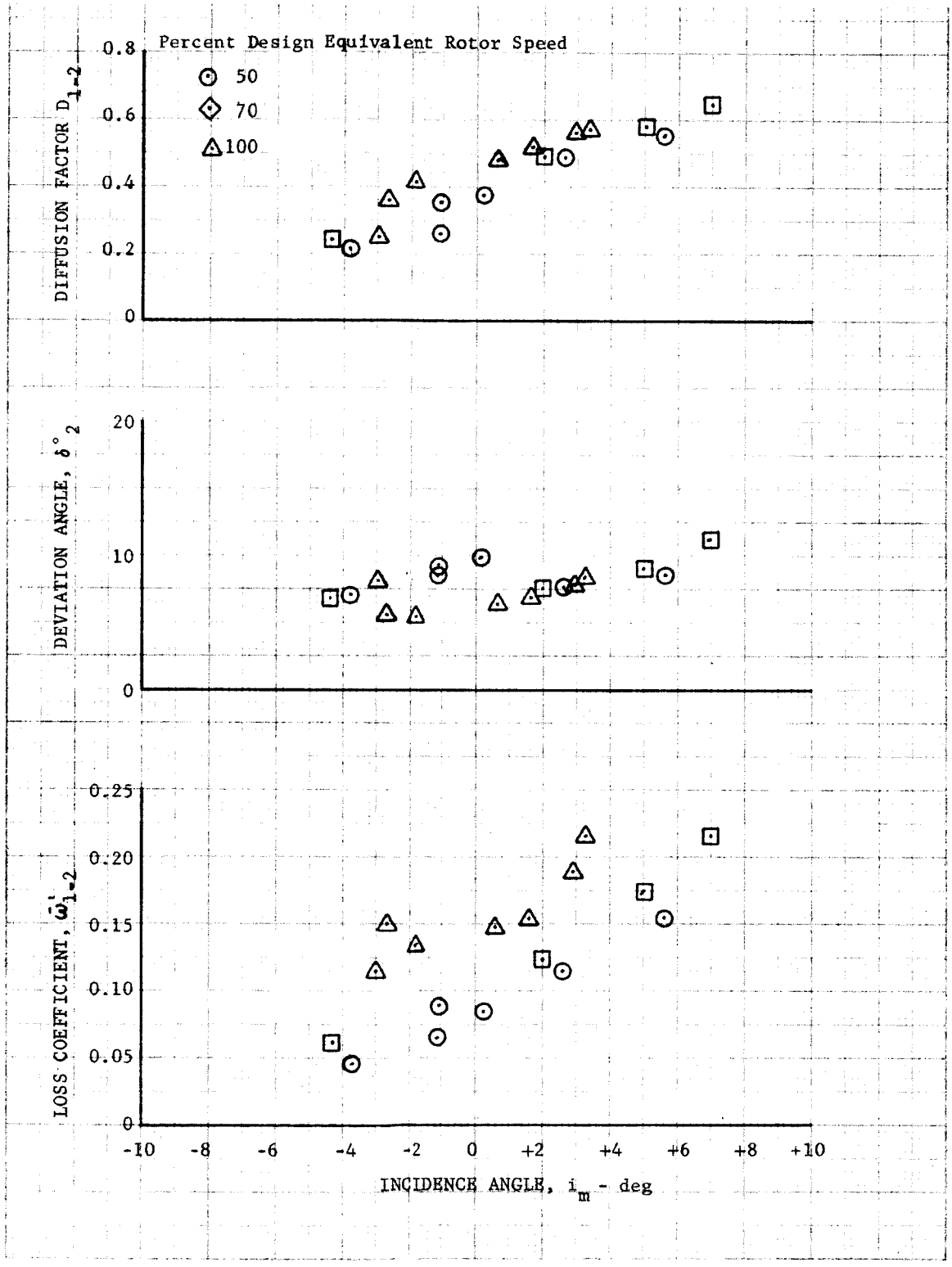


Figure V-16. Variation of Rotor Blade Element Parameters With Incidence, Slotted Rotor 2, 10% Span From Tip

DF 52299

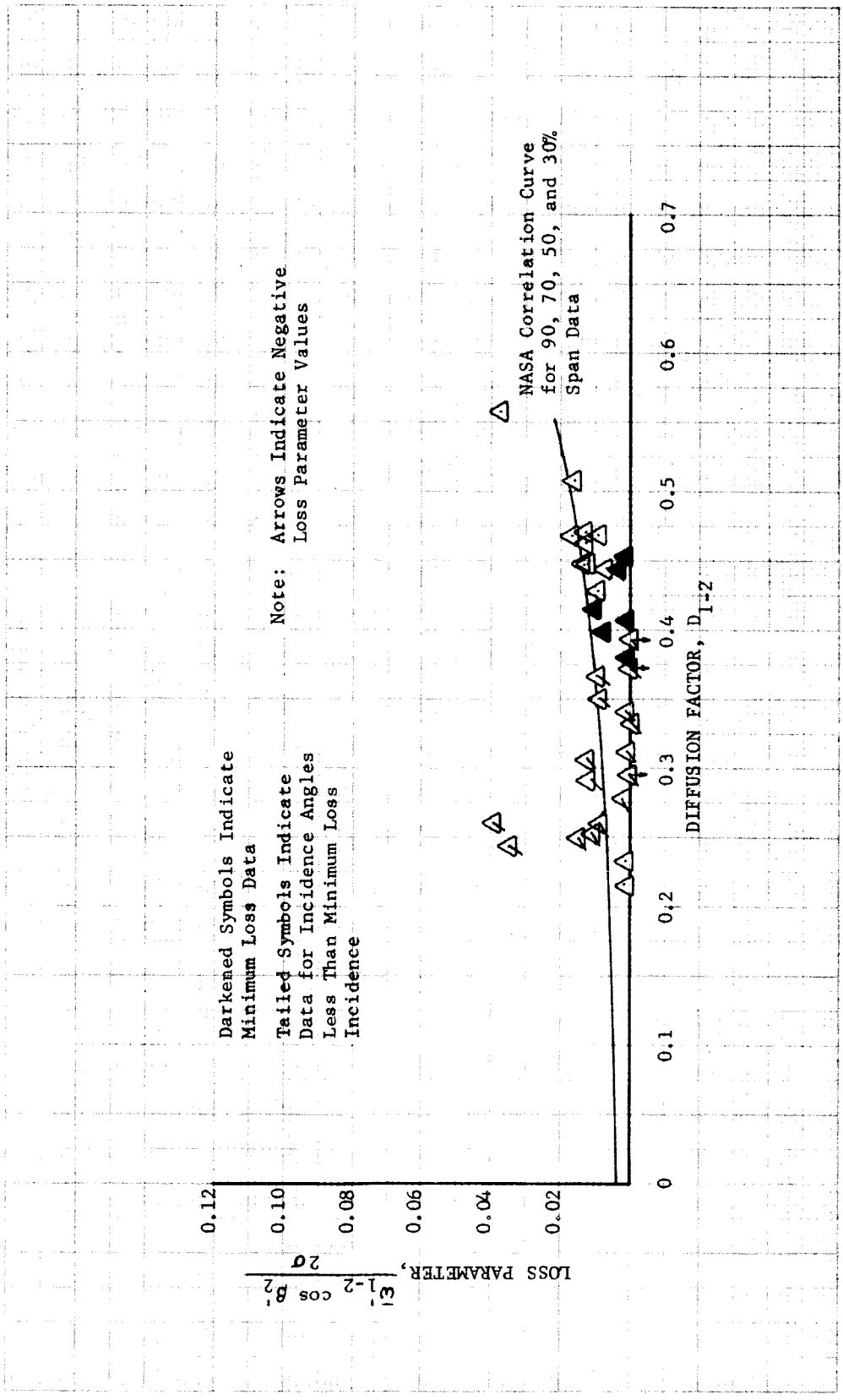


Figure V-17a. Loss Parameter Versus Diffusion Factor at 70 and 50% Span (From Tip) - 90, 100, and 110% Design Equivalent Rotor Speed

DF 53230-1

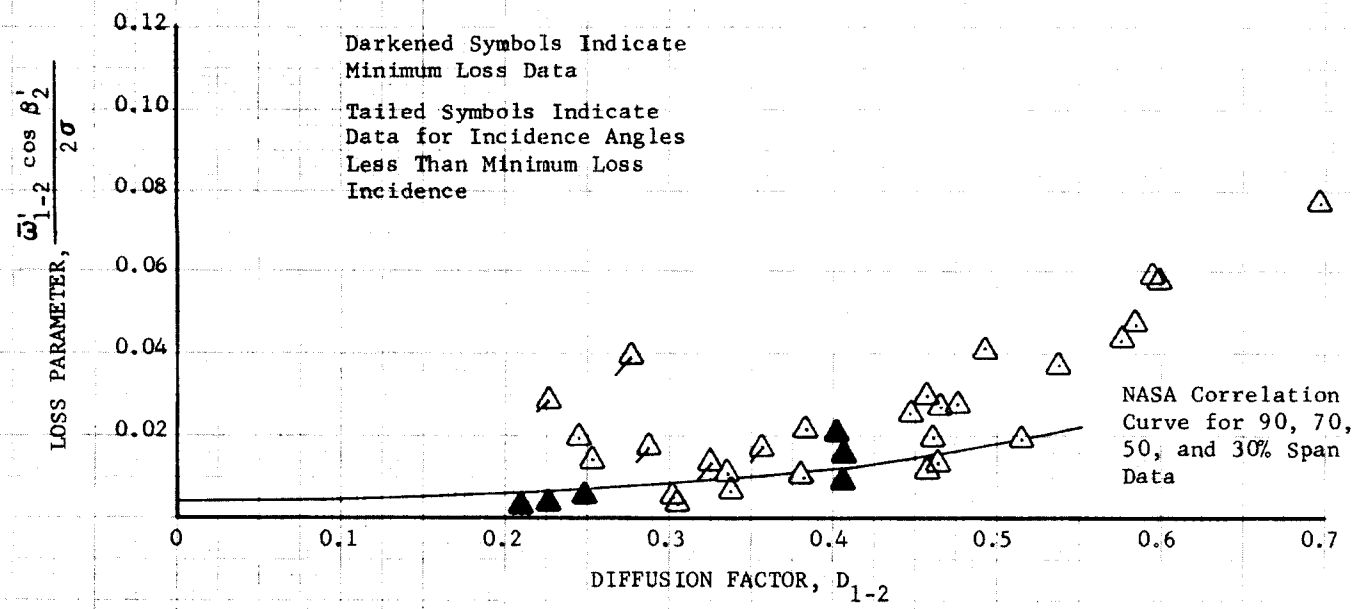


Figure V-17b. Loss Parameter Versus Diffusion Factor at 90 and 30% Span (From Tip) - 90, 100, and 110% Design Equivalent Rotor Speed

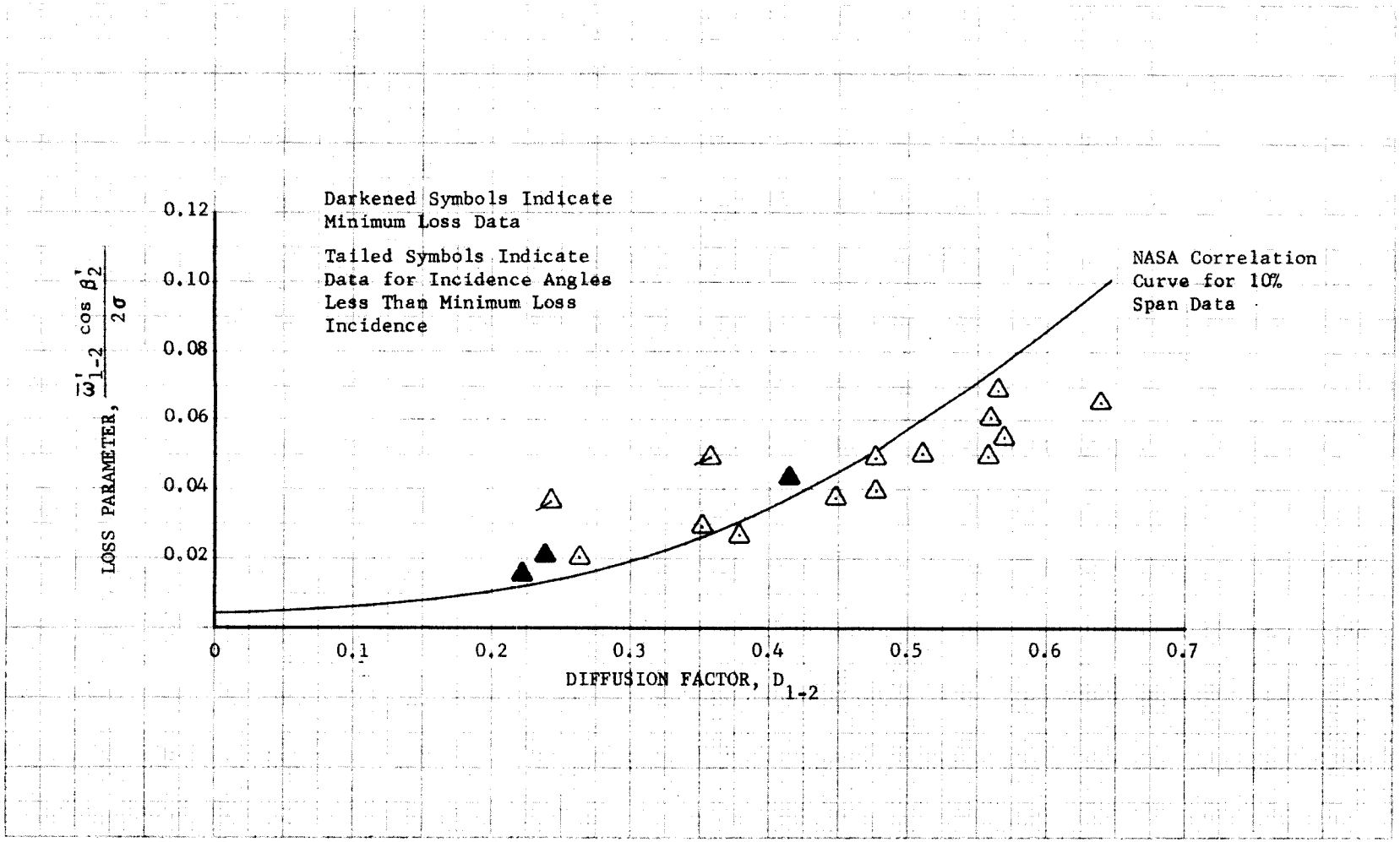


Figure V-17c. Loss Parameter Versus Diffusion Factor at 10% Span (From Tip) 90, 100, and 110% Design Equivalent Rotor Speed

