

## N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM  
MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT  
CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED  
IN THE INTEREST OF MAKING AVAILABLE AS MUCH  
INFORMATION AS POSSIBLE

NASA CR-54567  
AUGUST 1968  
Allison EDR-5861

32



# Single-Stage Experimental Evaluation of Boundary Layer Blowing Techniques for High Lift Stator Blades

IV - Data and Performance of Double-Slotted  
0.75 Hub Diffusion Factor Stator

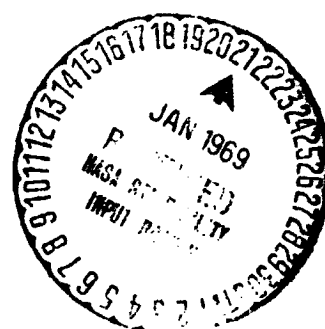
Prepared for  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Contract NAS3-7619

FACILITY FORM 602

N 09-74856  
(ACCESSION NUMBER)  
130  
(PAGES)  
NPSP-001-54567  
(NASA CR OR TMX OR AD NUMBER)  
(THRU)  
1  
(CODE)  
01  
(CATEGORY)

Allison Division • General Motors  
Indianapolis, Indiana



#### NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the National Aeronautics and Space Administration (NASA), nor any person acting on behalf of NASA:

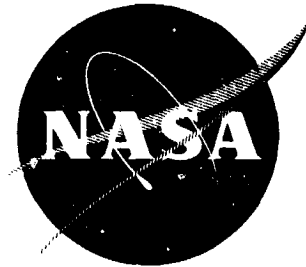
- A.) Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B.) Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method or process disclosed in this report.

As used above, "person acting on behalf of NASA" includes any employee or contractor of NASA, or employee of such contractor, to the extent that such employee or contractor of NASA, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with NASA, or his employment with such contractor.

Requests for copies of this report should be referred to

National Aeronautics and Space Administration  
Office of Scientific and Technical Information  
Attention: AFSS-A  
Washington, D.C. 20546

NASA CR-54567  
AUGUST 1968  
Allison EDR-5861



**Single-Stage Experimental Evaluation of  
Boundary Layer Blowing Techniques  
for High Lift Stator Blades**

**IV - Data and Performance of Double-Slotted  
0.75 Hub Diffusion Factor Stator**

by

**R. H. Carmody and G. Seren**

Prepared for  
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

**Contract NAS3-7619**

Technical Management  
**NASA-Lewis Research Center**  
Cleveland, Ohio

Lewis Project Manager: William L. Beede  
Lewis Research Advisor: L. Joseph Herrig

**Allison Division • General Motors**

**Indianapolis, Indiana**

PRECEDING PAGE BLANK NOT FILMED.

## ABSTRACT

The test described in this report is part of an overall program to establish experimentally the extent to which it is feasible to increase compressor stator loading and stall-free flow margin by employing suction surface boundary layer blowing techniques. A secondary objective was to obtain blade element data for design use.

In this test, overall and blade element performance of a row of 0.75 hub diffusion factor double slotted stators with self-energized blowing boundary layer control was measured. In addition the vane static pressure distribution was obtained at three radial locations. Overall and blade element performance was also obtained for the rotor and compared to data previously obtained for this rotor without stator vanes. Preliminary discussion of test results and correlations of data are presented.

PRECEDING PAGE BLANK NOT FILMED.

## TABLE OF CONTENTS

| <u>Title</u>                                                                | <u>Page</u> |
|-----------------------------------------------------------------------------|-------------|
| Summary . . . . .                                                           | 1           |
| Introduction . . . . .                                                      | 3           |
| Symbols . . . . .                                                           | 4           |
| Apparatus and Procedures . . . . .                                          | 6           |
| Test Facility . . . . .                                                     | 6           |
| Compressor Test Rig . . . . .                                               | 6           |
| Blading . . . . .                                                           | 6           |
| Instrumentation . . . . .                                                   | 7           |
| Determination of Annulus Wall Bleed Flow for Stator Vane<br>Tests . . . . . | 8           |
| Hysteresis Test with Slotted 0.75 Hub Diffusion Factor Stator . .           | 9           |
| Overall and Blade Element Performance Data . . . . .                        | 9           |
| Data Reduction . . . . .                                                    | 10          |
| Presentation of Results . . . . .                                           | 12          |
| Overall Performance of Flow Generation Rotor and Stage . . . .              | 12          |
| Blade Element Performance . . . . .                                         | 12          |
| Discussion of Results . . . . .                                             | 14          |
| Overall Performance . . . . .                                               | 14          |
| Flow Generation Rotor . . . . .                                             | 14          |
| Double-Slotted Stator Stage . . . . .                                       | 15          |
| Annulus Wall Bleed for Stator Test . . . . .                                | 16          |
| Hysteresis and Rotating Stall Results—Slotted Stator Stage .                | 16          |
| Blade Element Performance . . . . .                                         | 17          |
| Rotor . . . . .                                                             | 17          |
| Stator . . . . .                                                            | 18          |
| Stator Static Pressure Distributions . . . . .                              | 19          |
| Stator Slot Blowing Flow . . . . .                                          | 20          |
| Concluding Remarks . . . . .                                                | 21          |
| References . . . . .                                                        | 22          |
| Appendix: Performance Equations . . . . .                                   | 23          |

## LIST OF ILLUSTRATIONS

| <u>Figure</u> | <u>Title</u>                                                                                                 | <u>Page</u> |
|---------------|--------------------------------------------------------------------------------------------------------------|-------------|
| 1             | Compressor test facility . . . . .                                                                           | 27          |
| 2             | Layout of compressor test rig . . . . .                                                                      | 28          |
| 3             | Double slotted 0.75 hub diffusion factor stator slot<br>configuration . . . . .                              | 29          |
| 4             | Test rig flow path . . . . .                                                                                 | 30          |
| 5             | Circumferential location of instrumentation viewed<br>downstream . . . . .                                   | 31          |
| 6             | Radial location of streamlines for instrumentation<br>positions . . . . .                                    | 32          |
| 7             | Schematics of survey instrumentation . . . . .                                                               | 33-34       |
| 8             | Slotted stator vane static pressure tap locations at 10,<br>50 and 90% streamlines. . . . .                  | 35          |
| 9             | Flow generation rotor overall performance in stage<br>test-pressure ratio. . . . .                           | 36          |
| 10            | Flow generation rotor overall performance in stage<br>test-adiabatic efficiency . . . . .                    | 37          |
| 11            | Stage overall performance-pressure ratio . . . . .                                                           | 38          |
| 12            | Stage overall performance-adiabatic efficiency . . . . .                                                     | 39          |
| 13            | Rotor blade element performance-stage test . . . . .                                                         | 40-44       |
| 14            | Radial variation of rotor blade element performance . . . . .                                                | 45          |
| 15            | Rotor out radial mass flux distribution at design speed . . . . .                                            | 46          |
| 16            | Rotor loss parameter versus diffusion factor . . . . .                                                       | 47          |
| 17            | Slotted stator blade element performance . . . . .                                                           | 48-52       |
| 18            | Variation of wall bleed flows with stage pressure ratio . . . . .                                            | 53          |
| 19            | Stator slot blowing flow versus stage pressure ratio . . . . .                                               | 54          |
| 20            | Stator slot blowing flow spanwise distribution . . . . .                                                     | 55-56       |
| 21            | Radial variation of 0.75 $D_f$ slotted stator blade element<br>performance . . . . .                         | 57          |
| 22            | Stator loss parameter versus diffusion factor . . . . .                                                      | 58          |
| 23            | Slotted stator static pressure distribution at 60% speed. . . . .                                            | 59-63       |
| 24            | Slotted stator static pressure distribution at 80% speed. . . . .                                            | 64-68       |
| 25            | Slotted stator static pressure distribution at 90% speed. . . . .                                            | 69-73       |
| 26            | Slotted stator static pressure distribution at 100% speed . . . . .                                          | 74-79       |
| 27            | Slotted stator static pressure distribution at 110% speed . . . . .                                          | 80-86       |
| 28            | Double slotted stator wake surveys. . . . .                                                                  | 87-92       |
| 29            | Variation in stator wake at 10, 50, and 90% streamlines<br>from tip during wall bleed optimization . . . . . | 93          |

# LIST OF TABLES

| <u>Table</u> | <u>Title</u>                                                                                                     | <u>Page</u> |
|--------------|------------------------------------------------------------------------------------------------------------------|-------------|
| I            | Blade and vane geometry summary . . . . .                                                                        | 94          |
| II           | Rotor incidence at minimum and maximum flow for flow<br>generation rotor and slotted stator stage tests. . . . . | 95          |
| III          | Rotating stall results for double slotted stator stage test . .                                                  | 96          |
| IV           | Blade element performance—slotted stator stage . . . . .                                                         | 97-124      |

# SINGLE-STAGE EXPERIMENTAL EVALUATION OF BOUNDARY LAYER BLOWING TECHNIQUES FOR HIGH LIFT STATOR BLADES

## IV—DATA AND PERFORMANCE OF DOUBLE-SLOTTED 0.75 HUB DIFFUSION FACTOR STATOR

By

R. H. Carmody and G. Seren  
Allison Division, GMC

### SUMMARY

To establish the feasibility of increasing compressor stator loading and stall-free flow margin by the use of a boundary layer blowing technique and to determine the extent to which such concepts may be employed, an investigation was made of a single-stage compressor provided with a double-slotted stator row. The stator was designed with NACA 65-series airfoils and a hub diffusion factor of 0.75.

The two blowing slots were designed to re-energize the boundary layer air on the suction surface with the slots located at 40 and 70% chord. For this purpose, the air is inducted into the vane core through a full-span slot near the leading edge of the vane pressure surface and is discharged through the two full-span blowing slots. The front slot is located upstream of the point on the suction surface where flow separation is estimated to take place on the unslotted vane, and the rear slot is located upstream of the point, on the suction surface, where flow separation is estimated to take place if only the front slot were provided. The orientation of the blowing slots relative to the suction surface is as nearly tangential as mechanically feasible. To ensure an attached stator end wall boundary layer and to minimize secondary flows, annulus wall bleeding was employed during all stator testing from a point forward of to a point behind the stator. The flow into this stator row was generated by a state-of-the-art flow generation rotor with prewhirl established by a row of inlet guide vanes.

Overall performance of the rotor and inlet guide vanes was evaluated separately for this stage test. Compared with rotor design values of 1.37 pressure ratio, 88.2 lb/sec inlet flow, and 88.8% overall adiabatic efficiency at design pressure ratio, the corrected inlet flow was 94.9 lb/sec with an adiabatic efficiency of 92.2%. In general, this performance agreed well with the flow generation rotor performance without stators reported in Reference 2. Overall performance for the slotted stator stage indicated a pressure ratio of 1.33 at the 94.9 lb/sec airflow corresponding to the flow generation rotor design pressure ratio. Stage design values are a 1.35 pressure ratio at 88.2 lb/sec flow rate.

Blade element performance was measured for the rotor blade and stator vane row. Experimental values are presented in terms of diffusion factor, deviation angle and loss coefficient as a function of incidence for various annulus heights with rotative speed as a parameter. Minimum loss values are determined and compared with the NACA loss parameter versus diffusion factor correlation curves. Radial variations of the experimental rotor and stator blade element performance near their design inlet flow conditions are also compared with the design values.

A hysteresis test with acquisition of rotating stall characteristics was also obtained at 60% corrected speed for the slotted stator stage. Recorded data did not indicate a definite hysteresis effect for the slotted stator stage although differences, in terms of flow rate and pressure ratio, were observed between points going into and recovering from stall. Onset of stall was found to be abrupt at speeds up to and including 90% with stall cells first appearing in the hub region. However, at higher speeds, 100 and 110% of design, stall occurred gradually with intermittent stall zones appearing at the hub and tip with decreasing airflow. The stresses experienced at these points exceeded the steady state limit and approached the transient limit.

The double-slotted blowing 0.75 diffusion factor stator performance apparently met the design flow turning values over the entire vane span with acceptable total pressure losses at these high loadings. Blade element performance loss correlations for these stators at the tip were above an extension of the existing NACA correlations. For all other radial positions they agreed with or were less than the NACA correlations.

Surface pressure distributions and wake surveys were obtained for the double-slotted stator.

Suction surface pressure distributions indicated separation of the boundary layer occurring at 65 to 85% chord throughout the range of the test. However, the existence of flow separation was not evident in the wake patterns or deviation angle.

The experimental flow rates through the blowing slots at the suction surface of the slotted stator, at design speed, were found to be approximately 107% of the design values at the first slot and approximately 142% of the design value at the second slot.

## INTRODUCTION

Advanced airbreathing propulsion systems require lightweight compact compressors capable of high levels of performance. These compressors should have a broad range of operation and a large stall margin. High reliability and relative insensitivity to inlet flow distortion are generally required of all compressors. In meeting the more demanding compressor design requirements, compromises must be made that are strongly dependant on the particular application. New applications are steadily increasing the range of requirements which the compressor must meet.

Compressor technology has been advanced continuously by extending, among other parameters, the usable rotational speeds; increasing stage loadings or diffusion factors; and reducing stage length through the use of high blade aspect ratios. Whereas further advancements can be made through optimizations and improved combinations of these parameters, severe aerodynamic limitations such as increasing losses and decreased stall margin, are being encountered. Significant advancements in compressor technology require the application of advanced concepts in terms of improved blading for high flow Mach numbers and application of high lift devices to extend the stall-free flow range for compressor rotors and stators. Advanced concepts in these areas may result in sizable reductions in the number of compressor stages and improved compressor performance.

Airfoils, designed to provide high lift, experience steep blade surface pressure gradients which become steeper as the angle of incidence is increased. As a result, the suction surface boundary layer separates and high total pressure losses and a decrease in stall-free flow margin result. To some extent, however, separation of the suction surface boundary layer can be delayed by energizing it with high energy air. In view of these considerations, an experimental single-stage compressor rig was designed and constructed to test highly loaded stators using internal blowing concepts to reduce losses and to improve stall-free flow margin.

The objectives of this program are to establish experimentally the feasibility of increasing blade loading and stall-free flow margin by boundary layer blowing and the extent to which it may be employed. A secondary objective is to obtain blade element data for design use. The stator designs were to be representative of those for middle and latter stages of highly loaded axial-flow compressors. Stator inlet flow is generated by a state-of-the-art flow generation rotor. This report presents the test results for the double-slotted 0.75 hub diffusion factor stator. Previous test results on the flow generation rotor performance, the mid-span suction surface pressure distribution for an unslotted 0.75 hub diffusion factor stator, and the single-slotted 0.75 hub diffusion factor stator performance are presented in Reference 2. The test results of a single-slotted 0.65 hub diffuser factor stator, also employing blowing techniques, are presented in Reference 1.

## SYMBOLS

|                |                                                                                    |
|----------------|------------------------------------------------------------------------------------|
| $A_a$          | Annulus area, ft <sup>2</sup>                                                      |
| $c$            | Airfoil chord, in.                                                                 |
| $C_W$          | Flow coefficient                                                                   |
| $D_f$          | Diffusion factor                                                                   |
| $g$            | Gravitational constant, 32.2 ft-lb <sub>m</sub> /lb <sub>f</sub> -sec <sup>2</sup> |
| $H$            | Hysteresis loop data point                                                         |
| $h$            | Height of blowing slot, in.                                                        |
| $i$            | Incidence angle based on mean camber line, degrees                                 |
| $L$            | Net slot length, in.                                                               |
| $M$            | Mach number                                                                        |
| $\dot{m}$      | Blowing mass flow rate in blowing slot per blade, lb <sub>m</sub> /sec             |
| $n$            | Number of blades per row                                                           |
| $N$            | Rotational speed, rpm                                                              |
| $P_t$          | Total pressure, psia                                                               |
| $p$            | Static pressure, psia                                                              |
| $q$            | Dynamic pressure, psia                                                             |
| $R$            | Radius, in.                                                                        |
| $\mathcal{R}$  | Gas constant, 53.35 lb <sub>f</sub> -ft/lb <sub>m</sub> -°R                        |
| $R_c$          | Pressure ratio                                                                     |
| $S$            | Airfoil surface pressure coefficient, (Equation A13)                               |
| $T_t$          | Total temperature, °R                                                              |
| $t$            | Static temperature, °R                                                             |
| $t/c$          | Thickness-to-chord ratio                                                           |
| $V$            | Air velocity, ft/sec                                                               |
| $W_a$          | Compressor airflow, lb <sub>m</sub> /sec                                           |
| $W_{BL}$       | Annulus wall bleed flow, lb <sub>m</sub> /sec                                      |
| $x$            | Distance from blade leading edge, in.                                              |
| Greek          |                                                                                    |
| $\beta$        | Air angle measured from axial direction, degrees                                   |
| $\gamma$       | Ratio of specific heats                                                            |
| $\gamma^\circ$ | Blade chord angle, degrees                                                         |
| $\delta$       | Ratio of total pressure to standard sea level pressure of 14.7 psia                |
| $\delta^\circ$ | Deviation angle, degrees                                                           |
| $\Delta$       | Incremental value                                                                  |

|                                            |                                                                         |
|--------------------------------------------|-------------------------------------------------------------------------|
| $\eta$                                     | Efficiency                                                              |
| $\theta$                                   | Ratio of total temperature to standard sea level temperature of 518.6°R |
| $\kappa$                                   | Blade metal angle measured from axial direction, degrees                |
| $\rho$                                     | Density, lb <sub>m</sub> /ft <sup>3</sup>                               |
| $\psi$                                     | Slot angle with respect to chord                                        |
| $\sigma$                                   | Blade row solidity                                                      |
| $\phi$                                     | Camber angle, degrees                                                   |
| $\omega$                                   | Angular velocity of rotor, radians/sec                                  |
| $\bar{\omega}$                             | Total pressure loss coefficient                                         |
| $\frac{\bar{\omega} \cos \beta}{2 \sigma}$ | Loss parameter                                                          |

#### Subscripts

|          |                            |
|----------|----------------------------|
| 0        | Guide vane inlet           |
| 1        | Rotor inlet                |
| 2        | Stator inlet or rotor exit |
| 3        | Stator exit                |
| $\theta$ | Tangential direction       |
| ma       | Mass averaged              |
| ad       | Adiabatic                  |
| m        | Mean or 50% streamline     |
| z        | Axial direction            |

#### Superscripts

|   |                                |
|---|--------------------------------|
| ' | Relative value, rotor property |
|---|--------------------------------|

## APPARATUS AND PROCEDURES

### TEST FACILITY

A general arrangement of the test facility is shown in Figure 1. Air enters the test compressor after passing through the test facility filter house, an inlet duct, plenum, and bellmouth and is exhausted to the atmosphere through a diffuser. Provisions exist for maintaining compressor inlet pressures above or below atmospheric if necessary.

Two power units can be used simultaneously to drive the test compressor. One is a T56 power turbine with combustors which burn fuel mixed with high pressure air from test facility compressors; the other is a complete T56 power section. The two units are coupled by a primary gearbox whose output shaft drives a secondary gearbox which in turn drives the test compressor. Control of the test compressor speed is effected by throttling the turbine air supply with a hydraulically operated valve and by independent fuel controls for each unit.

### COMPRESSOR TEST RIG

The mechanical arrangement of the test compressor is shown in Figure 2. It consists of a cylindrical inlet section, the test compressor section, and an exhaust diffuser. The single-stage rotor is supported on two bearings whose housings are linked by a vertically split compressor case. The compressor case houses the inlet guide vanes, the rotor tip abradable coating, the stator vanes, and the case and hub bleed manifolds. The design of the rig allows the rapid exchange of inlet guide vanes, if necessary, without dismantling the remainder of the compressor, and the exchange of stator vanes without disassembly of the entire test rig.

Airflow rate and pressure ratio are varied by throttle plates located in the exhaust diffuser. The throttles are linked by a ring and operated by a common actuator.

Provision is made in the rig for bleeding the wall boundary layers at stator tip and hub. This is accomplished by fabricating the stator flow passage walls from perforated sheet metal. Manifolds behind the perforated metal surfaces are connected by multiple tubes to separate vacuum headers for tip and hub wall bleeds.

### BLADING

The design of the stator vanes, rotor blades and design inlet guide vanes is described in detail in Reference 3. Selected types of airfoil sections are:

(1) 63-006 series for the inlet guide vanes, (2) double-circular arc for the rotor blades, and (3) 65-series thickness distribution with circular arc meanline for the stator vanes. For convenience however, the principal geometric details of these components are repeated in Table I. Only the design inlet guide vanes (Ref 3) were used in this test. Basic details of the slot configuration of the double slotted 0.75 diffusion factor stator are shown in Figure 3.

## INSTRUMENTATION

Instrumentation was provided to obtain blade element performance for the rotor and stator row and to measure overall performance. The locations of instrumentation planes are shown in Figure 4. Figure 5 shows, schematically, the circumferential location of the instruments installed at each plane. The radial element locations at each plane were selected along streamlines passing through the 10, 30, 50, 70, and 90% annulus height stations from the tip at the stator inlet measurement plane. The streamline locations are shown in Figure 6. Instrumentation was distributed so as to minimize area blockages and prevent immersion in upstream instrument wakes. Duplicate instrumentation was distributed so as to average out any inlet guide vane effects. Dimensional sketches of the probes are shown in Figure 7.

### Compressor Inlet Conditions

Weight flow was measured with an ASME thin plate orifice located in each branch of the triple inlet header. Six total pressure probes and two 6-element temperature rakes were located in the cylindrical section approximately three feet upstream of the test compressor inlet for measurement of inlet total pressure and temperature (see Figure 5a). Inlet static pressure was measured at the same axial station by two static taps in the inlet wall.

### Rotor Inlet—Station 1

Four approximately equally spaced static pressure taps were located on both the inner and outer walls as shown in Figure 5b. An 8-degree wedge static pressure traverse probe was also installed to measure the radial static pressure distribution. Three radial traverse combination total pressure and yaw angle probes were used to measure the distribution of these parameters across the annulus. Total temperature was obtained from plenum thermocouples.

### Stator Inlet or Rotor Exit—Station 2

Four approximately equally spaced static pressure taps were located on both the inner and outer walls; the radial distribution of static pressure was measured by two 8-degree wedge static pressure traverse probes as shown in Figure 5c. Three radial traverse combination probes were installed at this station to measure the radial distribution of total pressure, total temperature, and flow angle.

### Stator Exit—Station 3

Four approximately equally spaced static pressure taps were located on both inner and outer walls; two 8-degree wedge traverse probes were installed for measurement of the radial static pressure distribution as shown in Figure 5d. One traverse combination total pressure, total temperature, and yaw probe was installed primarily to measure flow angle. A 16-element total pressure circumferential rake, shown in Figure 7d, was installed at this station to measure discharge total pressure and stator vane wake. This rake spanned 1.08 vane spaces at the 10% streamline and 1.43 vane spaces at the 90% streamline. Total temperature was measured by four 5-element radial rakes. Inner and outer wall boundary layers were surveyed by fixed 5-element total pressure probes. All taps, probes, and radial rakes were located on extensions of mid-channel streamlines.

### Special Instrumentation

In addition to the instrumentation already enumerated for blade element and overall performance, the following special instrumentation was installed. At the rotor exit, two fixed and one traverse hot wire anemometers were installed to signal the onset of compressor stall and to provide rotating stall data. Shaft whip was monitored by means of a whip pickup, mounted in the plane of the rotor blades; strain gages were mounted on eight rotor blades to monitor blade stresses.

The 10, 50, and 90% streamline sections of the slotted vanes were each provided with 10 suction surface and 7 pressure surface static pressure taps as indicated in Figure 8. Two blowing discharge slot static taps and one core static pressure tap were provided at each section to measure blowing flow rate. The 20 static pressure taps for each streamline section were distributed among 4 vanes.

### DETERMINATION OF ANNULUS WALL BLEED FLOW FOR STATOR VANE TESTS

With the compressor operating at design speed and stage pressure ratio, the circumferential total pressure rake at the stator exit was set at the streamline station 10% from the tip. Hub and tip wall bleeds were set at a

nominal flow of less than 1% of compressor flow. The stator wake pattern at this bleed flow was noted, and the tip wall bleed was then increased until no further improvement in wake pattern was visually observed on a manometer bank. This bleed flow rate was defined as the "optimum" bleed rate. One limiting consideration set as a reasonable upper value, however, was to extract no more than 2.5% of compressor inlet flow per wall at design conditions.

The circumferential rake was then set at the streamline station 90% from the tip. The tip wall bleed flow rate was reset at its original low value, and the procedure described was repeated for the hub bleed.

After hub and outer wall bleed flows had been optimized, the circumferential rake was moved to the mean position. Hub and outer wall bleeds were varied simultaneously in increments from the original nominal flow rate to optimum flow. The effects on the stator wake at mean depth were studied to check that optimum hub and tip wall bleeds coincided with an optimum wake at mid-span. The valve settings for these optimum bleed flow rates were left unchanged for all subsequent speed and flow conditions.

#### HYSTERESIS TEST WITH SLOTTED 0.75 HUB DIFFUSION FACTOR STATOR

The following method was employed to determine the characteristics of this stage at entry to, and when recovering from stall. With corrected speed set at 60%, the throttle was closed until stall cells were indicated by the three hot-wire anemometers (two of which were at the 10% and one at the 90% station from the tip) thus signaling the onset of stall. At this stalled condition, taken as the first hysteresis data point setting, a partial data recording, which consists of data required for airflow and pressure ratio calculation, was obtained. The throttle was then closed further and a second partial data recording was made at an intermediate point. After further throttle closure, a third partial data recording was obtained. The throttle was then gradually opened in steps and when indications of stall, as signalled by the hot-wire anemometers, disappeared a fourth short data cycle was recorded.

Rotor blade stresses were monitored continuously during the hysteresis test to ensure that excessive vibratory stresses were not encountered.

#### OVERALL AND BLADE ELEMENT PERFORMANCE DATA

Overall and blade element performance data were obtained at a sufficient number of points per speed line to define rotor or stage performance between choke and stall. The stage stall point is defined as the onset of a steady stall cell indication on the hot wire anemometers. The near-stall test point was taken as close to the rotating stall condition as could be set without actually being in rotating stall. This type of near-stall setting permitted a full data point recording. At each full data point, fixed and traverse

pressure and temperature data were recorded at five radial locations corresponding to streamlines passing through the 10, 30, 50, 70, and 90% span stations at the stator inlet measurement plane.

## DATA REDUCTION

Overall performance and blade element data reduction is accomplished in one program. A second program is used to calculate pressure coefficients and slot blowing flow rates for the stator vanes.

In the first program, raw data from the test stand is read in and printed. The program converts wedge probe static pressure transducer readings to inches of mercury absolute and applies a Mach number correction. All yaw units are converted to degrees. Data recording system, wire calibration, and Mach number corrections are applied to all temperatures. Pressures recorded on the data recording system are corrected to standard inlet total pressure. The corrected data is then printed.

Circumferential arithmetic averages of total pressures, static pressures, total temperatures, and yaw angles are calculated and printed. Individual data readings are compared with the averages to validate the data. Any individual reading which differs from its respective average by more than the prescribed deviation (0.5 in. Hg for all the pressures, 3° for the yaw angles, 1.5°R, 2°R, and 3°R, respectively, for the reference inlet, and all other temperatures) is not used in the final calculations. Mass-averaged values required for performance calculations are determined.

The program provides a choice of two radial distributions of static pressure: (1) distributions measured by the wedge probes and (2) a linear distribution across the flow annulus calculated from the arithmetically-averaged hub and case wall static pressure taps. Overall and blade element performance are calculated and printed using the two static pressure distributions mentioned. If a continuity check at any data measurement station is not satisfied within 5%, a simple radial equilibrium solution is provided to give an indication of the problem.

Overall performance values are calculated for the inlet guide vanes and rotor and for the complete stage. The following operations were performed to determine these values.

At the inlet plenum station two total temperatures are arithmetically averaged at each radial station. Mass flow is integrated radially, assuming that averaged wall static pressure exits over the entire cross section. Total pressure and temperature are then mass-averaged. Behind the rotor, all total pressures, total temperatures, and wall static pressures are arithmetically averaged circumferentially at each radial station. Mass flow is radially integrated and total pressures and temperatures are mass averaged.

At the stator exit, four total temperatures are arithmetically averaged circumferentially at each radial station. Mass flow is computed using an arithmetic average of the circumferential rake total pressure readings spanning a stator vane passage at each radial station. A radial integration is made for weight flow. For performance calculations, the total pressures at each radial station are mass averaged circumferentially and the total pressures and temperatures are mass averaged radially. The overall pressure ratio and adiabatic efficiencies are obtained using the radially mass averaged values of total pressure and temperature.

The calculation of performance variables, as programmed in the data reduction programs, are delineated in the Appendix.

## PRESENTATION OF RESULTS

Experimental results obtained in the test program are summarized for the double-slotted 0.75 hub diffusion factor stator vane and flow generation rotor with the design inlet guide vane set. The reduced data presented were based on a linear static pressure distribution across the annulus at each axial survey station rather than on the static wedge survey values. Comparison of results using both linear and wedge static data (Reference 2) showed that, when the wedge data were considered reliable, differences in reduced data were small; there was a tendency, however, for the wedge static data to be erratic for some test points. Use of the linear static data gives a consistent basis for comparison over the test range and with the data from other tests.

### OVERALL PERFORMANCE OF FLOW GENERATION ROTOR AND STAGE

Overall pressure ratio and adiabatic efficiency are each plotted versus corrected inlet flow with corrected speed as a parameter. These plots are presented in Figures 10 and 11 of Reference 1 for the flow generation rotor test; Figures 9 and 10 present data for the flow generation rotor during this stage test, and Figures 11 and 12 present data for the stage.

To indicate whether the rotor or the double-slotted stator caused the stage to choke or stall, rotor incidence range is summarized in Table II for the flow generation rotor test of Reference 2 and the flow generation rotor of the double-slotted 0.75  $D_f$  stator stage test. Stage rotating stall characteristics at the double slotted stator stall points and hysteresis points are summarized in Table III.

### BLADE ELEMENT PERFORMANCE

Rotor blade and stator vane blade element characteristics were computed at the five streamline positions previously defined. The blade element characteristics chosen to present the detailed performance of each blade row are as follows.

#### Blade element parameter

Incidence angle,  $i$   
Total pressure loss coefficient,  $\bar{\omega}'$  or  $\bar{\omega}$   
Diffusion factor,  $D_f$   
Deviation angle,  $\delta^\circ$   
Inlet flow angle,  $\beta'$  or  $\beta$   
Flow turning  $\Delta\beta'$  or  $\Delta\beta$   
Inlet axial velocity,  $V_z$   
Inlet Mach number,  $M'$  or  $M$

Rotor blade element data are plotted as a function of incidence with corrected speed as a parameter for each of the streamline stations. The blade element data obtained during the stage test are shown in Figure 13. For comparison and to aid the analysis of the rotor blade performance, blade element data for the rotor blade are plotted versus percent annulus height in Figure 14 for the flow providing the best approximation of the design incidence angle at design speed. Design values are also plotted for comparison. Mass flux distribution out of the rotor corresponding to the design flow rate is plotted and compared with the design flow distribution in Figure 15. Rotor blade element performance is evaluated, in Figure 16, by comparing the loss parameter versus diffusion factor curves at the 10, 50, and 90% streamline stations from the tip with the NACA correlation curve from Reference 4.

Stator vane blade element data are also plotted as a function of incidence angle with corrected speed as a parameter for each streamline station. The blade element data for the double-slotted stator are plotted in Figure 17. Also presented are the annulus wall bleed rates and the double-slotted stator slot blowing flow rates in Figures 18 through 20. Blade element data of the slotted stator vane for conditions nearest to the design incidence angle are plotted against the percent annulus height in Figure 21 to aid stator vane performance analysis and comparison. Stator vane blade element performance is also presented in Figure 22 where the loss parameter versus diffusion factor for 10, 50, and 90% streamline stations from tip, is compared with the NACA correlation curve from Reference 4.

The static pressure distributions, along the 10, 50, and 90% streamlines from the tip, of the double-slotted stator suction and pressure surfaces are presented in Figures 23 through 27 for all the speed lines tested.

The stator wakes and the variation of the stator wakes during the optimization of the wall bleeds are plotted in Figures 28 and 29, respectively.

To enable compressor designers to evaluate and apply the results of this test, a detailed summary of vector diagrams, blade element characteristics and loss data at each streamline station is provided. These summaries are listed in Table IV.

## DISCUSSION OF RESULTS

The method of presentation using the overall and blade element parameters for evaluating the performance has been described in detail. Since the figures and tables are self explanatory, only general observations are made.

### OVERALL PERFORMANCE

#### Flow Generation Rotor

Flow generation rotor pressure ratio and adiabatic efficiency with the design inlet guide vanes is shown in Figures 9 and 10. The adiabatic efficiency was based on the mass averaged temperature measured by the stator vane exit station radial temperature rakes.

A review of the test data on Figures 10 and 12 shows minor discrepancies the most apparent of which are the points on the 60% characteristic. The normal method of computing efficiency reveals this discrepancy may be due to small differences of two large numbers. Using standard inlet conditions the temperature rise across the rotor at the 60% speed points is of the order of 24°F. A 1-degree change in the measured temperature rise for these two test points will result in the three percent change in efficiency required to position the points on the curve. Conversely for the measured temperature rise minute differences in rotor exit pressure ( $\approx 0.2$  in. Hg) will result in the same three point decrement. The actual discrepancy could be either a pressure or temperature error but is well within experimental accuracy.

In general, the performance data for the flow generation rotor from this stage test agreed favorably with the data obtained from the flow generation rotor test of Reference 2. The design point pressure ratio and efficiency are 1.37 and 88.3%, respectively, at a design flow rate of 88.2 lb/sec with the design inlet guide vanes. At the design equivalent rotor speed, maximum efficiency was 96.5% with corresponding pressure ratio of 1.455 and flow rate of 90 lb/sec. At the design pressure ratio of 1.37 the flow rate was 7.6% higher than design at 94.9 lb/sec with an adiabatic efficiency of 92.2%. The excess flow was attributed to the effective overcambering of the blades as evidenced by the fact that the measured deviation angles were less than the design values. The difference between measured and design deviation angles for this test tended to be greater than those of References 1 and 2, particularly in the hub region.

Flow generation rotor pressure ratio and adiabatic efficiency with the design inlet guide vanes and no stators are shown in Figures 10 and 11 of Reference 2. The pressure ratio results are in good agreement with the rotor test results without stator vanes. When the maximum value of the adiabatic efficiencies are examined at 100% corrected speed, however, a value of 96.5% is obtained from the results of the stage test, Figure 10, as opposed to 92.5% from the flow generation rotor test, both at the same measured airflow rate. Since the accuracy of the thermocouple is  $\pm 0.75^\circ\text{F}$ , the

possible error in the adiabatic efficiency, corresponding to a pressure ratio of 1.4 would be  $\pm 1.2\%$ . The values of the adiabatic efficiencies are not, therefore, considered within the limits of experimental accuracy. The discrepancy observed in the value of the efficiency may be due to an additional error in the readout or the calibration.

A prime concern during the design phase of the flow generation rotor, discussed in Reference 3, was that sufficient flow range would be available to avoid excessive limitations on the stator operating range by the rotor or facility. In this report, Table II gives a summary of rotor incidence angles near stall and choke, at hub, mean, and tip streamlines. The stall incidence angles correspond to the minimum flow rate due to either rotor or stator stall. The choke incidence angles correspond to the maximum flow rate due either to rotor choke, stator choke, or facility pressure loss limitations. Rotor incidence angle differences at stall observed between slotted stator test and flow generation rotor test of Reference 2 are small, and stage stall may be due to rotor stall rather than stator stall.

The comparison of the incidence angles at maximum flows indicates that the stator limited the maximum flow at 60 and 80% corrected speed. At 100% corrected speed, the approximately equal rotor incidence angles for both tests indicate that either the rotor or stator are choked at nearly the same flow or the facility pressure loss was controlling. It is believed that the facility exit duct pressure loss was controlling at these relatively low pressure ratios with high flow rate conditions.

#### Double-Slotted Stator Stage

The overall stage pressure ratio and adiabatic efficiency are shown in Figures 11 and 12, respectively. During these tests only the design inlet guide vanes were employed.

Stage design pressure ratio and adiabatic efficiency are (as indicated in Reference 3) 1.35 and 85.5% at a design flow rate of 88.2 lb/sec. At the design equivalent rotor speed a maximum stage adiabatic efficiency of 87.6% was obtained with a pressure ratio of 1.395 and a flow rate of 91.0 lb/sec. At the flow generation rotor condition of 94.9 lb/sec corrected flow rate the stage pressure ratio was 1.33 and adiabatic efficiency was 84.9%. For simplicity, the stage adiabatic efficiency, presented herein, is not penalized by the case and hub wall bleed flows. Inasmuch as the rotor loading is not compatible with the stator loading, the stage efficiency is of secondary interest.

The design average total pressure recovery of the slotted stator is 0.986 (1.35/1.37) and the measured "design" total pressure recovery is 0.971 (1.33/1.37). Since the stator inlet flow conditions are equivalent to approximately a 1.6 pressure ratio rotor without inlet guide vanes, the stage efficiency of 84.9% would be increased by 1.5 to 2.0 points due to the additional work with the same average pressure recovery of 0.971 and rotor efficiency of 92.2%.

### Annulus Wall Bleed for Stator Test

Annulus wall bleed over the stator row at tip and hub surface was defined at 100% corrected speed and rotor pressure ratio of 1.37 by monitoring visually the circumferential rake and boundary layer total pressure rakes at tip and hub. Except at very low wall bleed flows of about 0.5% where stator wakes were still relatively large, the boundary layer total pressure rakes indicated an attached boundary layer. That is, total pressures increased away from the wall. Once the wall boundary layer attached, additional wall bleed essentially affected only the blade end regions. When the stator wake reduction showed negligible improvement with increased wall bleeds, the tip and hub bleed valves were held fixed throughout all remaining test points. The optimized hub and tip bleed values at the reference operating point were 2.06 and 1.70%, respectively. The tip and hub wall bleed rates experienced throughout this test with the fixed bleed line valve settings are summarized in Figure 18.