DF 53230-3

DF 53231

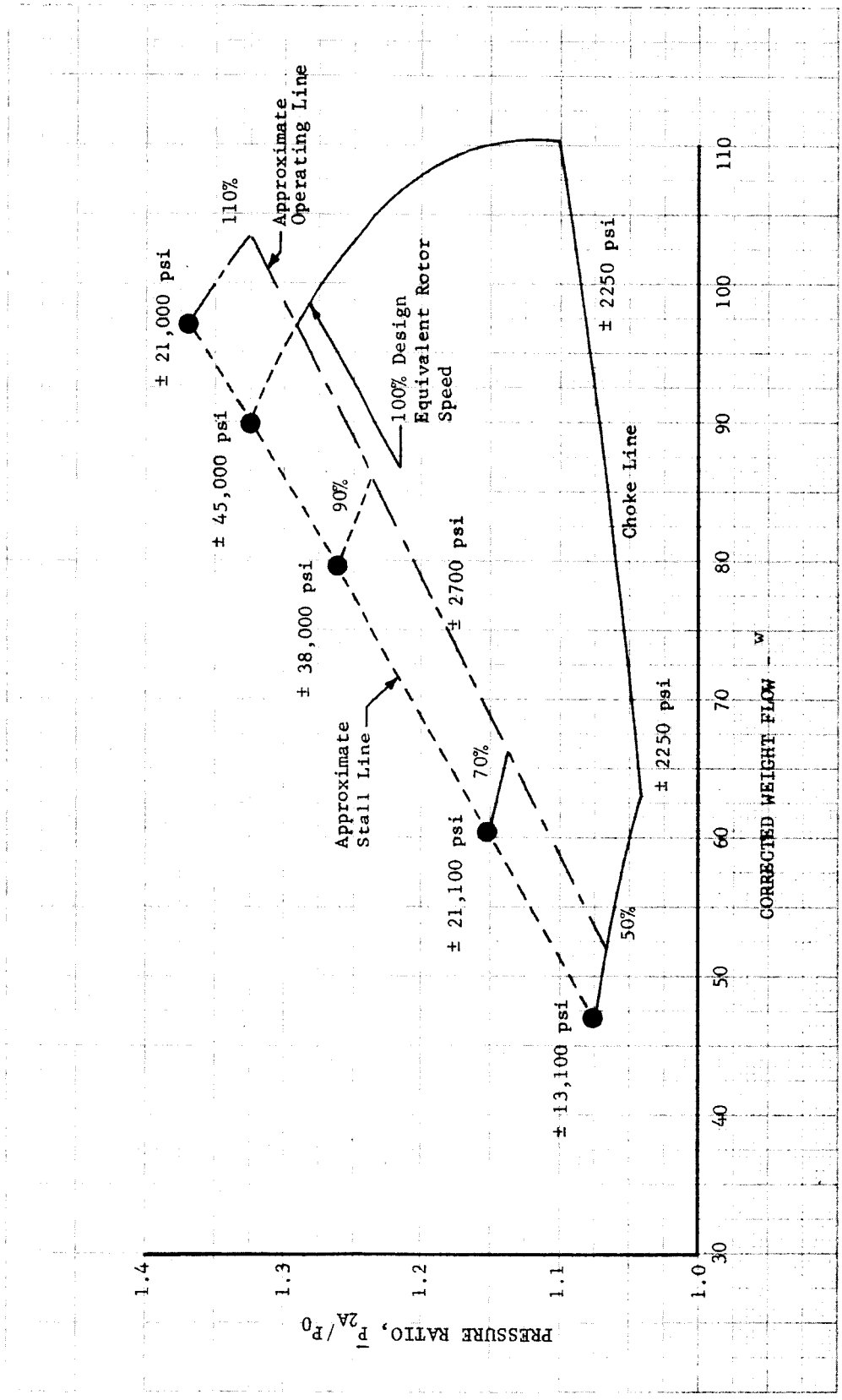


Figure V-18. Stress Survey Map

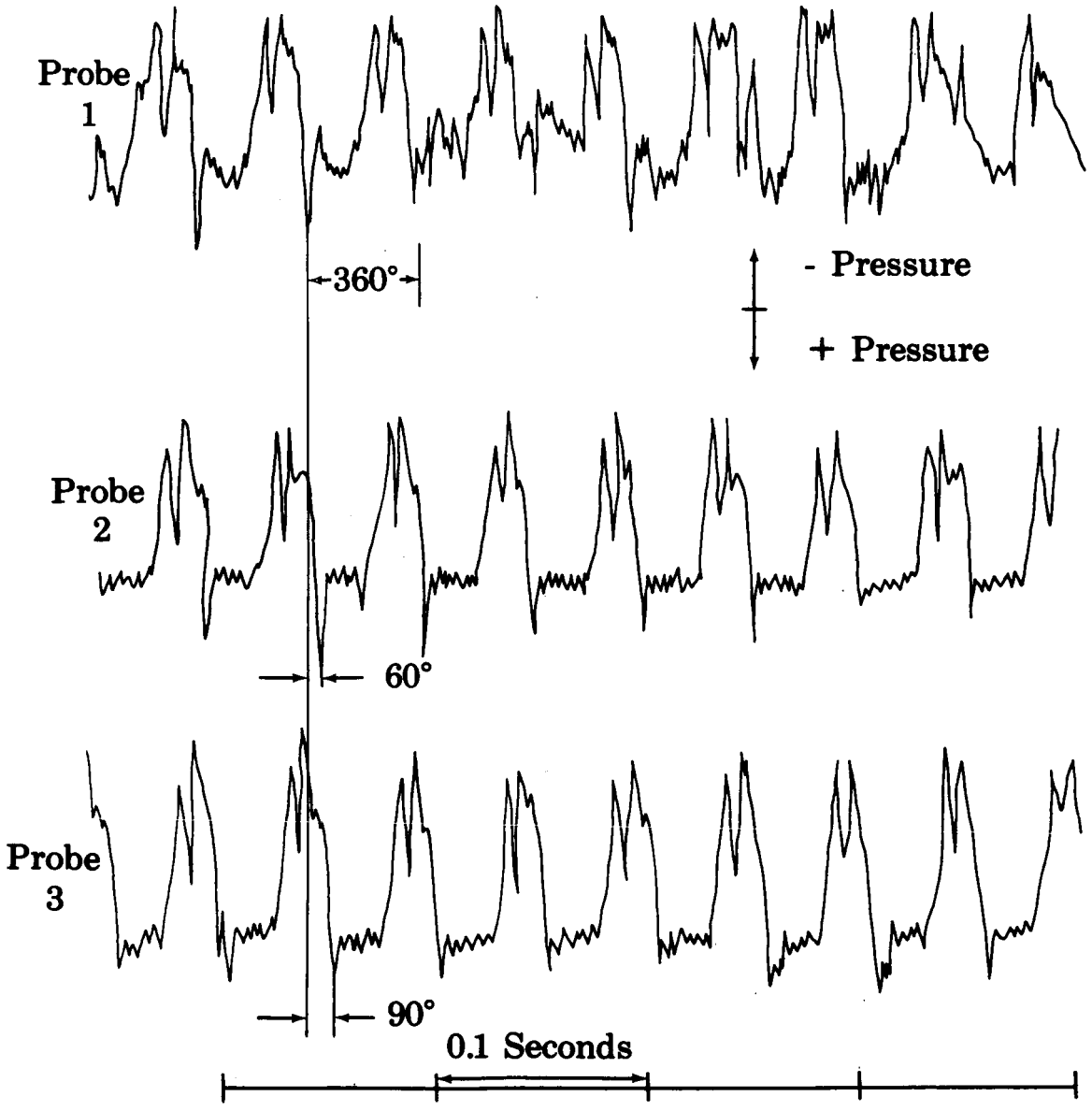


Figure V-19. Typical Rotating Stall Recording; Rotor Speed 6200 RPM FD 19356

Major Scale Division: Vertical = 60 ft/sec

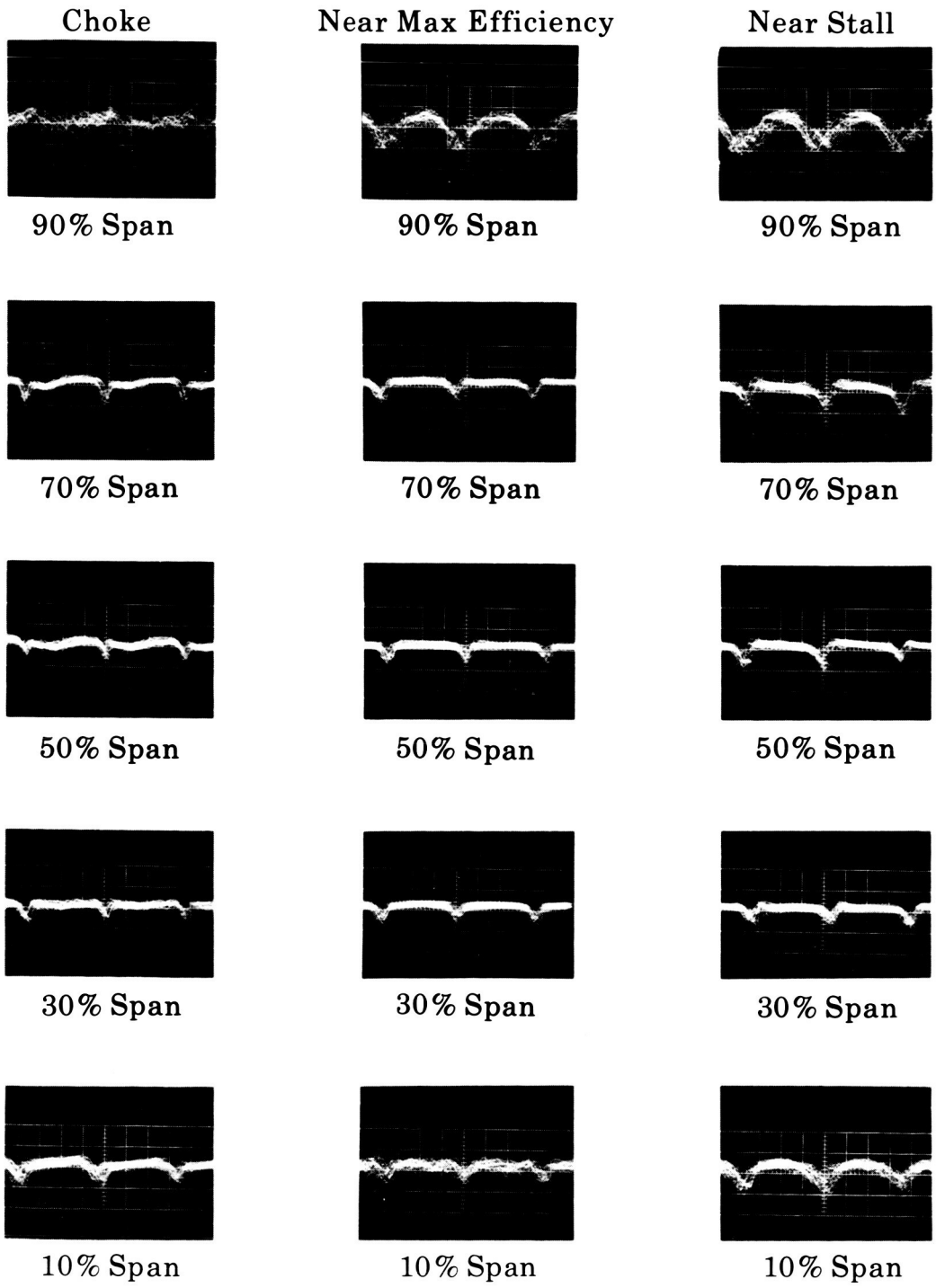


Figure V-20. Rotor Wake Surveys - 50% Design Equivalent Rotor Speed FD 19353

Major Scale Division: Vertical = 60 ft/sec

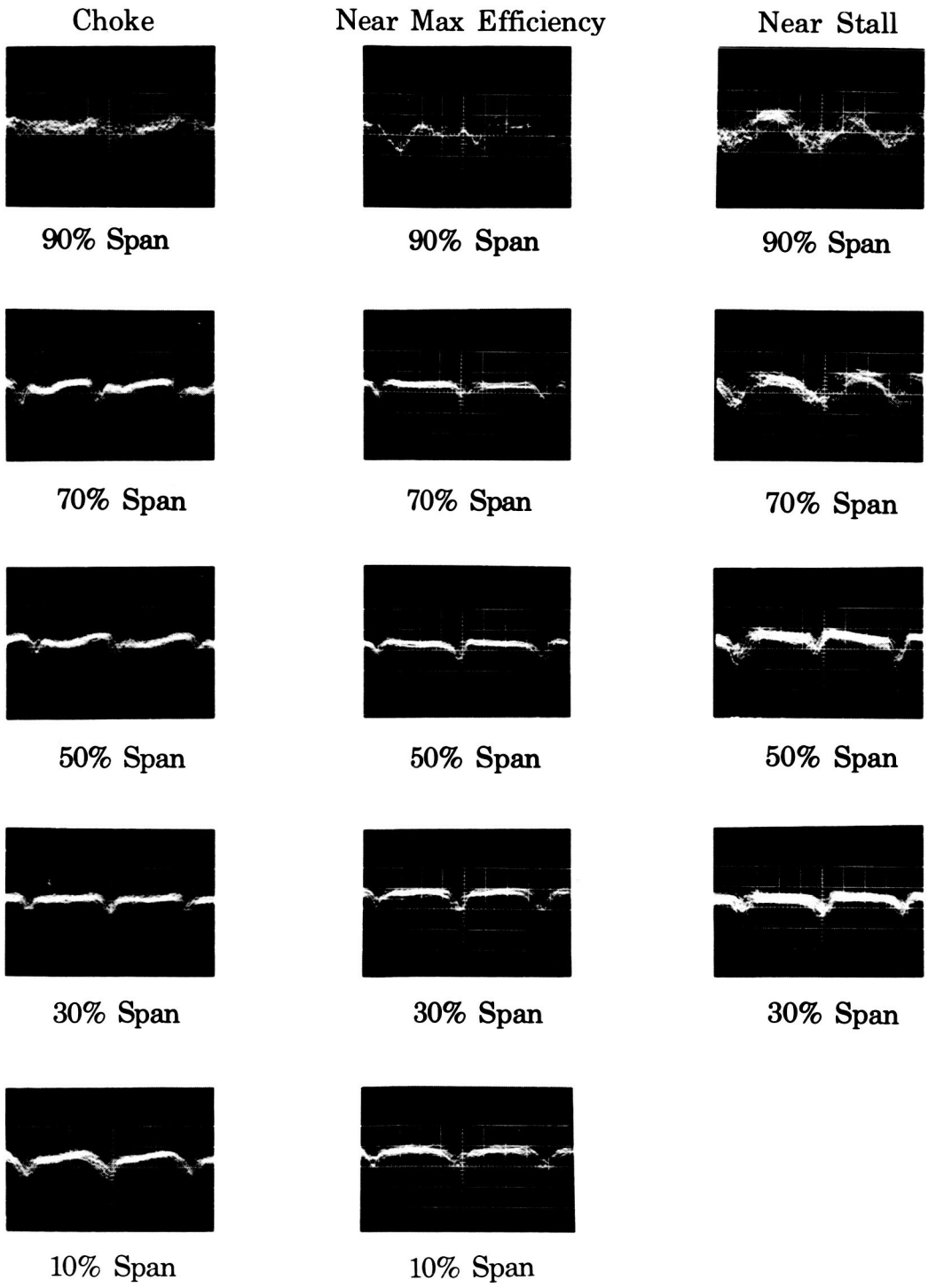


Figure V-21. Rotor Wake Surveys - 70% Design Equivalent Rotor Speed

FD 19354

Major Scale Division: Vertical = 60 ft/sec sec

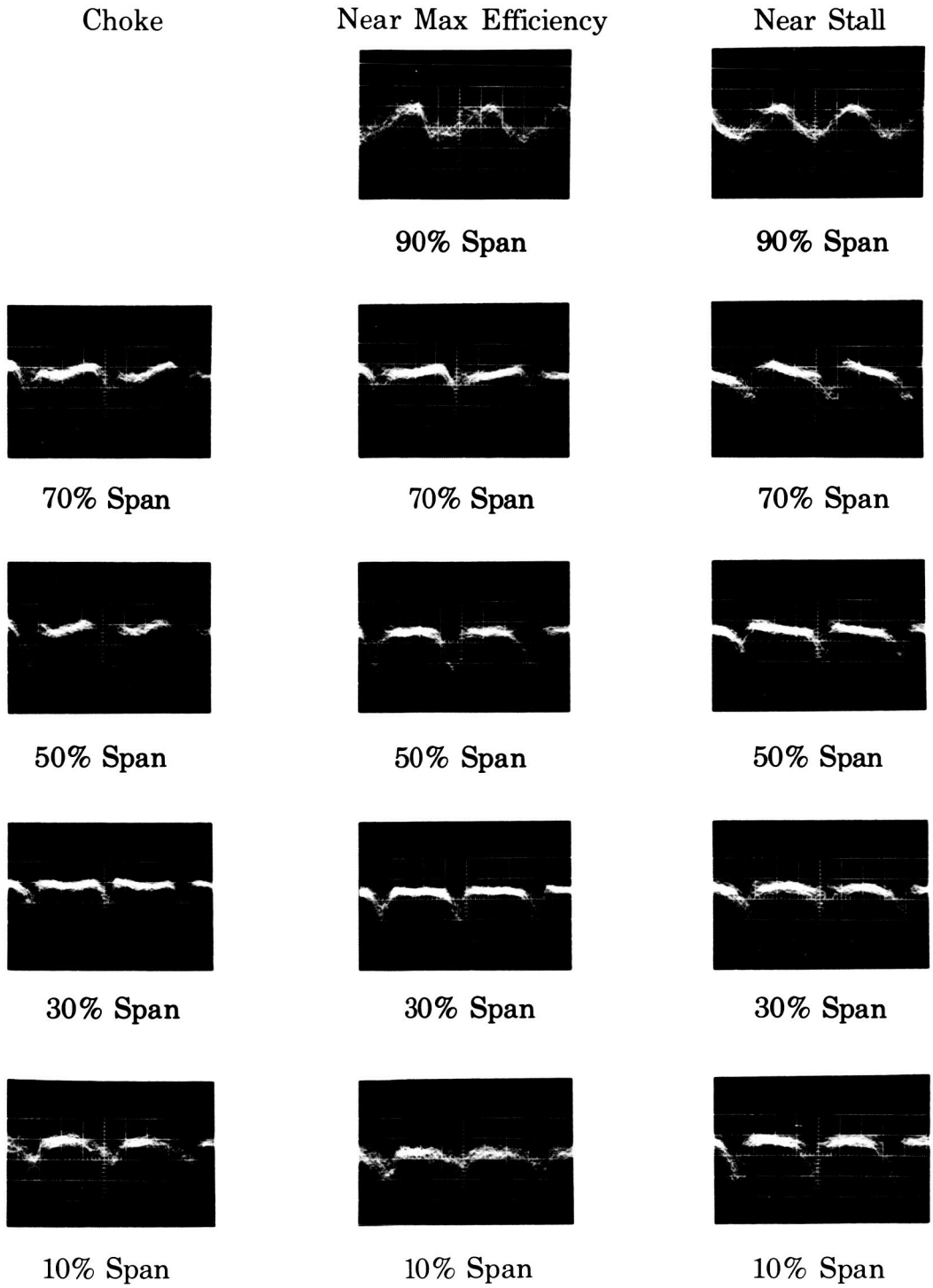


Figure V-22. Rotor Wake Surveys - 100% Design Equivalent Rotor Speed

FD 19355

DF 52302

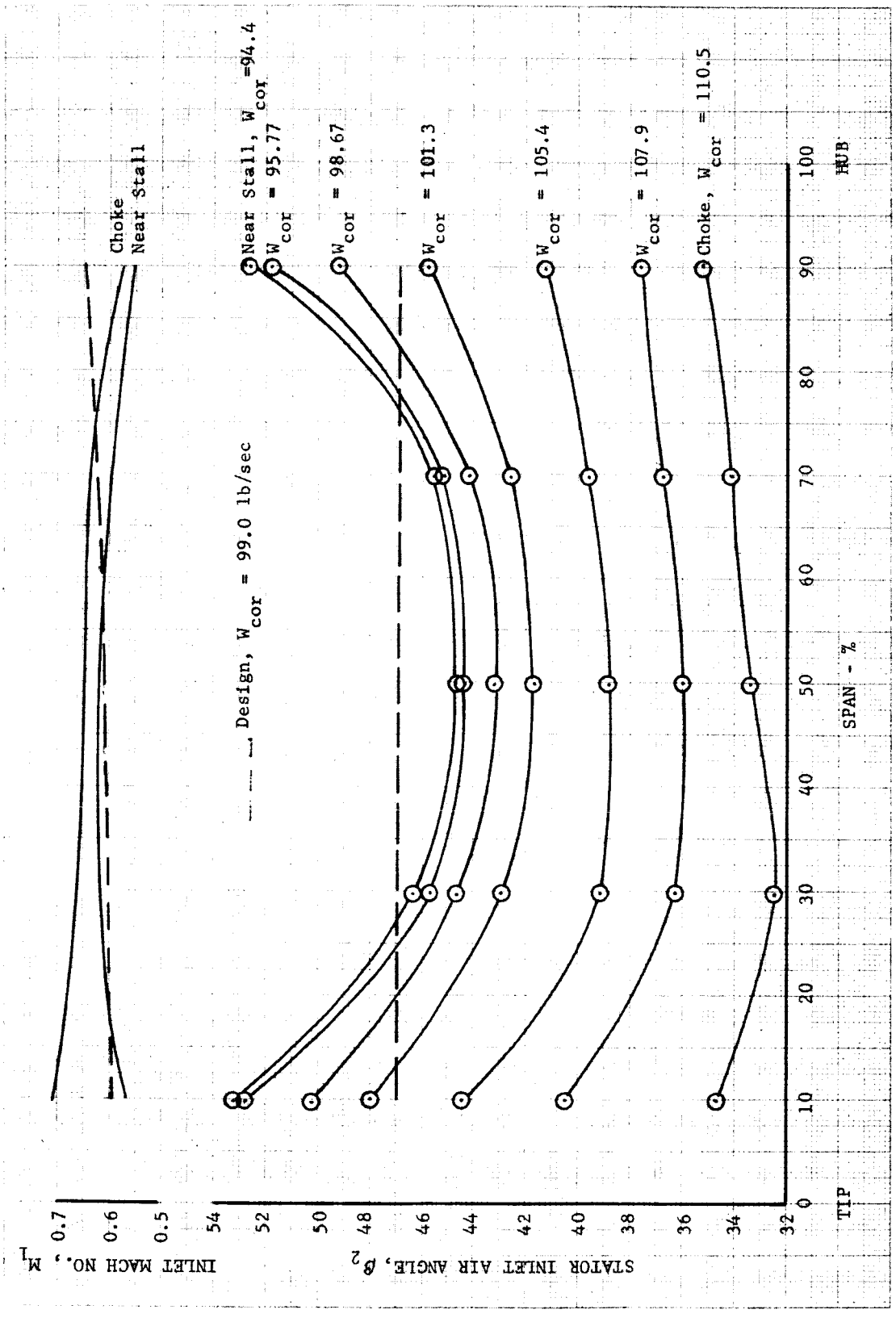


Figure V-23. Stator Inlet Air Angle and Mach Number Distribution, Slotted Rotor 2 Configuration, Design Rotor Speed

APPENDIX A
DEFINITION OF SYMBOLS

A. GENERAL NOMENCLATURE

A_A	Flow path annular area, $in.^2$
c	Chord length, in.
D	Diffusion factor
i_m	Incidence angle, deg
M	Absolute Mach number
O	Minimum blade passage gap, in.
O^*	Critical blade passage gap, in.
P	Total pressure, psia
p	Static pressure, psia
q	Pressure equivalent of the velocity head, psia
R	Reynolds number based on chord length
S	Blade spacing, in.
s	Blade span, in.
t	Blade maximum thickness, in.
U	Rotor speed, ft/sec
V	Absolute velocity, ft/sec
W	Actual flow rate, lb_m/sec
β	Absolute air angle, deg
γ	Ratio of specific heats
$\gamma°$	Blade-chord angle, deg
δ	Ratio of total pressure to NASA standard sea level pressure of 2116 psf
$\delta°$	Deviation angle, deg
η_{ad}	Adiabatic efficiency
θ	Ratio of total temperature to NASA standard sea level temperature of 518.7°R

κ	Blade metal angle, deg
ρ	Density, lb_m/ft^3
σ	Solidity, c/S
ϕ	Blade camber angle, $\kappa_1 - \kappa_2$, deg
$\bar{\omega}$	Total pressure loss coefficient

Subscripts:

0	Guide vane inlet
1	Rotor inlet
2	Rotor exit
2A	Stator exit
z	Axial component
θ	Tangential component

Superscripts:

'	Related to rotor blade
-	Mass average value

B. SLOT NOMENCLATURE

A_2	Slot throat area, $in.^2$
R	Coanda radius, in.
R_p	Pressure surface edge radius, in.
r_1	Slot leading edge radius, in.
r_2	Slot trailing edge radius, in.
t	Blade thickness at intersection of slot centerline and mean camber line, in.
Y_1	Slot capture dimension, in.
Y_2	Slot throat dimension, in.
ψ	Angle formed by slot centerline and mean camber line, deg

C. BLADE ELEMENT TABULATION NOMENCLATURE FOR TABLE B-2

PCT SPAN	Percent span
DIA	Diameter, inches
BETA	Absolute air angle, degrees
BETA(PR)	Relative air angle, degrees
V	Absolute velocity, ft/sec
VZ	Axial component of velocity, ft/sec
V-THETA	Tangential components of absolute velocity, ft/sec
V(PR)	Relative velocity, ft/sec
V-THETA PR	Tangential component of relative velocity, ft/sec
U	Wheel speed, ft/sec
M	Absolute Mach number
M(PR)	Relative Mach number
TURN	Air turning, degrees
TURN(PR)	Relative air turning, degrees
UUBAR	Loss coefficient
DFAC	Diffusion factor
EFFP	Polytropic efficiency
EFF	Adiabatic efficiency
INCID	Incidence, degrees
DEV	Deviation, degrees
LOSS PARA	Loss parameter

APPENDIX B
TABULATED PERFORMANCE

The overall performance and percent rotor and stator bleed flow rates for each test point are presented in table B-1.

Table B-2 presents blade element data for each test point. Definition of the blade element parameters as tabulated in the computer printouts is presented in Appendix A.