### Hysteresis and Rotating Stall Results—Slotted Stator Stage

This test was made to determine whether the stall of this stage was gradual or abrupt, and whether the stall would disappear and the stage recover smoothly. The onset of rotating stall at each corrected speed is indicated by the hot wire anemometer located at the 90% streamline. Rotor stall was abrupt at all speeds below 100% as indicated by the stall zone progression to the tip of the rotor with only a slight increase in backpressure. The onset of stall at the higher speeds, 100 and 110% of design, occurred gradually with stall zones appearing intermittently at the hub and tip. Despite the high rotor blade stresses observed, partial data readings were obtained.

At 60% corrected speed, a four-point hysteresis loop test was conducted. The pressure ratio-flow rate points are shown in Figure 11. The existence of a definite hysteresis effect, in terms of pressure ratio and flow rate, was not indicated by the measurements defining the path from point  $H_1$  to  $H_4$ . The value obtained for the pressure ratio at the data point  $H_4$  is significantly different from the value obtained at the point  $H_1$ , the first hysteresis point, going into stall. The mass flow rates at these two points, however, are approximately equal; therefore, they cannot be considered to be out of stall. The maximum transient blade stresses encountered during the hysteresis test were 13,600 psi.

There were indications, from the frequent recurrence of stress peaks, that these maximum transient stresses prevailed for a significant period during the hysteresis test. These blade stresses were considered to be at a potentially damaging level, since their magnitudes were appreciably higher than the stress limit which was 11,250 psi.

Rotating stall results in terms of rotative speed, frequency, and number of stall zones are summarized in Table III. Following the onset of stall, a

single stall cell was recorded in both hub and tip regions. The rotative speeds of the cells ranged from 27 to 43% rotor speed in the direction of rotation with frequencies varying from 23 to 50 cps for single-stall zones and 100 cps for two-stall zones, depending on the corrected speeds run. In deep stall, at 100% design speed, the stall cell rotative speed was approximately 36% rotor speed in the direction of rotation and the frequency was 100 cps. High rotor blade transient stresses prevented radial traversing of the hot wire probe. It appears, however, that the stall zone extended across the blade span.

## BLADE ELEMENT PERFORMANCE

An extensive study of the inlet guide vanes, both at design and off design conditions, was made as reported in Reference 2. Investigation into the possible persistence of the inlet guide vane wakes through the rotor, at the design flow rate condition, indicated the attenuation of these wakes before entering the stator rows. In view of these results, repeated study of the inlet guide vane flow for each test was found unnecessary.

### Rotor

Diffusion factor, deviation angle, and loss coefficient data throughout the rotor operating range for the slotted stator stage test are summarized in Figure 13. In general the measured loss coefficients are found to be less than design values at the 0° design incidence angle at the 10 and 30% streamline stations and about equal to the design values at the 50, 70, and 90% streamline stations.

Primary rotor blade element performance for the double-circular arc blade during the stator test is shown in Figure 14. Rotor blade measured data for both the flow generation rotor and slotted stator stage tests, operating near the design incidence angle at 100% design speed, are compared with the design values. The selection of measured data was based on the best agreement with the design incidence angle values, since the rotor exceeded its design pressure ratio. In general, the measured and design values of incidence angle compare favorably.

Values of deviation angle and diffusion factor differing significantly from the design values were observed as also evidenced in Reference 2. The lower than design deviation angles result in an effective overcambering of the rotor blades producing an excessive amount of work on the flow. The combination of higher work input and lower axial exit velocity results in the higher than design values of diffusion factors.

The radial distribution of mass flux at the rotor outlet, for the flow generation rotor and slotted stator stage test, are compared with the design values in Figure 15. A flow shift to the tip occurred experimentally with respect to the design distribution. This can be attributed to the low deviation angles in the tip region of the rotor. An additional mass flow shift was observed between the measured test values of the flow generation rotor test, Reference 2, and the test of Reference 1 for the 0.65 diffusion factor slotted stator stage. This additional mass flow shift at the rotor outlet could be due to an effective blockage in the hub region caused by the separation of the boundary layer at the stator suction surface inducing a secondary flow and end wall effects. The stator exit hub wall boundary layer rake, however, did not indicate any wall boundary layer separation.

Rotor loss parameter data at the 10, 50, and 90% streamlines are shown in Figure 16. Minimum loss coefficient values are indicated as filled symbols when they could be defined. The minimum values are selected as the data point nearest to the minimum value of the curve drawn through data points in Figure 13. Minimum loss data for the tip region or 10% streamline are found to lie on the lower band of the data scatter. Loss data for the mid-span and hub region are found to agree well with the NACA correlation curves in the test diffusion factor range. The comparison between the correlation curves obtained for the flow generation rotor in this report and those of Reference 2 shows favorable agreement. The data reported herein indicate an improvement in the rotor performance, with lower loss parameters at higher diffusion factors, particularly in the hub region, compared with Figure 25 of Reference 2.

### Stator

Measured results of higher flow turning and greater losses than design values are shown in Figure 17 representing diffusion factor, deviation angle, and loss coefficient over the entire test operating range for a given annulus height. A study of these results also indicates that the choke or minimum incidence angle limit may not be clearly defined except at the 90% streamline. Further study also shows that the loss coefficient versus incidence angle curve is quite flat over a wide range except at the 90% streamline height. It is indicated, therefore, that the operating range of this stator with self energized boundary layer control agrees favorably with the ranges obtained for the stators of References 1 and 2.

The radial variation of blade element data for the slotted stator at a point where the values of the incidence angle provided the best approximation to design incidence are compared with the design values in Figure 21. Inlet axial velocity and incidence angle variations from design trends of Figure 21 result from a mass flow shift with respect to the design value for the flow generation rotor. Other significant results shown in Figure 21 are that

flow turning was greater than expected or deviation angles were much less than design values at the tip region. Figure 17e shows similar results for the flow turning and deviation angles at the hub region. This deviation angle result agrees with the measured deviation angles for the single-slot 0.75 diffusion factor stator of Reference 2. Measured losses were found to be greater than the design values, particularly at the tip.

Loss parameter values calculated from the data of Figure 17 are compared with the NACA loss parameter versus diffusion factor correlation (Reference 4) in Figure 22 for the 10, 50, and 90% streamlines from the tip. The minimum loss values (filled symbols) for the 0.75 diffusion factor slotted stator for the 10% streamline are generally greater than the values on an extension of the NACA correlation curve; for the 50% streamline, the minimum loss values are less than those of the curve, while the 90% streamline has the majority of its values less than those of the extended curve. Comparing these data with the 0.75 diffusion factor single-slotted blowing stator results indicates that possibly all of the data are within experimental accuracy and that the present correlation curves are satisfactory. The minimum losses obtained for the double-slotted stator appear to be lower than the values obtained for the single-slotted 0.75 diffusion factor stator. The flow turning and loss performance of these stators are not significantly better than the performance of the single-slotted 0.75 diffusion factor stators, reported in Reference 2.

Typical slotted stator wake distributions are shown in Figure 28. Selected cases nearest to -3-degree incidence, which show the increasing wake size as inlet Mach number increases, are given in Figures 28a, b, c, and e. Figures 28f through 28i illustrate the effects of incidence angle at an inlet Mach number near 0.7. The wake surveys at high positive incidence angles in Figures 28h and 28i show that the hub region is experiencing a strong secondary flow or wall effect. That is, the peak total pressure at rake elements 7 and 8 are considerably lower than the inlet values for the test conditions of Figures 28h and 28i.

Wake survey data were recorded during the wall bleed optimization runs at the design stage pressure ratio of 1.35 and 100% corrected speed. The effect of reduced stator losses with increasing wall bleed rate is shown in Figure 29. It is evident in Figure 29 that increased wall bleed reduced the end region flow disturbances and stator losses. Higher wall bleed rates above the 30 and 29 in. H<sub>2</sub>O orifice pressure differential at tip and hub, respectively, had little effect on increasing wake total pressure at the 10 and 90% radial stations.

#### Stator Static Pressure Distributions

Suction surface static pressure distributions for the slotted stator indicate the possibility of boundary layer separation at 65 to 85% chord throughout

the entire range of tests as shown in Figures 23 through 27. The blowing slots were located at 40 and 70% chords. The possible existence of separation displayed by the static pressure distributions is not consistent with the wake surveys and loss coefficients. Therefore, the apparent separation may not be as severe as displayed by the static pressure distributions. The static pressure distributions given in this report also bear close resemblance to those given in Reference 2.

#### Stator Slot Blowing Flow

The variation of combined and individual slot blowing with pressure ratio is presented in Figure 19. The variation of slot blowing flow along the span of the stator is given in Figure 20. The test point representing design incidence angle at each corrected speed was selected to give the best approximation over the blade span. Experimental flow rates are found to be about 107 and 142% of the design values at 100% corrected speed for the first and second slots, respectively. The flow rates were estimated from a measured static pressure in the core of the stator, which was assumed equal to core total pressure, and a static tap located in the slot. Design values for the hub, mean, and tip section slots (i. e., separated by slot bridges) taken as an average for each slot section are: 0.00475, 0.00446, and 0.00421 lb<sub>m</sub>/sec-in. at the front slots, and 0.00639, 0.00600, and 0.00480 lb<sub>m</sub>/sec-in. at the rear slots, respectively. Experimental blowing flow spanwise gradients were greater than experienced on the 0.75 diffusion factor single-slotted stator test presented in Reference 2. Figure 20b shows the variation in blowing rates from the value at design incidence to either test extreme on the speed line characteristics was within 30% of the value at design incidence.

## CONCLUDING REMARKS

Discussion of the experimental results has been based on analysis work completed to date. In addition to the beneficial experience to be obtained on continuing stator tests, considerably more effort is required before final conclusions can be drawn. Analysis of the data, however, indicates the following points.

1. The overall performance of the flow generation rotor in this stage test agreed well with the performance of the flow generation rotor without stators, reported in Reference 2. At the flow rate corresponding to the flow generation rotor design pressure ratio the stage pressure ratio was lower than the design value.
2. The blade element performance of the double-slotted 0.75 hub diffusion factor stator in flow turning and total pressure loss was somewhat better than that of the single-slotted 0.75 hub diffusion factor stator. This difference was apparently due to the improved effectiveness of a double blowing slot configuration over one employing a single slot, with respect to distributing the blowing flow and re-energizing the boundary layer.
3. A hysteresis effect, in terms of pressure ratio and mass flow rate, was not definitely established at 60% corrected speed where different mass flow rates and pressure ratios were obtained going into and coming out of stall.
4. Rotor blade stresses exceeded the prescribed steady state limits approaching the transient limit during the hysteresis test at 60% of design speed and the stall point tests below 100% design speed. The transient stress limit was exceeded during the stall point tests at 100 and 110% design speeds.
5. The results of the stator loss parameter versus diffusion factor curves were in good agreement with the extension of the NACA correlation curves.
6. The blade suction surface static pressure distributions indicated the possibility of flow separation occurring at 65 to 85% chord. Flow turning and pressure loss levels do not indicate severe flow separation.

## REFERENCES

1. Miller, M. L., and Seren, G. Single-Stage Experimental Evaluation of Boundary Layer Blowing Techniques for High Lift Stator Blades, III - Data and Performance of Single Slotted 0.65 Hub Diffusion Factor. NASA CR-54566, Allison Division, GMC, EDR 5759, June 1968.
2. Miller, M. L., and Beck, T. E. Single-Stage Experimental Evaluation of Boundary Layer Blowing Techniques for High Lift Stator Blades, II - Data and Performance of Flow Generation Rotor and Single Slotted 0.75 Hub Diffusion Factor Stator. NASA CR-54565, Allison Division, GMC, EDR 5691, February 1968.
3. Chapman, D. C., and Miller, M. L. Single-Stage Experimental Evaluation of Boundary Layer Blowing Techniques for High Lift Stator Blades, I - Compressor Design. NASA CR-54564, Allison Division, GMC, EDR 5636, February 1968.
4. Aerodynamic Design of Axial Flow Compressors, NASA SP-36, 1965.

## APPENDIX

### PERFORMANCE EQUATIONS

The following overall and blade element performance parameters were calculated for the analysis of test data and the evaluation of the slotted stator performance.

#### WEIGHT FLOW

Overall performance is presented as a function of corrected weight flow, defined as

$$\frac{W_a \sqrt{\theta}}{\delta} \quad (A1)$$

#### ADIABATIC EFFICIENCY

Adiabatic efficiency for the inlet guide vane and rotor combination is

$$\eta_{ad2} = \frac{\left( \frac{P_{t2, ma}}{P_{t0}} \right)^{\gamma-1/\gamma} - 1}{\frac{T_{t3, ma}}{T_{t0}} - 1} \quad (A2)$$

and for the guide vane rotor and stator is

$$\eta_{ad3} = \frac{\left( \frac{P_{t3, ma}}{P_{t0}} \right)^{\gamma-1/\gamma} - 1}{\frac{T_{t3, ma}}{T_{t0}} - 1} \quad (A3)$$

#### DIFFUSION FACTOR

For the rotor, diffusion factor is defined as

$$D_{f2} = 1 - \frac{V_2'}{V_1'} + \frac{V_{\theta 1}' - V_{\theta 2}'}{2\sigma V_1'} \quad (A4)$$

and for the stator as

$$D_{f3} = 1 - \frac{V_3}{V_2} + \frac{V_{\theta 2} - V_{\theta 3}}{2 \sigma V_2} \quad (A5)$$

These quantities are calculated using the appropriate velocity triangle values previously computed by the program.

#### DEVIATION ANGLE

Rotor blade deviation is defined as

$$\delta_2^\circ = \beta_2' - \kappa_2' \quad (A6)$$

and stator deviation as

$$\delta_3^\circ = \beta_3 - \kappa_3 \quad (A7)$$

where  $\kappa_2'$  is the rotor blade exit metal angle based on the mean camber line for a double-circular arc airfoil and  $\kappa_3$  is the stator vane exit metal angle based on the circular arc camber line used with the 65-series thickness distribution.

#### INCIDENCE ANGLE

Rotor blade incidence is defined as

$$i_1' = \beta_1' - \kappa_1' \quad (A8)$$

and stator incidence as

$$i_2 = \beta_2 - \kappa_2 \quad (A9)$$

where  $\kappa_1'$  is the rotor blade inlet metal angle based on the mean camber line for a double-circular arc airfoil and  $\kappa_2$  is the stator vane inlet metal angle based on the circular arc camber line.

#### TOTAL PRESSURE LOSS COEFFICIENT

Total pressure loss coefficient for the rotor is defined as

$$\omega_l = \frac{\left[ 1 + \frac{\gamma-1}{2} \frac{(\omega R_2)^2}{\gamma g R T_{t1}'} \left( 1 - \frac{R_1^2}{R_2^2} \right) \right]^{\gamma/(\gamma-1)} \left[ 1 - \frac{P_{t2}/P_{t1}}{(T_{t2}/T_{t1}')^{\gamma/(\gamma-1)}} \right]}{1 - \left[ 1 + \frac{\gamma-1}{2} (M_1')^2 \right]^{\gamma/(\gamma-1)}} \quad (A10)$$

and for the inlet guide vanes as

$$\bar{\omega} = \frac{1 - \frac{P_{t1}}{P_{t0}}}{1 - \left[ 1 + \frac{\gamma-1}{2} (M_0)^2 \right]^{-\gamma/(\gamma-1)}} \quad (A11)$$

and stator as

$$\bar{\omega} = \frac{1 - \frac{P_{t3}}{P_{t2}}}{1 - \left[ 1 + \frac{\gamma-1}{2} (M_2)^2 \right]^{-\gamma/(\gamma-1)}} \quad (A12)$$

### Pressure Coefficient

Pressure coefficient (S) is defined by

$$S = \frac{P_{t2} - p}{q_2} \quad (A13)$$

where:

$P_{t2}$  = total pressure at stator inlet

$p$  = static pressure at a given point on the vane surface

$$q_2 = \frac{\gamma p_2 M_2^2}{2} = \text{dynamic pressure at stator inlet}$$

### Vane Blowing Flow

Vane blowing flow per unit slot length is first calculated at each station at which surface static pressure taps exist and is defined as

$$\dot{m} = C_W \rho_{\text{slot}} h V_{\text{slot}} \quad (A14)$$

where

$$C_W = \text{slot flow coefficient} = 0.82$$

$$\rho_{\text{slot}} = \frac{p_{\text{slot}}}{R_{t\text{slot}}}$$

Slot static conditions were based on stator inlet free stream total temperature, the core measured pressure taken as total pressure at the streamline in question, and the measured slot static pressure. The values thus obtained are used to calculate blowing flow through each segment of the slot and thence total blowing flow taking account of the blockage introduced by the interruption between slot segments.

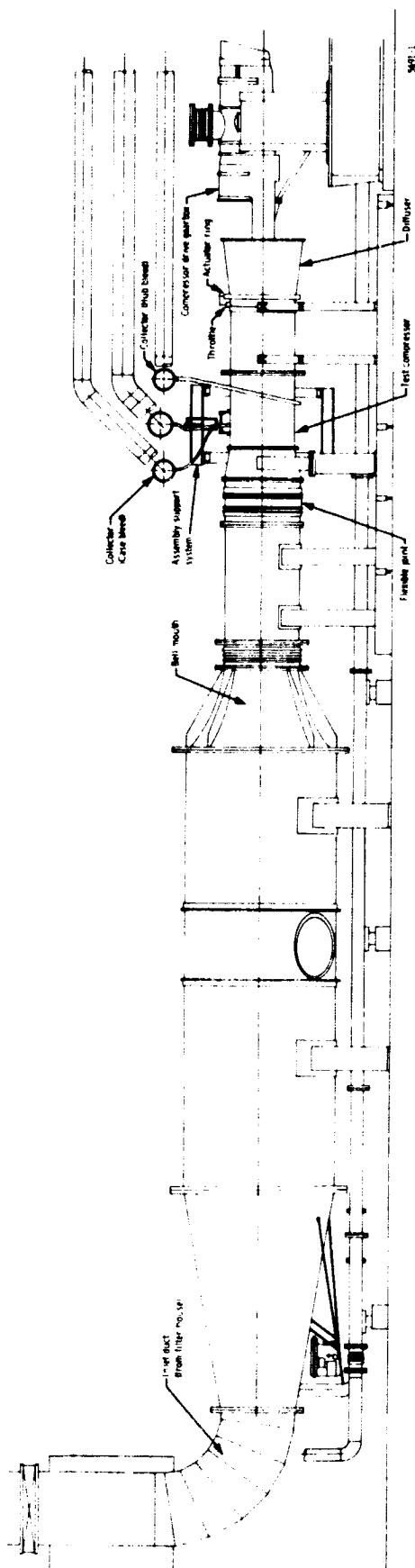
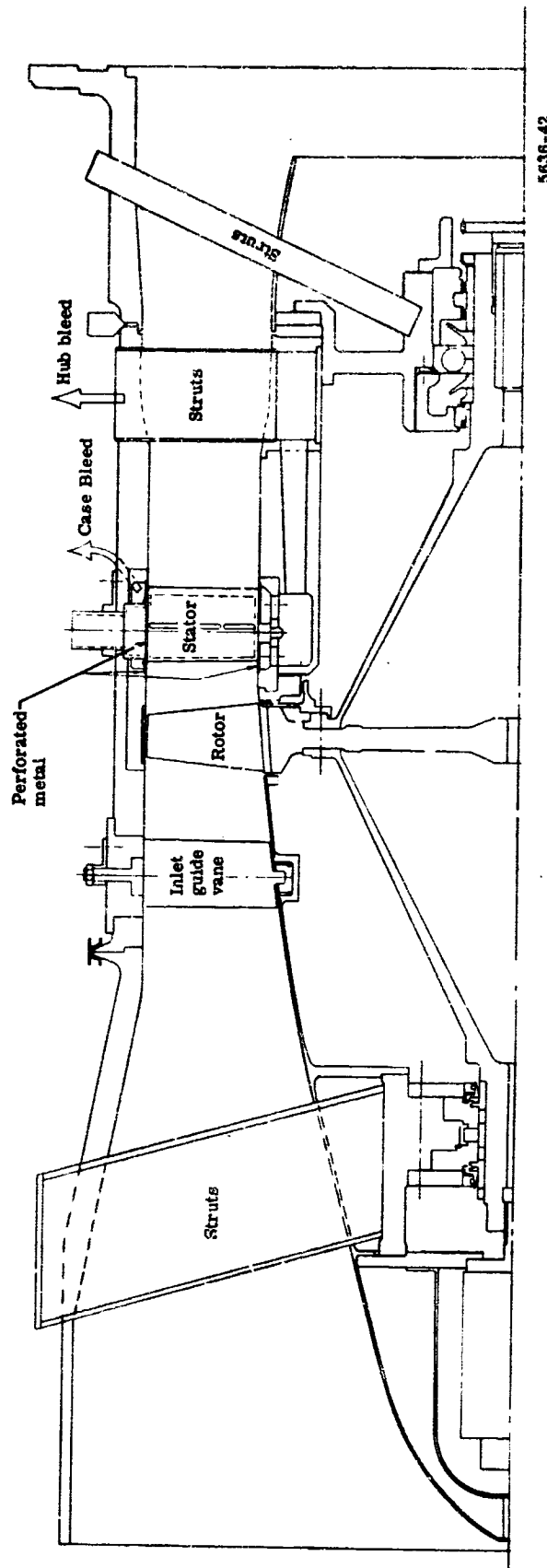
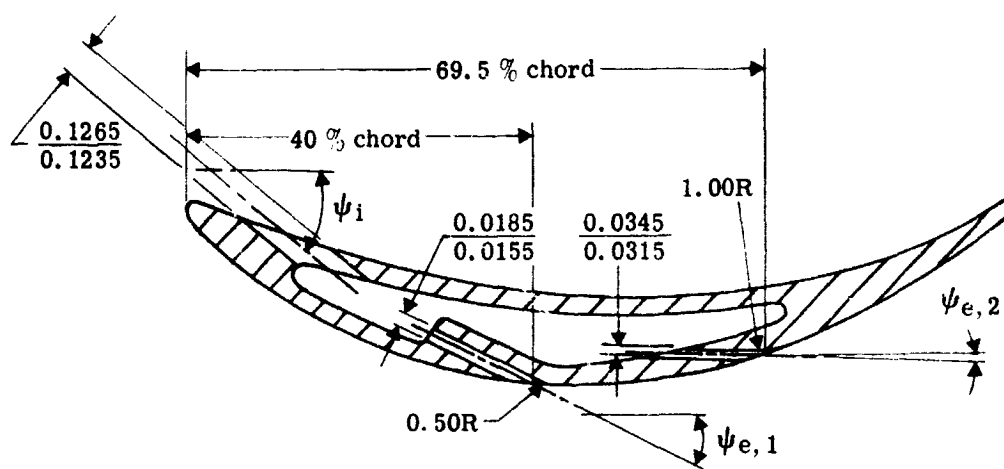


Figure 1. Compressor test facility.

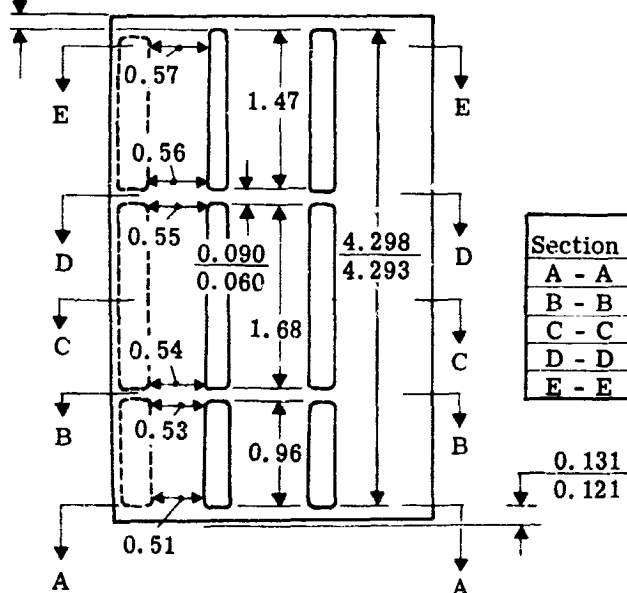


5638-42

Figure 2. Layout of compressor test rig.



$\frac{0.063}{0.061}$



Note: Dimensions are in inches

| Section | $\psi_i$ | $\psi_{e,1}$ | $\psi_{e,2}$ |
|---------|----------|--------------|--------------|
| A - A   | 36° 30'  | 22° 30'      | -1° 30'      |
| B - B   | 37° 35'  | 23° 35'      | -0° 25'      |
| C - C   | 38° 19'  | 24° 19'      | 0° 19'       |
| D - D   | 38° 50'  | 24° 50'      | 0° 50'       |
| E - E   | 39° 42'  | 25° 42'      | 1° 42'       |

5861-3

Figure 3. Double slotted 0.75 hub diffusion factor stator slot configuration.

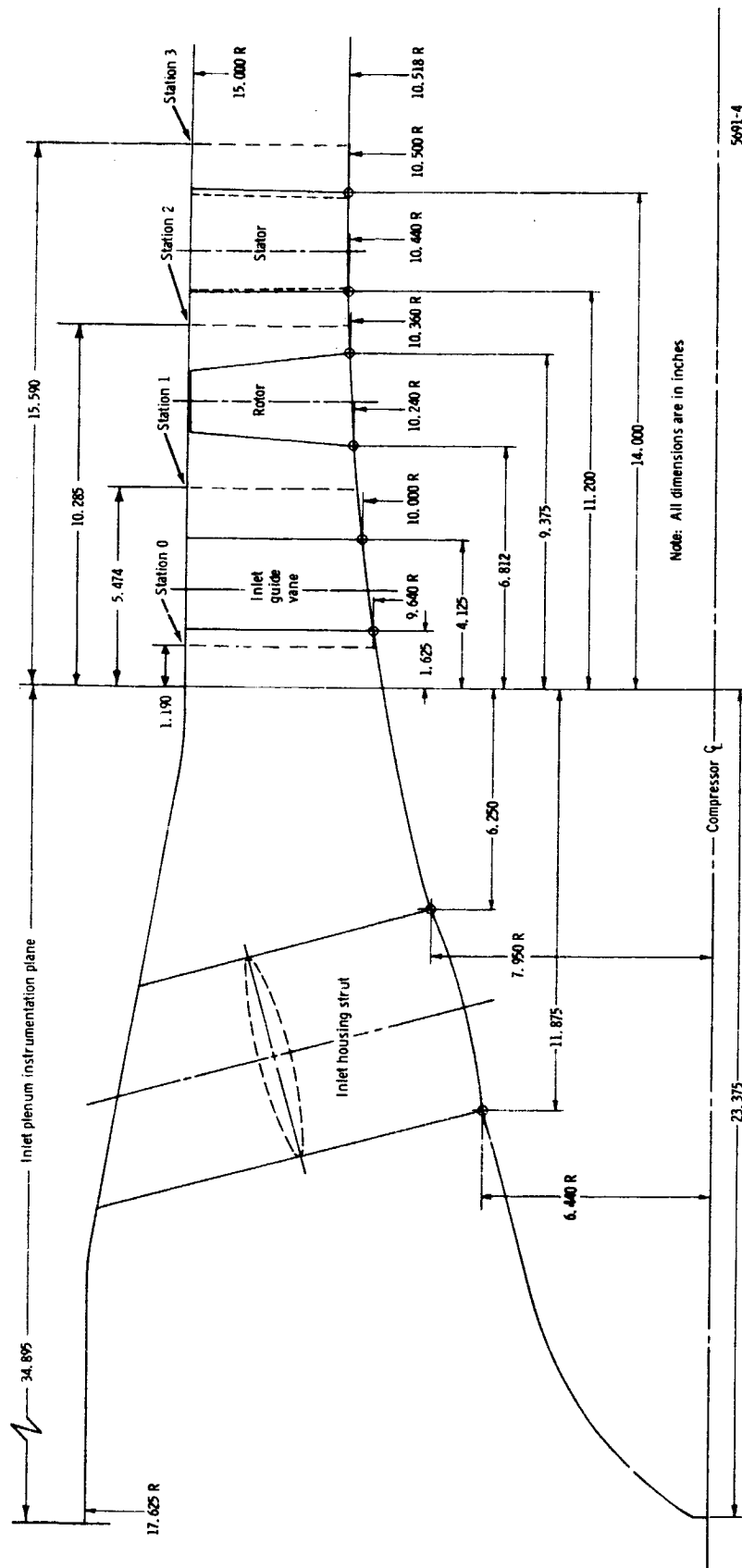
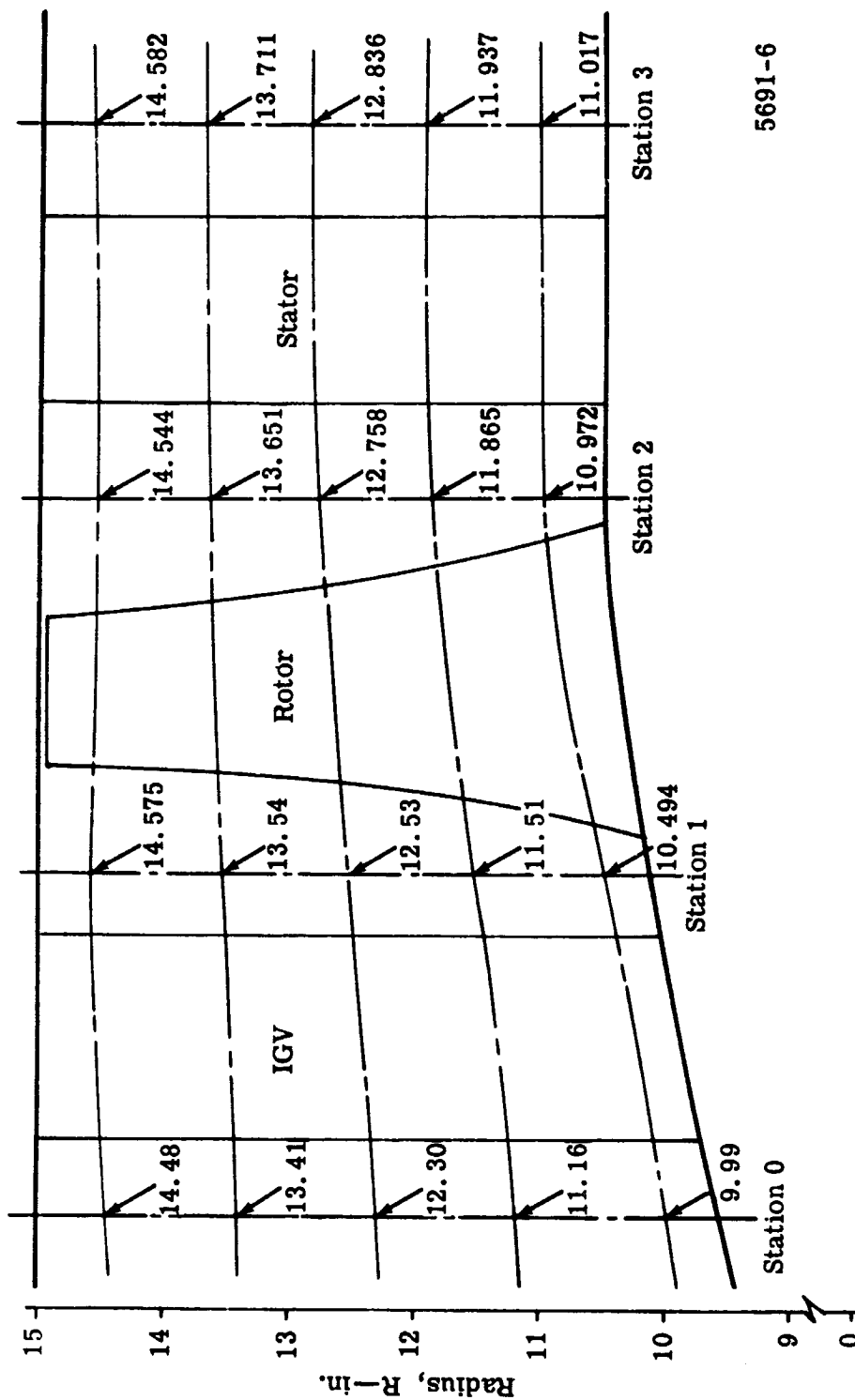


Figure 4. Test rig flow path.





5691-6

Figure 6. Radial location of streamlines for instrumentation positions.

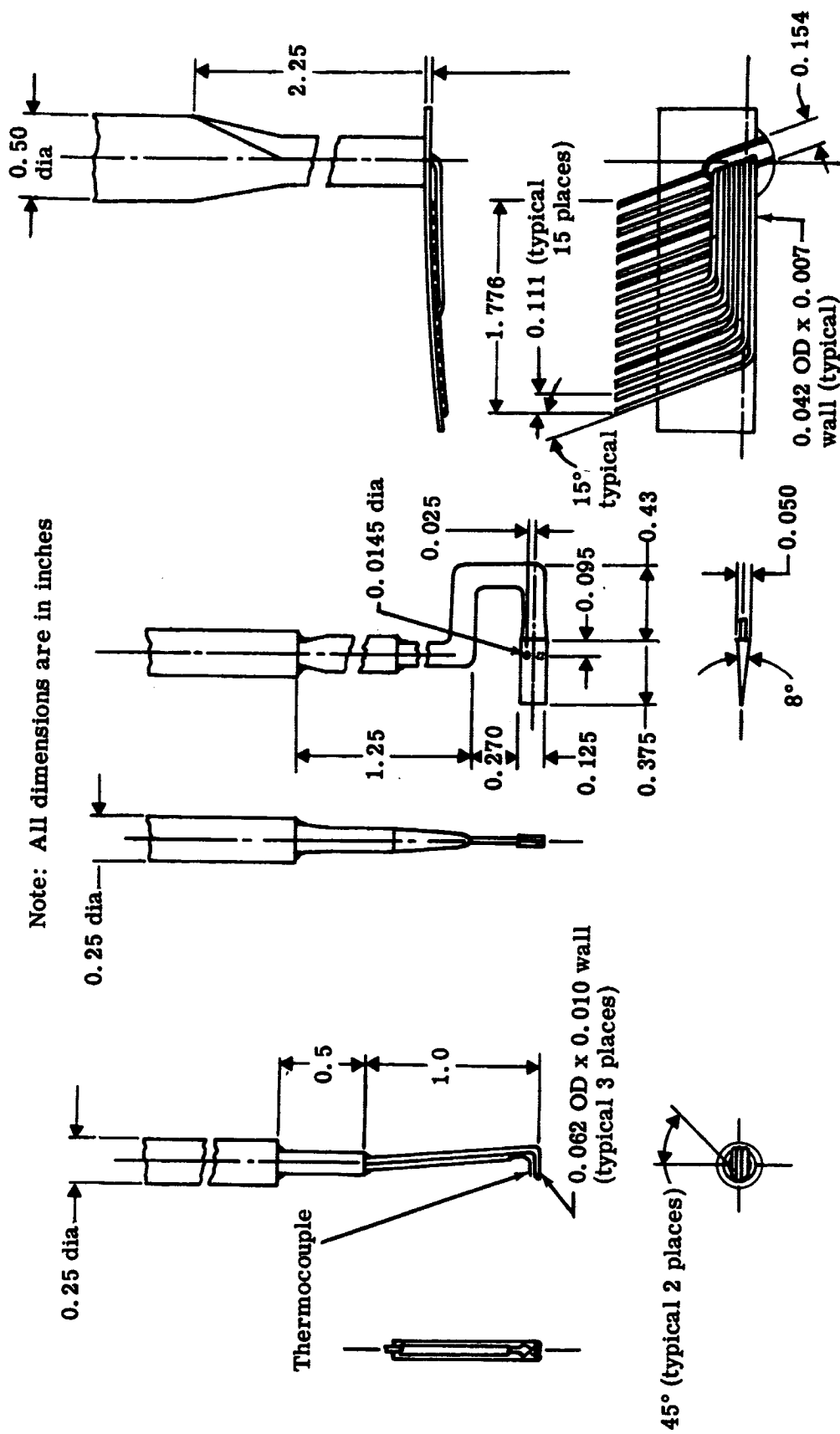
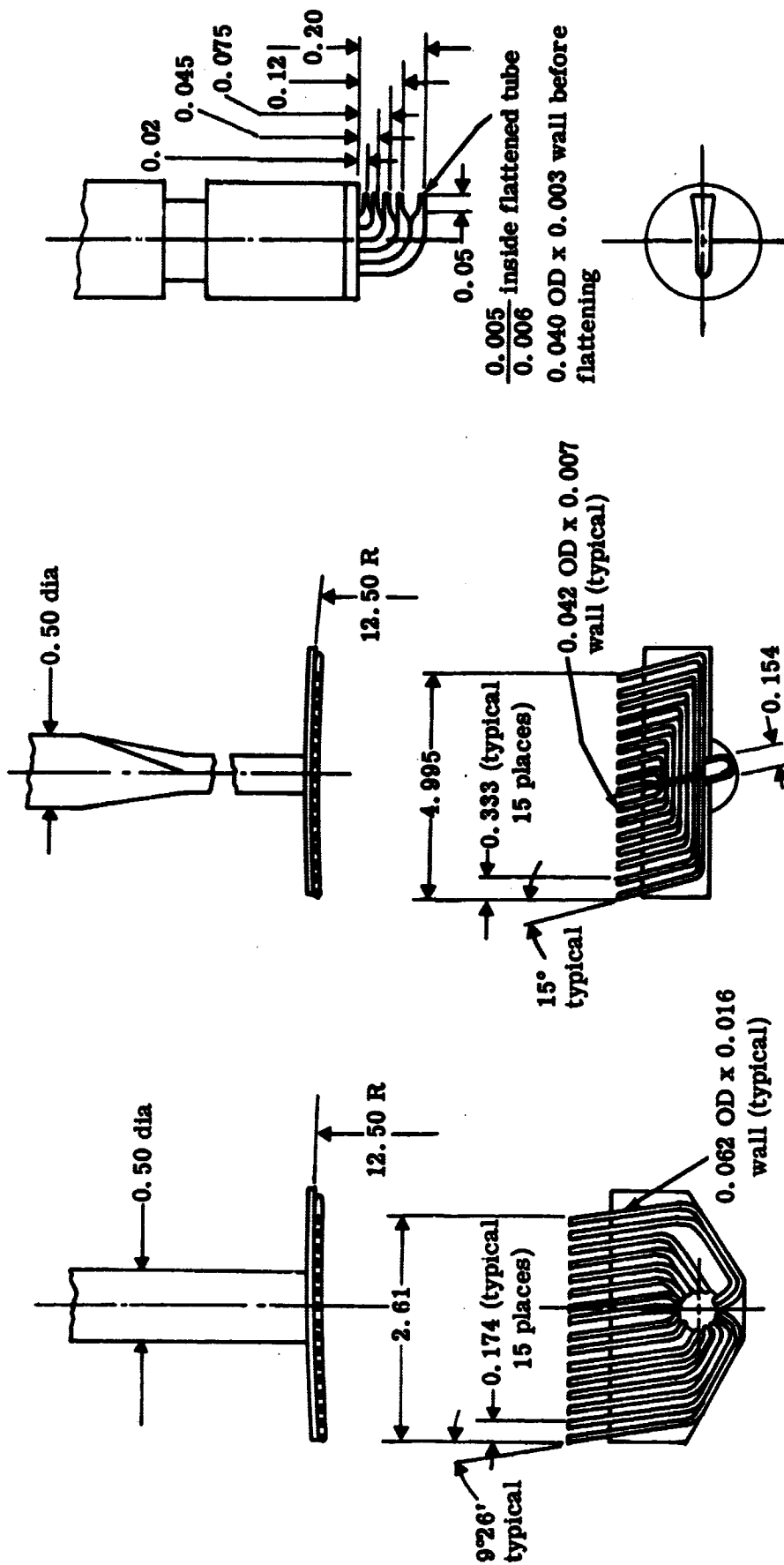


Figure 7. Schematics of survey instrumentation.