Table B-1. Tabulation of Overall Performance and Percent Bleed Flows

50% Design Equivalent Rotor Speed

Corrected Main Orifice Weight Flow $w\sqrt{\theta}/\delta$, lb/sec	Overall Performance Rotor $P_2/\overline{P}_1$	Rotor η_{ad} Percent	Stage $\overline{P}_{2a}/P_0$	Stage η_{ad} Percent	Percent Bleed Rotor	Percent Bleed Stator
47.41	1.08	91.7	1.07	82.1	1.34	3.40
53.15	1.07	93.8	1.07	87.6	1.08	1.96
56.18	1.06	93.2	1.06	87.2	0.96	1.44
58.38	1.06	93.3	1.05	84.7	0.86	1.46
60.60	1.05	89.3	1.05	76.7	0.70	0.61
63.28	1.05	90.6	1.04	79.6	0.57	0.58
70% Design Equivalent Rotor Speed						
60.76	1.16	87.0	1.15	80.1	1.30	2.55
65.06	1.15	88.6	1.14	82.1	1.16	1.89
70.98	1.14	94.9	1.13	86.3	0.98	2.11
85.62	1.09	91.6	1.07	68.9	0.69	0.97
100% Equivalent Design Rotor Speed						
94.42	1.31	83.2	1.30	81.0	0.82	2.45
95.77	1.32	85.2	1.30	81.6	0.75	2.24
98.67	1.30	86.2	1.29	82.0	0.73	2.17
101.31	1.29	88.5	1.27	83.5	0.67	2.05
105.45	1.25	87.9	1.23	81.0	0.57	1.67
107.88	1.22	85.0	1.19	73.1	0.25	1.18
110.53	1.16	74.9	1.14	64.0	0.13	0.51

Table B-2. Blade Element Performance

PERCENT DESIGN SPEED = 100.63

CORRECTED WEIGHT FLOW = 110.53

CORRECTED ROTOR SPEED = 5400.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	17.095	18.074	18.743	18.790	20.636
V 0	495.82	495.82	495.82	495.82	495.82
V 1	608.41	608.95	603.14	596.39	576.99
VZ 0	495.82	495.82	495.82	495.82	495.82
VZ 1	581.53	578.90	571.15	564.60	539.97
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	178.85	188.92	193.80	192.10	203.35
M 0	0.4532	0.4532	0.4532	0.4532	0.4532
M 1	0.5620	0.5625	0.5568	0.5502	0.5313
TURN	-17.10	-18.07	-18.74	-18.79	-20.64
UUBAR	0.0386	0.0028	0.0002	0.0013	0.0696
DFAC	-0.053	-0.033	-0.016	-0.002	0.052
EFFP	0.9440	1.0041	1.0092	1.0078	0.8593
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	6.945	5.896	6.097	7.810	8.244

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	35.362	34.277	33.546	32.467	34.782
BETA 2A	26.300	23.400	23.100	25.000	27.900
V 2	782.26	737.59	716.27	699.55	645.08
V 2A	683.49	659.88	636.01	650.10	612.41
VZ 2	637.94	609.49	596.97	590.21	529.82
VZ 2A	612.74	605.61	585.02	589.19	541.23
V-THETA 2	452.73	415.40	395.82	375.53	367.99
V-THETA 2A	302.83	262.07	249.53	274.74	286.56
M 2	0.7081	0.6695	0.6500	0.6350	0.5799
M 2A	0.6115	0.5952	0.5737	0.5871	0.5478
TURN	9.062	10.877	10.446	7.467	6.882
UUBAR	0.1436	0.0989	0.1267	0.0689	0.0684
DFAC	0.2063	0.1962	0.2053	0.1396	0.1138
EFFP	0.4954	0.7872	0.6935	0.6054	0.2815
INCID	-11.59	-12.67	-13.40	-14.48	-12.17
DEV	9.36	6.46	6.16	8.06	10.96
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	17.095	18.074	18.743	18.790	20.636
BETA 2	35.362	34.277	33.546	32.467	34.782
BETA(PR) 1	46.526	47.855	49.603	51.480	53.676
BETA(PR) 2	27.965	33.983	37.931	41.402	46.725
V 1	608.41	608.95	603.14	596.39	576.99
V 2	782.26	737.59	716.27	699.55	645.08
VZ 1	581.53	578.90	571.15	564.60	539.97
VZ 2	637.94	609.49	596.97	590.21	529.82
V-THETA 1	178.85	188.92	193.80	192.10	203.35
V-THETA 2	452.73	415.40	395.82	375.53	367.99
V(PR) 1	845.2	862.7	881.3	906.6	911.6
V(PR) 2	722.3	735.0	756.9	786.8	772.9
VTHETA PR1	-613.4	-639.7	-671.2	-709.3	-734.4
VTHETA PR2	-338.7	-410.8	-465.3	-520.4	-562.7
U 1	792.20	828.60	864.98	901.39	937.79
U 2	791.42	826.25	861.07	895.90	930.72
M 1	0.5620	0.5625	0.5568	0.5502	0.5313
M 2	0.7081	0.6695	0.6500	0.6350	0.5799
M(PR) 1	0.7807	0.7970	0.8136	0.8364	0.8394
M(PR) 2	0.6538	0.6671	0.6868	0.7143	0.6948
TURN(PR)	18.561	13.872	11.672	10.078	6.951
UUBAR	0.1125	0.1142	0.1017	0.0830	0.1133
DFAC	0.2766	0.2601	0.2445	0.2284	0.2432
EFFP	0.7543	0.7945	0.8088	0.8561	0.6463
EFF	0.7474	0.7896	0.8045	0.8529	0.6396
INCID	-5.63	-5.75	-5.43	-4.56	-3.11
DEV	11.815	10.383	8.691	7.492	8.075
LOSS PARA	0.039771	0.039626	0.034922	0.028069	0.036274

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 100.07

CORRECTED WEIGHT FLOW = 95.77

CORRECTED ROTOR SPEED = 5370.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	17.119	17.640	18.227	18.706	19.452
V 0	416.71	416.71	416.71	416.71	416.71
V 1	502.00	503.98	499.42	493.86	479.88
VZ 0	416.71	416.71	416.71	416.71	416.71
VZ 1	479.76	480.29	474.36	467.78	452.49
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	147.77	152.72	156.21	158.39	159.81
M 0	0.3786	0.3786	0.3786	0.3786	0.3786
M 1	0.4591	0.4610	0.4566	0.4513	0.4381
TURN	-17.12	-17.64	-18.23	-18.71	-19.45
UUBAR	0.0356	-0.0027	-0.0034	0.0010	0.0529
DFAC	-0.033	-0.022	-0.006	0.012	0.050
EFFP	0.9452	1.0199	1.0227	1.0143	0.8859
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	6.921	6.330	6.613	7.894	9.428

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	51.940	45.368	44.474	45.775	52.944
BETA 2A	29.700	27.900	26.100	28.800	32.900
V 2	657.03	690.32	692.97	674.02	645.16
V 2A	414.07	475.97	500.54	496.08	459.71
VZ 2	405.05	484.98	494.48	470.12	388.77
VZ 2A	359.67	420.64	449.50	434.72	385.98
V-THETA 2	517.32	491.25	485.48	483.01	514.87
V-THETA 2A	205.15	222.72	220.21	238.99	249.70
M 2	0.5740	0.6113	0.6151	0.5961	0.5639
M 2A	0.3581	0.4153	0.4379	0.4326	0.3982
TURN	22.240	17.468	18.374	16.975	20.044
UUBAR	0.0636	0.0852	0.0759	0.0648	0.1073
DFAC	0.5680	0.4802	0.4519	0.4358	0.4902
EFFP	1.7293	1.1039	1.0505	0.9879	1.3565
INCID	4.99	-1.58	-2.48	-1.17	5.99
DEV	12.76	10.96	9.16	11.86	15.96
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	17.119	17.640	18.227	18.706	19.452
BETA 2	51.940	45.368	44.474	45.775	52.944
BETA(PR) 1	53.145	54.417	56.026	57.631	59.650
BETA(PR) 2	33.657	34.265	36.866	40.948	46.570
V 1	502.00	503.98	499.42	493.86	479.88
V 2	657.03	690.32	692.97	674.02	645.16
VZ 1	479.76	480.29	474.36	467.78	452.49
VZ 2	405.05	484.98	494.48	470.12	388.77
V-THETA 1	147.77	152.72	156.21	158.39	159.81
V-THETA 2	517.32	491.25	485.48	483.01	514.87
V(PR) 1	799.9	825.4	848.9	873.8	895.5
V(PR) 2	486.6	586.8	618.1	622.4	565.5
VTHETA PR1	-640.0	-671.3	-704.0	-738.0	-772.8
VTHETA PR2	-269.7	-330.4	-370.8	-407.9	-410.7
U 1	787.80	824.00	860.18	896.38	932.58
U 2	787.03	821.66	856.29	890.92	925.55
M 1	0.4591	0.4610	0.4566	0.4513	0.4381
M 2	0.5740	0.6113	0.6151	0.5961	0.5639
M(PR) 1	0.7315	0.7550	0.7761	0.7985	0.8175
M(PR) 2	0.4252	0.5197	0.5487	0.5505	0.4943
TURN(PR)	19.488	20.152	19.161	16.684	13.080
UUBAR	0.1982	0.0521	0.0280	0.0644	0.1881
DFAC	0.5784	0.4631	0.4444	0.4607	0.5609
EFFP	0.6253	0.8522	0.9293	0.8854	0.7395
EFF	0.6119	0.8461	0.9262	0.8806	0.7288
INCID	0.99	0.81	1.00	1.59	2.86
DEV	17.507	10.665	7.626	7.038	7.920
LOSS PARA	0.043984	0.012273	0.007315	0.019009	0.060338

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 100.11

CORRECTED WEIGHT FLOW = 98.67

CORRECTED ROTOR SPEED = 5371.65

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.808	17.389	18.042	17.784	20.244
V 0	431.64	431.64	431.64	431.64	431.64
V 1	521.07	522.26	517.41	511.70	499.21
VZ 0	431.64	431.64	431.64	431.64	431.64
VZ 1	498.81	498.39	491.97	487.25	468.37
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	150.67	156.08	160.25	156.29	172.74
M 0	0.3926	0.3926	0.3926	0.3926	0.3926
M 1	0.4773	0.4784	0.4738	0.4683	0.4564
TURN	-16.81	-17.39	-18.04	-17.78	-20.24
UUBAR	0.0342	-0.0022	0.0012	0.0079	0.0537
DFAC	-0.042	-0.025	-0.008	0.003	0.054
EFFP	0.9478	1.0179	1.0117	0.9973	0.8869
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.232	6.581	6.798	8.816	8.636

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	49.327	44.167	43.316	44.619	50.246
BETA 2A	29.200	27.600	25.900	28.900	32.900
V 2	677.02	701.25	698.03	674.99	650.22
V 2A	425.56	502.28	503.34	494.99	453.52
VZ 2	441.24	503.01	507.87	480.46	415.81
VZ 2A	371.48	445.12	452.78	433.34	380.78
V-THETA 2	513.48	488.60	478.86	474.11	499.89
V-THETA 2A	207.61	232.70	219.86	239.22	246.34
M 2	0.5935	0.6225	0.6208	0.5996	0.5701
M 2A	0.3695	0.4400	0.4415	0.4331	0.3940
TURN	20.127	16.567	17.416	15.719	17.346
UUBAR	0.1078	0.0604	0.0818	0.0720	0.1354
DFAC	0.5599	0.4429	0.4478	0.4318	0.4949
EFFP	1.7817	1.2324	1.1007	0.9311	1.3409
INCID	2.38	-2.78	-3.63	-2.33	3.30
DEV	12.26	10.66	8.96	11.96	15.96
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.808	17.389	18.042	17.784	20.244
BETA 2	49.327	44.167	43.316	44.619	50.246
BETA(PR) 1	51.953	53.281	54.907	56.650	58.360
BETA(PR) 2	31.819	33.530	36.637	40.961	45.690
V 1	521.07	522.26	517.41	511.70	499.21
V 2	677.02	701.25	698.03	674.99	650.22
VZ 1	498.81	498.39	491.97	487.25	468.37
VZ 2	441.24	503.01	507.87	480.46	415.81
V-THETA 1	150.67	156.08	160.25	156.29	172.74
V-THETA 2	513.48	488.60	478.86	474.11	499.89
V(PR) 1	809.3	833.6	855.7	886.3	892.8
V(PR) 2	519.3	603.4	632.9	636.2	595.3
VTHETA PR1	-637.4	-668.2	-700.2	-740.4	-760.1
VTHETA PR2	-273.8	-333.3	-377.7	-417.1	-425.9
U 1	788.04	824.25	860.44	896.65	932.87
U 2	787.27	821.91	856.55	891.19	925.83
M 1	0.4773	0.4784	0.4738	0.4683	0.4564
M 2	0.5935	0.6225	0.6208	0.5996	0.5701
M(PR) 1	0.7414	0.7636	0.7836	0.8112	0.8163
M(PR) 2	0.4552	0.5357	0.5629	0.5652	0.5219
TURN(PR)	20.134	19.751	18.270	15.689	12.570
UUBAR	0.1790	0.0590	0.0376	0.0864	0.1538
DFAC	0.5396	0.4454	0.4261	0.4493	0.5115
EFFP	0.6388	0.8509	0.9142	0.9193	0.7379
EFF	0.6259	0.8449	0.9107	0.9161	0.7275
INCID	-0.21	-0.33	-0.12	0.61	1.57
DEV	15.669	9.930	7.397	7.051	7.040
LOSS PARA	0.037733	0.013612	0.009755	0.025557	0.050146

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 99.89

CORRECTED WEIGHT FLOW = 101.31

CORRECTED ROTOR SPEED = 5360.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	17.216	17.755	18.318	18.942	20.005
V 0	445.48	445.48	445.48	445.48	445.48
V 1	538.24	540.08	535.66	528.93	515.23
VZ 0	445.48	445.48	445.48	445.48	445.48
VZ 1	514.13	514.36	508.52	500.29	484.15
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	159.31	164.70	168.35	171.70	176.26
M 0	0.4056	0.4056	0.4056	0.4056	0.4056
M 1	0.4938	0.4956	0.4913	0.4848	0.4717
TURN	-17.22	-17.76	-18.32	-18.94	-20.01
UUBAR	0.0439	0.0008	-0.0030	0.0065	0.0528
DFAC	-0.036	-0.023	-0.008	0.013	0.052
EFFP	0.9305	1.0109	1.0195	0.9996	0.8885
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	6.824	6.215	6.522	7.658	8.875

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	45.946	42.653	41.920	42.882	48.045
BETA 2A	28.900	26.700	25.400	28.100	33.200
V 2	684.76	707.75	702.67	675.17	653.21
V 2A	450.26	517.90	510.37	510.59	463.35
VZ 2	476.14	520.53	522.84	494.74	436.70
VZ 2A	394.19	462.68	461.03	450.41	387.72
V-THETA 2	492.12	479.54	469.45	459.45	485.77
V-THETA 2A	217.60	232.70	218.92	240.49	253.71
M 2	0.6021	0.6305	0.6263	0.6013	0.5752
M 2A	0.3914	0.4554	0.4491	0.4484	0.4042
TURN	17.046	15.953	16.520	14.782	14.845
UUBAR	0.0939	0.0587	0.0934	0.0483	0.1315
DFAC	0.5097	0.4204	0.4360	0.3977	0.4661
EFFP	1.4855	1.2196	1.1577	0.9809	1.3007
INCID	-1.00	-4.30	-5.03	-4.07	1.10
DEV	11.96	9.76	8.46	11.16	16.26
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	17.216	17.755	18.318	18.942	20.005
BETA 2	45.946	42.653	41.920	42.882	48.045
BETA(PR) 1	50.650	51.975	53.619	55.319	57.315
BETA(PR) 2	31.645	33.197	36.384	40.983	45.089
V 1	538.24	540.08	535.66	528.93	515.23
V 2	684.76	707.75	702.67	675.17	653.21
VZ 1	514.13	514.36	508.52	500.29	484.15
VZ 2	476.14	520.53	522.84	494.74	436.70
V-THETA 1	159.31	164.70	168.35	171.70	176.26
V-THETA 2	492.12	479.54	469.45	459.45	485.77
V(PR) 1	810.9	835.0	857.3	879.2	896.5
V(PR) 2	559.3	622.1	649.4	655.4	618.5
VTHETA PR1	-627.0	-657.8	-690.2	-723.0	-754.6
VTHETA PR2	-293.4	-340.6	-385.2	-429.8	-438.1
U 1	786.33	822.47	858.58	894.71	930.84
U 2	785.56	820.13	854.69	889.26	923.83
M 1	0.4938	0.4956	0.4913	0.4848	0.4717
M 2	0.6021	0.6305	0.6263	0.6013	0.5752
M(PR) 1	0.7439	0.7662	0.7863	0.8059	0.8208
M(PR) 2	0.4918	0.5542	0.5789	0.5836	0.5447
TURN(PR)	19.005	18.778	17.236	14.335	12.227
UUBAR	0.1326	0.0443	0.0285	0.0536	0.1466
DFAC	0.4762	0.4152	0.3990	0.4075	0.4783
EFFP	0.6367	0.8666	0.9031	0.9153	0.7517
EFF	0.6242	0.8614	0.8993	0.9121	0.7425
INCID	-1.51	-1.63	-1.41	-0.72	0.53
DEV	15.495	9.597	7.144	7.073	6.439
LOSS PARA	0.027792	0.010141	0.007359	0.015855	0.048312

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 99.33

CORRECTED WEIGHT FLOW = 105.45

CORRECTED ROTOR SPEED = 5330.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.541	17.548	17.930	18.048	20.287
V 0	467.71	467.71	467.71	467.71	467.71
V 1	580.16	580.20	574.01	566.90	551.75
VZ 0	467.71	467.71	467.71	467.71	467.71
VZ 1	556.15	553.20	546.13	539.01	517.52
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	165.17	174.93	176.71	175.63	191.30
M 0	0.4265	0.4265	0.4265	0.4265	0.4265
M 1	0.5344	0.5344	0.5284	0.5215	0.5068
TURN	-16.54	-17.55	-17.93	-18.05	-20.29
UUBAR	0.0407	0.0026	0.0008	0.0055	0.0517
DFAC	-0.070	-0.049	-0.033	-0.017	0.035
EFFP	0.9444	1.0054	1.0089	1.0006	0.9038
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.499	6.422	6.910	8.552	8.593

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	41.357	39.704	38.832	39.181	44.404
BETA 2A	28.500	25.400	23.700	27.100	33.300
V 2	720.61	728.81	709.92	686.69	657.40
V 2A	513.09	544.58	532.32	533.46	493.93
VZ 2	540.90	560.71	553.02	532.29	469.66
VZ 2A	450.91	491.94	487.43	474.89	412.83
V-THETA 2	476.14	465.58	445.14	433.83	459.99
V-THETA 2A	244.82	233.59	213.96	243.02	271.18
M 2	0.6383	0.6538	0.6370	0.6149	0.5824
M 2A	0.4491	0.4818	0.4713	0.4714	0.4338
TURN	12.857	14.304	15.132	12.081	11.104
UUBAR	0.0953	0.0857	0.0878	0.0497	0.1039
DFAC	0.4219	0.3917	0.3984	0.3552	0.3908
EFFP	1.3505	1.1042	1.0627	0.9850	1.3047
INCID	-5.59	-7.25	-8.12	-7.77	-2.55
DEV	11.56	8.46	6.76	10.16	16.36
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.541	17.548	17.930	18.048	20.287
BETA 2	41.357	39.704	38.832	39.181	44.404
BETA(PR) 1	47.958	49.290	51.110	52.953	54.826
BETA(PR) 2	29.420	31.970	36.201	40.240	44.321
V 1	580.16	580.20	574.01	566.90	551.75
V 2	720.61	728.81	709.92	686.69	657.40
VZ 1	556.15	553.20	546.13	539.01	517.52
VZ 2	540.90	560.71	553.02	532.29	469.66
V-THETA 1	165.17	174.93	176.71	175.63	191.30
V-THETA 2	476.14	465.58	445.14	433.83	459.99
V(PR) 1	830.5	848.2	869.9	894.7	898.4
V(PR) 2	621.0	661.0	685.3	697.3	656.5
VTHETA PR1	-616.8	-642.9	-677.1	-714.1	-734.3
VTHETA PR2	-305.0	-350.0	-404.8	-450.5	-458.7
U 1	781.93	817.86	853.77	889.70	925.63
U 2	781.16	815.54	849.91	884.28	918.66
M 1	0.5344	0.5344	0.5284	0.5215	0.5068
M 2	0.6383	0.6538	0.6370	0.6149	0.5824
M(PR) 1	0.7649	0.7812	0.8007	0.8230	0.8252
M(PR) 2	0.5501	0.5929	0.6149	0.6245	0.5816
TURN(PR)	18.538	17.320	14.908	12.713	10.504
UUBAR	0.1044	0.0439	0.0370	0.0615	0.1319
DFAC	0.4037	0.3664	0.3500	0.3559	0.4158
EFFP	0.6446	0.8775	0.9069	0.8900	0.7264
EFF	0.6330	0.8732	0.9037	0.8864	0.7176
INCID	-4.20	-4.32	-3.92	-3.09	-1.96
DEV	13.270	8.370	6.961	6.330	5.671
LOSS PARA	0.020500	0.009725	0.009509	0.017898	0.043006

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 100.07

CORRECTED WEIGHT FLOW = 107.88

CORRECTED ROTOR SPEED = 5370.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	17.182	18.082	18.717	19.162	19.704
V 0	481.02	481.02	481.02	481.02	481.02
V 1	598.81	600.56	593.92	587.23	571.29
VZ 0	481.02	481.02	481.02	481.02	481.02
VZ 1	572.09	570.90	562.51	554.69	537.84
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	176.89	186.40	190.58	192.75	192.62
M 0	0.4391	0.4391	0.4391	0.4391	0.4391
M 1	0.5525	0.5542	0.5477	0.5412	0.5257
TURN	-17.18	-18.08	-18.72	-19.16	-19.70
UUBAR	0.0477	0.0007	0.0018	0.0062	0.0543
DFAC	-0.067	-0.050	-0.031	-0.013	0.023
EFFP	0.9266	0.9989	0.9969	0.9887	0.8920
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	6.858	5.888	6.123	7.438	9.176

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	37.702	36.823	36.035	36.116	40.566
BETA 2A	27.400	24.400	22.700	25.400	32.200
V 2	754.71	728.39	706.37	689.13	666.51
V 2A	573.93	585.49	561.12	573.62	531.56
VZ 2	597.13	583.07	571.21	556.70	506.32
VZ 2A	509.55	533.19	517.66	518.17	449.81
V-THETA 2	461.55	436.56	415.54	406.19	433.45
V-THETA 2A	264.12	241.87	216.54	246.05	283.26
M 2	0.6756	0.6579	0.6368	0.6200	0.5956
M 2A	0.5081	0.5223	0.5006	0.5098	0.4701
TURN	10.302	12.423	13.335	10.716	8.366
UUBAR	0.1507	0.0843	0.1038	0.0477	0.1309
DFAC	0.3487	0.3129	0.3340	0.2782	0.3142
EFFP	1.1436	0.9543	1.0458	0.8307	0.8345
INCID	-9.25	-10.13	-10.91	-10.83	-6.38
DEV	10.46	7.46	5.76	8.46	15.26
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	17.182	18.082	18.717	19.162	19.704
BETA 2	37.702	36.823	36.035	36.116	40.566
BETA(PR) 1	46.879	48.159	49.967	51.750	53.988
BETA(PR) 2	28.594	33.444	37.653	41.047	44.184
V 1	598.81	600.56	593.92	587.23	571.29
V 2	754.71	728.39	706.37	689.13	666.51
VZ 1	572.09	570.90	562.51	554.69	537.84
VZ 2	597.13	583.07	571.21	556.70	506.32
V-THETA 1	176.89	186.40	190.58	192.75	192.62
V-THETA 2	461.55	436.56	415.54	406.19	433.45
V(PR) 1	837.0	855.8	874.5	896.0	914.8
V(PR) 2	680.1	698.8	721.5	738.2	706.1
VTHETA PR1	-610.9	-637.6	-669.6	-703.6	-740.0
VTHETA PR2	-325.5	-385.1	-440.7	-484.7	-492.1
U 1	787.80	824.00	860.18	896.38	932.58
U 2	787.03	821.66	856.29	890.92	925.55
M 1	0.5525	0.5542	0.5477	0.5412	0.5257
M 2	0.6756	0.6579	0.6368	0.6200	0.5956
M(PR) 1	0.7722	0.7898	0.8065	0.8257	0.8417
M(PR) 2	0.6088	0.6312	0.6504	0.6641	0.6309
TURN(PR)	18.286	14.716	12.314	10.703	9.804
UUBAR	0.0680	0.0549	0.0450	0.0561	0.1499
DFAC	0.3251	0.3081	0.2904	0.2887	0.3579
EFFP	0.7096	0.8890	0.8621	0.8358	0.7405
EFF	0.7004	0.8857	0.8581	0.8313	0.7335
INCID	-5.28	-5.45	-5.06	-4.29	-2.80
DEV	12.444	9.844	8.413	7.137	5.534
LOSS PARA	0.013020	0.012643	0.011974	0.016594	0.048790

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 99.94

CORRECTED WEIGHT FLOW = 94.42

CORRECTED ROTOR SPEED = 5363.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	17.060	17.664	18.313	18.738	19.173
V 0	409.86	409.86	409.86	409.86	409.86
V 1	494.79	494.55	489.05	484.32	474.86
VZ 0	409.86	409.86	409.86	409.86	409.86
VZ 1	473.02	471.23	464.28	458.65	448.52
V-THETA 0	0.00	0.00	0.00	0.00	0.00
V-THETA 1	145.16	150.06	153.66	155.58	155.95
M 0	0.3722	0.3722	0.3722	0.3722	0.3722
M 1	0.4522	0.4519	0.4467	0.4422	0.4333
TURN	-17.06	-17.66	-18.31	-18.74	-19.17
UUBAR	0.0351	0.0022	0.0112	0.0149	0.0388
DFAC	-0.039	-0.019	-0.001	0.015	0.042
EFFP	0.9331	0.9955	0.9760	0.9660	0.9040
INCID	0.0001	0.0001	0.0001	0.0001	0.0001
DEV	6.980	6.306	6.527	7.862	9.707

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	52.657	45.781	44.775	46.314	53.347
BETA 3	29.700	28.200	26.300	28.900	33.000
V 2	637.57	681.24	684.59	662.05	638.61
V 2A	416.96	468.45	501.96	482.31	454.77
VZ 2	386.74	475.10	485.98	457.28	381.23
VZ 2A	362.18	412.85	450.00	422.24	381.40
V-THETA 2	506.88	488.23	482.17	478.75	512.34
V-THETA 2A	206.59	221.37	222.40	233.09	247.69
M 1	0.5550	0.6008	0.6056	0.5837	0.5564
M 2A	0.3604	0.4084	0.4391	0.4197	0.3932
TURN	22.957	17.581	18.475	17.414	20.347
UUBAR	0.0142	0.0729	0.0318	0.0446	0.0762
DFAC	0.5425	0.4832	0.4395	0.4475	0.4923
EFFP	2.3709	1.4082	1.3651	1.0903	1.6494
INCID	5.71	-1.17	-2.17	-0.64	6.40
DEV	12.76	11.26	9.36	11.96	16.06
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	17.060	17.664	18.313	18.738	19.173
BETA 2	52.657	45.781	44.775	46.314	53.347
BETA(PR) 1	53.601	54.995	56.648	58.196	59.954
BETA(PR) 2	35.819	34.975	37.507	41.949	47.222
V 1	494.79	494.55	489.05	484.32	474.86
V 2	637.57	681.24	684.59	662.05	638.61
VZ 1	473.02	471.23	464.28	458.65	448.52
VZ 2	386.74	475.10	485.98	457.28	381.23
V-THETA 1	145.16	150.06	153.66	155.58	155.95
V-THETA 2	506.88	488.23	482.17	478.75	512.34
V(PR) 1	797.1	821.5	844.5	870.3	895.8
V(PR) 2	476.9	579.8	612.6	614.8	561.3
VTHETA PR1	-641.6	-672.9	-705.4	-739.6	-775.4
VTHETA PR2	-279.1	-332.4	-373.0	-411.0	-412.0
U 1	786.77	822.93	859.06	895.21	931.36
U 2	786.00	820.59	855.17	889.76	924.34
M 1	0.4522	0.4519	0.4467	0.4422	0.4333
M 2	0.5550	0.6008	0.6056	0.5837	0.5564
M(PR) 1	0.7285	0.7507	0.7714	0.7947	0.8173
M(PR) 2	0.4152	0.5114	0.5420	0.5421	0.4891
TURN(PR)	17.782	20.020	19.141	16.247	12.732
UUBAR	0.2033	0.0672	0.0468	0.0885	0.2159
DFAC	0.5851	0.4689	0.4476	0.4665	0.5664
EFFP	0.5888	0.7884	0.8638	0.8253	0.6847
EFF	0.5745	0.7799	0.8581	0.8182	0.6721
INCID	1.44	1.38	1.62	2.16	3.16
DEV	19.669	11.375	8.267	8.039	8.572
LOSS PARA	0.047572	0.016114	0.012398	0.026645	0.068478