Note: All dimensions are in inches



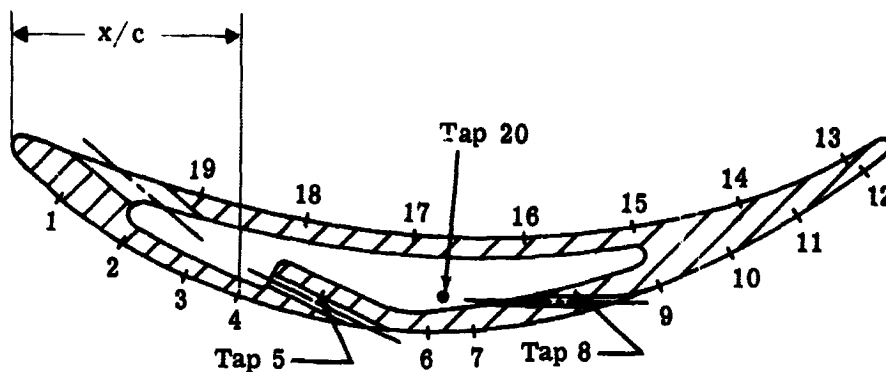
d. Stator circumferential rake

e. IGV wake persistence circumferential rake

f. Boundary layer probe for tip and hub

Figure 7. Schematics of survey instrumentation.

5691-8



| Tap       | 1    | 2     | 3     | 4     | 5 | 6     | 7     | 8 | 9     |
|-----------|------|-------|-------|-------|---|-------|-------|---|-------|
| $x/c$ (%) | 4.98 | 11.62 | 19.59 | 25.23 | — | 47.48 | 52.46 | — | 73.37 |
| Vane No.  | 1    | 2     | 3     | 4     | 1 | 2     | 3     | 4 | 1     |

| Tap       | 10    | 11    | 12    | 13    | 14    | 15    | 16    | 17    | 18    |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| $x/c$ (%) | 81.34 | 88.98 | 96.28 | 94.29 | 82.67 | 70.72 | 58.10 | 45.82 | 33.53 |
| Vane No.  | 2     | 3     | 4     | 1     | 2     | 3     | 4     | 1     | 2     |

| Tap       | 19    | 20 |
|-----------|-------|----|
| $x/c$ (%) | 21.25 | —  |
| Vane No.  | 3     | 4  |

5861-9

Figure 8. Slotted stator vane static pressure tap locations at 10, 50, and 90% streamlines.

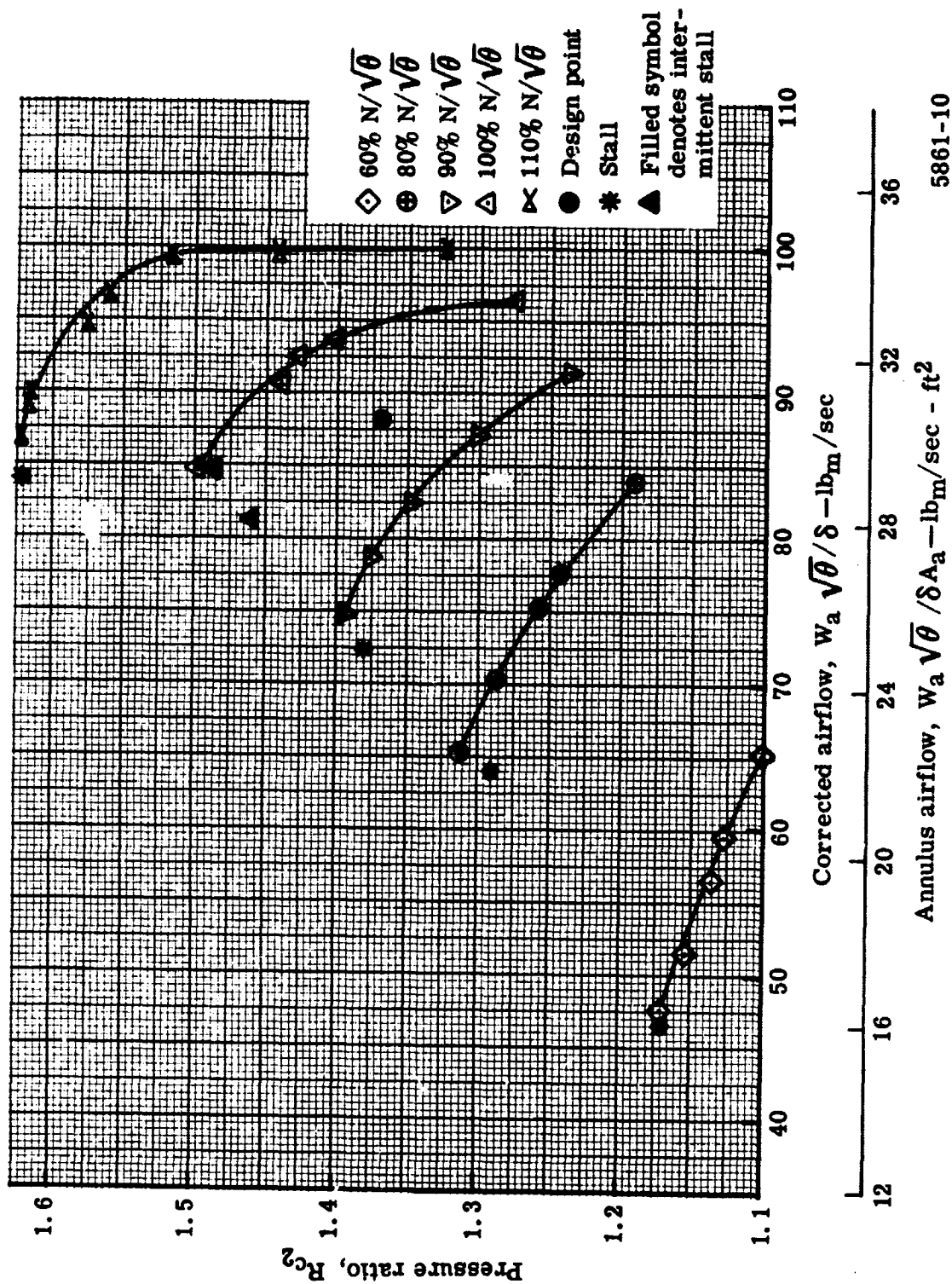
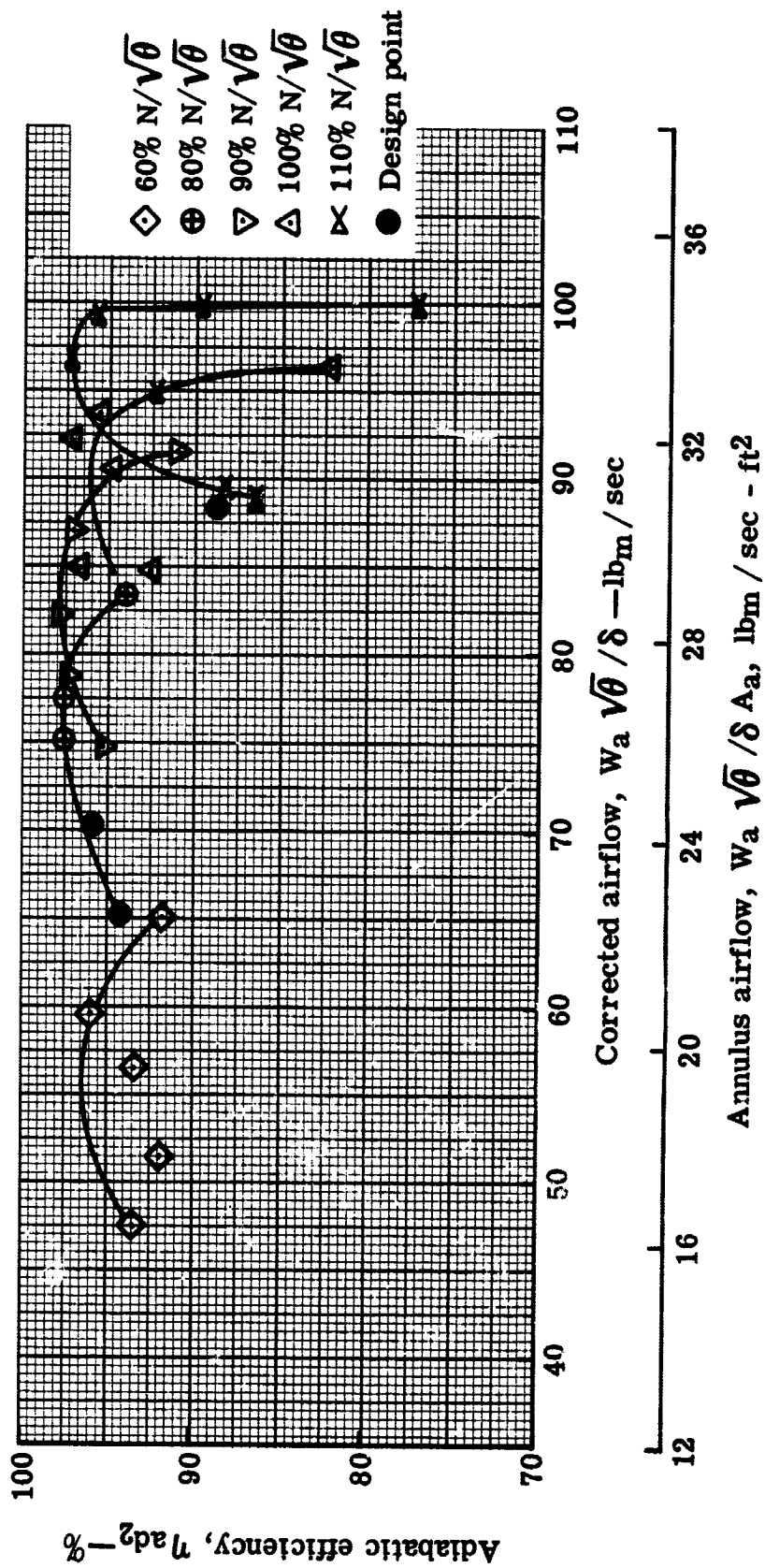
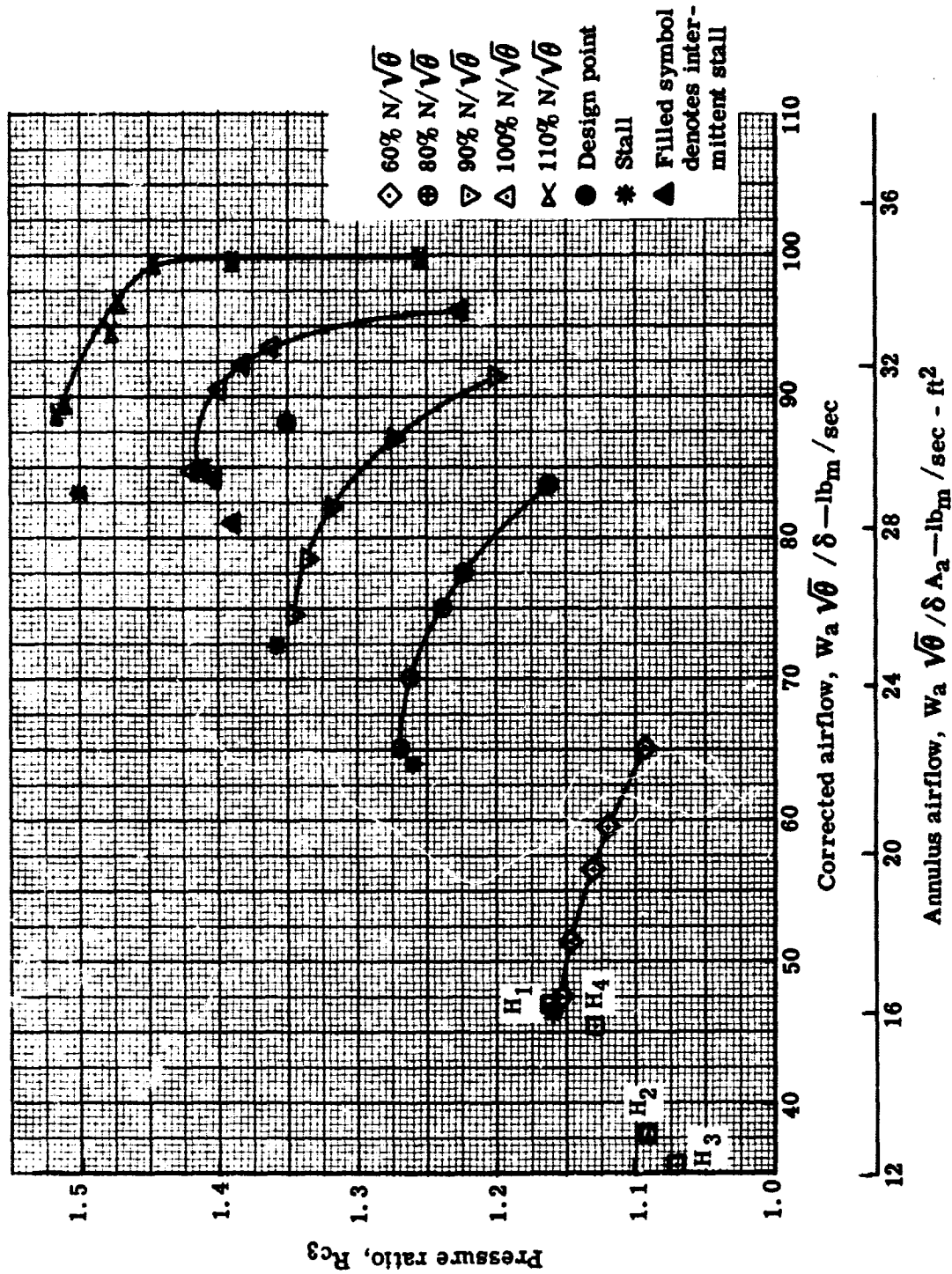


Figure 9. Flow generation rotor overall performance in stage test-pressure ratio.



5861-11

Figure 10. Flow generation rotor overall performance in stage test-adiabatic efficiency.



5861-12

Figure 11. Stage overall performance-pressure ratio.

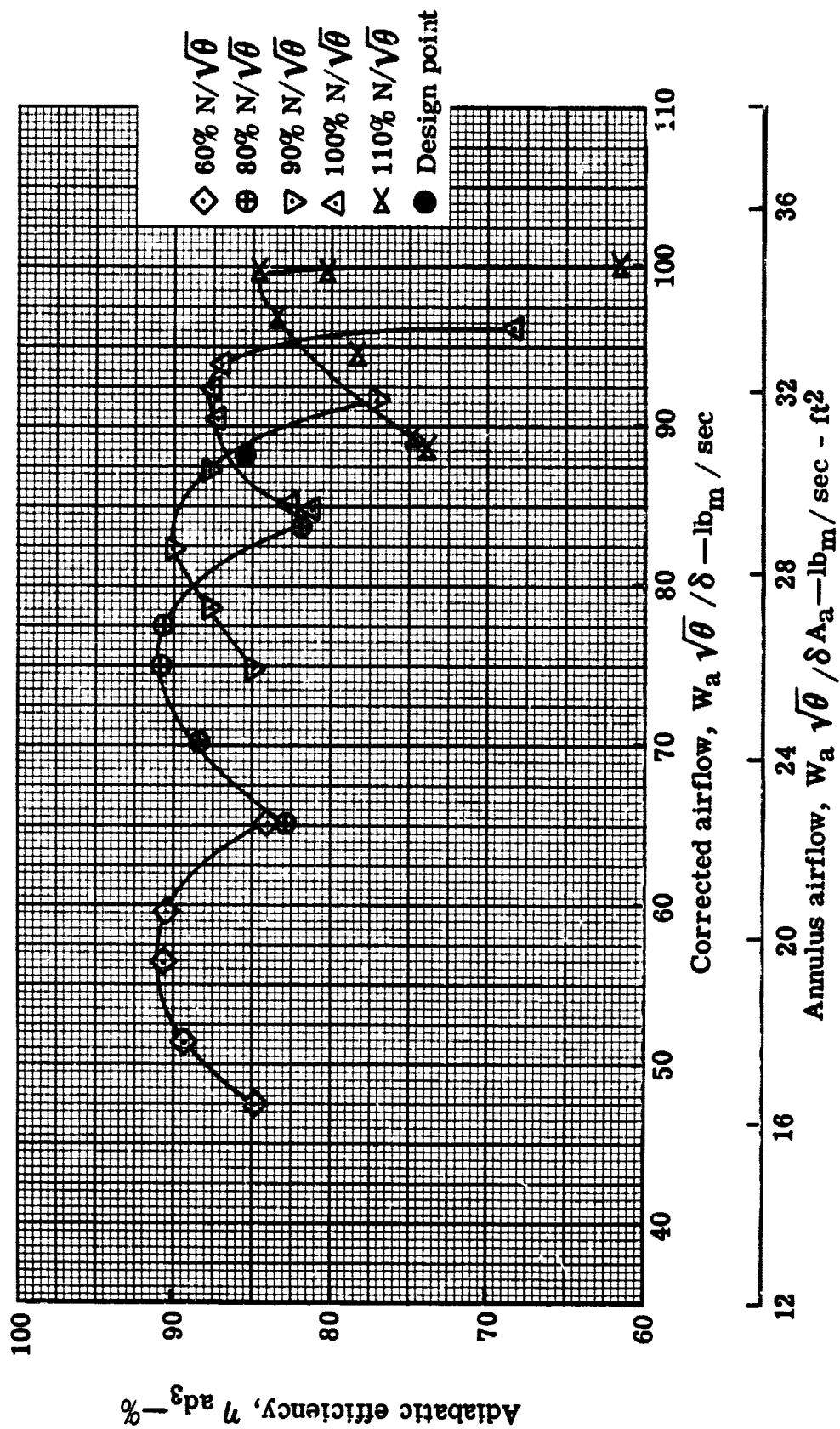
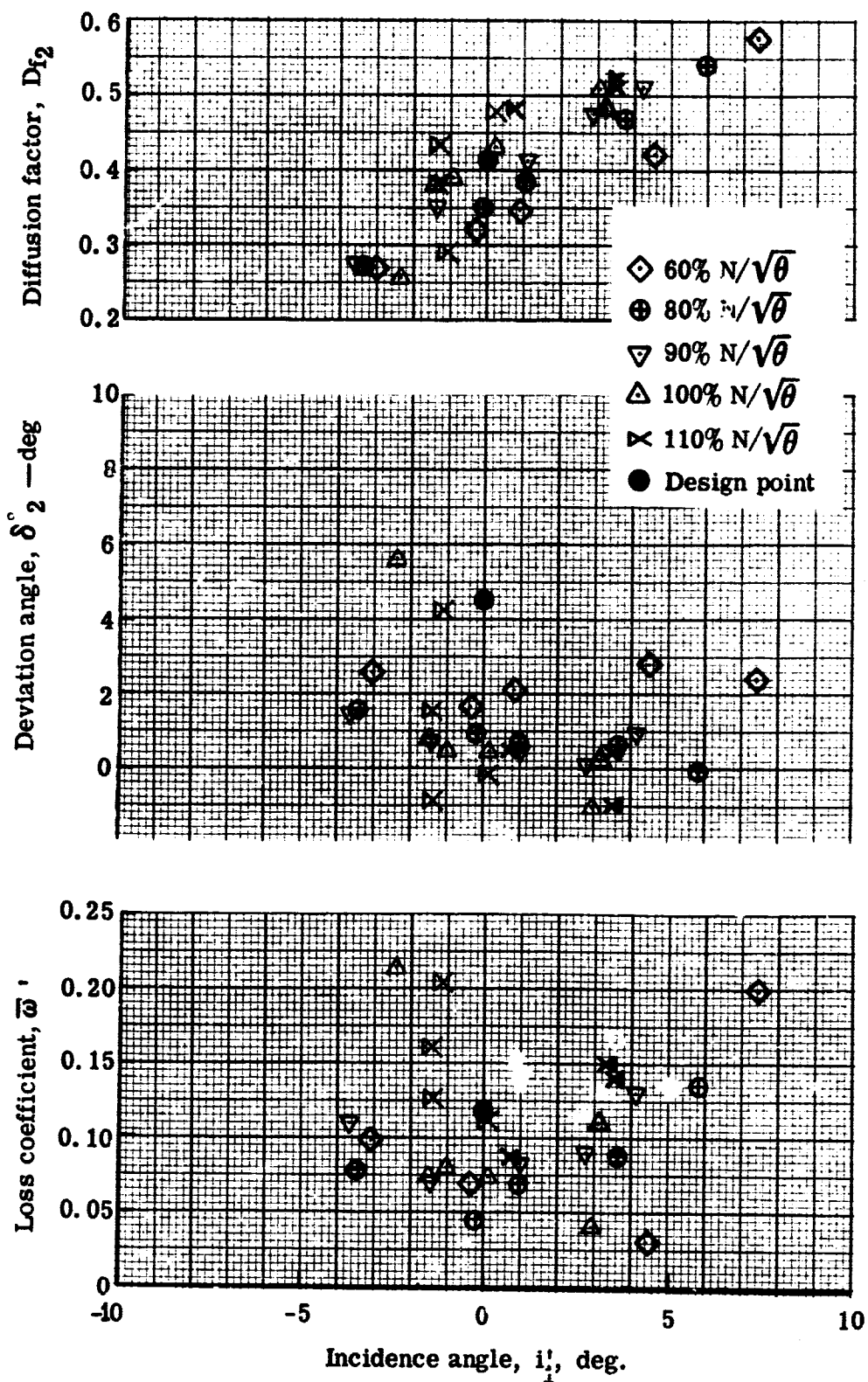


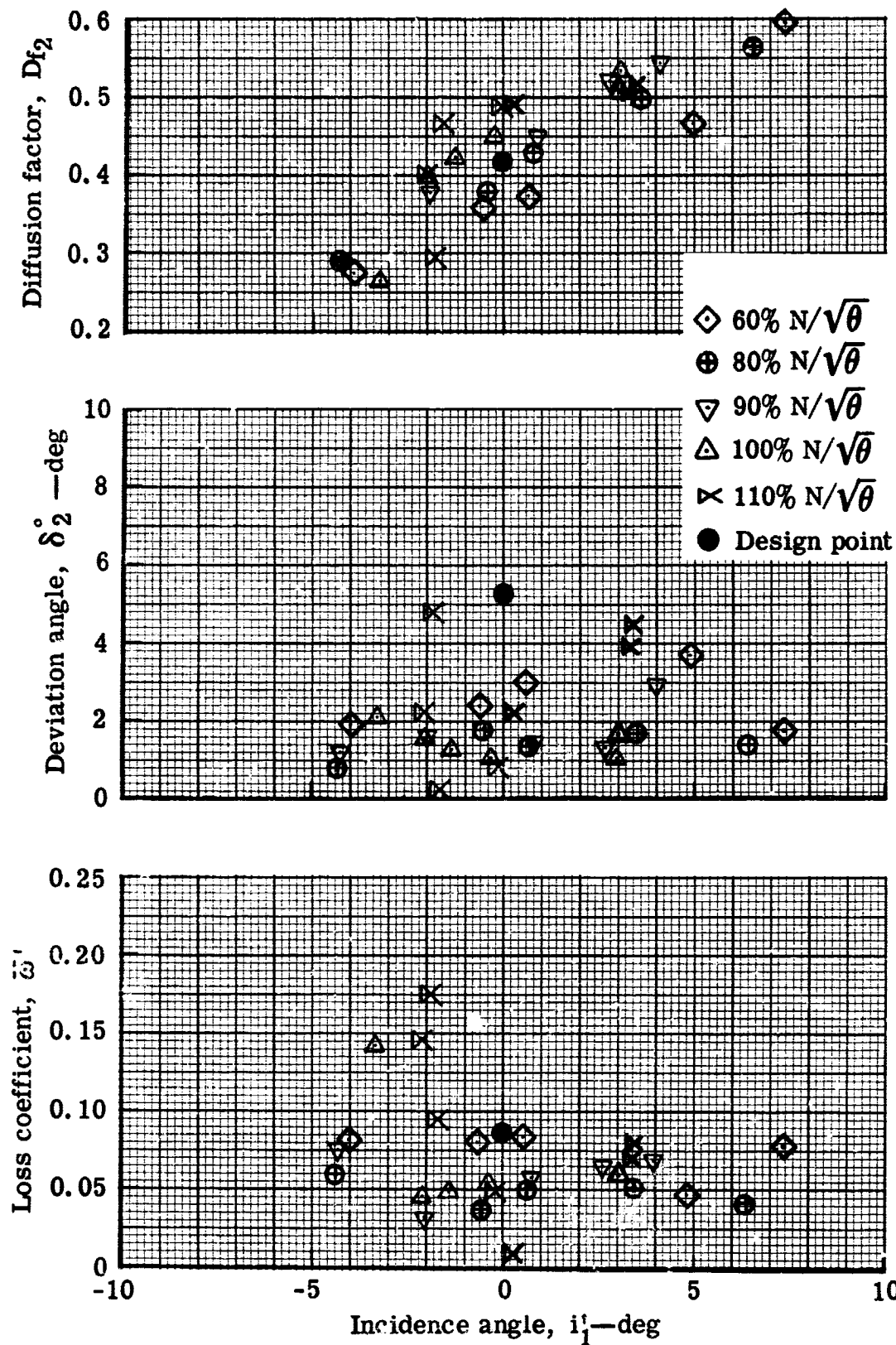
Figure 12. Stage overall performance-adiabatic efficiency.

5861-13



5861-14

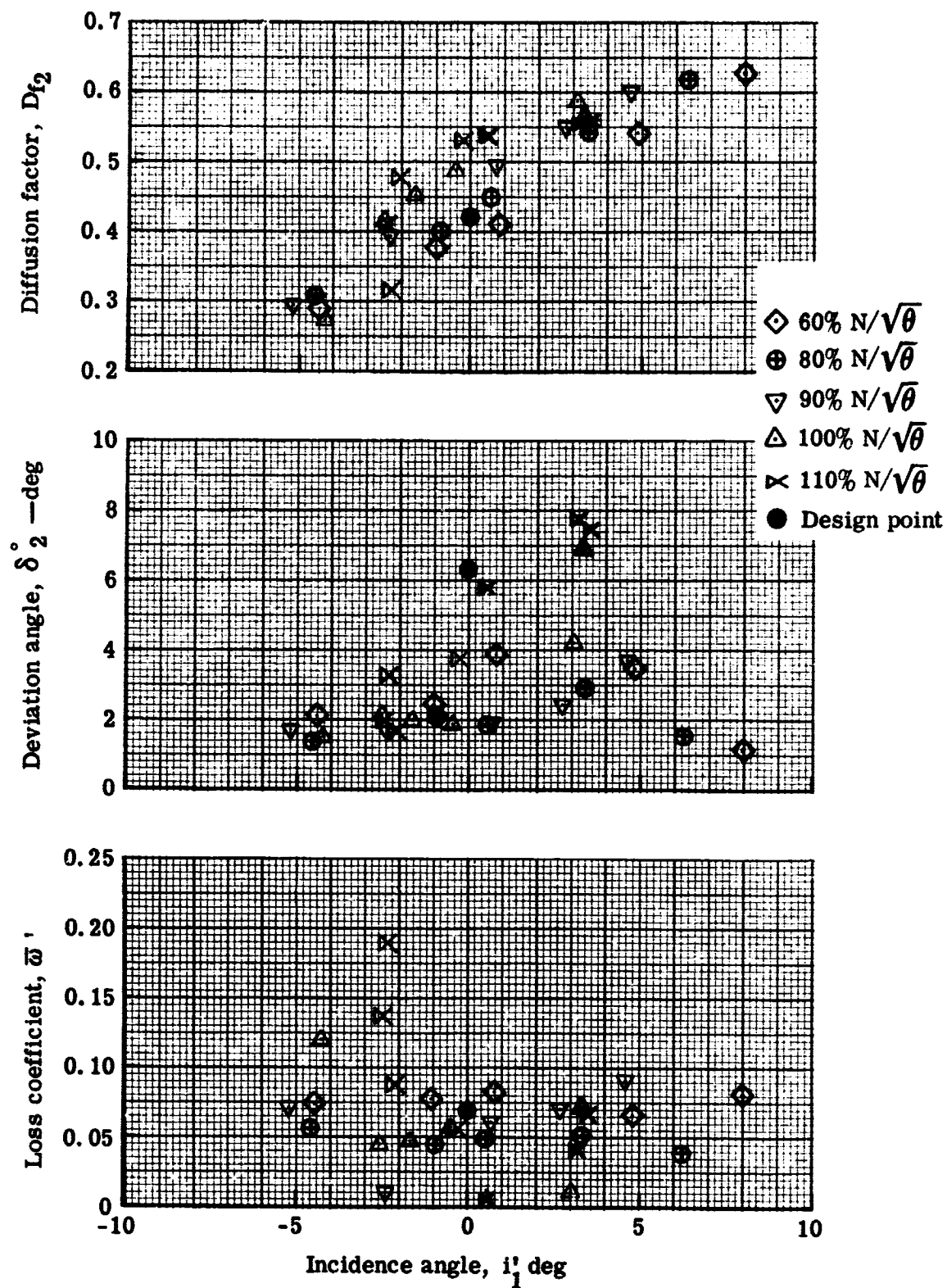
Figure 13. Rotor blade element performance-stage test.



b. 30% streamline from tip

5861-15

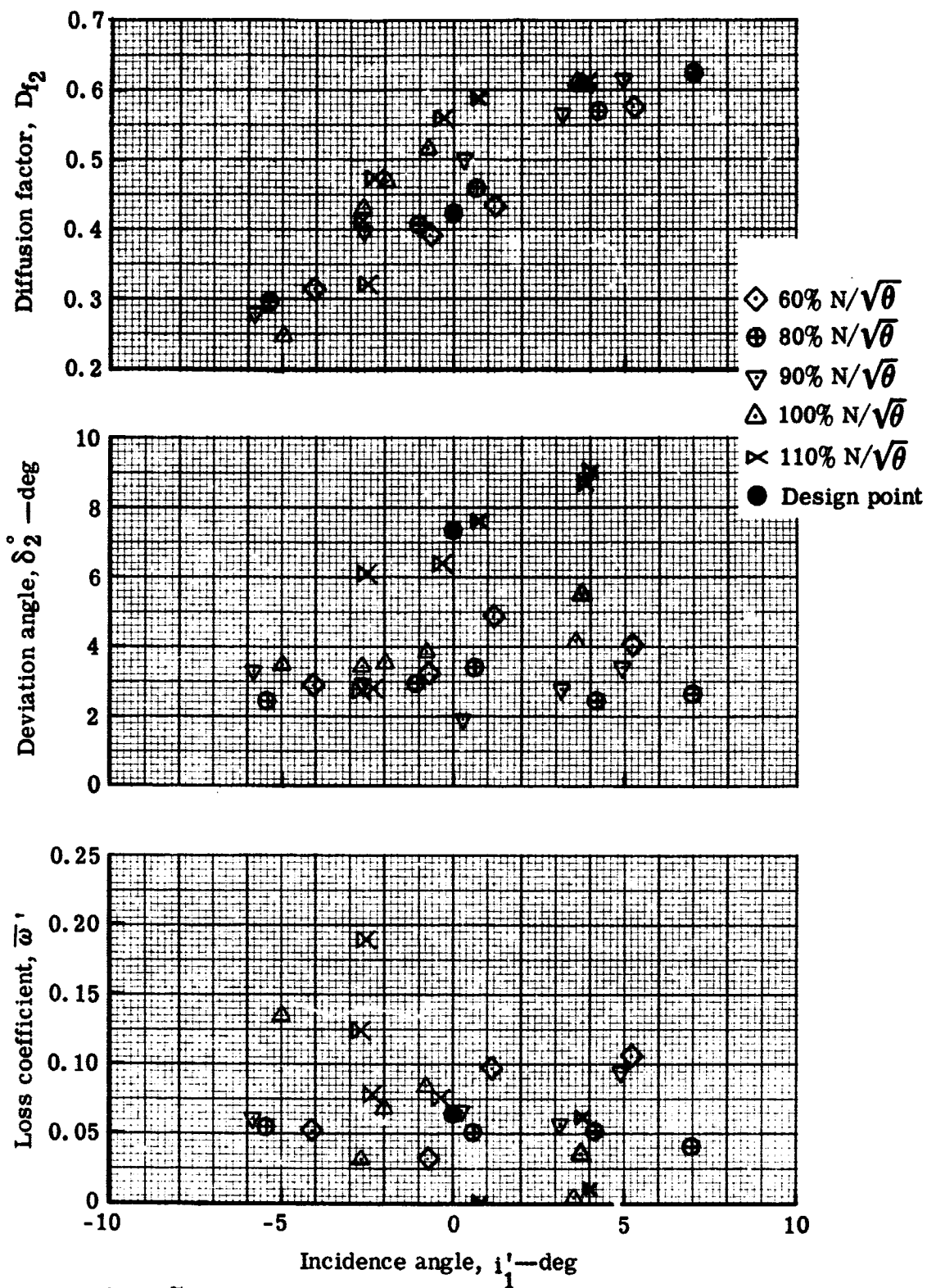
Figure 13. Rotor blade element performance-stage test.



c. 50% streamline from tip

5861-16

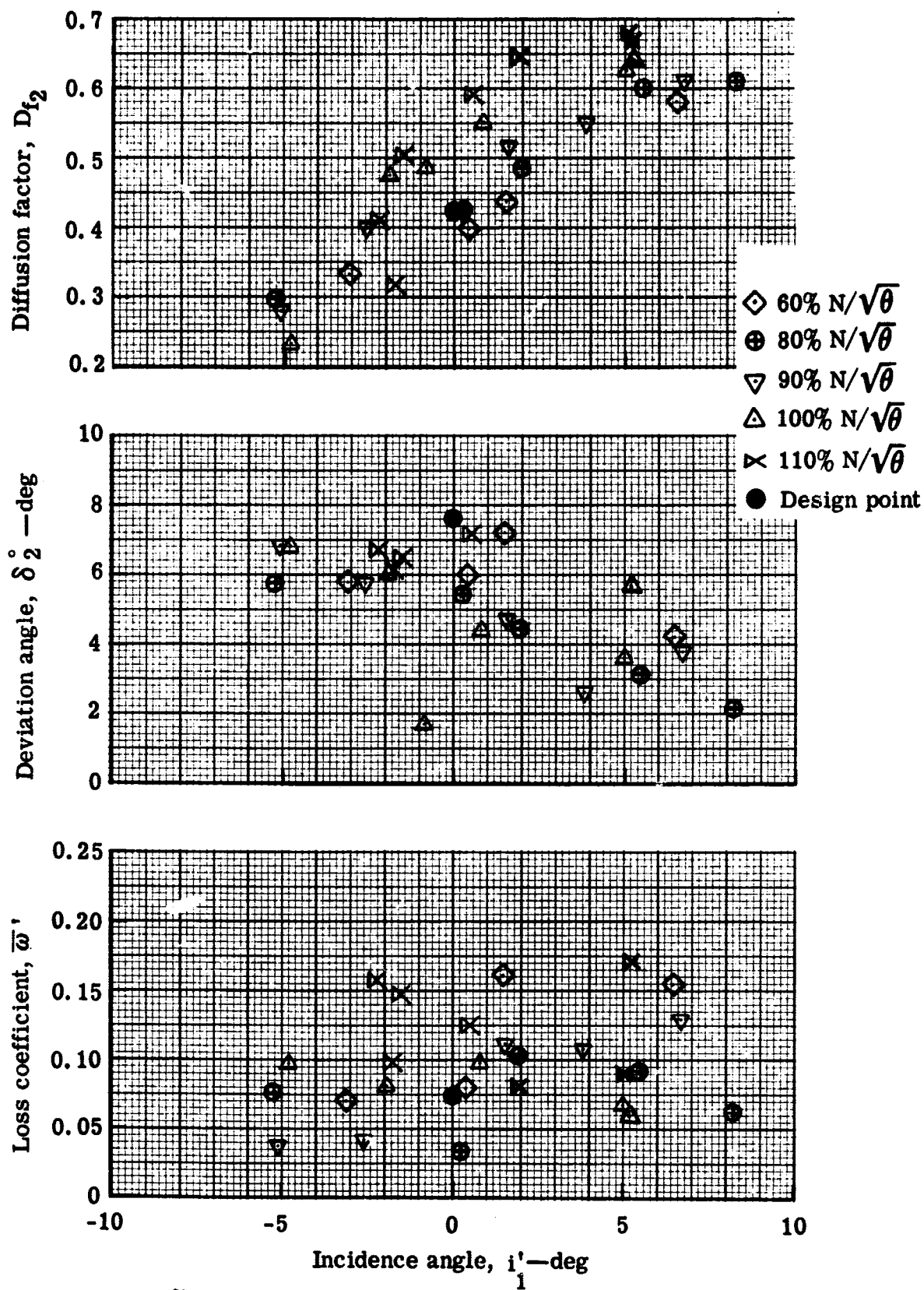
Figure 13. Rotor blade element performance-stage test.



d. 70% streamline from tip

5861-17

Figure 13. Rotor blade element performance-stage test.



e. 90% streamline from tip

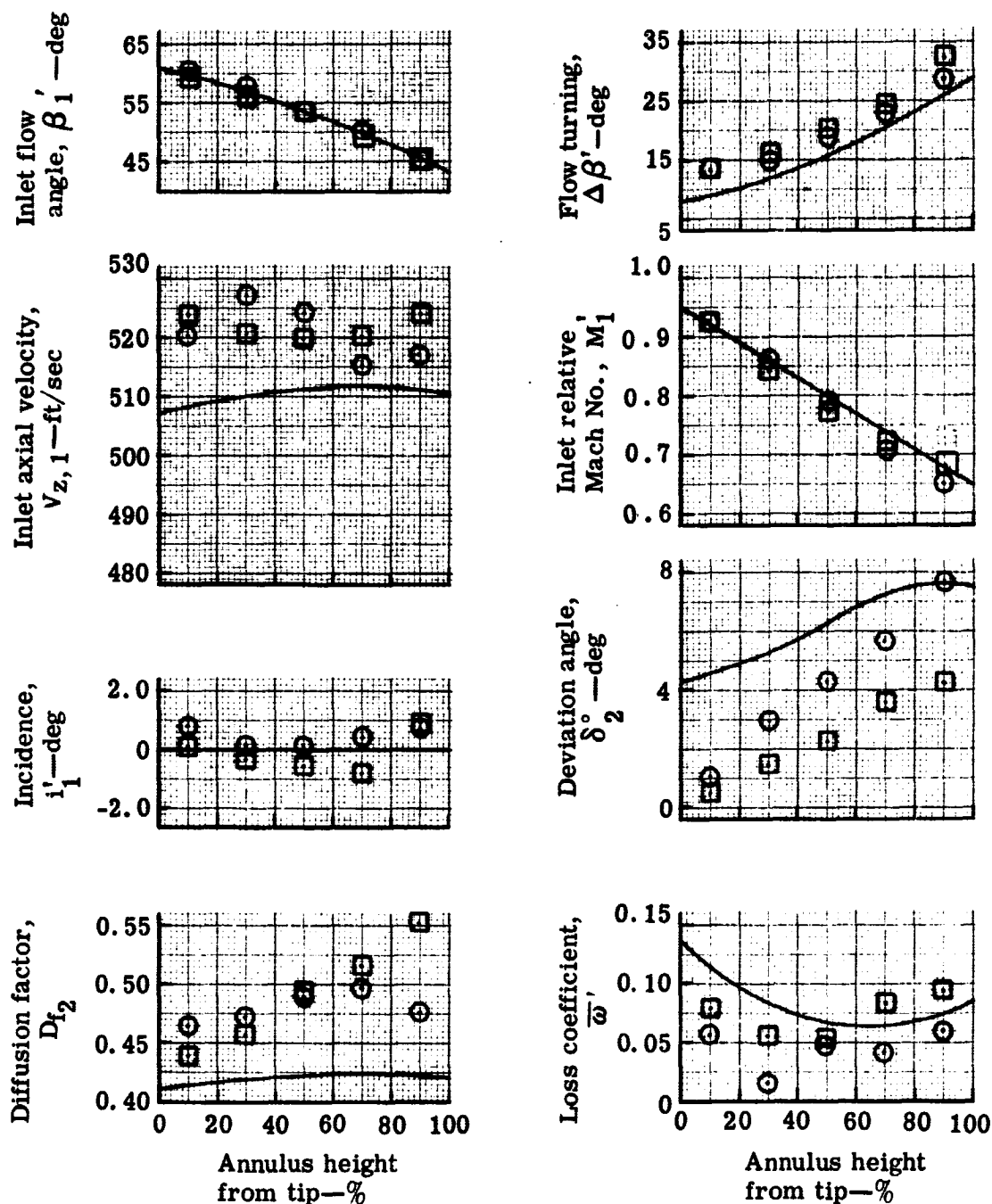
5861-18

Figure 13. Rotor blade element performance-stage test.