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 50.30

CORRECTED WEIGHT FLOW = 63.28

CORRECTED ROTOR SPEED = 2699.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	17.782	17.417	18.083	18.503	18.997
V 0	263.87	263.87	263.87	263.87	263.87
V 1	305.60	310.38	307.94	305.09	297.62
VZ 0	263.87	263.87	263.87	263.87	263.87
VZ 1	291.00	296.15	292.73	289.32	281.41
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	93.33	92.91	95.58	96.82	96.88
M 0	0.2377	0.2377	0.2377	0.2377	0.2377
M 1	0.2758	0.2802	0.2780	0.2753	0.2685
TURN	-17.78	-17.42	-18.08	-18.50	-19.00
UUBAR	0.0564	0.0036	0.0018	0.0053	0.0440
DFAC	0.009	0.004	0.019	0.034	0.065
EFFP	0.8614	0.9910	0.9951	0.9848	0.8638
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	6.258	6.553	6.757	8.097	9.883

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	33.484	32.665	31.660	31.211	32.211
BETA 2A	23.900	22.300	22.000	23.000	26.500
V 2	396.80	387.73	374.95	355.08	331.21
V 2A	351.36	355.76	342.64	339.30	298.59
VZ 2	330.95	326.40	319.15	303.69	280.23
VZ 2A	321.24	329.15	317.69	312.33	267.22
V-THETA 2	218.92	209.27	196.80	184.00	176.55
V-THETA 2A	142.35	135.00	128.35	132.58	133.23
M 2	0.3557	0.3483	0.3369	0.3188	0.2968
M 2A	0.3147	0.3197	0.3077	0.3047	0.2674
TURN	9.584	10.365	9.660	8.211	5.711
UUBAR	0.1127	0.0655	0.0855	0.0153	0.1325
DFAC	0.1951	0.1662	0.1696	0.1136	0.1638
EFFP	1.3579	-4.2316	2.4835	-5.3364	0.8077
INCID	-13.47	-14.28	-15.29	-15.74	-14.74
DE.M	6.96	5.36	5.06	6.06	9.56
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	17.782	17.417	18.083	18.503	18.997
BETA 2	33.484	32.665	31.660	31.211	32.211
BETA(PR) 1	46.122	47.327	49.001	50.718	52.882
BETA(PR) 2	28.091	31.968	36.199	40.978	45.847
V 1	305.60	310.38	307.94	305.09	297.62
V 2	396.80	387.73	374.95	355.08	331.21
VZ 1	291.00	296.15	292.73	289.32	281.41
VZ 2	330.95	326.40	319.15	303.69	280.23
V-THETA 1	93.33	92.91	95.58	96.82	96.88
V-THETA 2	218.92	209.27	196.80	184.00	176.55
V(PR) 1	419.8	436.9	446.2	457.0	466.3
V(PR) 2	375.1	384.8	395.5	402.3	402.3
VTHETA PR1	-302.6	-321.2	-336.8	-353.7	-371.8
VTHETA PR2	-176.6	-203.7	-233.6	-263.8	-288.6
U 1	395.95	414.15	432.33	450.53	468.72
U 2	395.56	412.97	430.38	447.78	465.19
M 1	0.2758	0.2802	0.2780	0.2753	0.2685
M 2	0.3557	0.3483	0.3369	0.3188	0.2968
M(PR) 1	0.3789	0.3944	0.4028	0.4124	0.4207
M(PR) 2	0.3363	0.3456	0.3553	0.3612	0.3605
TURN(PR)	18.030	15.359	12.801	9.740	7.034
UUBAR	0.0177	0.0059	-0.0041	0.0097	0.0464
DFAC	0.2276	0.2330	0.2158	0.2108	0.2237
EFFP	0.6972	0.8387	0.8648	0.8215	0.6552
EFF	0.6947	0.8374	0.8638	0.8204	0.6533
INCID	-6.04	-6.28	-6.03	-5.32	-3.91
DEV	11.941	8.368	6.959	7.068	7.197
LOSS PARA	0.003334	0.001306	0.001053	0.002875	0.015102

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 50.22

CORRECTED WEIGHT FLOW = 47.41

CORRECTED ROTOR SPEED = 2695.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.671	17.214	17.869	18.263	18.622
V 0	195.34	195.34	195.34	195.34	195.34
V 1	222.66	225.85	226.36	225.02	220.16
VZ 0	195.34	195.34	195.34	195.34	195.34
VZ 1	213.30	215.73	215.44	213.68	208.63
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	63.87	66.84	69.46	70.52	70.30
M 0	0.1755	0.1755	0.1755	0.1755	0.1755
M 1	0.2002	0.2031	0.2036	0.2024	0.1980
TURN	-16.67	-17.21	-17.87	-18.26	-18.62
UUBAR	0.0509	0.0062	-0.0065	0.0030	0.0540
DFAC	0.015	0.019	0.024	0.036	0.062
EFFP	0.8565	0.9822	1.0192	0.9910	0.8353
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.369	6.756	6.971	8.337	10.258

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	52.709	45.726	44.368	45.496	52.506
BETA 2A	28.300	25.100	27.100	26.700	32.500
V 2	328.99	339.38	334.48	334.97	319.77
V 2A	213.61	257.85	247.55	242.87	227.03
VZ 2	199.32	236.92	239.11	234.80	194.64
VZ 2A	188.08	233.50	220.37	216.97	191.47
V-THETA 2	261.74	243.00	233.89	238.90	253.71
V-THETA 2A	101.27	109.38	112.77	109.13	121.98
M 2	0.2918	0.3018	0.2982	0.2986	0.2843
M 2A	0.1895	0.2296	0.2200	0.2160	0.2014
TURN	24.409	20.626	17.268	18.796	20.006
UUBAR	0.0969	-0.0062	0.0535	0.1356	0.1414
DFAC	0.5542	0.4029	0.4157	0.4778	0.4933
EFFP	3.1331	-3.2349	1.1399	1.2187	1.3000
INCID	5.76	-1.22	-2.58	-1.45	5.56
DEV	11.36	8.16	10.16	9.76	15.56
DIA	33.564	36.420	37.848	34.992	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.671	17.214	17.869	18.263	18.622
BETA 2	52.709	45.726	44.368	45.496	52.506
BETA(PR) 1	57.241	58.108	59.258	60.607	62.320
BETA(PR) 2	33.762	35.560	39.320	41.567	47.281
V 1	222.66	225.85	226.36	225.02	220.16
V 2	328.99	339.38	334.48	334.97	319.77
VZ 1	213.30	215.73	215.44	213.68	208.63
VZ 2	199.32	236.92	239.11	234.80	194.64
V-THETA 1	63.87	66.84	69.46	70.52	70.30
V-THETA 2	261.74	243.00	233.89	238.90	253.71
V(PR) 1	394.2	408.3	421.5	435.4	449.1
V(PR) 2	239.8	291.2	309.1	313.8	286.9
VTHETA PR1	-331.5	-346.7	-362.2	-379.3	-397.7
VTHETA PR2	-133.2	-169.4	-195.8	-208.2	-210.8
U 1	395.37	413.53	431.69	449.86	468.03
U 2	394.98	412.36	429.74	447.12	464.50
M 1	0.2002	0.2031	0.2036	0.2024	0.1980
M 2	0.2918	0.3018	0.2982	0.2986	0.2843
M(PR) 1	0.3545	0.3673	0.3791	0.3916	0.4039
M(PR) 2	0.2127	0.2590	0.2756	0.2797	0.2551
TURN(PR)	23.479	22.549	19.938	19.041	15.040
UUBAR	0.1781	0.0407	0.0111	0.0352	0.1569
DFAC	0.5946	0.4698	0.4402	0.4592	0.5592
EFFP	0.5605	0.6757	0.8247	0.8448	0.7317
EFF	0.5560	0.6721	0.8228	0.8430	0.7286
INCIDM	5.08	4.50	4.23	4.57	5.53
DEVM	17.612	11.960	10.080	7.657	8.631
LOSS PARA	0.05953	0.05349	0.00372	0.09582	0.04967

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 50.37

CORRECTED WEIGHT FLOW = 53.15

CORRECTED ROTOR SPEED = 2703.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.037	16.950	17.623	17.709	19.201
V 0	219.87	219.87	219.87	219.87	219.87
V 1	245.83	259.96	258.26	254.20	244.92
VZ 0	219.87	219.87	219.87	219.87	219.87
VZ 1	236.27	248.67	246.14	242.16	231.30
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	67.91	75.79	78.19	77.32	80.55
M 0	0.1977	0.1977	0.1977	0.1977	0.1977
M 1	0.2213	0.2341	0.2326	0.2289	0.2205
TURN	-16.04	-16.95	-17.62	-17.71	-19.20
UUBAR	0.1838	0.0072	-0.0003	0.0173	0.0627
DFAC	0.028	-0.006	0.008	0.026	0.079
EFFP	0.5803	0.9825	1.0008	0.9519	0.7963
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	8.003	7.020	7.217	8.891	9.679

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	44.525	40.469	40.126	40.855	46.218
BETA 2A	27.400	24.300	23.600	26.000	30.500
V 2	349.90	361.67	354.18	338.84	320.36
V 2A	253.84	283.17	279.10	271.75	247.93
VZ 2	249.46	275.15	270.82	256.28	221.66
VZ 2A	225.36	258.08	255.76	244.25	213.62
V-THETA 2	245.36	234.74	228.26	221.65	231.29
V-THETA 2A	116.82	116.53	111.74	119.13	125.83
M 2	0.3115	0.3231	0.3164	0.3025	0.2855
M 2A	0.2258	0.2528	0.2491	0.2424	0.2207
TURN	17.125	16.169	16.526	14.855	15.718
UUBAR	0.0850	0.0569	0.0677	0.0525	0.1005
DFAC	0.4278	0.3597	0.3618	0.3417	0.3887
EFFP	4.4364	4.5474	3.4459	2.7819	1.9080
INCID	-2.42	-6.48	-6.82	-6.09	-0.73
DEV	10.46	7.36	6.66	9.06	13.56
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.037	16.950	17.623	17.709	19.201
BETA 2	44.525	40.469	40.126	40.855	46.218
BETA(PR) 1	54.286	53.737	55.249	57.069	59.256
BETA(PR) 2	31.151	33.024	36.821	41.507	46.623
V 1	245.83	259.96	258.26	254.20	244.92
V 2	349.90	361.67	354.18	338.84	320.36
VZ 1	236.27	248.67	246.14	242.16	231.30
VZ 2	249.46	275.15	270.82	256.28	221.66
V-THETA 1	67.91	75.79	78.19	77.32	80.55
V-THETA 2	245.36	234.74	228.26	221.65	231.29
V(PR) 1	404.7	420.4	431.8	445.4	452.5
V(PR) 2	291.5	328.2	338.3	342.2	322.7
VTHETA PR1	-328.6	-339.0	-354.8	-373.9	-388.9
VTHETA PR2	-150.8	-178.8	-202.8	-226.8	-234.6
U 1	396.54	414.76	432.97	451.19	469.42
U 2	396.15	413.58	431.01	448.45	465.88
M 1	0.2213	0.2341	0.2326	0.2289	0.2205
M 2	0.3115	0.3231	0.3164	0.3025	0.2855
M(PR) 1	0.3643	0.3786	0.3889	0.4011	0.4072
M(PR) 2	0.2595	0.2932	0.3022	0.3055	0.2876
TURN(PR)	23.134	20.713	18.427	15.561	12.633
UUBAR	0.0869	0.0011	-0.0012	0.0298	0.1164
DFAC	0.4571	0.3800	0.3715	0.3832	0.4494
EFFP	0.6343	0.8103	0.8243	0.8020	0.7251
EFF	0.6306	0.8083	0.8224	0.8000	0.7224
INCID	2.13	0.13	0.22	1.03	2.47
DEV	15.001	9.424	7.581	7.597	7.973
LOSS PARA	0.02975	0.00038	-0.00418	0.01006	0.03733

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 50.32

CORRECTED WEIGHT FLOW = 56.18

CORRECTED ROTOR SPEED = 2700.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.209	16.826	17.632	17.889	19.348
V 0	232.90	232.90	232.90	232.90	232.90
V 1	272.59	275.76	274.15	270.55	263.74
VZ 0	232.90	232.90	232.90	232.90	232.90
VZ 1	261.75	263.95	261.27	257.47	248.85
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	76.09	79.82	83.04	83.10	87.38
M 0	0.2095	0.2095	0.2095	0.2095	0.2095
M 1	0.2456	0.2485	0.2471	0.2438	0.2376
TURN	-16.21	-16.83	-17.63	-17.89	-19.35
UUBAR	0.0629	0.0066	-0.0001	0.0134	0.0584
DFAC	-0.016	-0.009	0.006	0.024	0.065
EFFP	0.8572	0.9841	1.0003	0.9638	0.8315
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.831	7.144	7.208	8.711	9.532

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	40.512	38.268	37.955	38.201	42.610
BETA 2A	26.700	23.800	23.100	25.400	29.300
V 2	363.32	368.21	362.09	345.62	308.66
V 2A	279.49	298.00	287.47	275.96	252.06
VZ 2	276.22	289.09	285.50	271.60	227.17
VZ 2A	249.69	272.66	264.42	249.29	219.81
V-THETA 2	236.01	228.05	222.70	213.74	208.96
V-THETA 2A	125.58	120.26	112.78	118.37	123.35
M 2	0.3241	0.3295	0.3240	0.3092	0.2752
M 2A	0.2492	0.2664	0.2568	0.2464	0.2246
TURN	13.812	14.468	14.855	12.801	13.310
UUBAR	0.0950	0.0701	0.1164	0.1153	0.0690
DFAC	0.3576	0.3184	0.3443	0.3326	0.3206
EFFP	5.8890	2.8798	1.5550	1.1501	3.6832
INCID	-6.44	-8.68	-8.99	-8.75	-4.34
DEV	9.76	6.86	6.16	8.46	12.36
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.209	16.826	17.632	17.889	19.348
BETA 2	40.512	38.268	37.955	38.201	42.610
BETA(PR) 1	50.719	51.721	53.216	54.992	56.885
BETA(PR) 2	30.035	32.628	36.053	40.772	48.459
V 1	272.59	275.76	274.15	270.55	263.74
V 2	363.32	368.21	362.09	345.62	308.66
VZ 1	261.75	263.95	261.27	257.47	248.85
VZ 2	276.22	289.09	285.50	271.60	227.17
V-THETA 1	76.09	79.82	83.04	83.10	87.38
V-THETA 2	236.01	228.05	222.70	213.74	208.96
V(PR) 1	413.4	426.1	436.3	448.8	455.5
V(PR) 2	319.1	343.3	353.1	358.6	342.6
VTHETA PR1	-320.0	-334.5	-349.5	-367.6	-381.5
VTHETA PR2	-159.7	-185.1	-207.8	-234.2	-256.4
U 1	396.10	414.30	432.49	450.69	468.89
U 2	395.71	413.12	430.54	447.95	465.36
M 1	0.2456	0.2485	0.2471	0.2438	0.2376
M 2	0.3241	0.3295	0.3240	0.3092	0.2752
M(PR) 1	0.3726	0.3840	0.3932	0.4044	0.4103
M(PR) 2	0.2846	0.3072	0.3160	0.3208	0.3054
TURN(PR)	20.684	19.093	17.163	14.220	8.426
UUBAR	0.0608	0.0048	-0.0027	0.0181	0.0857
DFAC	0.3847	0.3423	0.3336	0.3374	0.3795
EFFP	0.6401	0.8370	0.8568	0.8549	0.6446
EFF	0.6368	0.8354	0.8555	0.8536	0.6418
INCID	-1.44	-1.89	-1.81	-1.05	0.10
DEV	13.885	9.028	6.813	6.862	9.809
LOSS PARA	0.02106	0.00168	0.00095	0.00317	0.02655

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 50.11

CORRECTED WEIGHT FLOW = 58.36

CORRECTED ROTOR SPEED = 2689.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.240	16.905	17.761	17.965	19.070
V 0	242.36	242.36	242.36	242.36	242.36
V 1	285.27	288.29	285.29	282.25	273.56
VZ 0	242.36	242.36	242.36	242.36	242.36
VZ 1	273.89	275.84	271.69	268.49	258.54
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	79.78	83.83	87.03	87.06	89.38
M 0	0.2181	0.2181	0.2181	0.2181	0.2181
M 1	0.2572	0.2600	0.2572	0.2545	0.2465
TURN	-16.24	-16.90	-17.76	-17.97	-19.07
UUBAR	0.0466	-0.0054	0.0030	0.0113	0.0737
DFAC	-0.021	-0.012	0.007	0.022	0.065
EFFP	0.8942	1.0128	0.9925	0.9700	0.7916
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.800	7.065	7.079	8.635	9.810

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	37.856	36.673	35.939	36.255	40.377
BETA 2A	26.100	23.600	22.600	24.600	29.300
V 2	372.74	374.01	366.82	347.26	315.90
V 2A	297.65	313.42	308.59	285.79	263.37
VZ 2	294.30	299.98	296.99	280.02	240.65
VZ 2A	267.30	287.21	284.89	259.85	229.68
V-THETA 2	228.74	223.38	215.30	205.36	204.64
V-THETA 2A	130.95	125.48	118.59	118.97	128.89
M 2	0.3331	0.3350	0.3286	0.3109	0.2822
M 2A	0.2656	0.2806	0.2762	0.2555	0.2350
TURN	11.756	13.073	13.339	11.655	11.077
UUBAR	0.1129	0.0706	0.0812	0.1155	0.0839
DFAC	0.3110	0.2763	0.2789	0.2952	0.2851
EFFP	1.6366	8.3591	3.1172	1.2825	1.5201
INCID	-9.09	-10.28	-11.01	-10.69	-6.57
DEV	9.16	6.66	5.66	7.66	12.36
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.240	16.905	17.761	17.965	19.070
BETA 2	37.856	36.673	35.939	36.255	40.377
BETA(PR) 1	48.967	50.005	51.675	53.422	55.601
BETA(PR) 2	29.330	32.085	35.709	40.689	47.084
V 1	285.27	288.29	285.29	282.25	273.56
V 2	372.74	374.01	366.82	347.26	315.90
VZ 1	273.89	275.84	271.69	268.49	258.54
VZ 2	294.30	299.98	296.99	280.02	240.65
V-THETA 1	79.78	83.83	87.03	87.06	89.38
V-THETA 2	228.74	223.38	215.30	205.36	204.64
V(PR) 1	417.2	429.2	438.1	450.5	457.6
V(PR) 2	337.6	354.1	365.8	369.3	353.4
VTHETA PR1	-314.7	-328.8	-343.7	-361.8	-377.6
VTHETA PR2	-165.4	-188.1	-213.5	-240.8	-258.8
U 1	394.49	412.61	430.73	448.86	466.98
U 2	394.10	411.44	428.78	446.12	463.46
M 1	0.2572	0.2600	0.2572	0.2545	0.2465
M 2	0.3331	0.3350	0.3286	0.3109	0.2822
M(PR) 1	0.3762	0.3870	0.3950	0.4062	0.4124
M(PR) 2	0.3017	0.3171	0.3276	0.3307	0.3158
TURN(PR)	19.637	17.920	15.965	12.733	8.517
UUBAR	0.0296	0.0035	-0.0158	0.0142	0.0905
DFAC	0.3353	0.3133	0.2961	0.3039	0.3522
EFFP	0.6734	0.8158	0.8551	0.8370	0.6951
EFF	0.6705	0.8141	0.8537	0.8356	0.6929
INCID	-3.19	-3.61	-3.36	-2.62	-1.19
DEV	13.180	8.485	6.469	6.779	8.434
LOSS PARA	0.01042	0.00123	0.00558	0.00485	0.02875

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 50.97

CORRECTED WEIGHT FLOW = 60.60

CORRECTED ROTOR SPEED = 2735.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.109	17.041	17.631	17.842	19.080
V 0	252.13	252.13	252.13	252.13	252.13
V 1	328.52	312.57	291.63	288.81	278.35
VZ 0	252.13	252.13	252.13	252.13	252.13
VZ 1	315.62	298.85	277.93	274.92	263.05
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	91.15	91.60	88.33	88.49	90.99
M 0	0.2270	0.2270	0.2270	0.2270	0.2270
M 1	0.2969	0.2822	0.2630	0.2604	0.2509
TURN	-16.11	-17.04	-17.63	-17.84	-19.08
UUBAR	0.0403	0.0018	0.0038	-0.0001	0.0654
DFAC	-0.132	-0.054	0.023	0.037	0.086
EFFP	0.9467	0.9967	0.9893	1.0003	0.7741
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.931	6.929	7.209	8.758	9.800

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	35.140	34.326	33.749	33.286	35.068
BETA 2A	24.206	23.000	22.200	24.200	27.500
V 2	373.55	370.14	359.69	338.56	320.34
V 2A	480.88	331.19	324.74	300.72	280.97
VZ 2	305.47	305.67	299.08	283.02	262.19
VZ 2A	438.60	304.86	300.67	274.30	249.22
V-THETA 2	215.01	208.72	199.83	185.81	184.05
V-THETA 2A	197.17	129.41	122.70	123.27	129.74
M 2	0.3347	0.3325	0.3231	0.3037	0.2869
M 2A	0.4341	0.2969	0.2911	0.2692	0.2512
TURN	10.934	11.326	11.549	9.086	7.568
UUBAR	0.0621	0.0340	0.0314	0.0617	0.0903
DFAC	0.2672	0.1988	0.1950	0.1998	0.2072
EFFP	1.0894	0.8370	0.8374	0.7182	0.6211
INCID	-11.81	-12.62	-13.20	-13.66	-11.88
DEV	7.27	6.06	5.26	7.26	10.56
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.109	17.041	17.631	17.842	19.080
BETA 2	35.140	34.326	33.749	33.286	35.068
BETA(PR) 1	44.493	47.669	51.529	53.242	55.586
BETA(PR) 2	31.314	34.459	38.310	43.434	47.621
V 1	328.52	312.57	291.63	288.81	278.35
V 2	373.55	370.14	359.69	338.56	320.34
VZ 1	315.62	298.85	277.93	274.92	263.05
VZ 2	305.47	305.67	299.08	283.02	262.19
V-THETA 1	91.15	91.60	88.33	88.49	90.99
V-THETA 2	215.01	208.72	199.83	185.81	184.05
V(PR) 1	442.5	443.8	446.7	459.4	465.4
V(PR) 2	357.6	370.7	381.2	389.7	389.0
VTHETA PR1	-310.1	-328.1	-349.8	-368.0	-384.0
VTHETA PR2	-185.8	-209.8	-236.3	-267.9	-287.3
U 1	401.23	419.67	438.10	456.54	474.97
U 2	400.84	418.48	436.12	453.75	471.39
M 1	0.2969	0.2822	0.2630	0.2604	0.2509
M 2	0.3347	0.3325	0.3231	0.3037	0.2869
M(PR) 1	0.3998	0.4007	0.4029	0.4143	0.4195
M(PR) 2	0.3204	0.3331	0.3423	0.3496	0.3484
TURN(PR)	13.179	13.210	13.219	9.808	7.965
UUBAR	0.0067	0.0069	0.0265	0.0428	0.0650
DFAC	0.3039	0.2762	0.2583	0.2519	0.2643
EFFP	0.7218	0.9792	0.9748	0.8443	0.7542
EFF	0.7196	0.9790	0.9746	0.8433	0.7527
INCID	-7.67	-5.94	-3.50	-2.80	-1.20
DEV	15.164	10.859	9.070	9.524	8.971
LOSS PARA	0.00228	0.00237	0.00904	0.01401	0.02040

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 69.51

CORRECTED WEIGHT FLOW = 85.62

CORRECTED ROTOR SPEED = 3730.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	15.370	16.792	17.183	16.846	17.900
V 0	366.40	366.40	366.40	366.40	366.40
V 1	437.92	441.49	435.24	429.76	419.46
VZ 0	366.40	366.40	366.40	366.40	366.40
VZ 1	422.26	422.66	415.82	411.31	399.15
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	116.07	127.54	128.58	124.54	128.92
M 0	0.3318	0.3318	0.3318	0.3318	0.3318
M 1	0.3984	0.4018	0.3959	0.3908	0.3811
TURN	-15.37	-16.79	-17.18	-16.85	-17.90
UUBAR	0.0481	0.0027	0.0045	0.0110	0.0592
DFAC	-0.045	-0.027	-0.008	0.004	0.040
EFFP	0.9037	0.9944	0.9897	0.9729	0.8465
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	8.670	7.178	7.657	9.754	10.980

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	32.855	32.882	32.707	31.822	32.201
BETA 2A	24.000	22.300	22.200	23.600	27.000
V 2	557.88	533.20	523.09	492.87	462.94
V 2A	475.38	465.95	458.04	432.29	402.16
VZ 2	468.65	447.77	440.15	418.79	391.73
VZ 2A	434.28	431.10	424.09	396.14	358.33
V-THETA 2	302.66	289.48	282.65	259.88	246.69
V-THETA 2A	193.35	176.81	173.07	173.07	182.58
M 2	0.5028	0.4813	0.4712	0.4446	0.4160
M 2A	0.4253	0.4185	0.4117	0.3882	0.3598
TURN	8.855	10.582	10.507	8.222	5.201
UUBAR	0.1693	0.1347	0.1426	0.1536	0.1808
DFAC	0.2297	0.2184	0.2200	0.2069	0.2004
EFFP	0.4128	0.5278	0.9994	0.3802	0.2846
INCID	-14.09	-14.07	-14.24	-15.13	-14.75
DEV	7.06	5.36	5.26	6.66	10.06
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	15.370	16.792	17.183	16.846	17.900
BETA 2	32.855	32.882	32.707	31.822	32.201
BETA(PR) 1	45.596	46.462	48.434	50.450	52.429
BETA(PR) 2	27.504	32.133	35.342	40.600	45.324
V 1	437.92	441.49	435.24	429.76	419.46
V 2	557.88	533.20	523.09	492.87	462.94
VZ 1	422.26	422.66	415.82	411.31	399.15
VZ 2	468.65	447.77	440.15	418.79	391.73
V-THETA 1	116.07	127.54	128.58	124.54	128.92
V-THETA 2	302.66	289.48	282.65	259.88	246.69
V(PR) 1	603.5	613.6	626.7	646.0	654.6
V(PR) 2	528.4	528.8	539.6	551.6	557.2
VTHETA PR1	-431.1	-444.8	-468.9	-498.1	-518.8
VTHETA PR2	-244.0	-281.2	-312.1	-359.0	-396.2
U 1	547.20	572.35	597.48	622.62	647.77
U 2	546.67	570.72	594.78	618.83	642.89
M 1	0.3984	0.4018	0.3959	0.3908	0.3811
M 2	0.5028	0.4813	0.4712	0.4446	0.4160
M(PR) 1	0.5491	0.5584	0.5701	0.5874	0.5948
M(PR) 2	0.4762	0.4773	0.4861	0.4976	0.5007
TURN(PR)	18.091	14.329	13.092	9.850	7.104
UUBAR	0.0144	0.0328	0.0416	0.0576	0.0619
DFAC	0.2496	0.2508	0.2494	0.2456	0.2394
EFFP	0.8483	0.9201	0.8430	0.9631	0.7640
EFF	0.8459	0.9190	0.8409	0.9626	0.7515
INCID	-6.56	-7.15	-6.60	-5.59	-4.36
DEV	11.354	8.533	6.102	6.690	6.674
LOSS PARA	0.00510	0.01161	0.01477	0.01976	0.02032