— Design,  $W_a \sqrt{\theta}/\delta = 88.2 \text{ lb}_m/\text{sec}$ ,  $N/\sqrt{\theta} = 100\%$

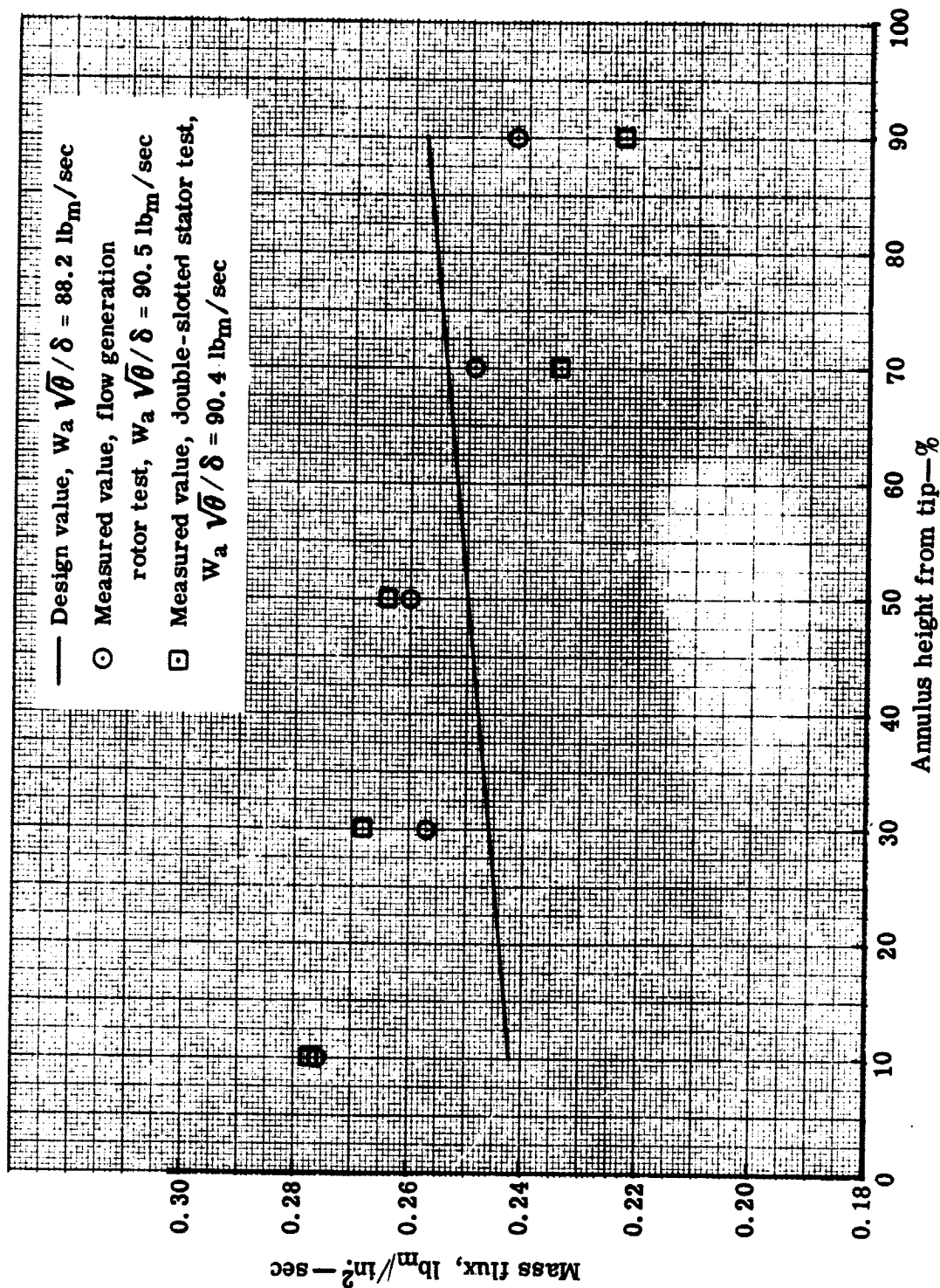
○ Flow generation rotor test,  $W_a \sqrt{\theta}/\delta = 89.3 \text{ lb}_m/\text{sec}$ ,  $N/\sqrt{\theta} = 99.3\%$

□ Slotted stator test,  $W_a \sqrt{\theta}/\delta = 90.4 \text{ lb}_m/\text{sec}$ ,  $N/\sqrt{\theta} = 99.9\%$



5861-19

Figure 14. Radial variation of rotor blade element performance.



5861-20

Figure 15. Rotor out radial mass flux distribution at design speed.

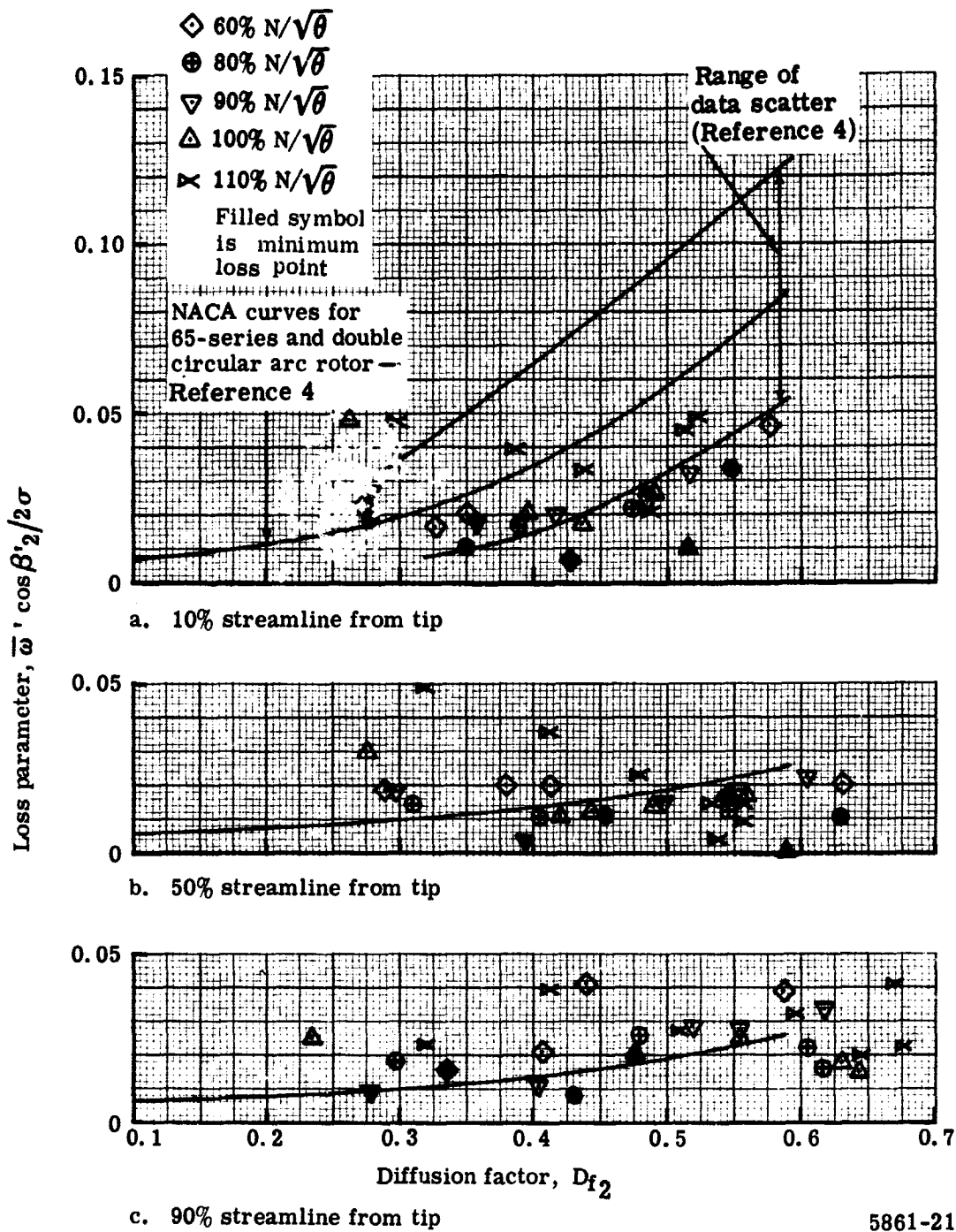
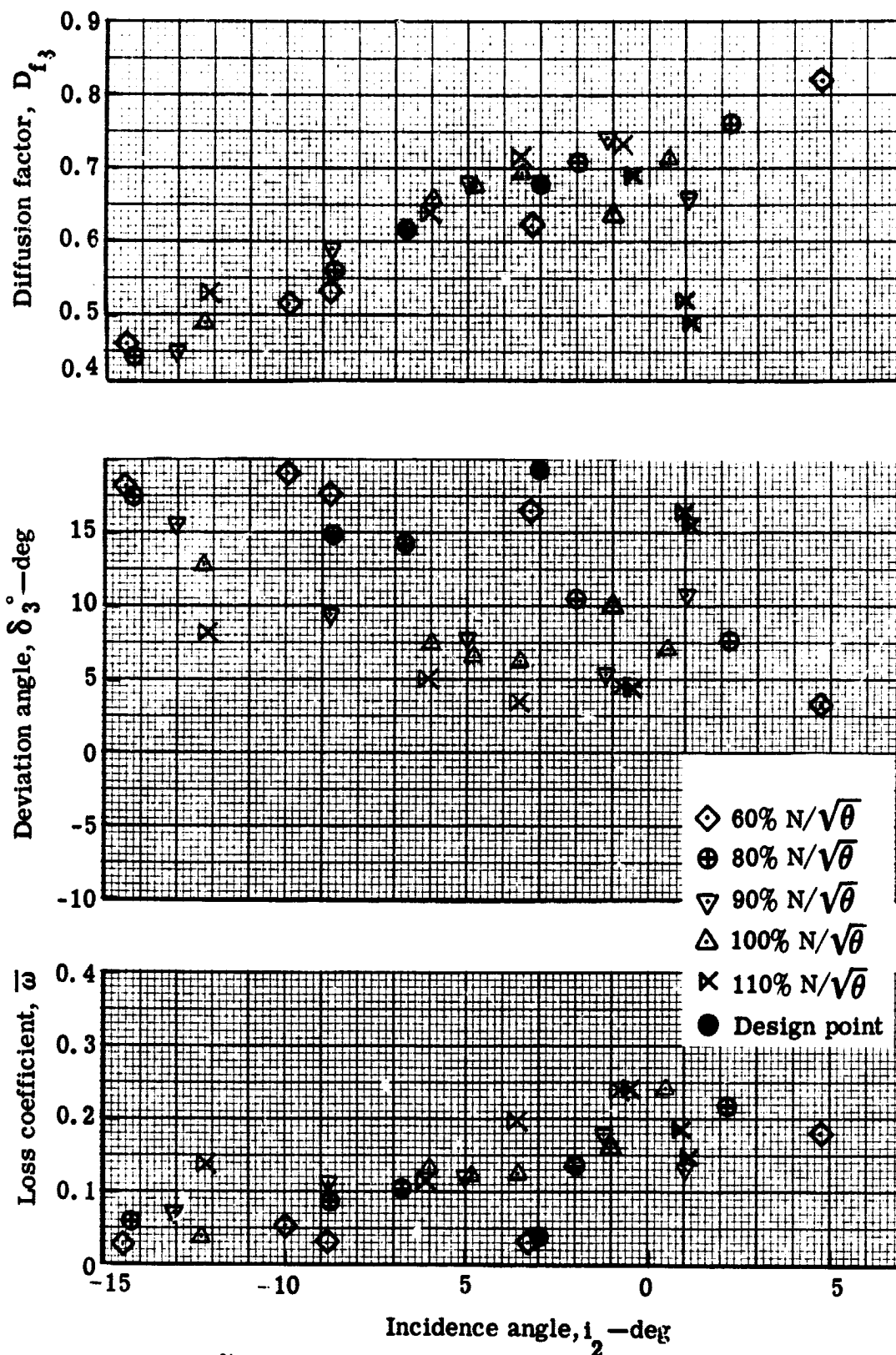


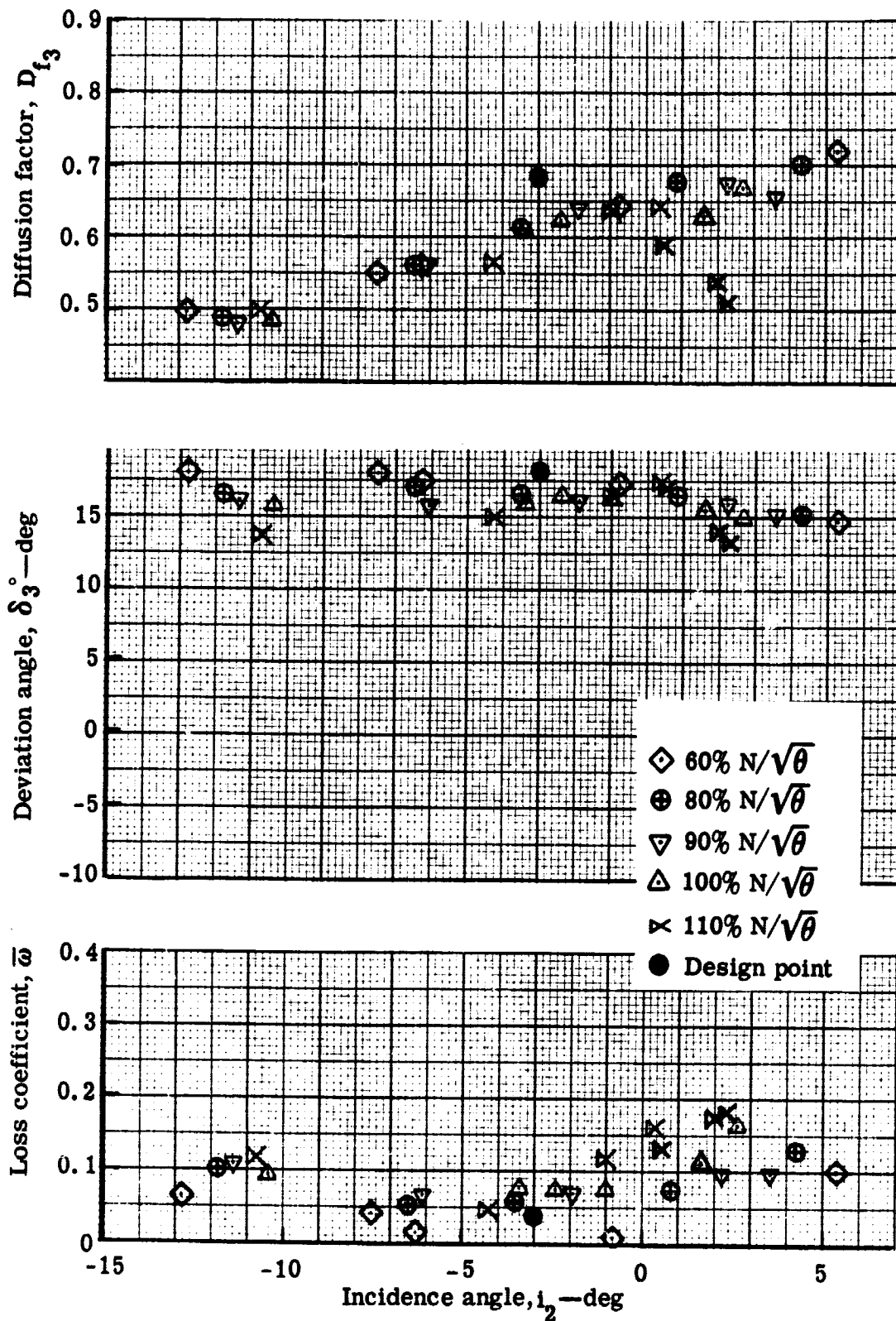
Figure 16. Rotor loss parameter versus diffusion factor.



a. 10% streamline from tip

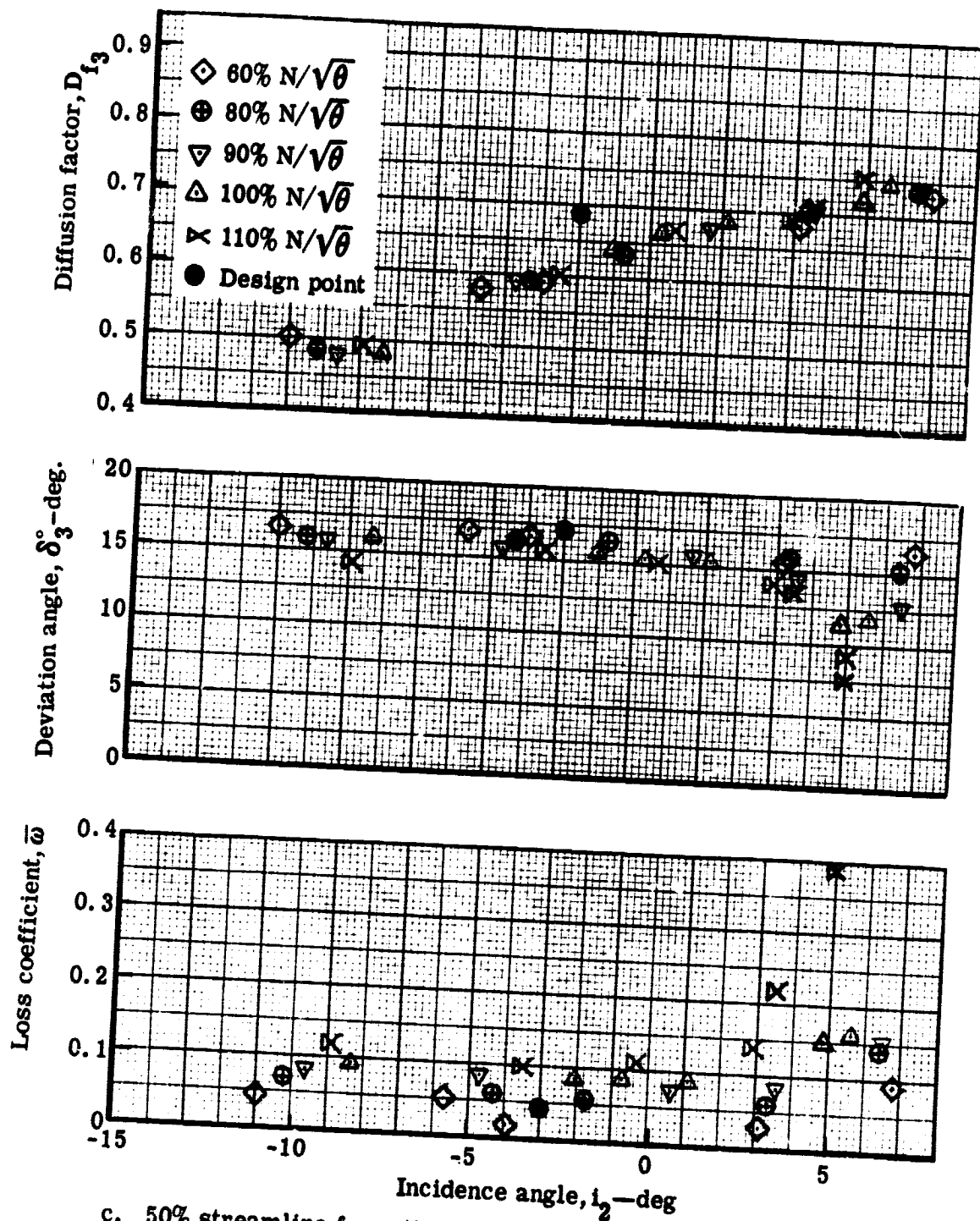
5861-22

Figure 17. Slotted stator blade element performance.



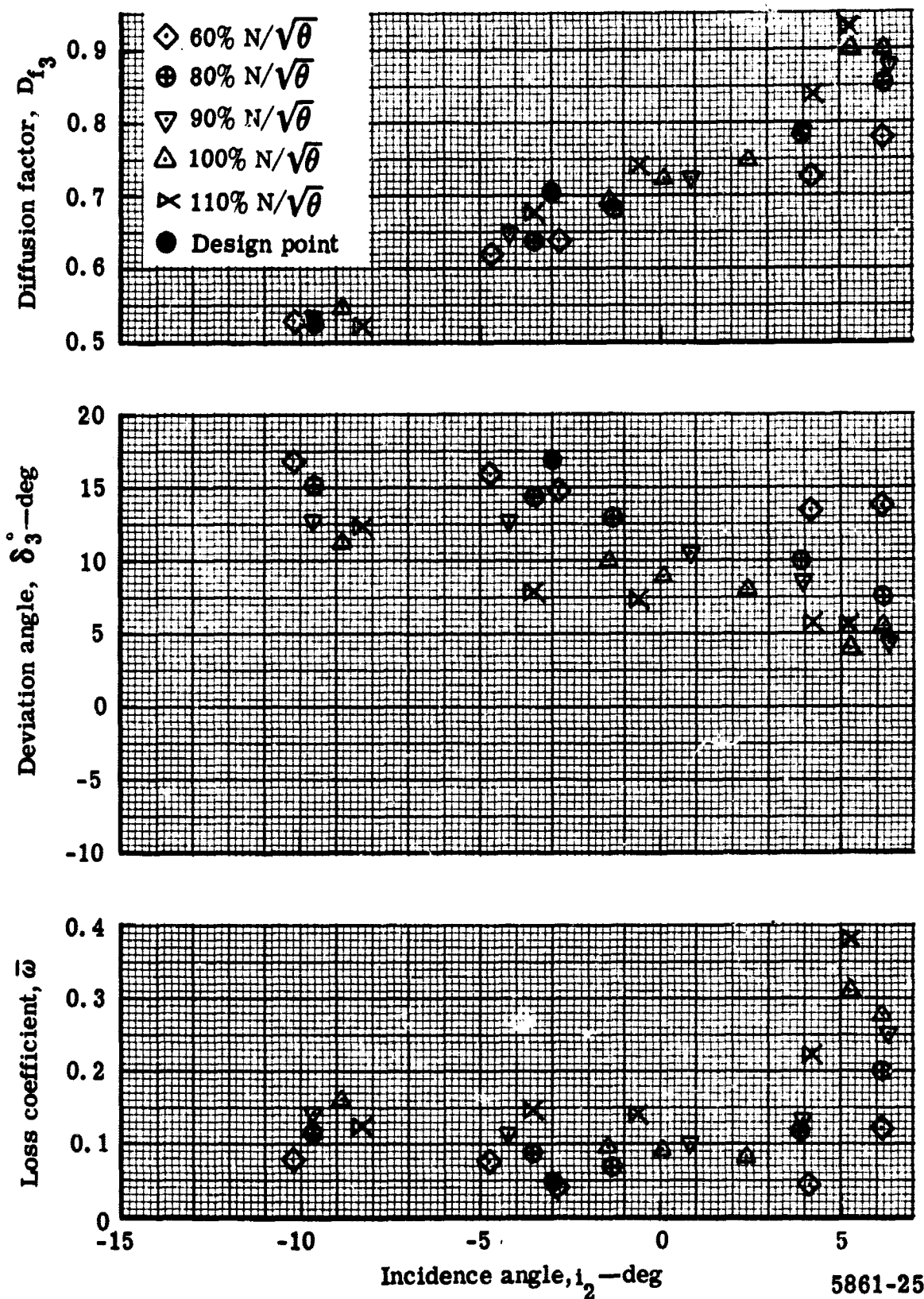
5861-23

Figure 17. Slotted stator blade element performance.



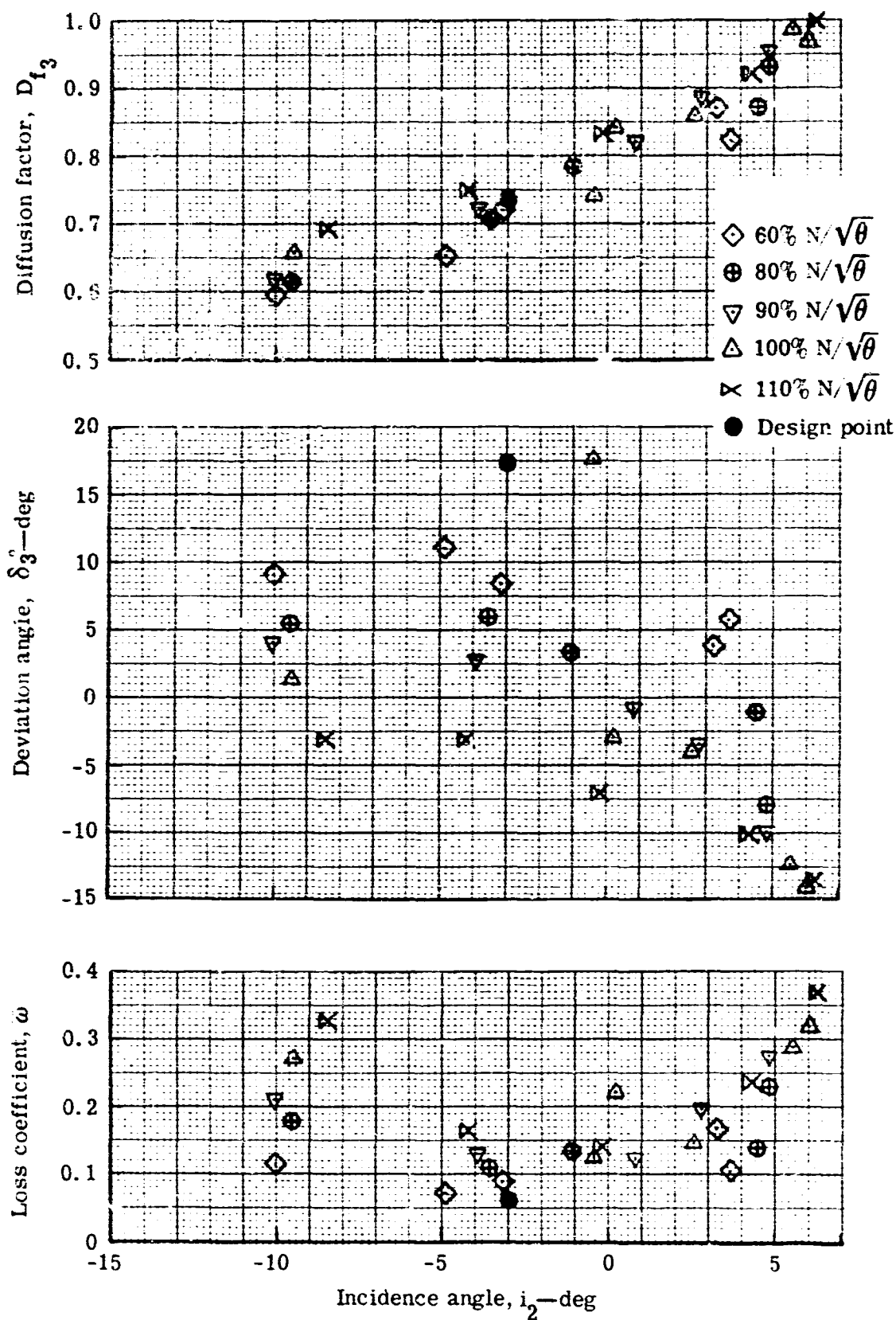
5861-24

Figure 17. Slotted stator blade element performance.



d. 70% streamline from tip

Figure 17. Slotted stator blade element performance.



e. 90% streamline from tip

5861-26

Figure 17. Slotted stator b' de element performance.

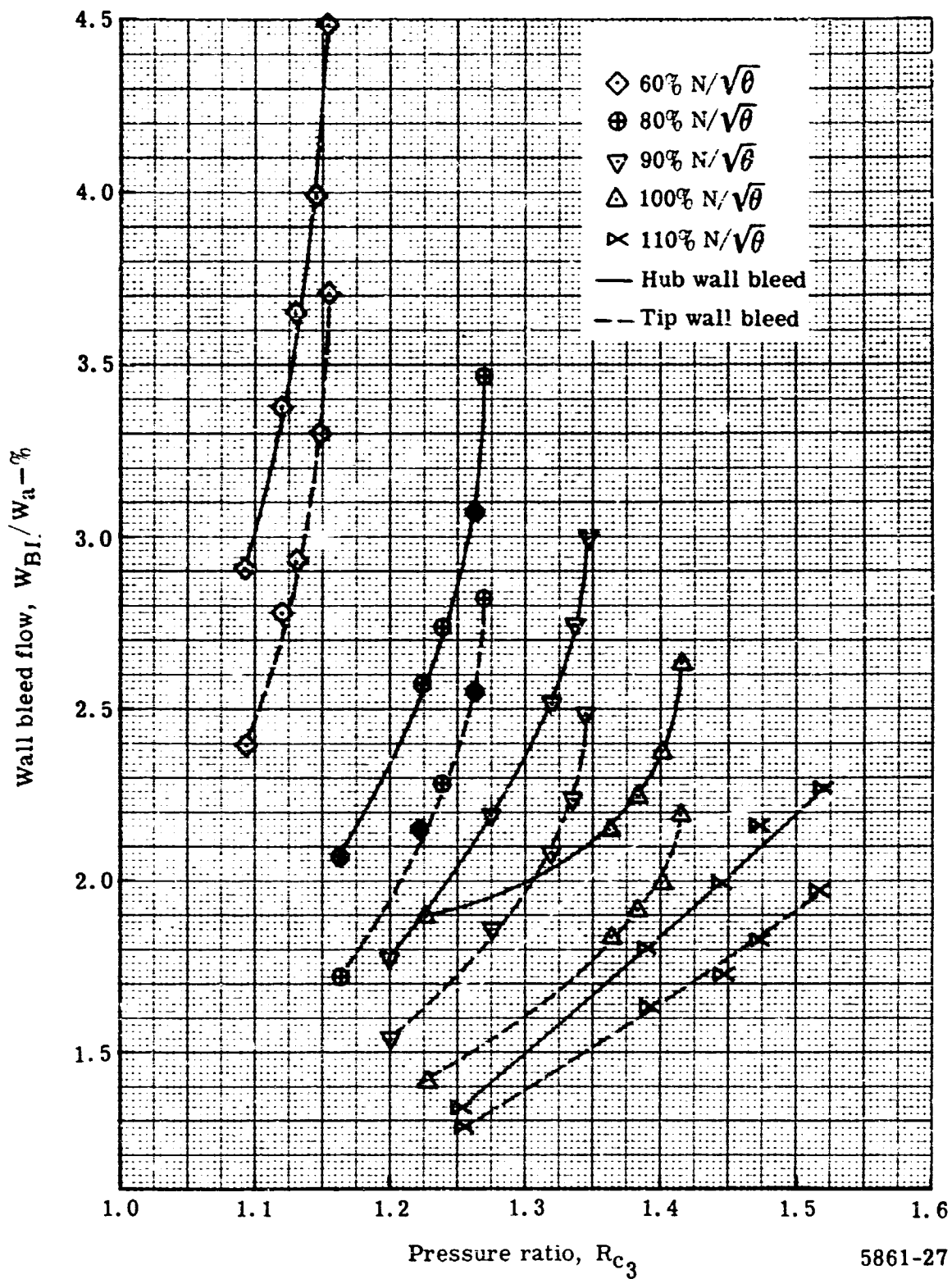
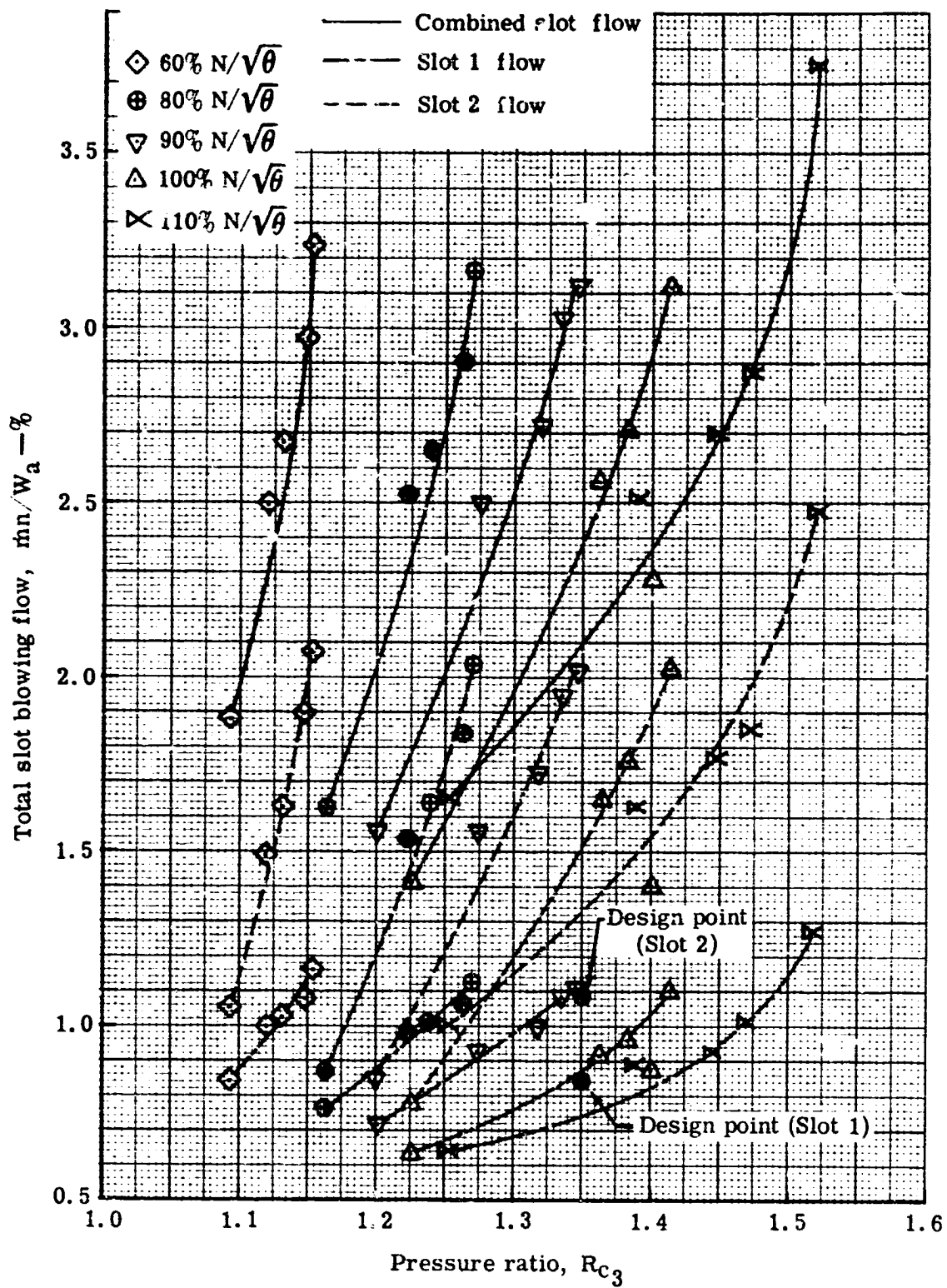
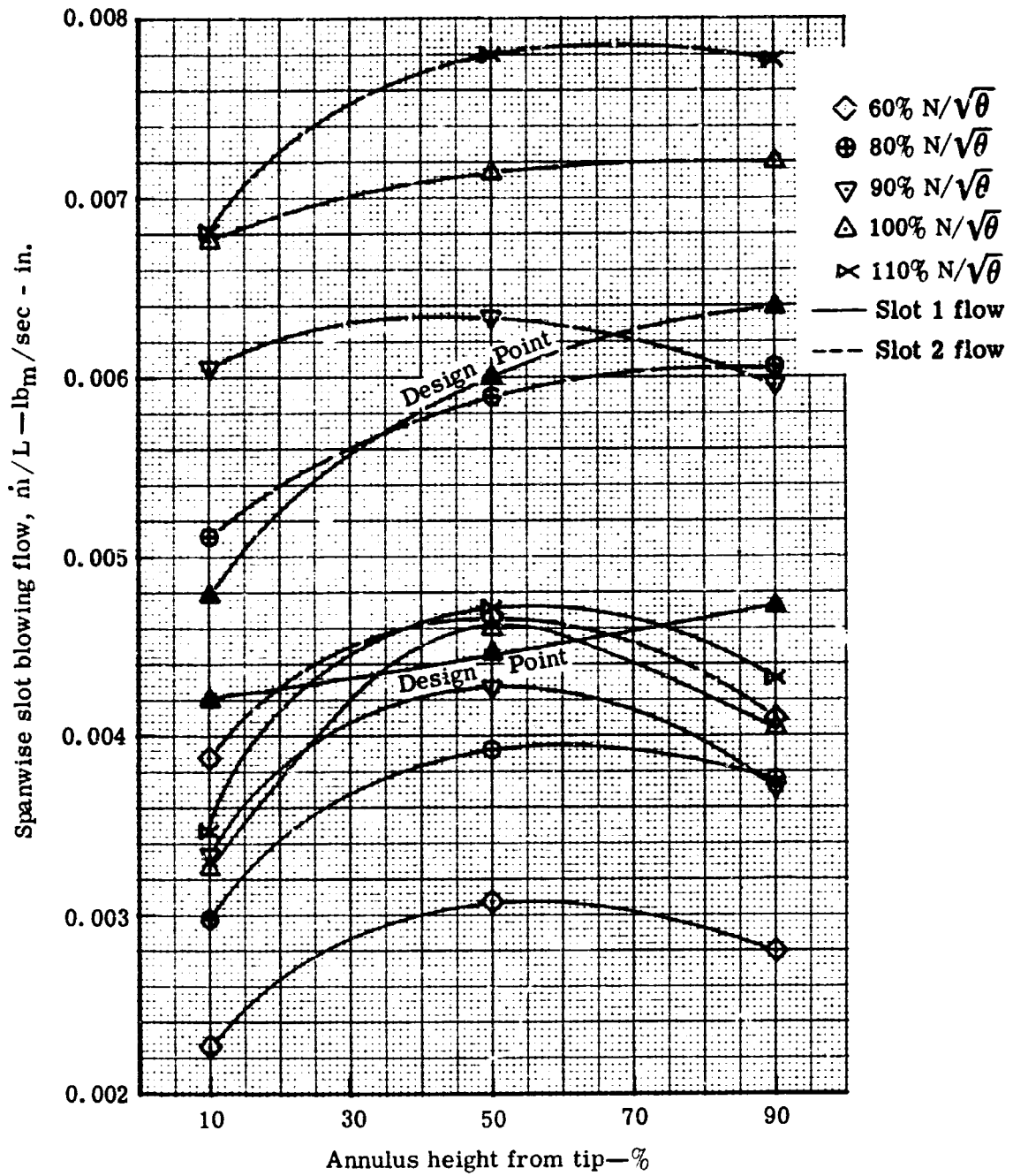


Figure 18. Variation of wall bleed flows with stage pressure ratio.



5861-28

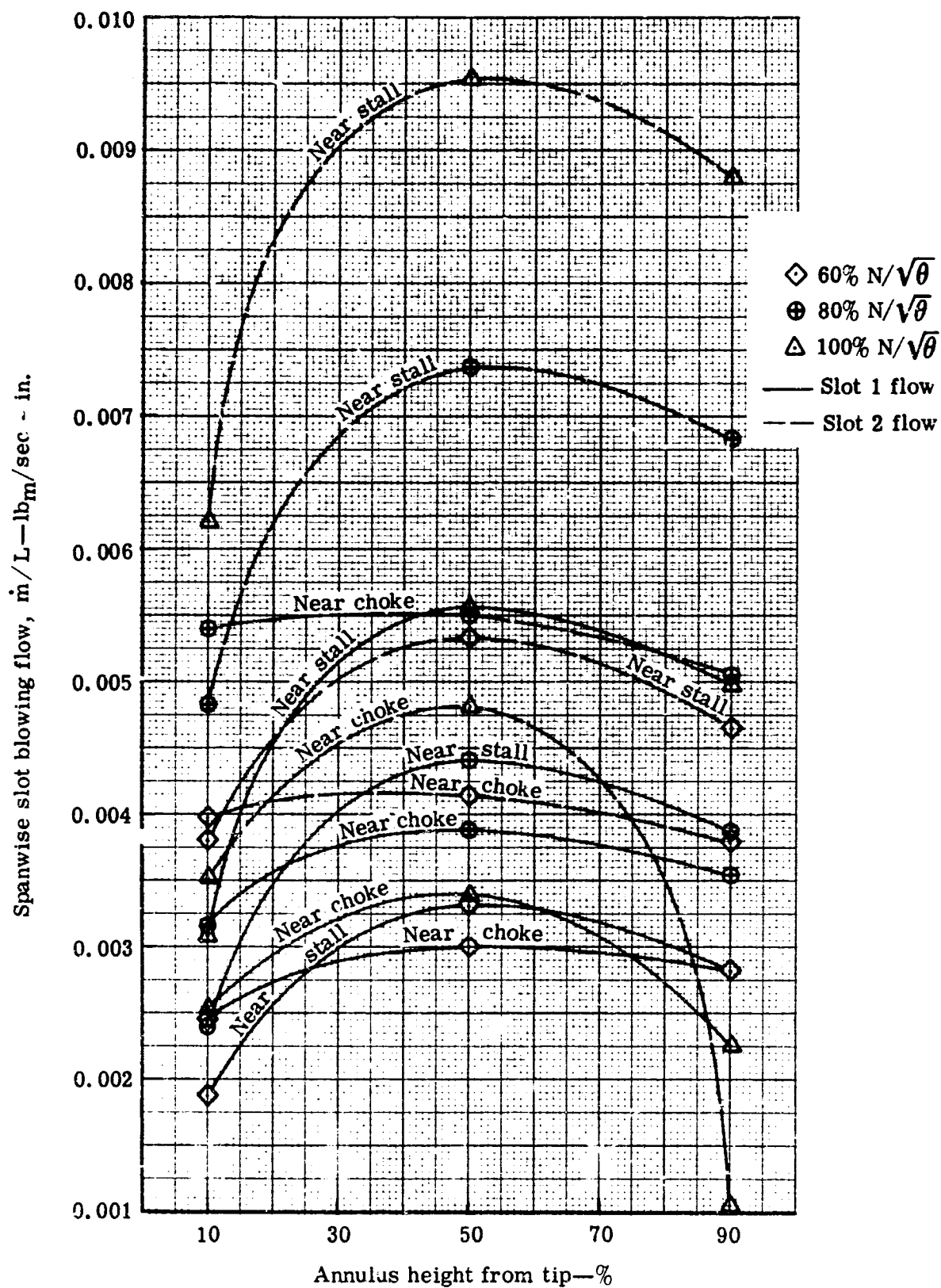
Figure 19. Stator slot blowing flow versus stage pressure ratio.



a. At stator design incidence

5861-29

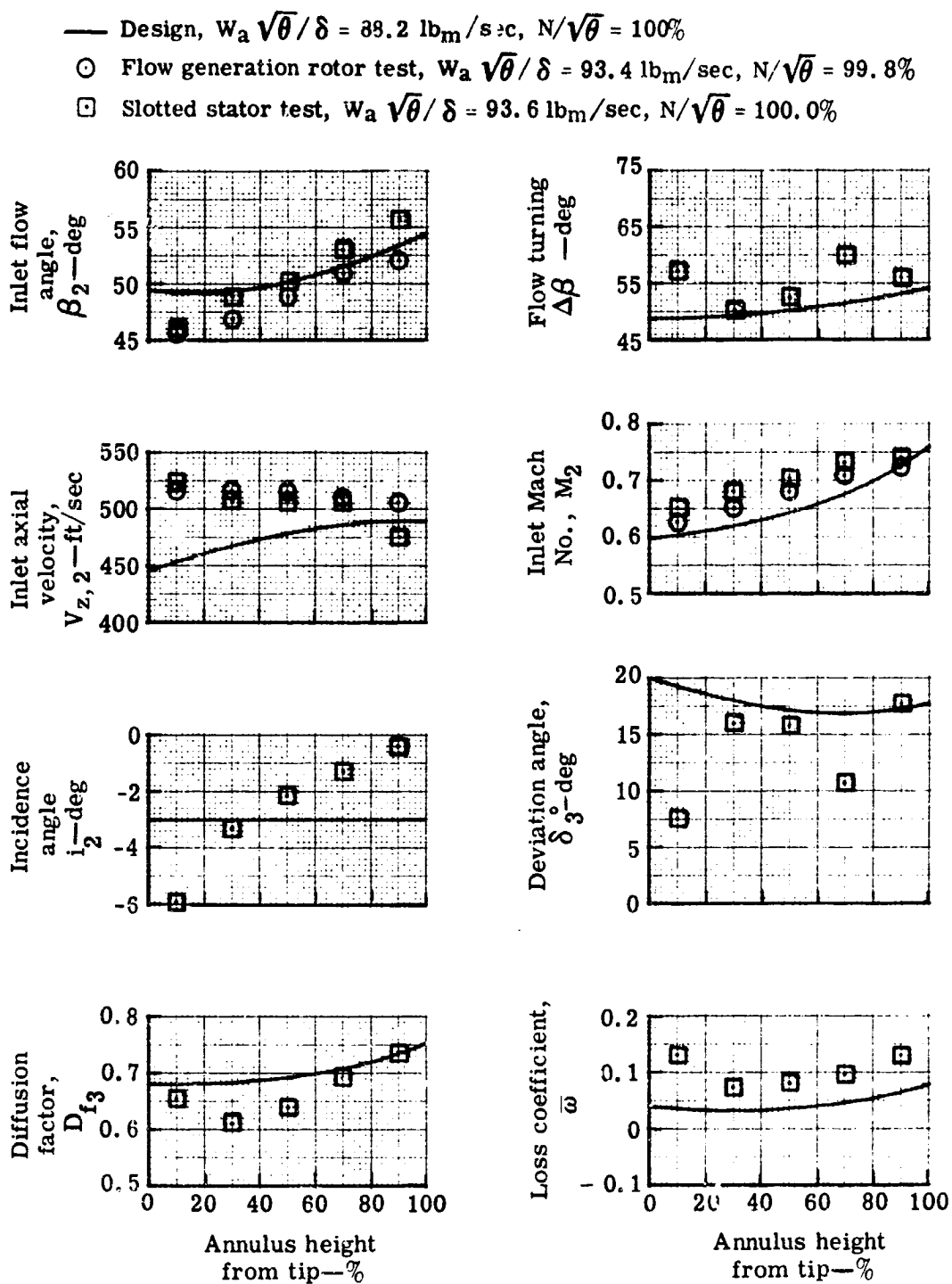
Figure 20. Stator slot blowing flow spanwise distribution.



b. Variation over speed characteristic

5861-30

Figure 20. Stator slot blowing flow spanwise distribution.



5861-31

Figure 21. Radial variation of 0.75  $D_f$  slotted stator blade element performance.

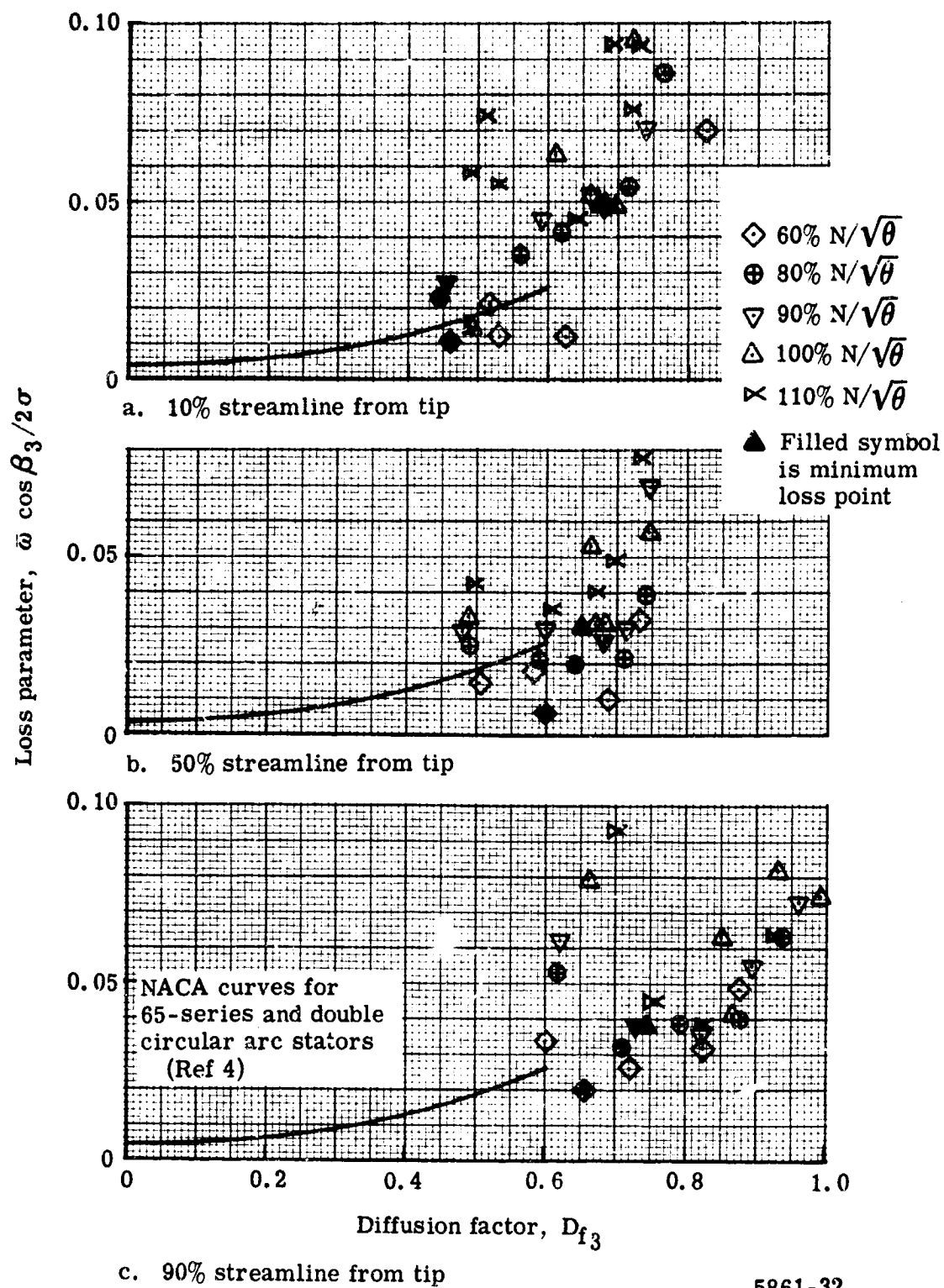


Figure 22. Stator loss parameter versus diffusion factor.

| Symbol          | Streamline from tip (%) | In. Hg abs              |                      |                          |                    |
|-----------------|-------------------------|-------------------------|----------------------|--------------------------|--------------------|
|                 |                         | $P_{t2}$                | $P_{t \text{ core}}$ | $P \text{ slot 1}$       | $P \text{ slot 2}$ |
| x               | 10                      | 30.47                   | 28.15                | 26.45                    | 26.95              |
| .               | 50                      | 30.82                   | 28.25                | 25.49                    | 26.99              |
| +               | 90                      | 31.12                   | 27.25                | 25.75                    | 27.25              |
| $M_{2m} = 0.44$ |                         | $i_{2m} = -10.99^\circ$ |                      | $N/\sqrt{\theta} = 60\%$ |                    |

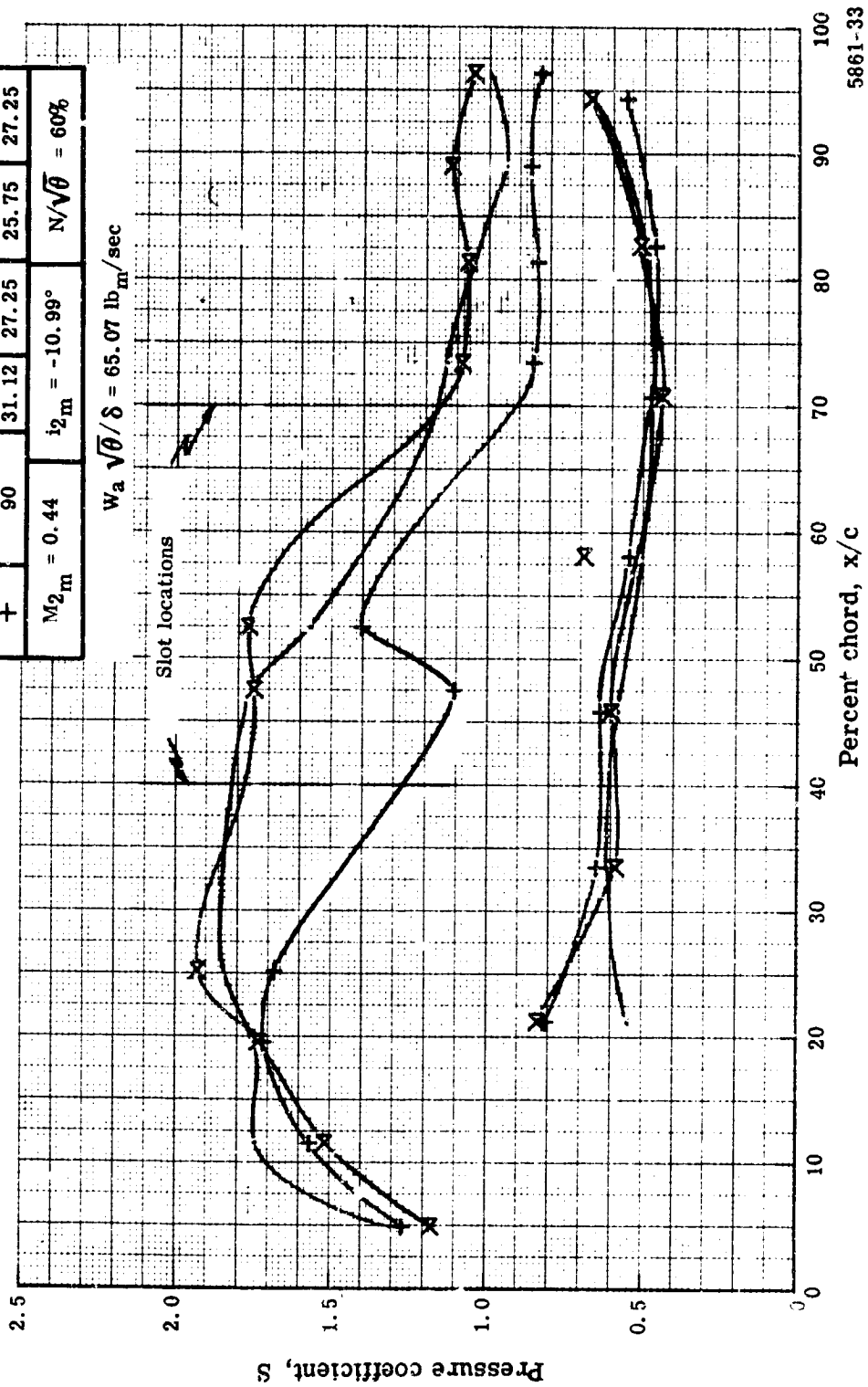


Figure 23a. Slotted stator static pressure distribution at 60% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                          |          |
|-----------------|-------------------------|------------------------|----------------------|--------------------------|----------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | P slot 1                 | P slot 2 |
| ✕               | 10                      | 31.80                  | 30.00                | 28.20                    | 28.75    |
| •               | 50                      | 31.80                  | 30.05                | 27.20                    | 28.70    |
| +               | 90                      | 31.78                  | 29.50                | 27.00                    | 28.35    |
| $M_{2m} = 0.42$ |                         | $i_{2m} = -5.68^\circ$ |                      | $N/\sqrt{\theta} = 60\%$ |          |

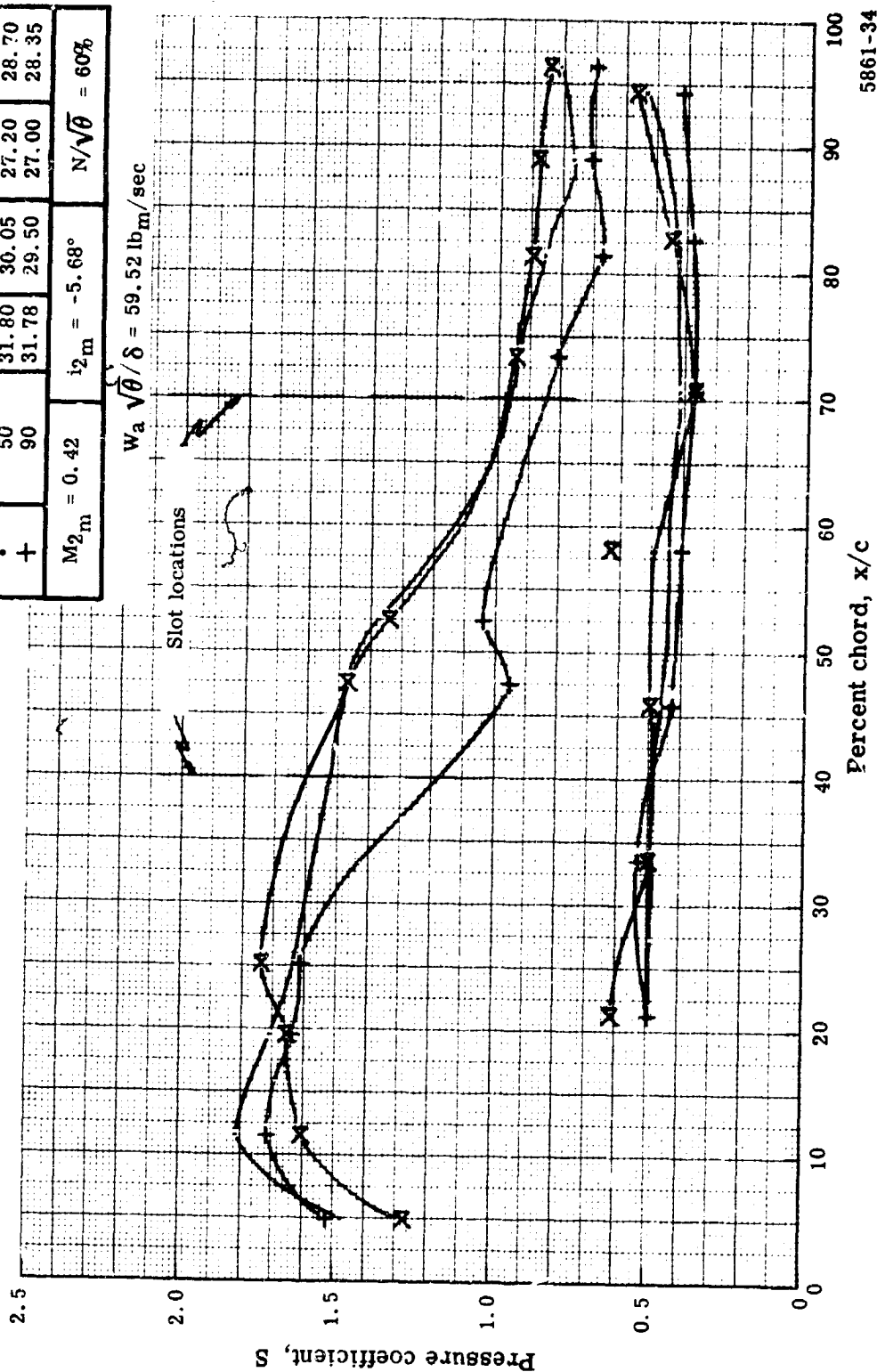


Figure 23b. Slotted stator static pressure distribution at 60% speed.

| Symbol                 | Streamline from tip (%) | In. Hg abs               |                     |            |          |
|------------------------|-------------------------|--------------------------|---------------------|------------|----------|
|                        |                         | P <sub>t2</sub>          | P <sub>t</sub> core | P slot 1   | P slot 2 |
| x                      | 10                      | 32.11                    | 30.57               | 29.07      | 29.42    |
| .                      | 50                      | 31.95                    | 30.72               | 27.80      | 29.05    |
| +                      | 90                      | 31.85                    | 30.17               | 27.77      | 28.87    |
| M <sub>2m</sub> = 0.41 |                         | i <sub>2m</sub> = -3.92° |                     | N/√θ = 60% |          |

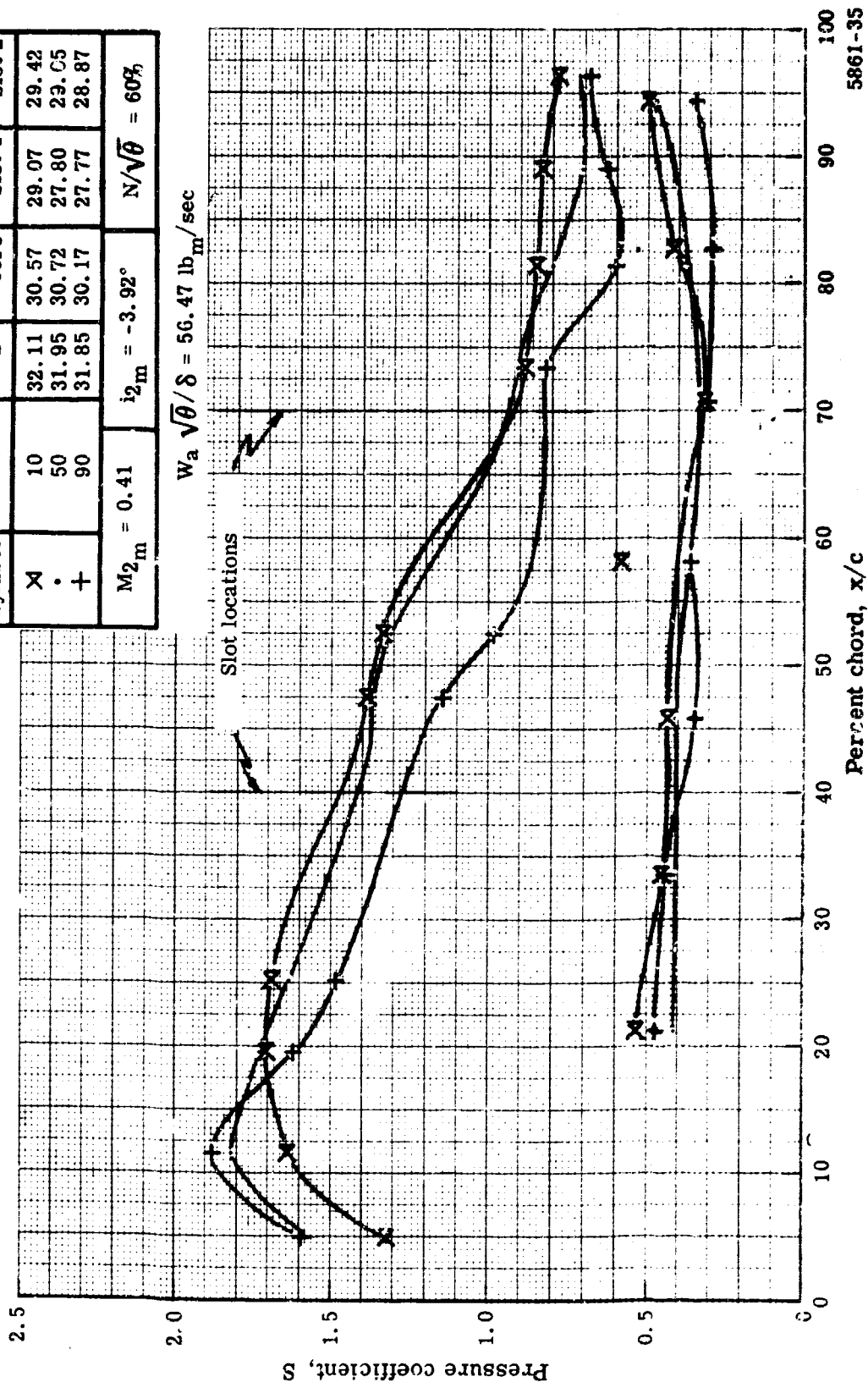


Figure 23c. Slotted stator static pressure distribution at 60% speed.

| Streamline from tip (%) |    | In. Hg abs              |                     |            |          |
|-------------------------|----|-------------------------|---------------------|------------|----------|
| Symbol                  |    | P <sub>t2</sub>         | P <sub>t</sub> core | p slot 1   | p slot 2 |
| x                       | 10 | 32.84                   | 31.62               | 30.57      | 30.57    |
| •                       | 50 | 32.69                   | 32.02               | 28.97      | 30.02    |
| +                       | 90 | 32.52                   | 31.67               | 29.32      | 29.87    |
| M <sub>2in</sub> = 0.41 |    | l <sub>2m</sub> = 3.16° |                     | N/√θ = 60% |          |

$W_a \sqrt{\theta} / \delta = 51.32 \text{ lb}_m / \text{sec}$

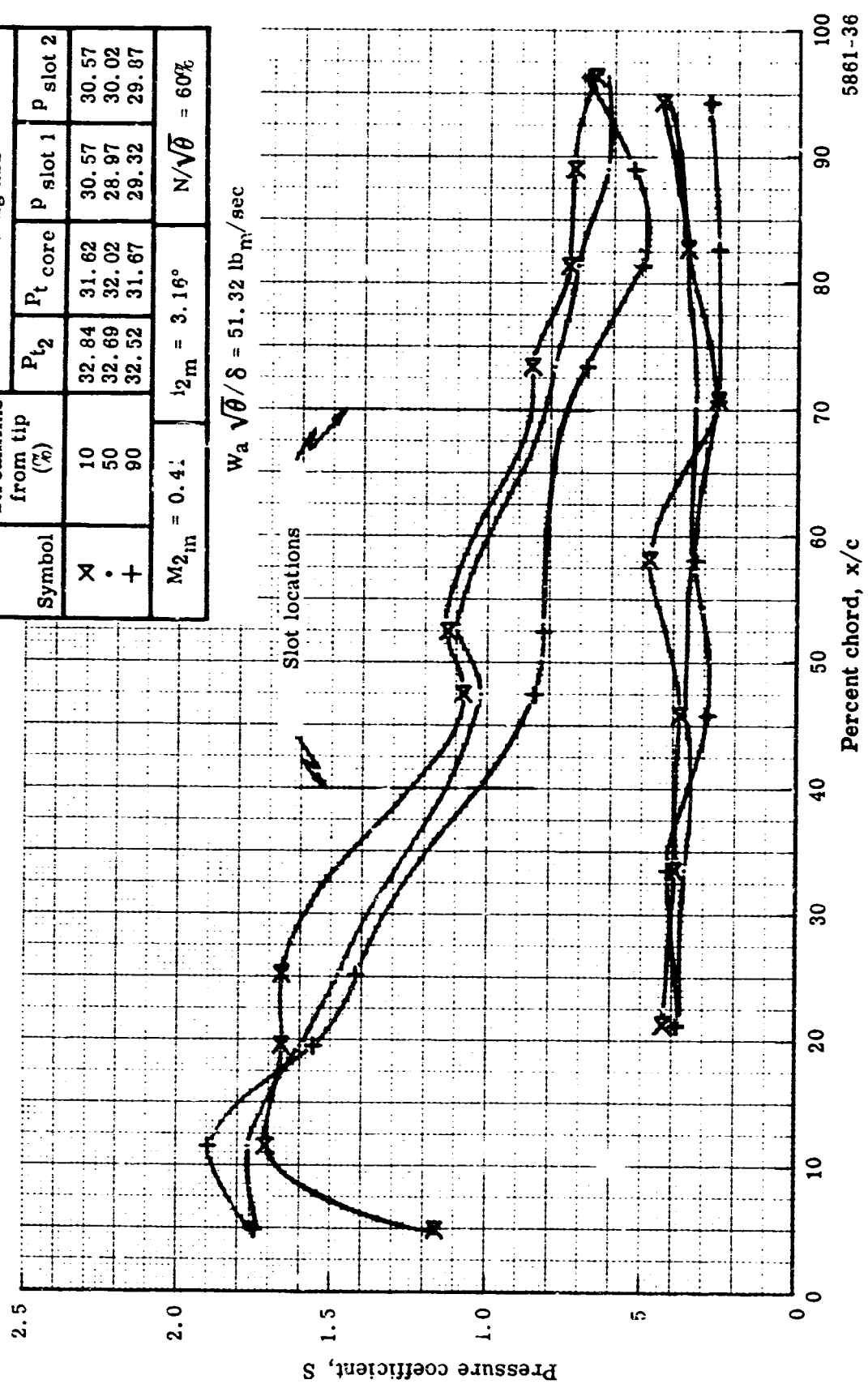


Figure 23d. Slotted stator static pressure distribution at 60% speed.