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 69.42

CORRECTED WEIGHT FLOW = 60.76

CORRECTED ROTOR SPEED = 3725.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.233	16.966	17.259	17.665	18.214
V 0	252.83	252.83	252.83	252.83	252.83
V 1	303.23	306.84	301.14	306.56	289.77
VZ 0	252.83	252.83	252.83	252.83	252.83
VZ 1	291.14	293.48	287.58	292.10	275.25
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	84.77	89.54	89.35	93.02	90.57
M 0	0.2276	0.2276	0.2276	0.2276	0.2276
M 1	0.2736	0.2769	0.2717	0.2767	0.2613
TURN	-16.23	-16.97	-17.26	-17.66	-18.21
UUBAR	0.0037	-0.0519	-0.0366	-0.0289	0.0210
DFAC	-0.041	-0.032	-0.010	-0.021	0.042
EFFP	0.9918	1.1198	1.0931	1.0637	0.9387
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.807	7.004	7.581	8.935	10.666

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	59.698	51.057	47.599	48.490	57.874
BETA 2A	29.100	27.300	26.700	30.700	35.800
V 2	425.33	444.25	467.60	458.29	435.75
V 2A	254.61	267.78	357.26	340.58	323.12
VZ 2	214.60	279.23	315.31	303.73	231.72
VZ 2A	222.47	237.95	319.17	292.84	262.07
V-THETA 2	367.22	345.52	345.29	343.19	369.03
V-THETA 2A	123.82	122.82	160.52	173.88	189.01
M 2	0.3742	0.3912	0.4132	0.4045	0.3823
M 2A	0.2232	0.2351	0.3152	0.3000	0.2842
TURN	30.598	23.757	20.899	17.790	22.074
UUBAR	0.0737	0.1636	0.0251	0.0835	0.0824
DFAC	0.6401	0.6158	0.4158	0.4322	0.4624
EFFP	2.3196	2.3448	3.9534	2.8507	-1.9801
INCID	12.75	4.11	0.65	1.54	10.92
DEV	12.16	10.36	9.76	13.76	18.86
DIA	33.564	34.992	36.240	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.233	16.966	17.259	17.665	18.214
BETA 2	59.698	51.057	47.599	48.490	57.874
BETA(PR) 1	57.765	58.666	60.453	61.083	63.676
BETA(PR) 2	39.787	38.791	38.263	42.139	49.675
V 1	303.23	306.84	301.14	306.56	289.77
V 2	425.33	444.25	467.60	458.29	435.75
VZ 1	291.14	293.48	287.58	292.10	275.25
VZ 2	214.60	279.23	315.31	303.73	231.72
V-THETA 1	84.77	89.54	89.35	93.02	90.57
V-THETA 2	367.22	345.52	345.29	343.19	369.03
V(PR) 1	545.8	564.4	583.2	604.1	620.7
V(PR) 2	279.3	358.2	401.6	409.6	358.1
VTHETA PR1	-461.7	-482.0	-507.3	-528.8	-556.3
VTHETA PR2	-178.7	-224.4	-248.7	-274.8	-273.0
U 1	546.47	571.58	596.68	621.79	646.90
U 2	545.93	569.96	593.98	618.00	642.02
M 1	0.2736	0.2769	0.2717	0.2767	0.2613
M 2	0.3742	0.3912	0.4132	0.4045	0.3823
M(PR) 1	0.4926	0.5094	0.5262	0.5452	0.5598
M(PR) 2	0.2457	0.3155	0.3549	0.3615	0.3142
TURN(PR)	17.978	19.875	22.190	18.944	14.000
UUBAR	0.2508	0.1139	0.0474	0.0593	0.2149
DFAC	0.6975	0.5575	0.5062	0.5143	0.6400
EFFP	0.5810	0.6302	0.7507	0.7436	0.6326
EFF	0.5732	0.6227	0.7450	0.7377	0.6244
INCID	5.61	5.06	5.42	5.04	6.89
DEV	23.637	15.191	9.023	8.229	11.025
LOSS PARA	0.07709	0.03711	0.01619	0.01983	0.06501

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 68.77

CORRECTED WEIGHT FLOW = 65.06

CORRECTED ROTOR SPEED = 3690.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.595	17.225	17.651	18.074	18.735
V 0	271.73	271.73	271.73	271.73	271.73
V 1	326.12	325.60	324.26	316.98	307.58
VZ 0	271.73	271.73	271.73	271.73	271.73
VZ 1	312.54	310.99	308.99	301.34	291.29
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	93.14	96.42	98.32	98.34	98.79
M 0	0.2449	0.2449	0.2449	0.2449	0.2449
M 1	0.2946	0.2942	0.2929	0.2863	0.2776
TURN	-16.60	-17.23	-17.65	-18.07	-18.73
UUBAR	0.0836	0.0353	0.0387	0.0420	0.0886
DFAC	-0.038	-0.017	-0.007	0.021	0.059
EFFP	0.8441	0.9269	0.9186	0.8983	0.7653
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.445	6.745	7.189	8.526	10.145

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	52.922	45.631	44.639	45.772	53.319
BETA 2A	28.800	26.200	25.700	28.400	32.400
V 2	451.05	464.50	468.80	457.25	437.72
V 2A	284.57	325.05	354.66	340.44	306.51
VZ 2	271.94	324.82	333.57	318.94	261.48
VZ 3	249.37	291.66	319.58	299.46	258.80
V-THETA 2	359.86	332.05	329.40	327.65	351.04
V-THETA 2A	137.09	143.51	153.80	161.92	164.24
M 2	0.3980	0.4124	0.4165	0.4054	0.3858
M 2A	0.2505	0.2872	0.3141	0.3007	0.2698
TURN	24.122	19.431	18.939	17.372	20.919
UUBAR	0.1030	0.0840	0.0421	0.0787	0.1459
DFAC	0.5751	0.4772	0.4140	0.4274	0.5102
EFFP	3.2674	1.5148	2.2152	1.6318	4.5666
INCID	5.97	-1.32	-2.31	-1.18	6.37
DEV	11.86	9.26	8.76	11.46	15.46
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.595	17.225	17.651	18.074	18.735
BETA 2	52.922	45.631	44.639	45.772	53.319
BETA(PR) 1	55.111	56.497	57.909	59.793	61.746
BETA(PR) 2	33.640	35.601	37.828	41.738	47.460
V 1	326.12	325.60	324.26	316.98	307.58
V 2	451.05	464.50	468.80	457.25	437.72
VZ 1	312.54	310.99	308.99	301.34	291.29
VZ 2	271.94	324.82	333.57	318.94	261.48
V-THETA 1	93.14	96.42	98.32	98.34	98.79
V-THETA 2	359.86	332.05	329.40	327.65	351.04
V(PR) 1	546.4	563.4	581.6	598.9	615.3
V(PR) 2	326.6	399.5	422.3	427.4	386.7
VTHETA PR1	-448.2	-469.8	-492.8	-517.6	-542.0
VTHETA PR2	-180.9	-232.6	-259.0	-284.5	-285.0
U 1	541.34	566.21	591.07	615.95	640.82
U 2	540.81	564.60	588.40	612.20	635.99
M 1	0.2946	0.2942	0.2929	0.2863	0.2776
M 2	0.3980	0.4124	0.4165	0.4054	0.3858
M(PR) 1	0.4937	0.5090	0.5254	0.5409	0.5554
M(PR) 2	0.2882	0.3546	0.3752	0.3789	0.3408
TURN(PR)	21.471	20.896	20.082	18.055	14.287
UUBAR	0.1718	0.0288	0.0058	0.0411	0.1717
DFAC	0.5995	0.4684	0.4506	0.4646	0.5702
EFFP	0.6110	0.7901	0.8459	0.8009	0.6703
EFF	0.6037	0.7858	0.8426	0.7967	0.6635
INCID	2.95	2.89	2.88	3.75	4.96
DEV	17.490	12.001	8.588	7.828	8.810
LOSS PARA	0.05721	0.00979	0.00197	0.01383	0.05425

Table B-2. Blade Element Performance (Continued)

PERCENT DESIGN SPEED = 68.21

CORRECTED WEIGHT FLOW = 70.98

CORRECTED ROTOR SPEED = 3660.00

INLET GUIDE VANE 2

STATION 0 - STATION 1

PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801
BETA 0	0.000	0.000	0.000	0.000	0.000
BETA 1	16.517	17.256	18.088	17.968	19.337
V 0	298.21	298.21	298.21	298.21	298.21
V 1	351.07	356.30	352.85	346.54	337.25
VZ 0	298.21	298.21	298.21	298.21	298.21
VZ 1	336.59	340.26	335.42	329.64	318.22
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00
V-THETA 1	99.81	105.69	109.55	106.90	111.67
M 0	0.2690	0.2690	0.2690	0.2690	0.2690
M 1	0.3176	0.3225	0.3193	0.3134	0.3049
TURN	-16.52	-17.26	-18.09	-17.97	-19.34
UUBAR	0.0512	-0.0098	0.0068	0.0138	0.0582
DFAC	-0.019	-0.013	0.006	0.024	0.066
EFFP	0.8863	1.0226	0.9837	0.9634	0.8321
INCID	0.0000	0.0000	0.0000	0.0000	0.0000
DEV	7.523	6.714	6.752	8.632	9.543

STATOR 1

STATION 2 - STATION 2A

PCT SPAN	90	70	50	30	10
BETA 2	46.562	41.976	41.513	42.343	47.890
BETA 2A	28.500	25.100	24.100	26.800	32.100
V 2	461.54	486.08	479.89	459.96	439.18
V 2A	315.36	367.41	370.36	358.32	322.34
VZ 2	317.34	361.36	359.34	339.97	294.50
VZ 2A	277.15	332.72	338.08	319.83	273.06
V-THETA 2	335.14	325.10	318.06	309.81	325.81
V-THETA 2A	150.48	155.86	151.23	161.56	171.29
M 2	0.4091	0.4337	0.4284	0.4101	0.3896
M 2A	0.2785	0.3266	0.3293	0.3182	0.2852
TURN	18.062	16.876	17.413	15.543	15.790
UUBAR	0.0922	0.0647	0.0622	0.0522	0.1204
DFAC	0.4837	0.3960	0.3865	0.3740	0.4398
EFFP	1.9171	1.8271	1.5214	1.4055	1.9930
INCID	-0.39	-4.97	-5.44	-4.61	0.94
DEV	11.56	8.16	7.16	9.86	15.16
DIA	33.564	34.992	36.420	37.848	39.276

SLOTTED ROTOR 2

STATION 1 - STATION 2

PCT SPAN	90	70	50	30	10
DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	16.517	17.256	18.088	17.968	19.337
BETA 2	46.562	41.976	41.513	42.343	47.890
BETA(PR) 1	52.404	53.265	54.870	56.815	58.727
BETA(PR) 2	32.385	33.027	36.464	41.180	46.004
V 1	351.07	356.30	352.85	346.54	337.25
V 2	461.54	486.08	479.89	459.96	439.18
VZ 1	336.59	340.26	335.42	329.64	318.22
VZ 2	317.34	361.36	359.34	339.97	294.50
V-THETA 1	99.81	105.69	109.55	106.90	111.67
V-THETA 2	335.14	325.10	318.06	309.81	325.81
V(PR) 1	551.7	568.9	582.9	602.3	613.0
V(PR) 2	375.8	431.0	446.8	451.7	424.0
VTHETA PR1	-437.1	-455.9	-476.7	-504.0	-523.9
VTHETA PR2	-201.3	-234.9	-265.6	-297.4	-305.0
U 1	536.94	561.61	586.27	610.94	635.61
U 2	536.41	560.01	583.62	607.22	630.82
M 1	0.3176	0.3225	0.3193	0.3134	0.3049
M 2	0.4091	0.4337	0.4284	0.4101	0.3896
M(PR) 1	0.4991	0.5149	0.5274	0.5447	0.5542
M(PR) 2	0.3331	0.3845	0.3989	0.4027	0.3761
TURN(PR)	20.019	20.238	18.406	15.635	12.723
UUBAR	0.1200	0.0036	-0.0141	0.0292	0.1215
DFAC	0.4913	0.4061	0.3928	0.4073	0.4786
EFFP	0.6364	0.8613	0.9213	0.8912	0.7386
EFF	0.6302	0.8586	0.9197	0.8891	0.7338
INCID	0.24	-0.35	-0.16	0.78	1.94
DEV	16.235	9.427	7.224	7.270	7.354
LOSS PARA	0.04052	0.00126	0.00494	0.00990	0.03940

APPENDIX C
REFERENCES

1. NASA CR-54544, PWA FR-1713, "Single Stage Experimental Evaluation of Slotted Rotor and Stator Blading, Part I Analysis and Design," July 1966.

2. NASA CR-54545, PWA FR-1669, "Single Stage Experimental Evaluation of Slotted Rotor and Stator Blading, Part II Annular Cascade Investigation of Slot Location and Geometry," September 1966.

3. NASA SP-36, "Aerodynamic Design of Axial-Flow Compressors," 1965.

4. NASA CR-54546, PWA FR-2110, "Single Stage Experimental Evaluation of Slotted Rotor Stator Blading, Part III Data and Performance for Slotted Rotor 1," 1966.