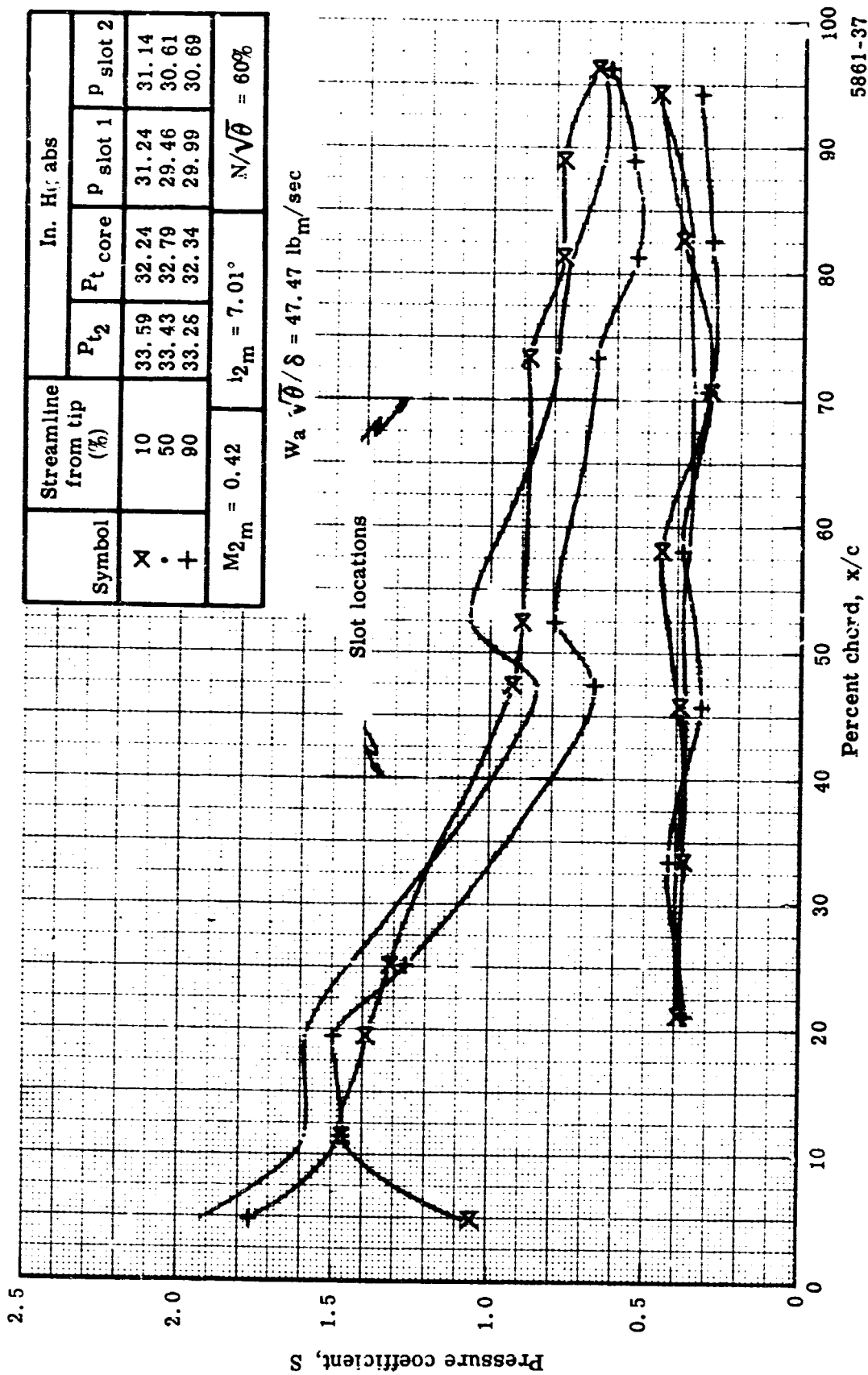


Figure 23e. Slotted stator static pressure distribution at 60% speed.

| Symbol          | Streamline<br>from tip<br>(%) | In. Hg abs                  |                      |                          |                    |
|-----------------|-------------------------------|-----------------------------|----------------------|--------------------------|--------------------|
|                 |                               | $P_{t2}$                    | $P_{t \text{ core}}$ | $P \text{ slot 1}$       | $P \text{ slot 2}$ |
| x               | 10                            | 31.74                       | 26.84                | 24.59                    | 25.54              |
| .               | 50                            | 32.31                       | 26.84                | 22.46                    | 25.21              |
| +               | 90                            | 32.71                       | 25.49                | 23.19                    | 25.49              |
| $M_{2m} = 0.59$ |                               | $\iota_{2m} = -10.21^\circ$ |                      | $N/\sqrt{\theta} = 80\%$ |                    |

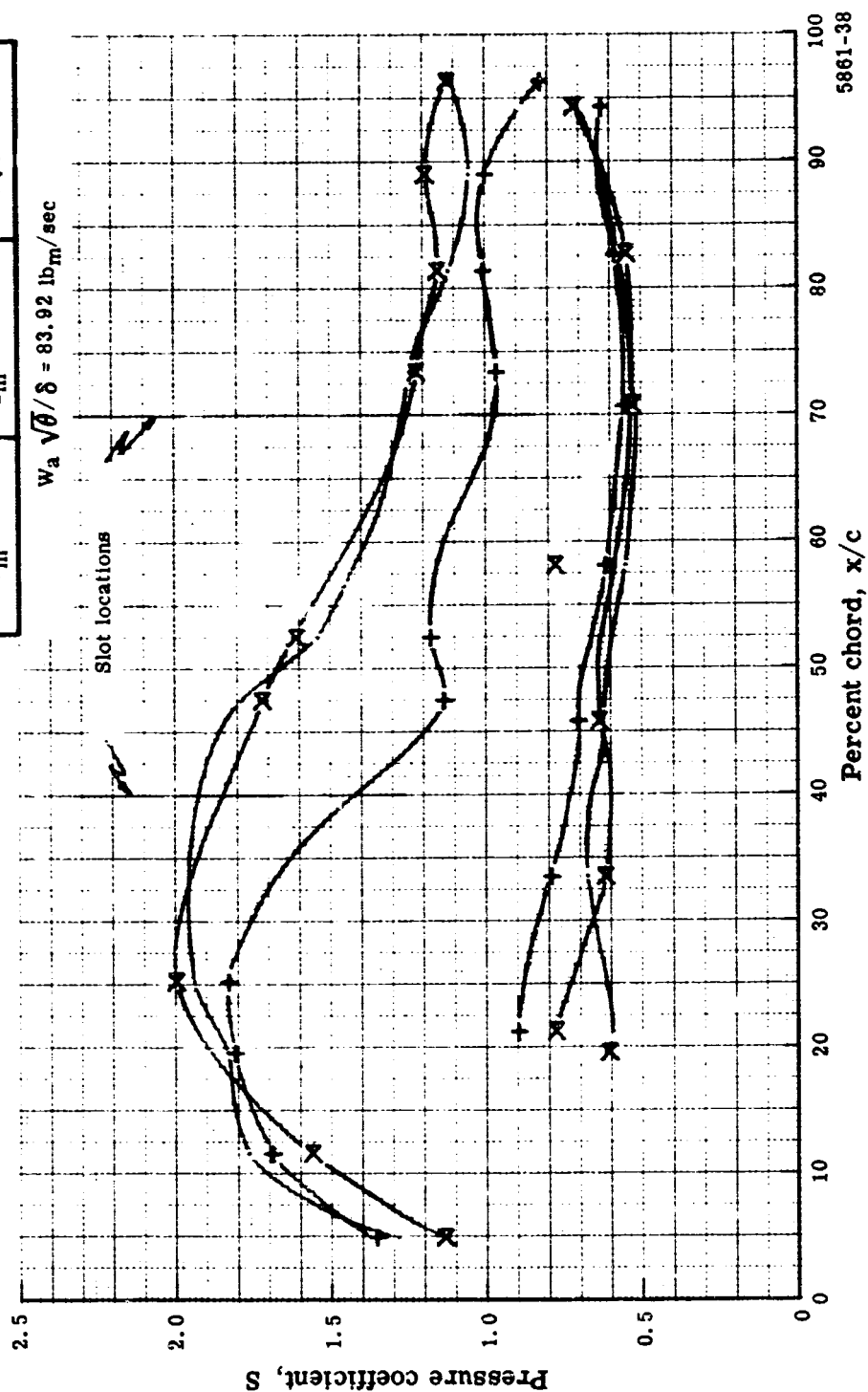


Figure 24a. Slotted stator static pressure distribution at 80% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs             |                     |                          |          |
|-----------------|-------------------------|------------------------|---------------------|--------------------------|----------|
|                 |                         | P <sub>t2</sub>        | P <sub>t</sub> core | p slot 1                 | p slot 2 |
| ✕               | 10                      | 34.25                  | 30.92               | 27.92                    | 28.67    |
| •               | 50                      | 34.06                  | 30.87               | 26.06                    | 28.51    |
| +               | 90                      | 33.92                  | 29.97               | 25.92                    | 27.97    |
| $M_{2m} = 0.57$ |                         | $l_{2m} = -4.29^\circ$ |                     | $N/\sqrt{\theta} = 80\%$ |          |

$$W_a \sqrt{\theta} / \delta = 77.55 \text{ lb}_m/\text{sec}$$

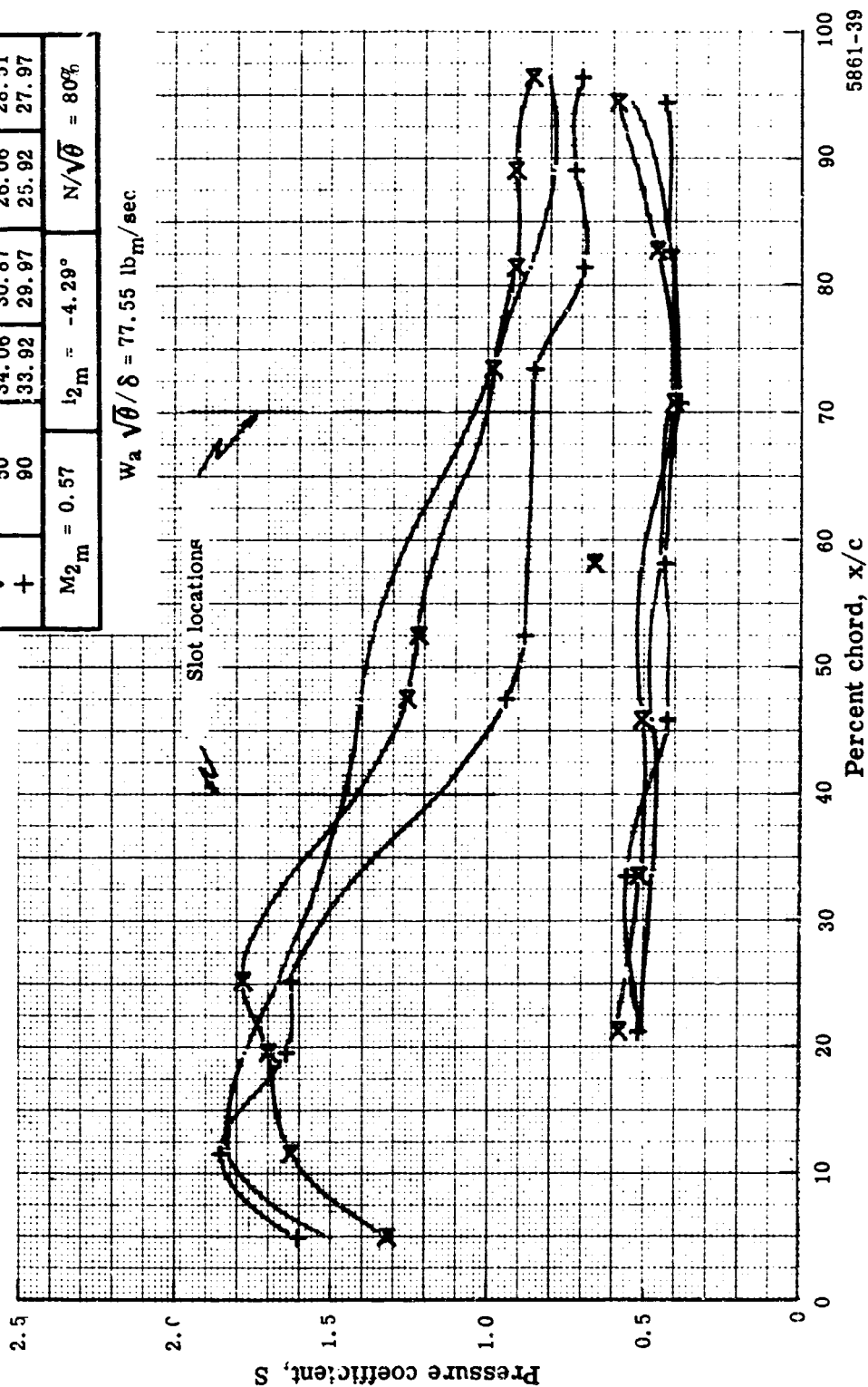


Figure 24b. Slotted stator static pressure distribution at 80% speed.

| Symbol                 | Streamline from tip (%) | In. Hg abs               |                     |            |          |
|------------------------|-------------------------|--------------------------|---------------------|------------|----------|
|                        |                         | P <sub>t2</sub>          | P <sub>t</sub> core | P slot 1   | P slot 2 |
| x                      | 10                      | 34.90                    | 31.88               | 29.33      | 29.93    |
| .                      | 50                      | 34.62                    | 31.93               | 27.14      | 29.29    |
| +                      | 90                      | 34.37                    | 31.58               | 27.18      | 28.73    |
| M <sub>2m</sub> = 0.56 |                         | i <sub>2m</sub> = -1.72° |                     | N/√θ = 80% |          |

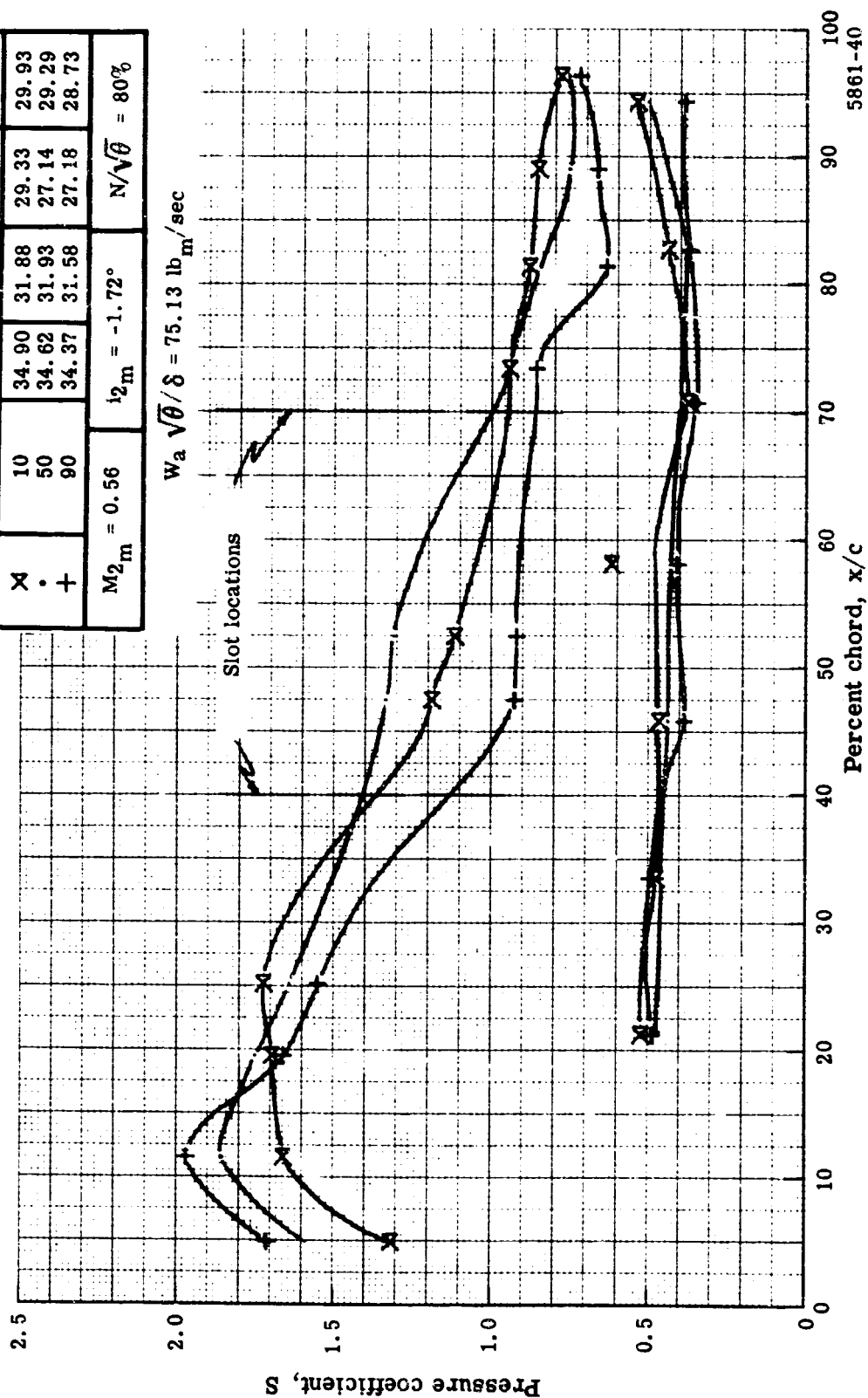


Figure 24c. Slotted stator static pressure distribution at 80% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                          |                    |
|-----------------|-------------------------|-----------------------|----------------------|--------------------------|--------------------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | $p \text{ slot 1}$       | $p \text{ slot 2}$ |
| ✕               | 10                      | 36.22                 | 33.28                | 31.43                    | 31.48              |
| •               | 50                      | 35.59                 | 34.03                | 28.74                    | 30.64              |
| +               | 90                      | 35.24                 | 33.63                | 29.03                    | 30.25              |
| $M_{2m} = 0.55$ |                         | $i_{2m} = 3.38^\circ$ |                      | $N/\sqrt{\theta} = 80\%$ |                    |

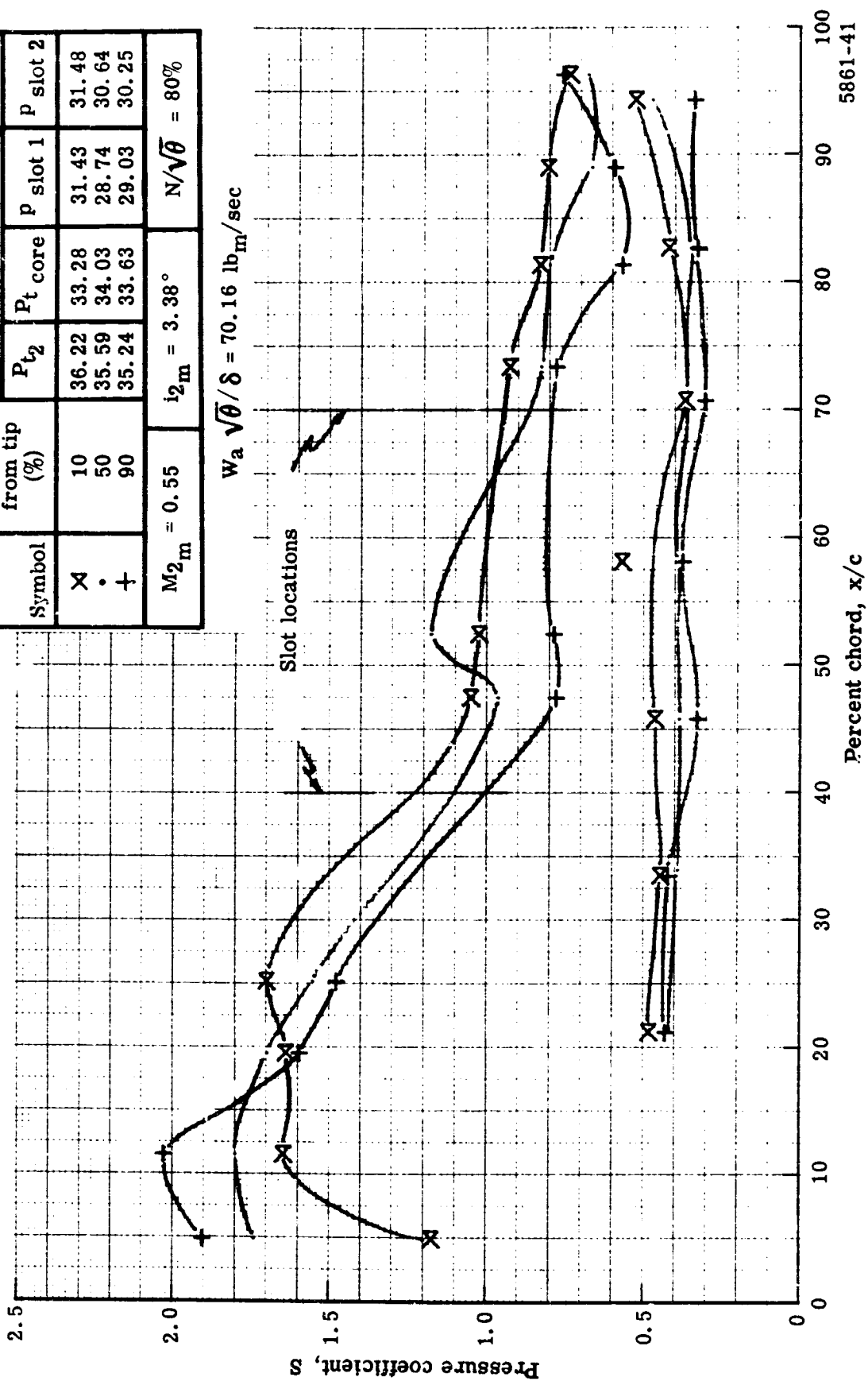


Figure 24d. Slotted stator static pressure distribution at 80% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                          |          |
|-----------------|-------------------------|-----------------------|----------------------|--------------------------|----------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | P slot 1                 | P slot 2 |
| X               | 10                      | 37.29                 | 33.84                | 32.24                    | 32.14    |
| .               | 50                      | 36.64                 | 35.24                | 29.37                    | 31.17    |
| +               | 90                      | 36.20                 | 34.54                | 30.19                    | 31.04    |
| $M_{2m} = 0.56$ |                         | $i_{2m} = 6.48^\circ$ |                      | $N/\sqrt{\theta} = 80\%$ |          |

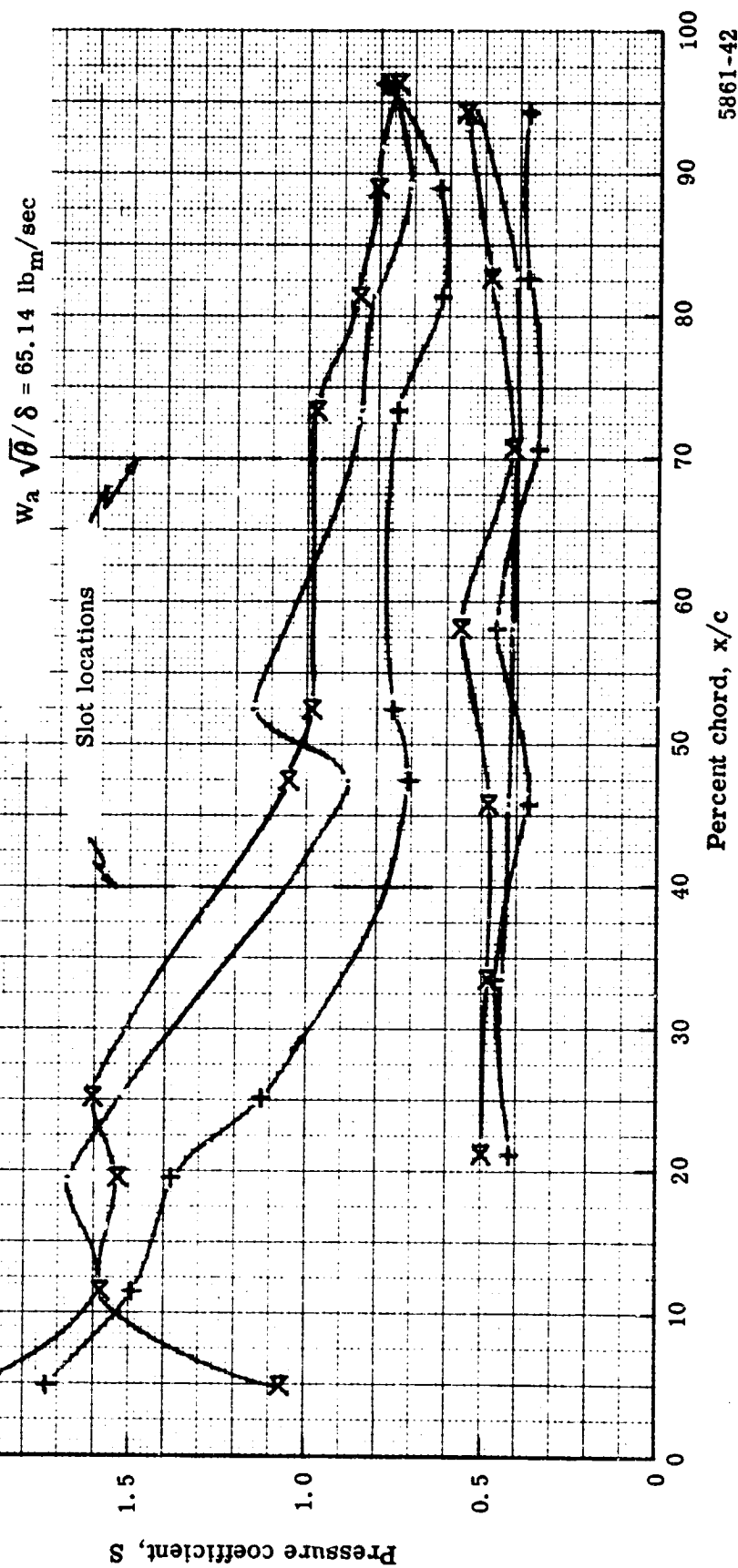


Figure 24e. Slotted stator static pressure distribution at 80% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                          |                    |
|-----------------|-------------------------|------------------------|----------------------|--------------------------|--------------------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | $p \text{ slot 1}$       | $p \text{ slot 2}$ |
| x               | 10                      | 32.60                  | 26.13                | 23.78                    | 24.58              |
| .               | 50                      | 33.23                  | 26.13                | 21.11                    | 24.21              |
| +               | 90                      | 33.68                  | 24.63                | 22.33                    | 24.63              |
| $M_{2m} = 0.66$ |                         | $i_{2m} = -9.61^\circ$ |                      | $N/\sqrt{\theta} = 90\%$ |                    |

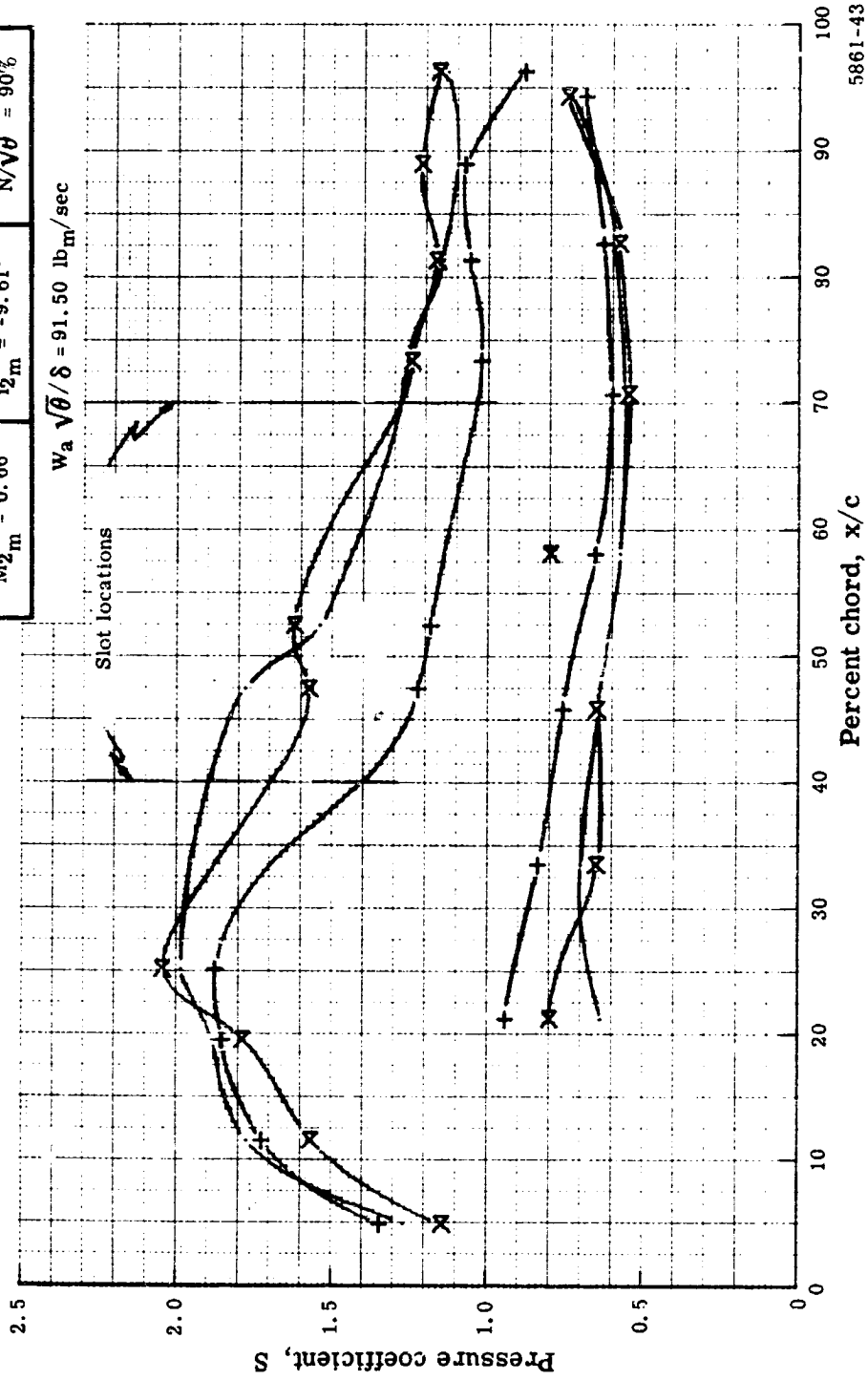


Figure 25a. Slotted stator static pressure distribution at 90% speed.

5861-43

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                          |                    |
|-----------------|-------------------------|------------------------|----------------------|--------------------------|--------------------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | $P \text{ slot 1}$       | $P \text{ slot 2}$ |
| x               | 10                      | 35.33                  | 30.67                | 27.37                    | 27.82              |
| .               | 50                      | 35.17                  | 30.87                | 24.94                    | 27.74              |
| +               | 90                      | 34.76                  | 29.82                | 25.42                    | 27.02              |
| $M_{2m} = 0.64$ |                         | $i_{2m} = -4.68^\circ$ |                      | $N/\sqrt{\theta} = 90\%$ |                    |

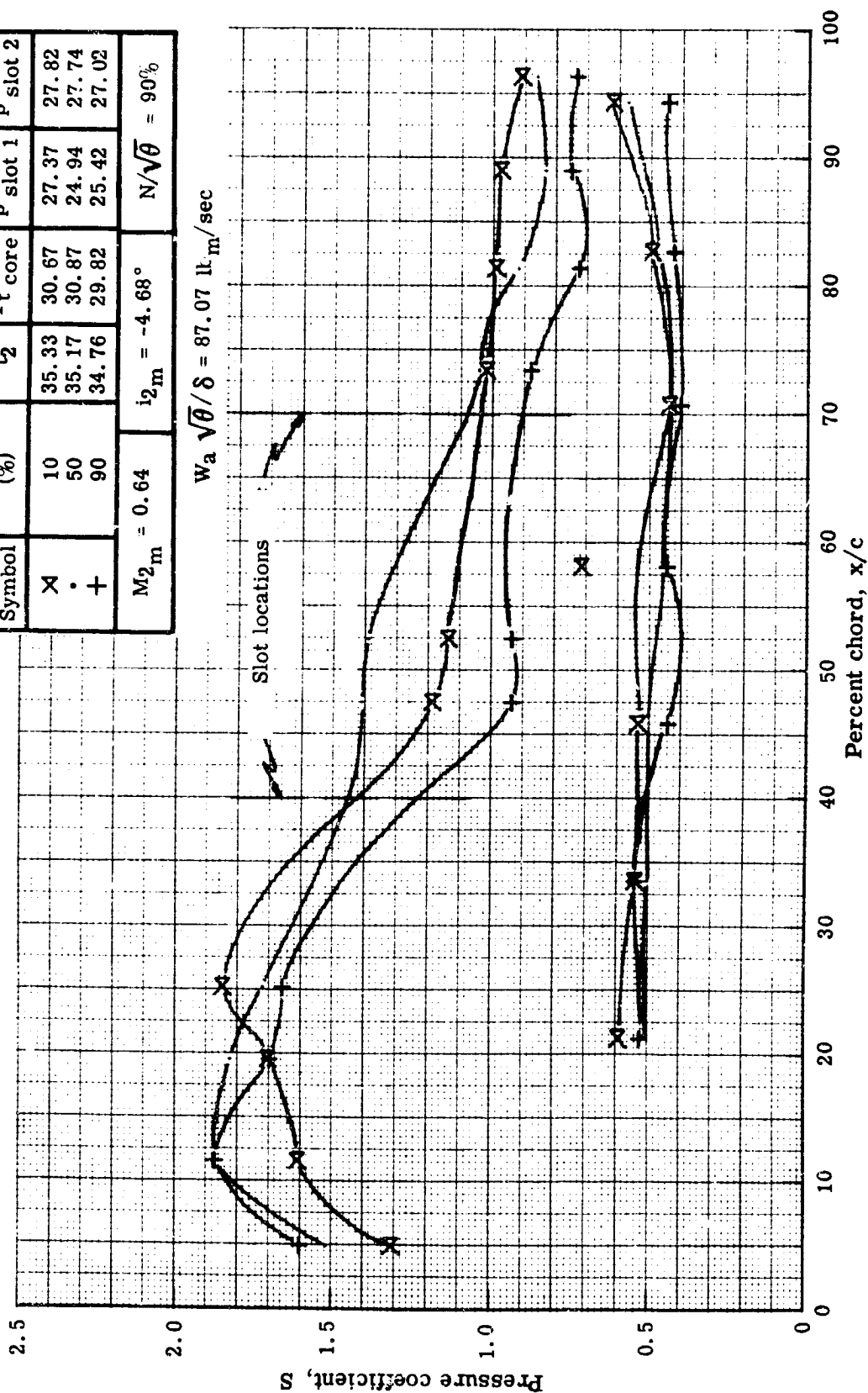


Figure 25b. Slotted stator static pressure distribution at 90% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                          |                    |
|-----------------|-------------------------|-----------------------|----------------------|--------------------------|--------------------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | $p \text{ slot 1}$       | $p \text{ slot 2}$ |
| x               | 10                      | 37.04                 | 32.98                | 30.53                    | 30.73              |
| .               | 50                      | 36.46                 | 33.73                | 27.41                    | 29.76              |
| +               | 90                      | 35.83                 | 33.18                | 28.23                    | 29.23              |
| $M_{2m} = 0.63$ |                         | $i_{2m} = 0.68^\circ$ |                      | $N/\sqrt{\theta} = 90\%$ |                    |

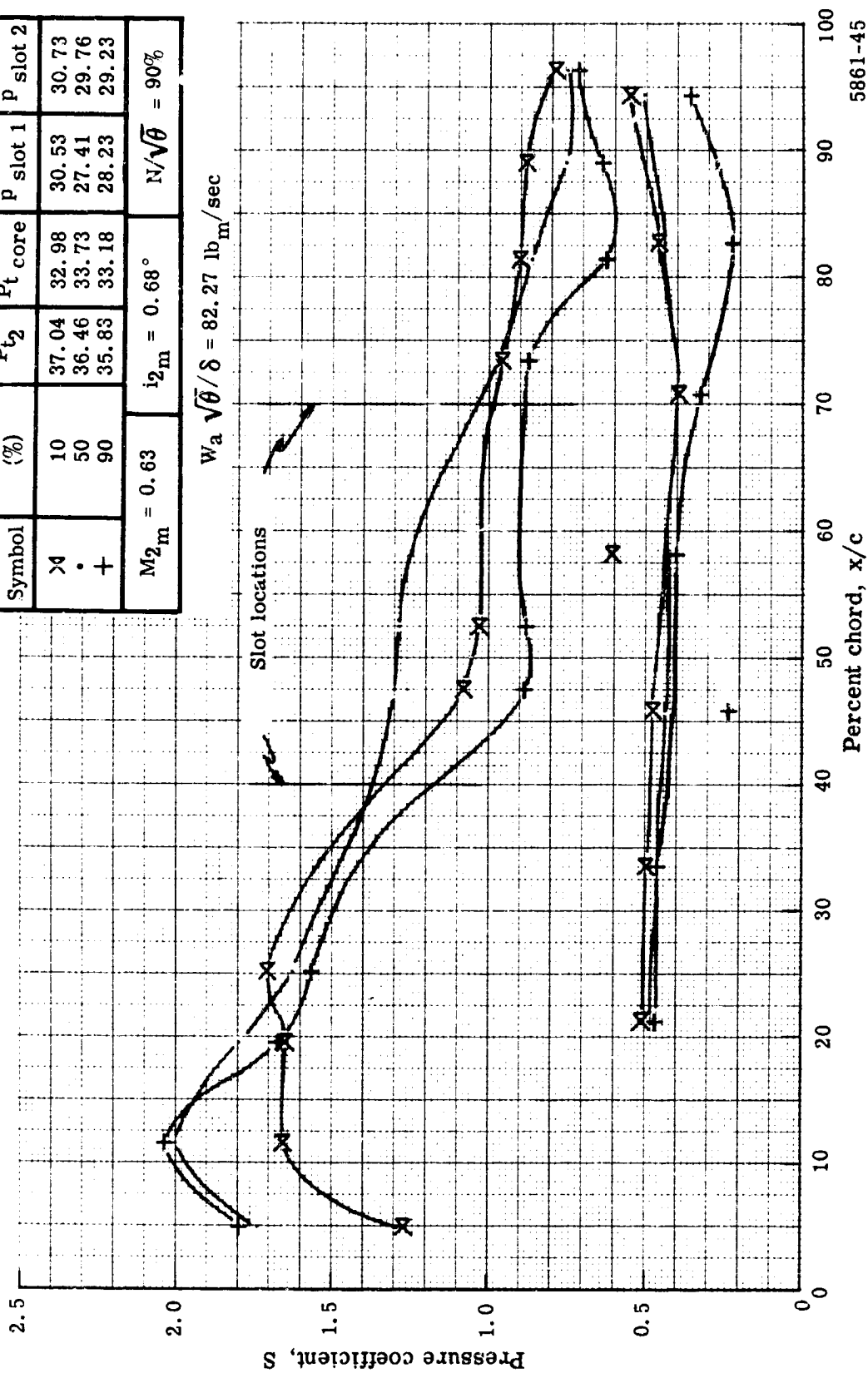


Figure 25c. Slotted stator static pressure distribution at 90% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                          |                     |
|-----------------|-------------------------|-----------------------|----------------------|--------------------------|---------------------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | $p \text{ slot } 1$      | $p \text{ slot } 2$ |
| x               | 10                      | 38.28                 | 34.23                | 31.88                    | 31.83               |
| .               | 50                      | 37.36                 | 35.53                | 28.11                    | 30.56               |
| +               | 90                      | 37.09                 | 34.88                | 29.18                    | 30.48               |
| $M_{2m} = 0.62$ |                         | $i_{2m} = 3.62^\circ$ |                      | $N/\sqrt{\theta} = 90\%$ |                     |

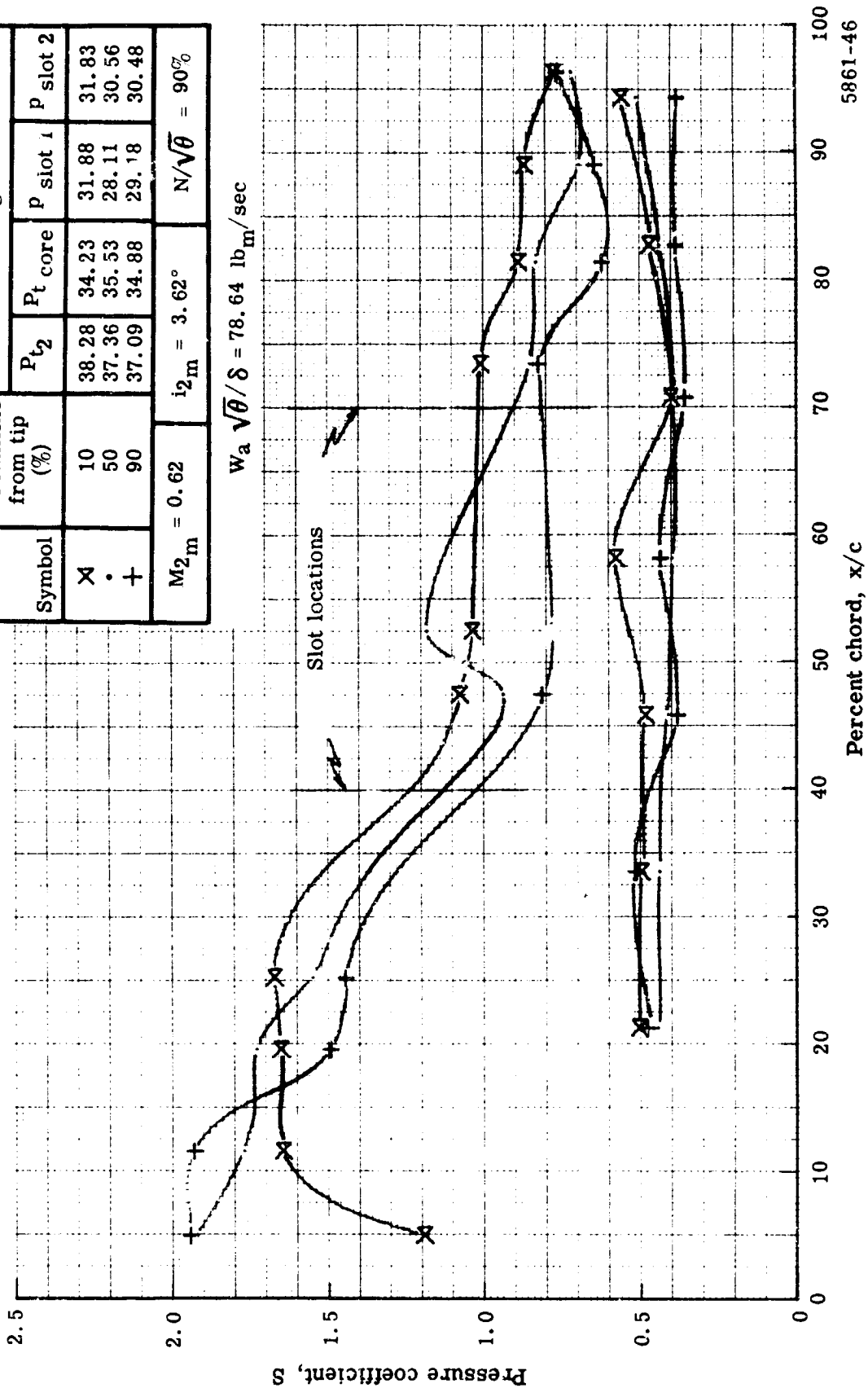


Figure 25d. Slotted stator static pressure distribution at 90% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                     |                          |          |
|-----------------|-------------------------|-----------------------|---------------------|--------------------------|----------|
|                 |                         | P <sub>t2</sub>       | P <sub>t</sub> core | p slot 1                 | p slot 2 |
| x               | 10                      | 39.10                 | 34.73               | 32.78                    | 32.68    |
| .               | 50                      | 38.18                 | 36.63               | 29.18                    | 31.43    |
| +               | 90                      | 37.76                 | 35.83               | 29.98                    | 31.28    |
| $M_{2m} = 0.61$ |                         | $i_{2m} = 6.56^\circ$ |                     | $N/\sqrt{\theta} = 90\%$ |          |

$$W_a \sqrt{\theta} / \delta = 74.74 \text{ lb}_m/\text{sec}$$

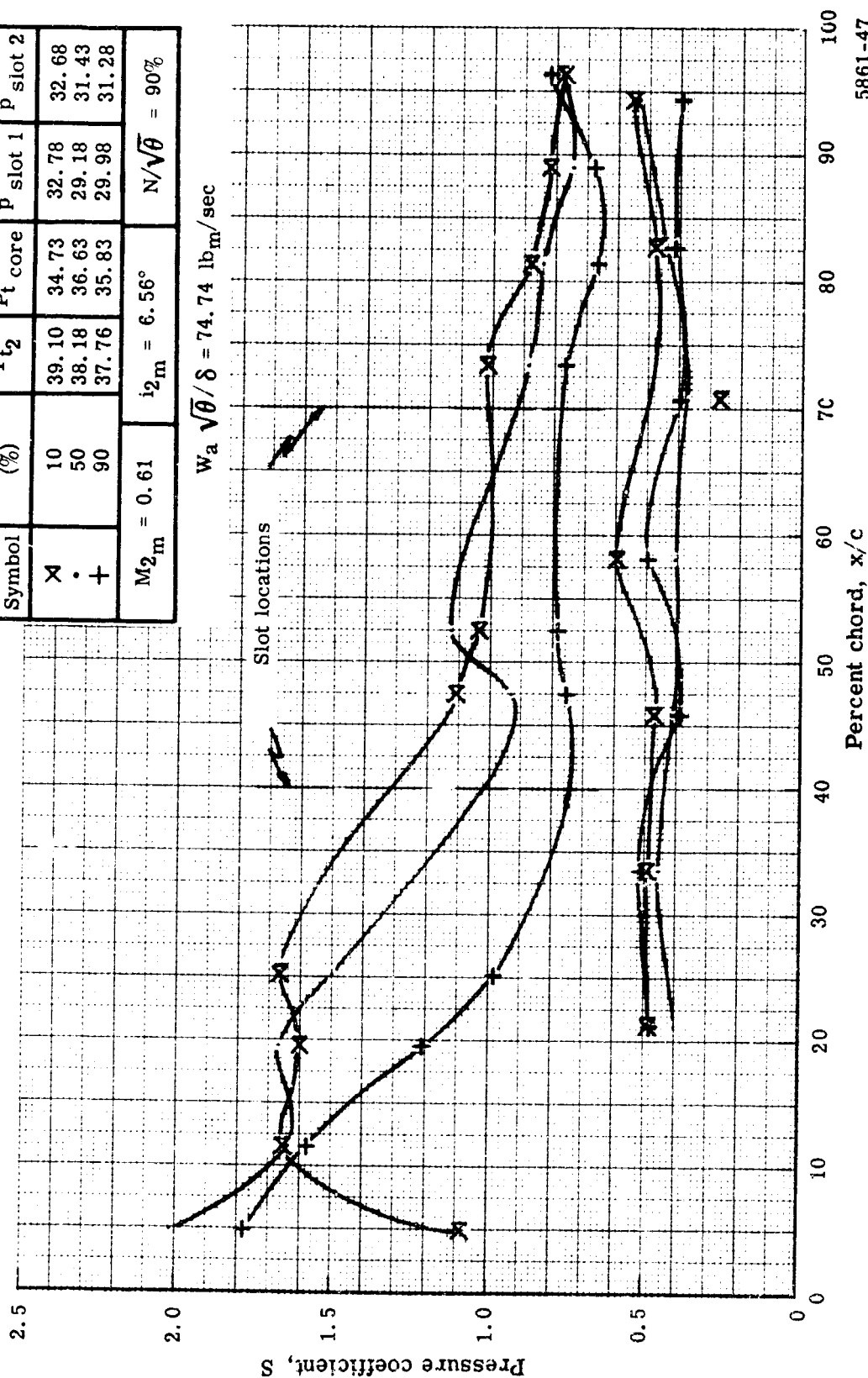


Figure 25e. Slotted stator static pressure distribution at 90% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs       |                      |                           |                     |
|-----------------|-------------------------|------------------|----------------------|---------------------------|---------------------|
|                 |                         | $P_{t2}$         | $P_{t \text{ core}}$ | $P_{\text{slot 1}}$       | $P_{\text{slot 2}}$ |
| x               | 10                      | 32.08            | 24.77                | 22.47                     | 23.67               |
| .               | 50                      | 34.51            | 25.67                | 21.33                     | 23.58               |
| +               | 90                      | 35.22            | 23.67                | 21.77                     | 23.77               |
| $M_{2m} = 0.73$ |                         | $l_{2m} = -8.33$ |                      | $N/\sqrt{\theta} = 100\%$ |                     |

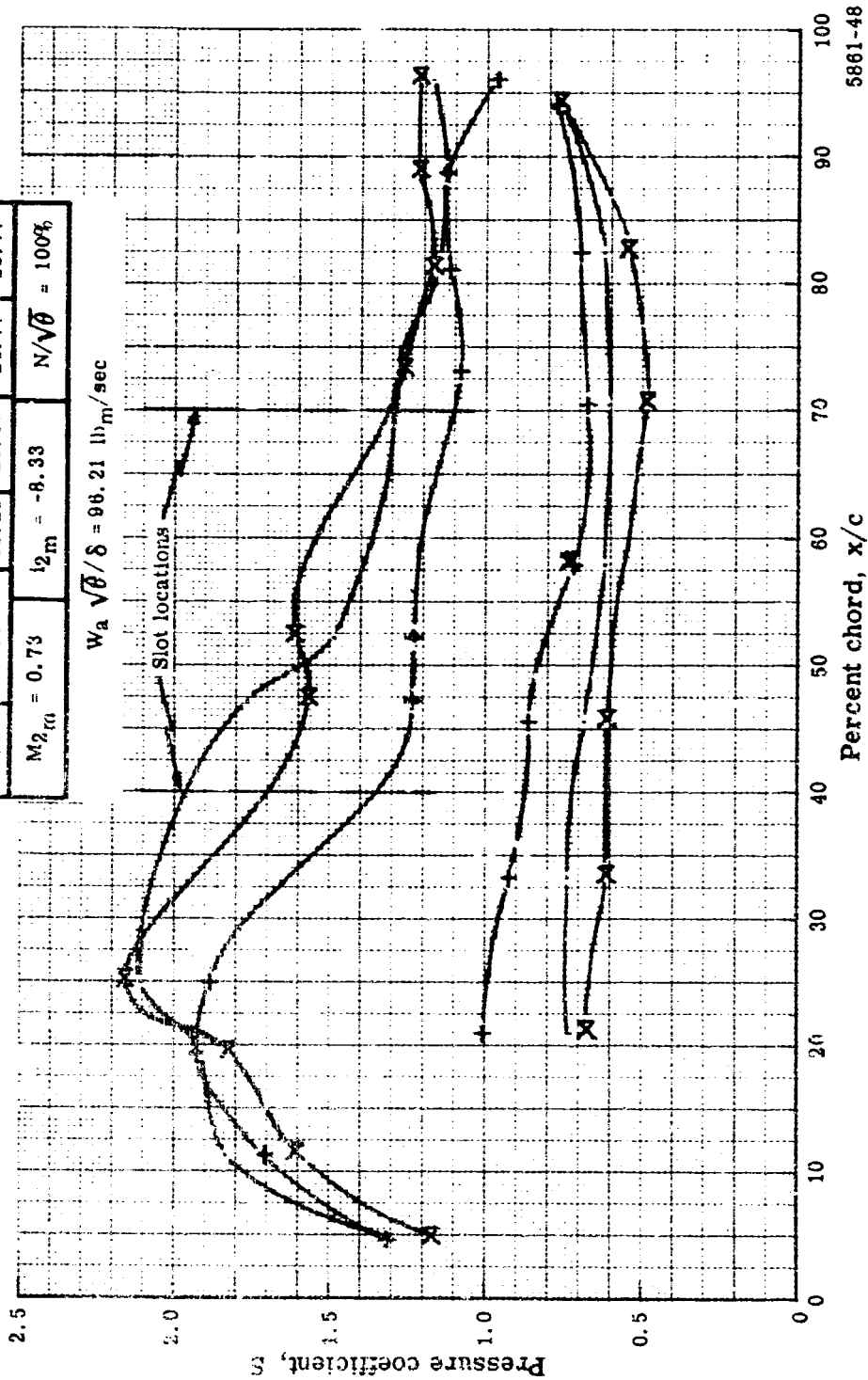


Figure 26a. Slotted stator static pressure distribution at 100% speed.

| Symbol                 | Streamline from tip (%) | In. Hg abs               |                     |             |          |
|------------------------|-------------------------|--------------------------|---------------------|-------------|----------|
|                        |                         | P <sub>t2</sub>          | P <sub>t core</sub> | P slot 1    | P slot 2 |
| x                      | 10                      | 38.14                    | 32.37               | 29.37       | 28.87    |
| .                      | 50                      | 37.62                    | 32.82               | 26.05       | 28.95    |
| +                      | 90                      | 36.65                    | 32.17               | 27.17       | 28.17    |
| M <sub>2m</sub> = 0.70 |                         | l <sub>2m</sub> = -2.02° |                     | N/√θ = 100% |          |

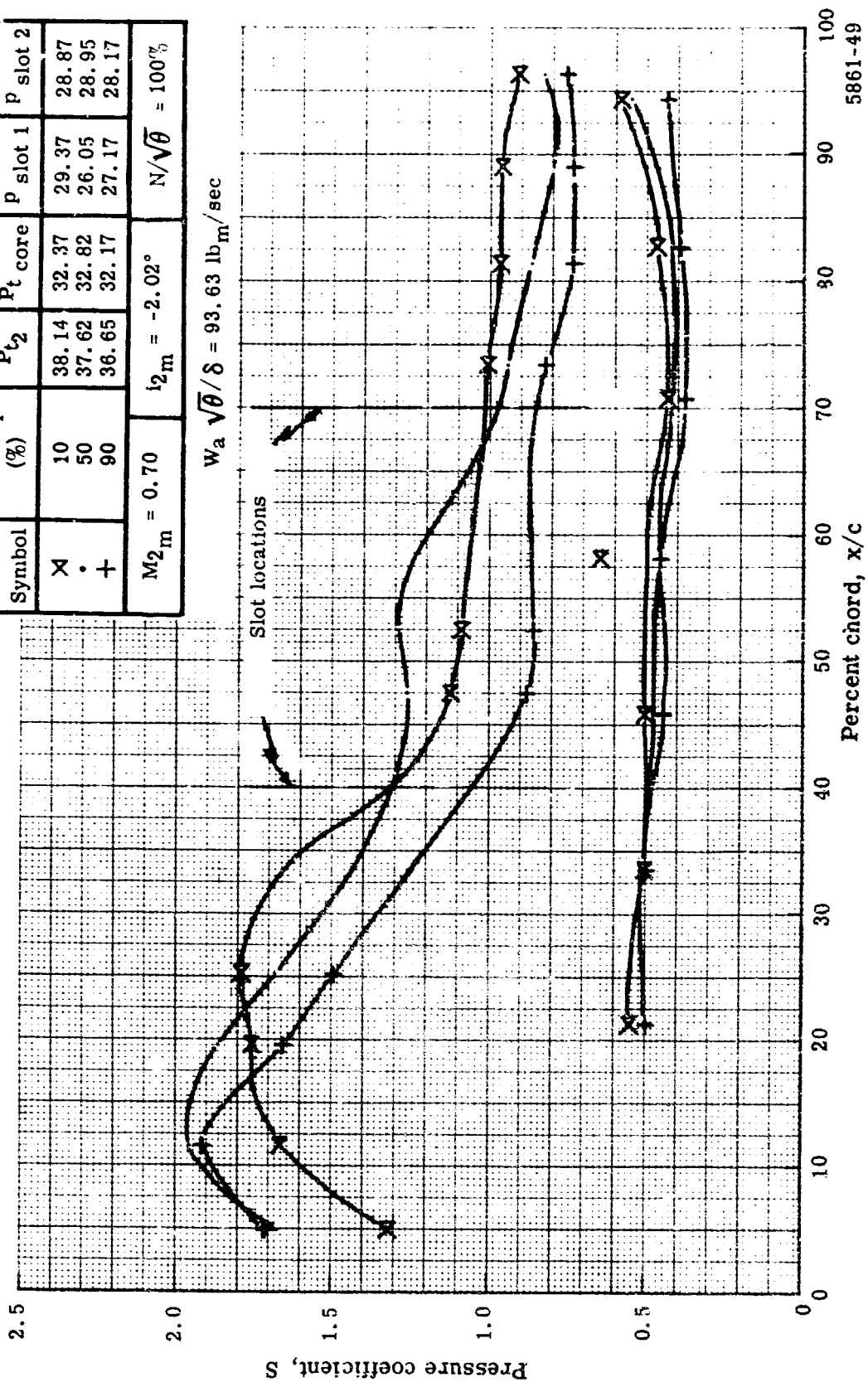


Figure 26b. Slotted stator static pressure distribution at 100% speed.

5861-49

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                           |                    |
|-----------------|-------------------------|------------------------|----------------------|---------------------------|--------------------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | $P \text{ slot 1}$        | $P \text{ slot 2}$ |
| $\times$        | 10                      | 38.76                  | 33.34                | 30.24                     | 29.79              |
| $\cdot$         | 50                      | 38.06                  | 33.94                | 26.86                     | 29.56              |
| $+$             | 90                      | 38.30                  | 33.54                | 27.99                     | 29.14              |
| $M_{2m} = 0.70$ |                         | $i_{2m} = -0.68^\circ$ |                      | $N/\sqrt{\theta} = 100\%$ |                    |

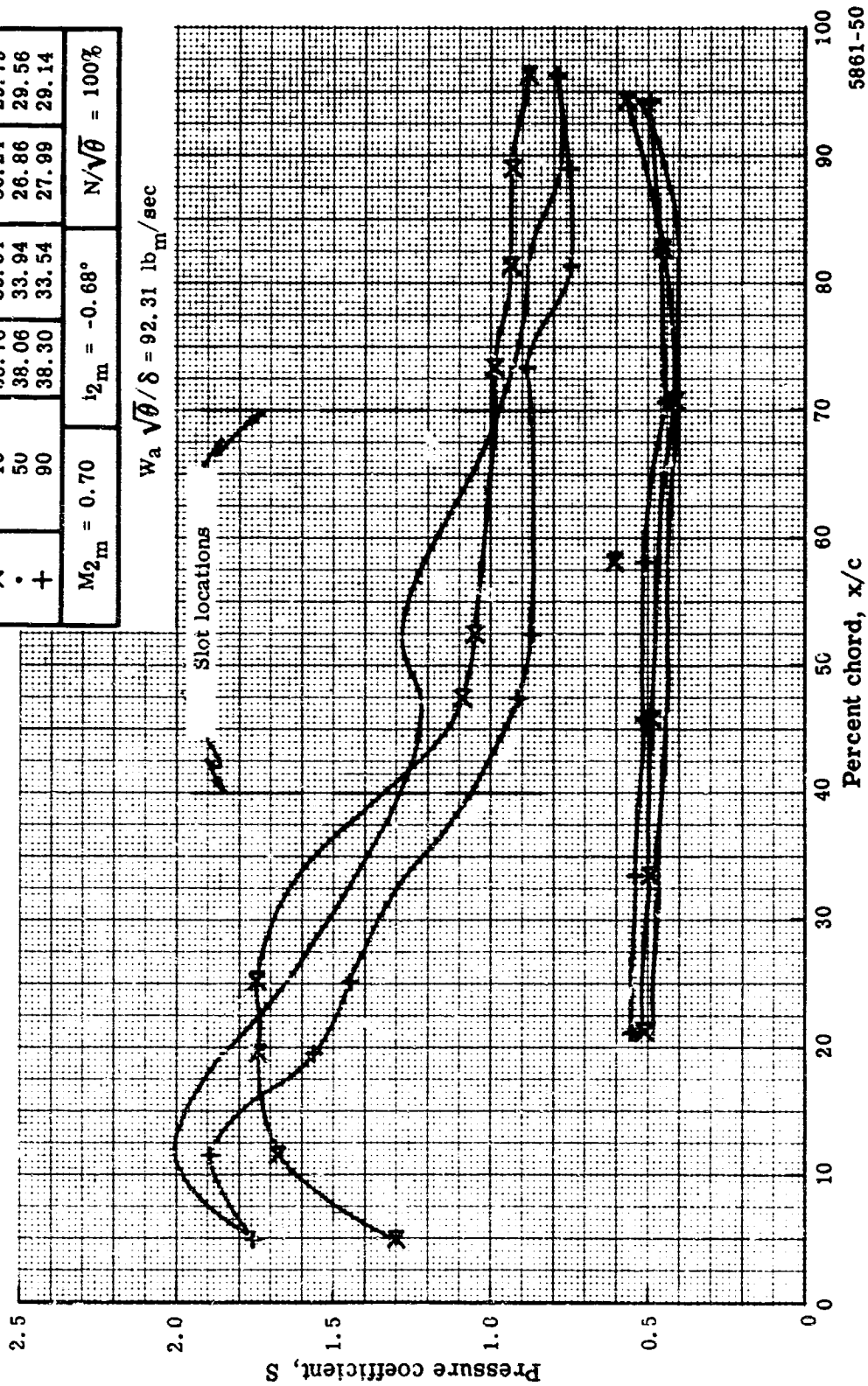


Figure 26c. Slotted stator static pressure distribution at 100% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                           |                    |
|-----------------|-------------------------|-----------------------|----------------------|---------------------------|--------------------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | $p \text{ slot 1}$        | $p \text{ slot 2}$ |
| $\times$        | 10                      | 39.43                 | 34.34                | 31.14                     | 30.74              |
| $\cdot$         | 50                      | 38.62                 | 29.94                | 27.29                     | 30.09              |
| $+$             | 90                      | 37.58                 | 35.09                | 28.19                     | 29.74              |
| $M_{2m} = 0.70$ |                         | $i_{2m} = 1.16^\circ$ |                      | $N/\sqrt{\theta} = 100\%$ |                    |

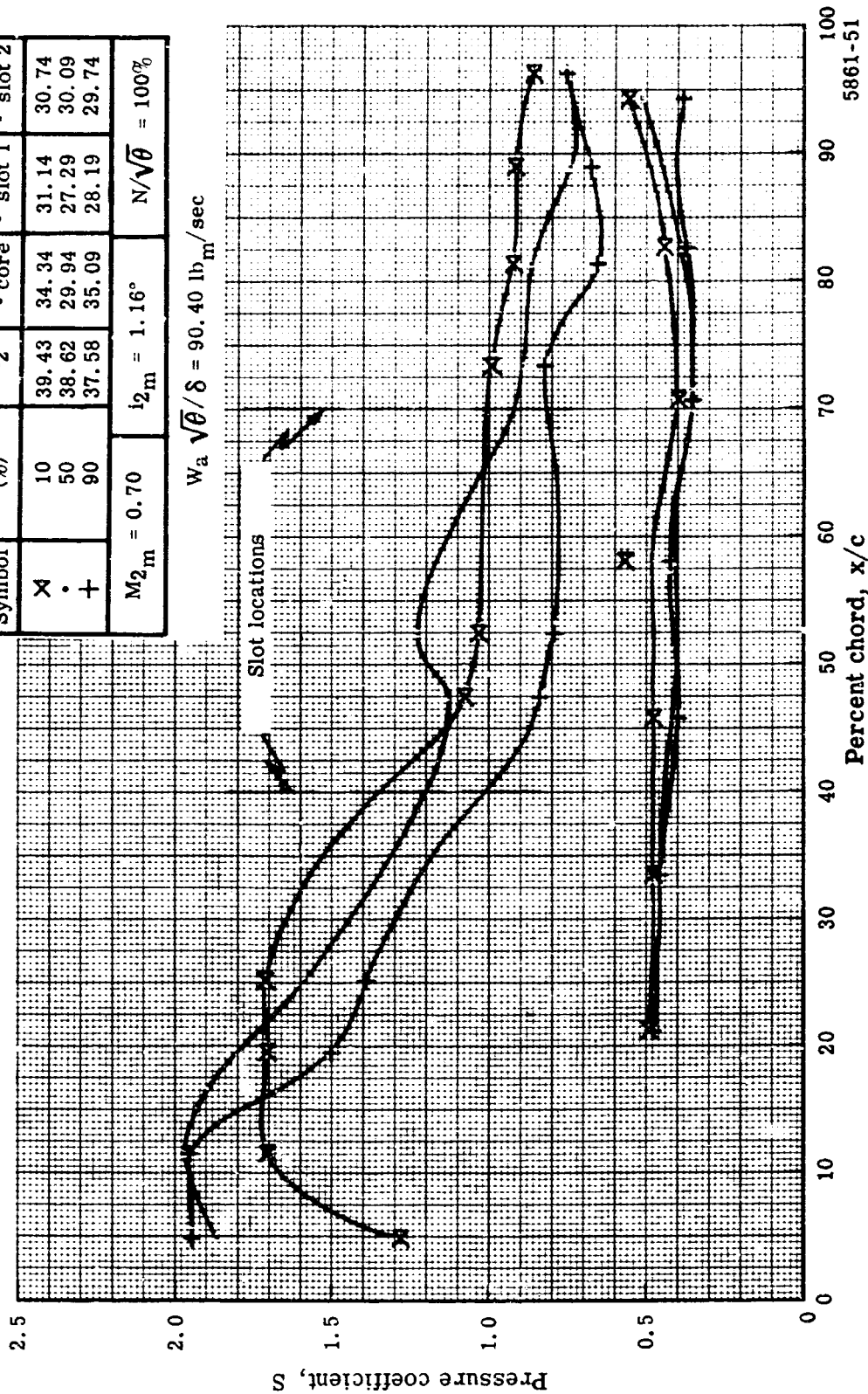
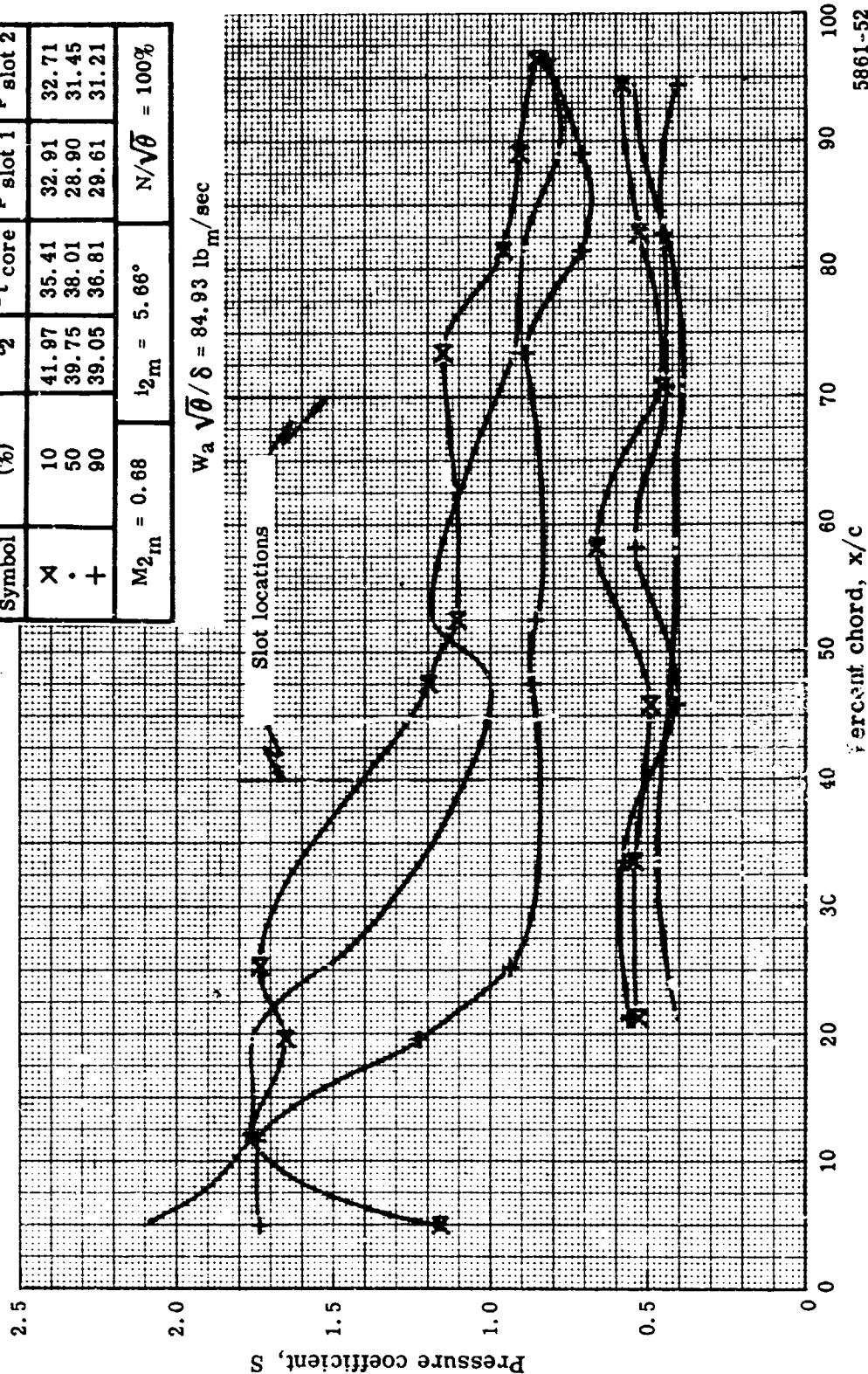


Figure 26d. Slotted stator static pressure distribution at 100% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                           |          |
|-----------------|-------------------------|-----------------------|----------------------|---------------------------|----------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | p slot 1                  | p slot 2 |
| ✕               | 10                      | 41.97                 | 35.41                | 32.91                     | 32.71    |
| •               | 50                      | 39.75                 | 38.01                | 28.90                     | 31.45    |
| +               | 90                      | 39.05                 | 36.81                | 29.61                     | 31.21    |
| $M_{2m} = 0.68$ |                         | $l_{2m} = 5.66^\circ$ |                      | $N/\sqrt{\theta} = 100\%$ |          |

$$W_a \sqrt{\theta} / \delta = 84.93 \text{ lb}_m/\text{sec}$$



5861-52

Figure 26e. Slotted stator static pressure distribution at 100% speed.

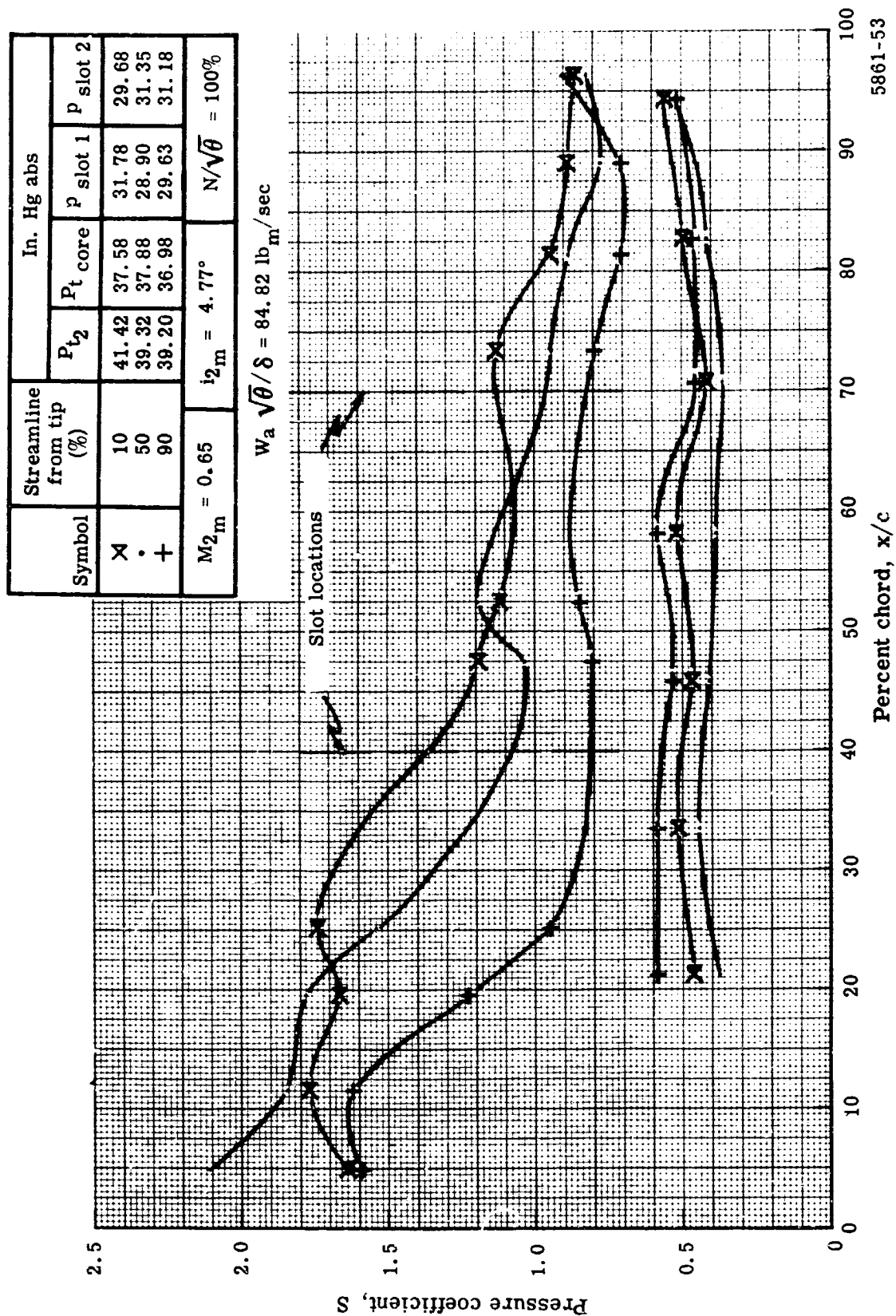


Figure 26f. Slotted stator pressure distribution at 100% speed.

5861-53

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                           |                    |
|-----------------|-------------------------|------------------------|----------------------|---------------------------|--------------------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | $P \text{ slot 1}$        | $P \text{ slot 2}$ |
| ×               | 10                      | 33.55                  | 25.18                | 22.73                     | 23.23              |
| •               | 50                      | 35.16                  | 25.33                | 20.54                     | 22.89              |
| +               | 90                      | 36.78                  | 23.53                | 20.98                     | 22.48              |
| $M_{2m} = 0.78$ |                         | $l_{2m} = -8.88^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |                    |

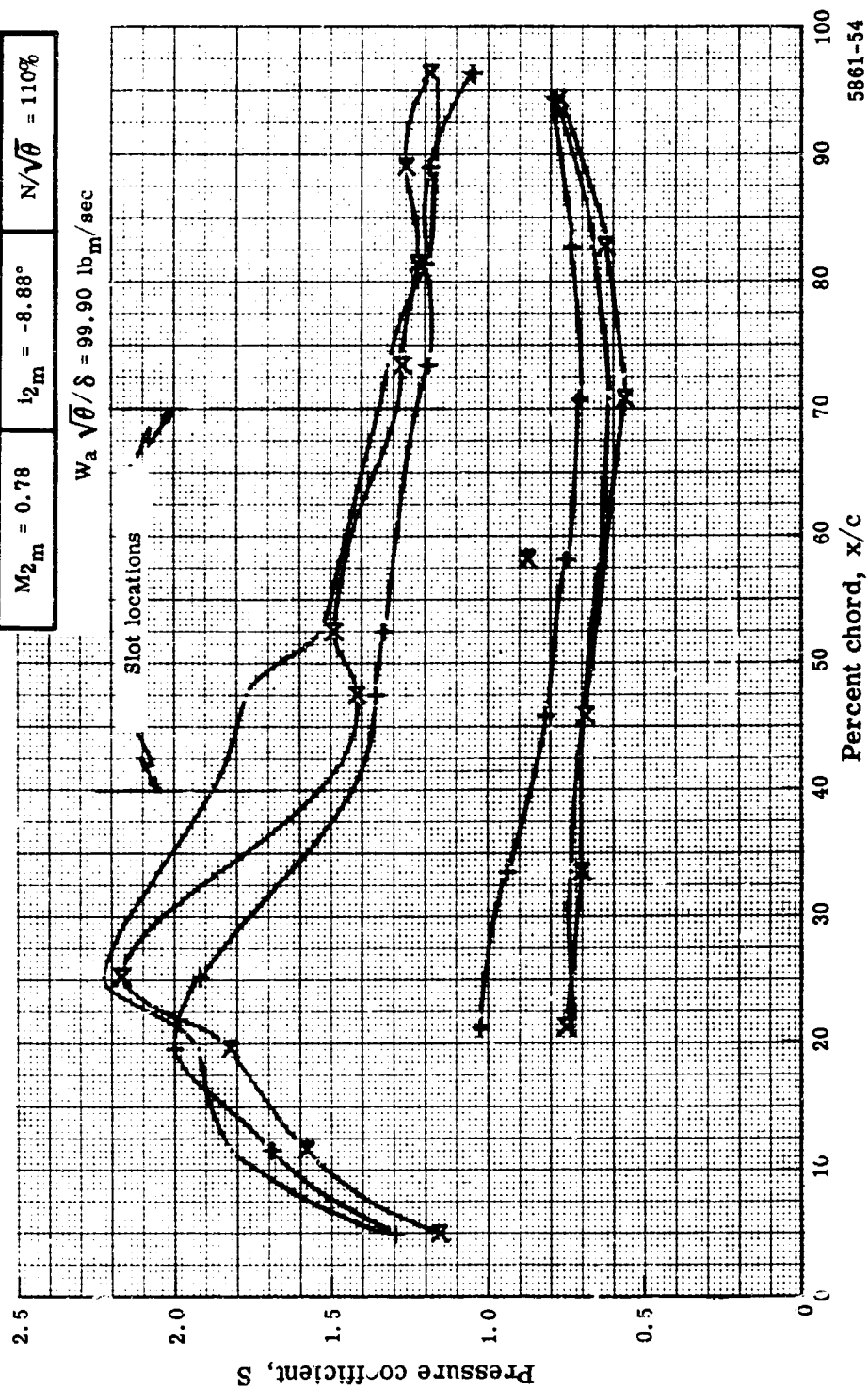
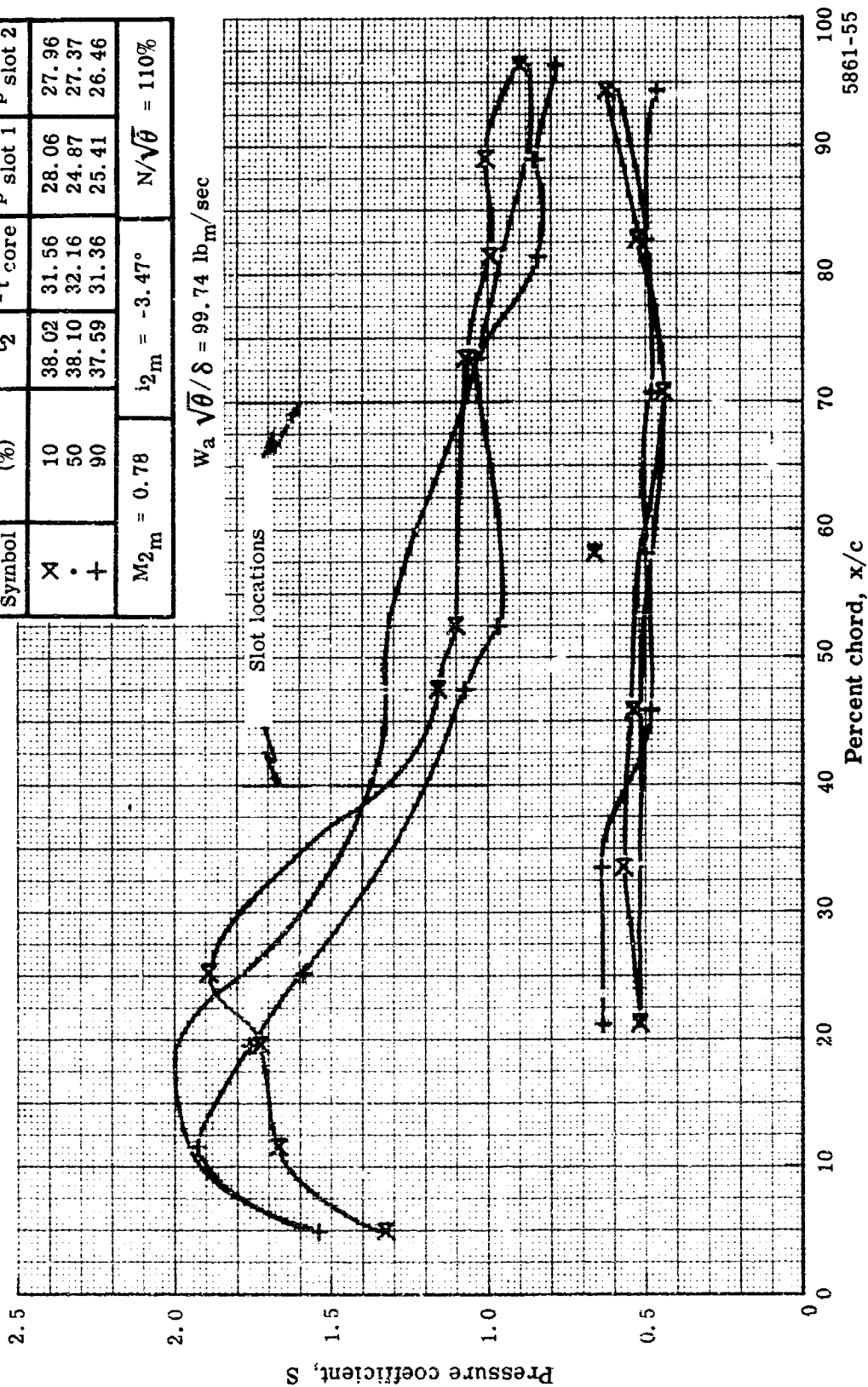


Figure 27a. Slotted stator static pressure distribution at 110% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                           |          |
|-----------------|-------------------------|------------------------|----------------------|---------------------------|----------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | P slot 1                  | P slot 2 |
| $\times$        | 10                      | 38.02                  | 31.56                | 28.06                     | 27.96    |
| $\cdot$         | 50                      | 38.10                  | 32.16                | 24.87                     | 27.37    |
| $+$             | 90                      | 37.59                  | 31.36                | 25.41                     | 26.46    |
| $M_{2m} = 0.78$ |                         | $i_{2m} = -3.47^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |          |

$$W_a \sqrt{\theta} / \delta = 99.74 \text{ lb}_m / \text{sec}$$



Figuer 27b. Slotted stator static pressure distribution at 110% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs             |                      |                           |                     |
|-----------------|-------------------------|------------------------|----------------------|---------------------------|---------------------|
|                 |                         | $P_{t2}$               | $P_{t \text{ core}}$ | $p_{\text{slot 1}}$       | $p_{\text{slot 2}}$ |
| x               | 10                      | 41.12                  | 33.92                | 30.77                     | 30.72               |
| .               | 50                      | 39.73                  | 34.22                | 26.80                     | 29.40               |
| +               | 90                      | 38.12                  | 34.47                | 27.22                     | 24.77               |
| $M_{2m} = 0.77$ |                         | $i_{2m} = -0.30^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |                     |

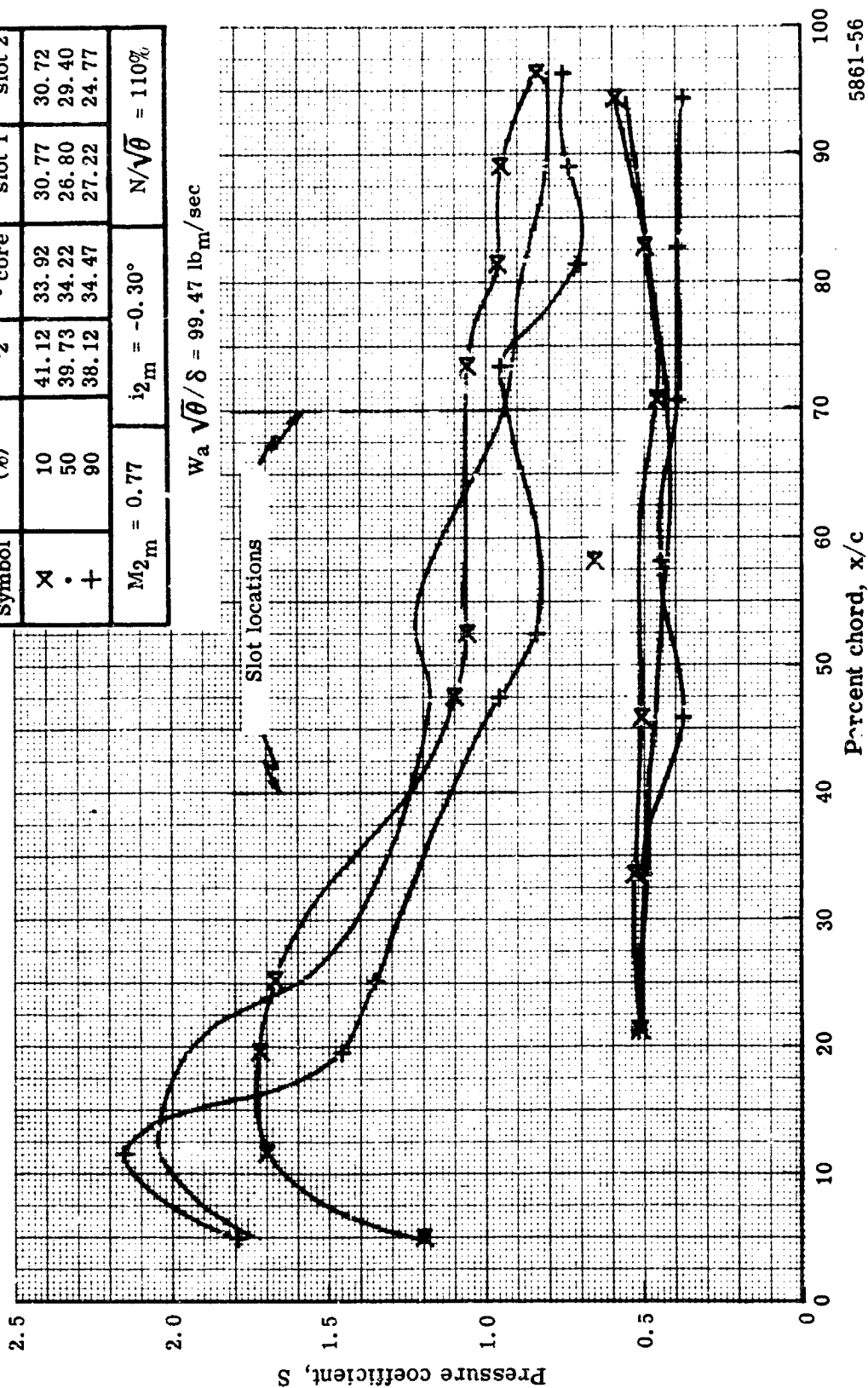


Figure 27c. Slotted stator static pressure distribution at 110% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs              |                      |                           |          |
|-----------------|-------------------------|-------------------------|----------------------|---------------------------|----------|
|                 |                         | $P_{t2}$                | $P_{t \text{ core}}$ | P slot 1                  | P slot 2 |
| x               | 10                      | 42.89                   | 34.97                | 32.17                     | 32.07    |
| .               | 50                      | 41.06                   | 37.87                | 27.86                     | 30.55    |
| +               | 90                      | 39.52                   | 36.47                | 28.27                     | 30.22    |
| $M_{2m} = 0.74$ |                         | $\nu_{2m} = 2.95^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |          |

$$w_a \sqrt{\theta} / \delta = 96.65 \text{ lb}_m/\text{sec}$$

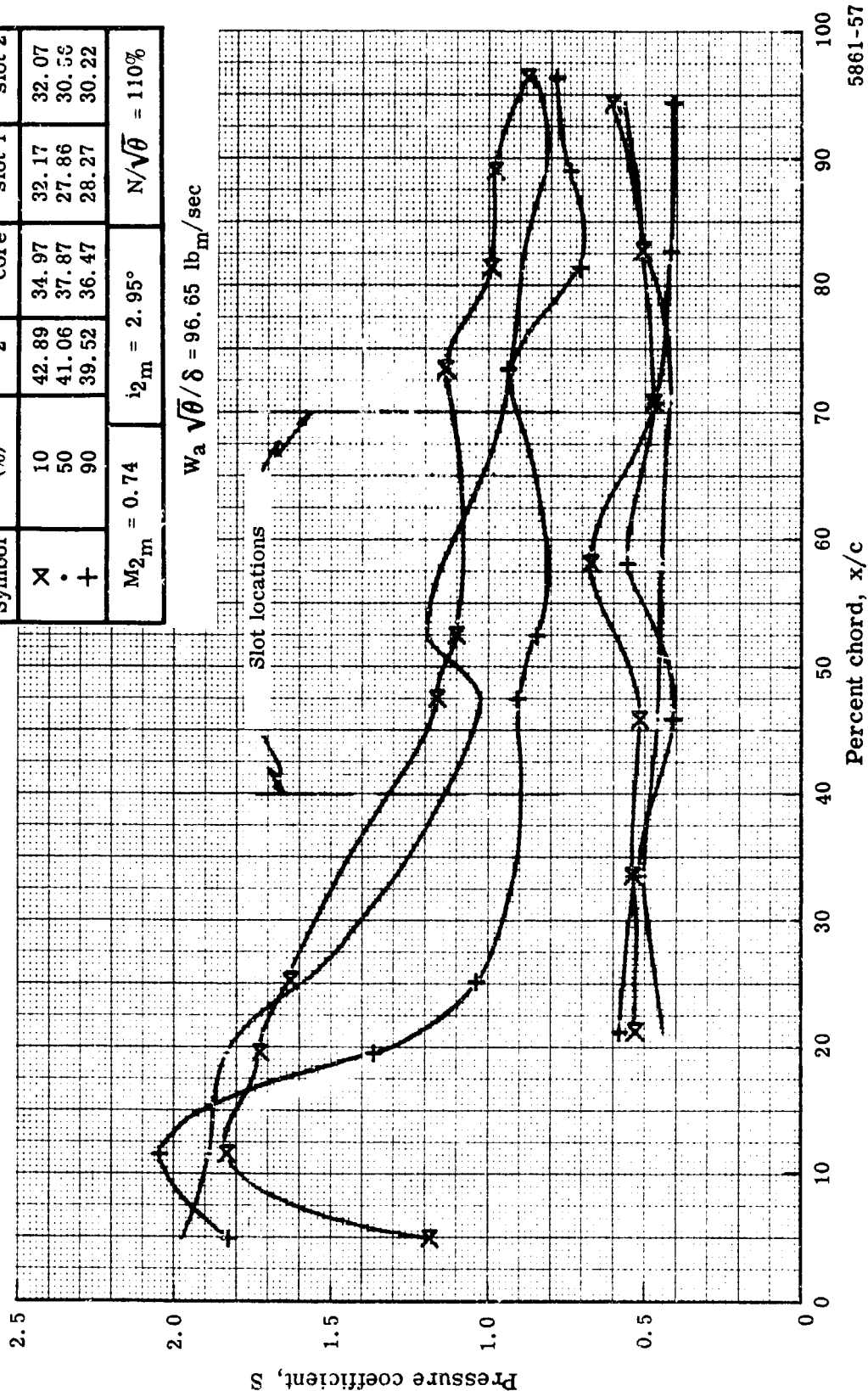


Figure 27d. Slotted stator static pressure distribution at 110% speed.

5861-57

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                           |          |
|-----------------|-------------------------|-----------------------|----------------------|---------------------------|----------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | p slot 1                  | p slot 2 |
| x               | 10                      | 43.35                 | 36.28                | 31.36                     | 31.18    |
| .               | 50                      | 41.34                 | 38.38                | 28.07                     | 30.27    |
| +               | 90                      | 39.60                 | 36.58                | 28.68                     | 29.98    |
| $M_{2m} = 0.73$ |                         | $i_{2m} = 3.48^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |          |

$W_a \sqrt{\theta}/\delta = 94.72 \text{ lb}_m/\text{sec}$

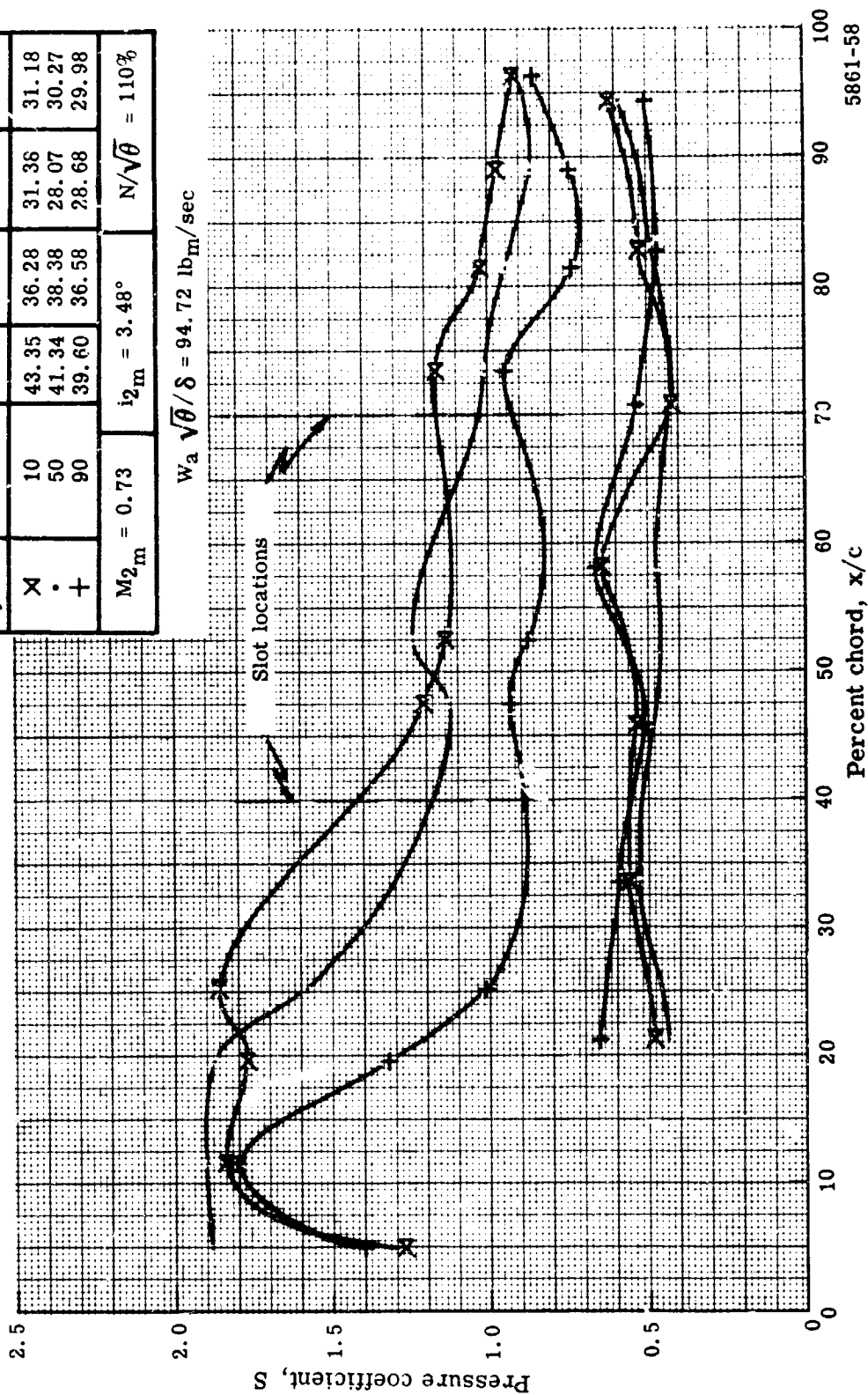
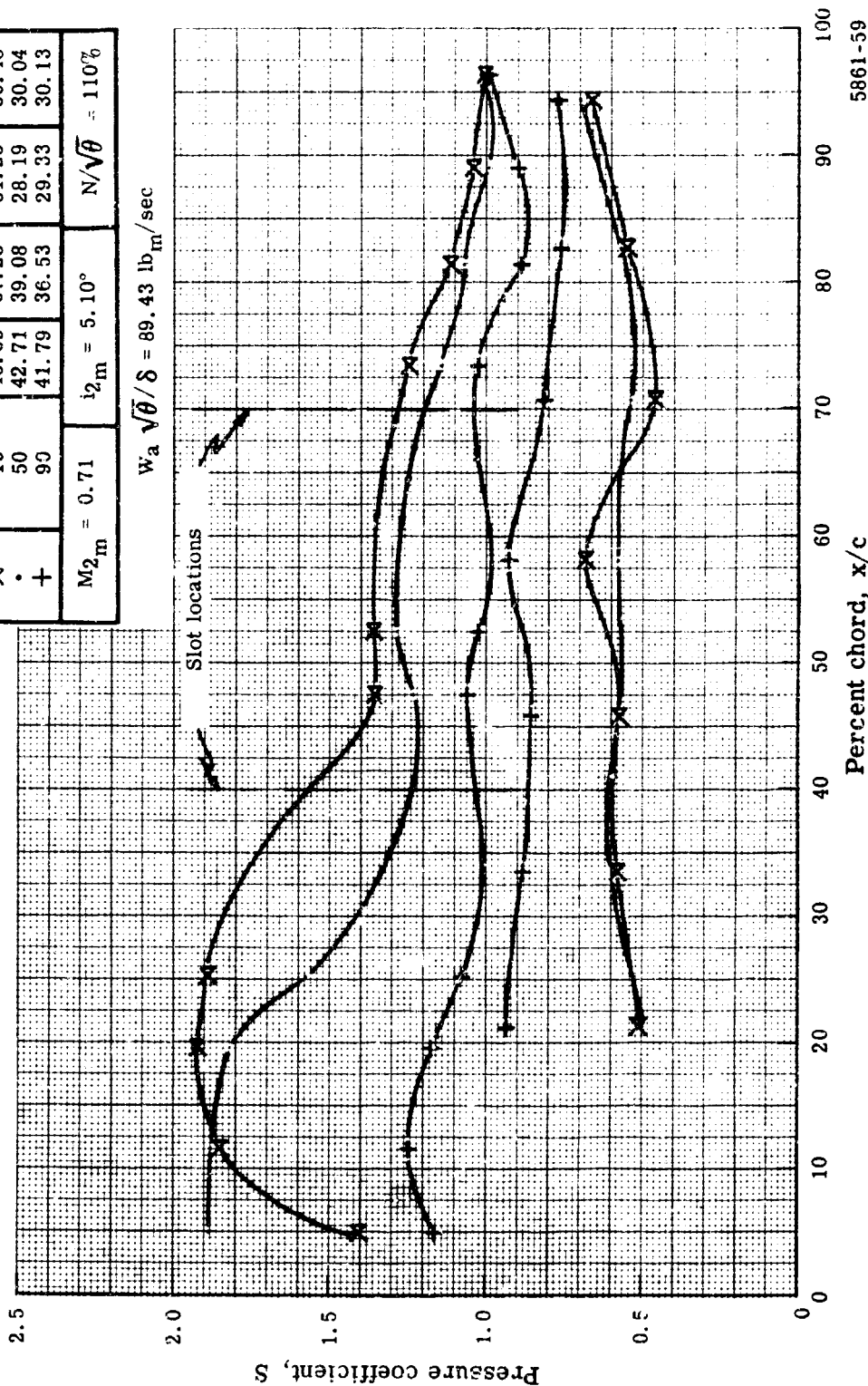


Figure 27e. Slotted stator static pressure distribution at 110% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                           |                    |
|-----------------|-------------------------|-----------------------|----------------------|---------------------------|--------------------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | $p \text{ slot 1}$        | $p \text{ slot 2}$ |
| $\times$        | 10                      | 45.09                 | 37.28                | 31.28                     | 30.48              |
| $\cdot$         | 50                      | 42.71                 | 39.08                | 28.19                     | 30.04              |
| $+$             | 90                      | 41.79                 | 36.53                | 29.33                     | 30.13              |
| $M_{2m} = 0.71$ |                         | $i_{2m} = 5.10^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |                    |



5861-59

Figure 2/f. Slotted stator static pressure distribution at 110% speed.

| Symbol          | Streamline from tip (%) | In. Hg abs            |                      |                           |          |
|-----------------|-------------------------|-----------------------|----------------------|---------------------------|----------|
|                 |                         | $P_{t2}$              | $P_{t \text{ core}}$ | P slot 1                  | P slot 2 |
| x               | 10                      | 45.72                 | 37.52                | 31.42                     | 30.17    |
| .               | 50                      | 42.77                 | 38.92                | 28.17                     | 29.97    |
| +               | 90                      | 41.70                 | 36.72                | 29.17                     | 29.97    |
| $M_{2m} = 0.71$ |                         | $l_{2m} = 5.13^\circ$ |                      | $N/\sqrt{\theta} = 110\%$ |          |

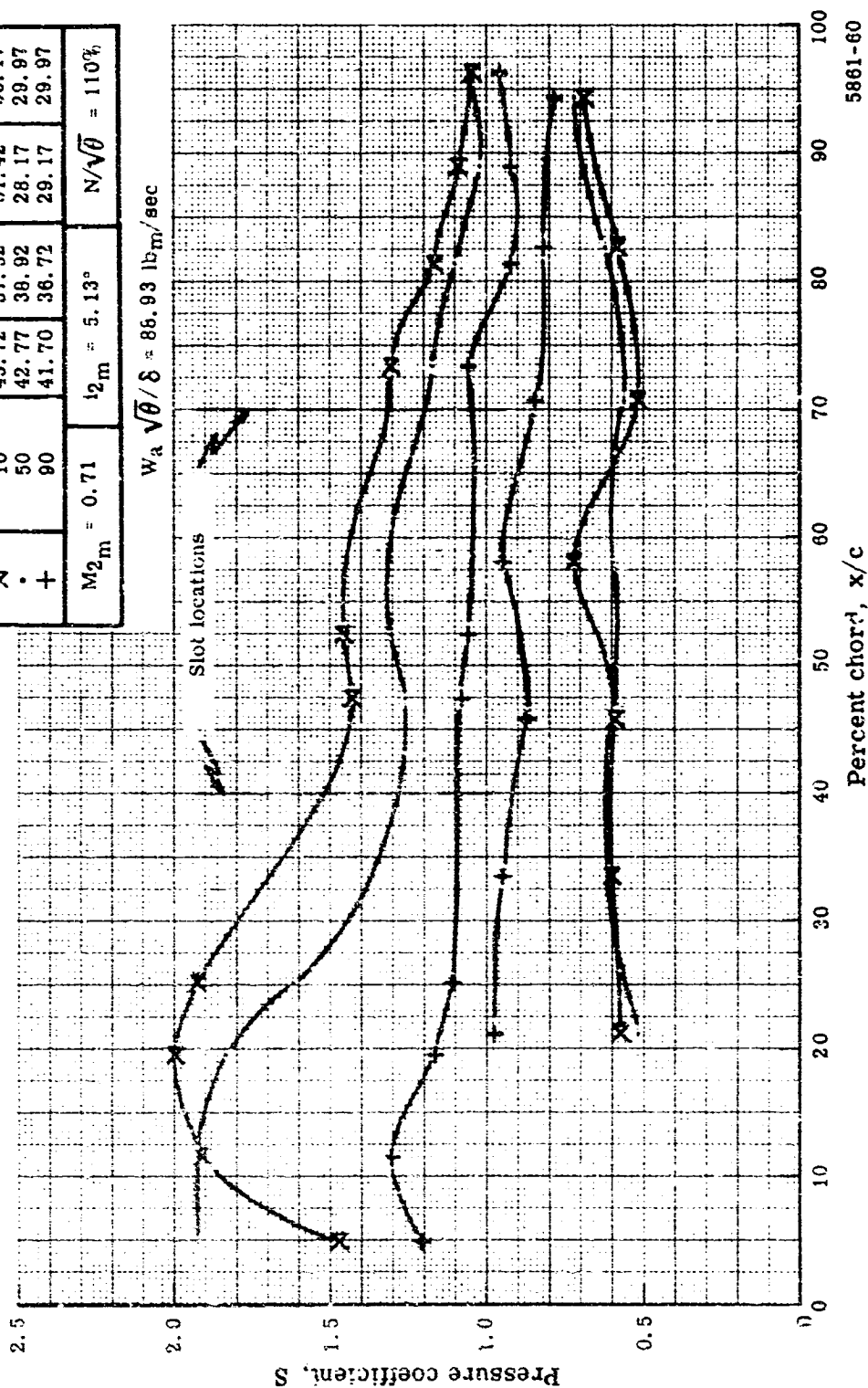
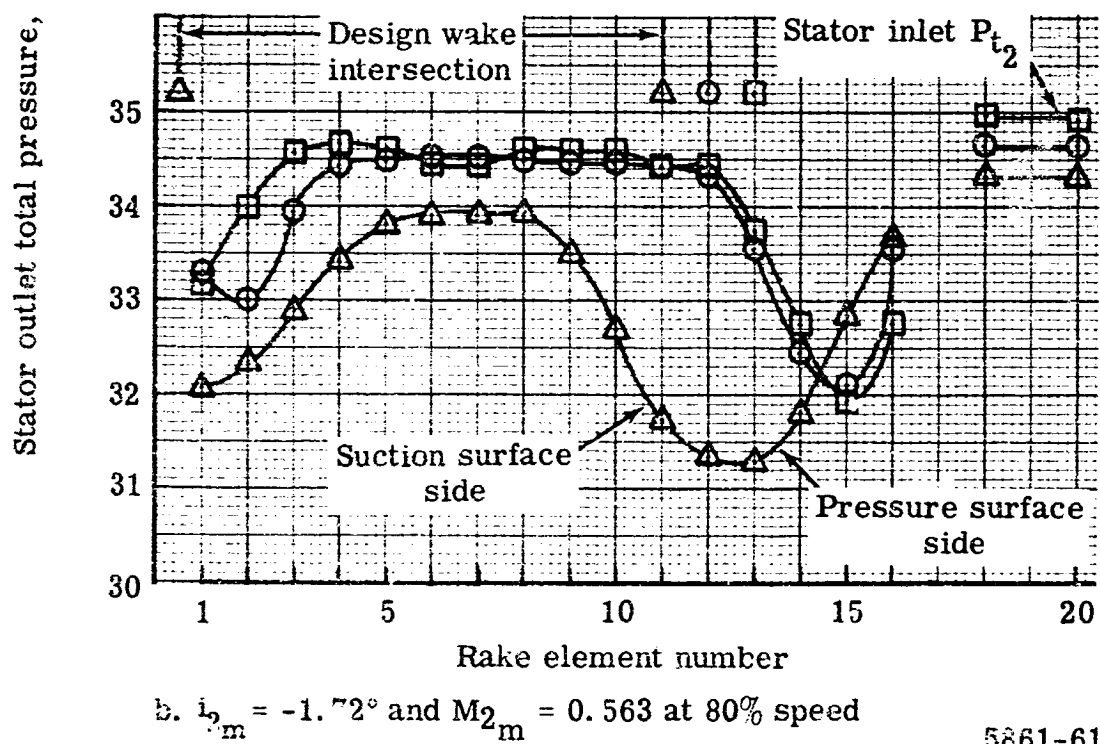
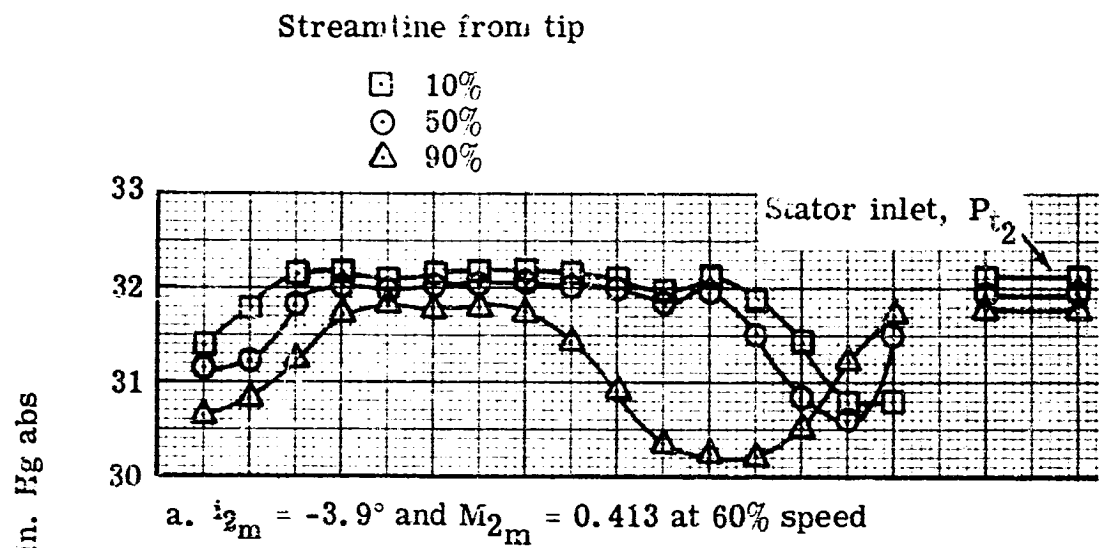
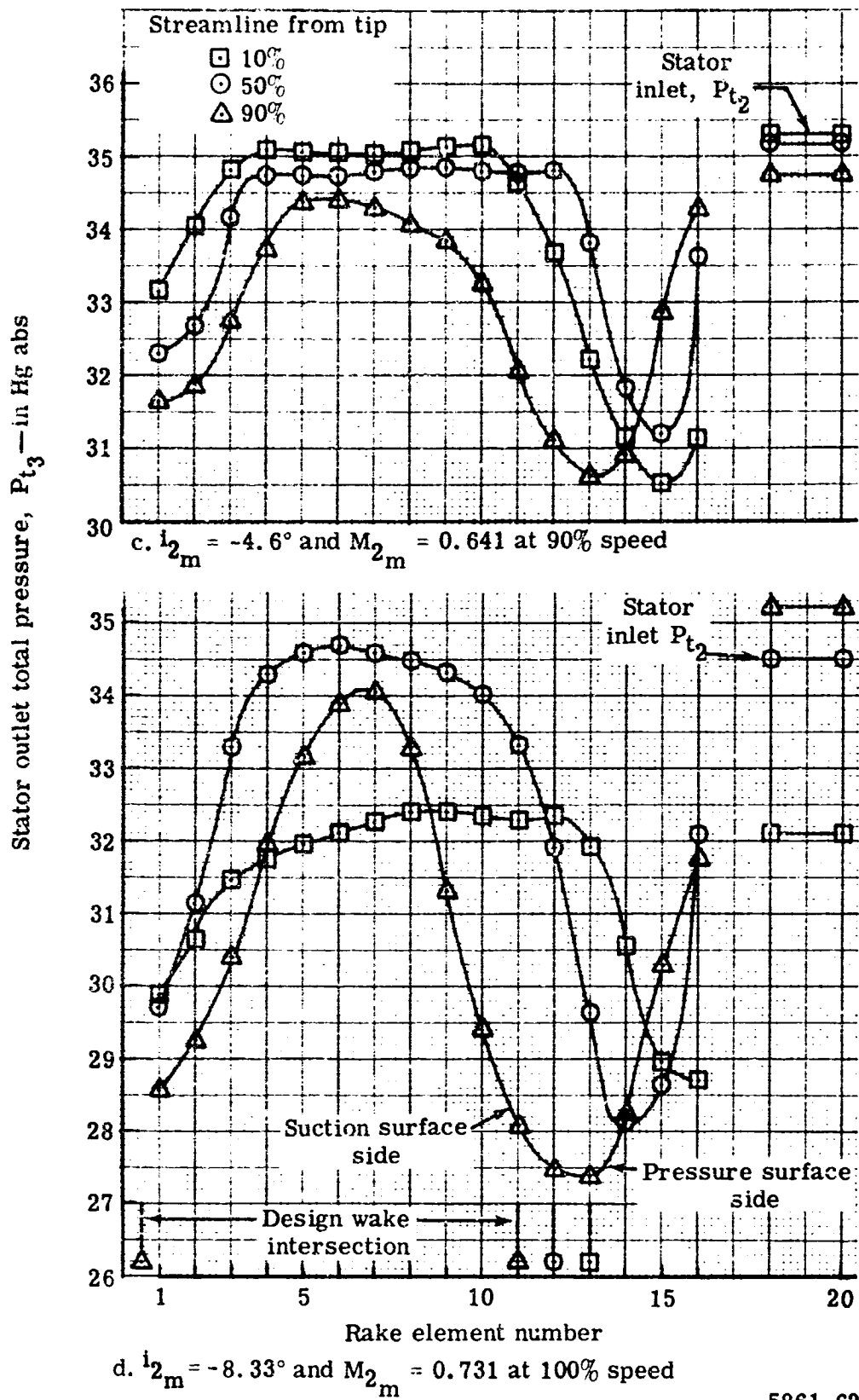


Figure 27g. Slotted stator static pressure distribution at 110% speed.



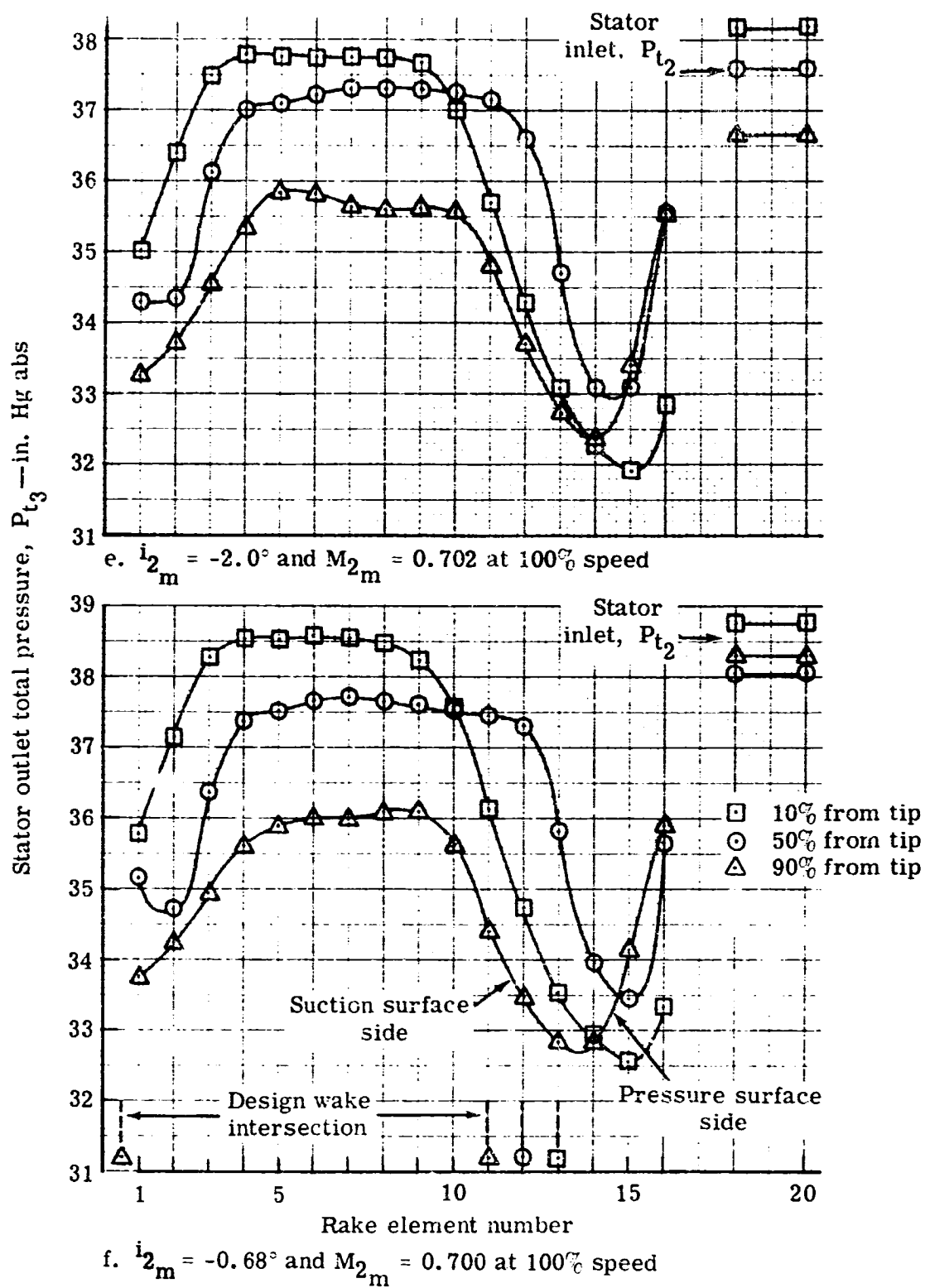
5861-61

Figure 28. Double slotted stator wake surveys.



5861-62

Figure 28. Double slotted stator wake surveys.



5861-63

Figure 28. Double slotted stator wake surveys.

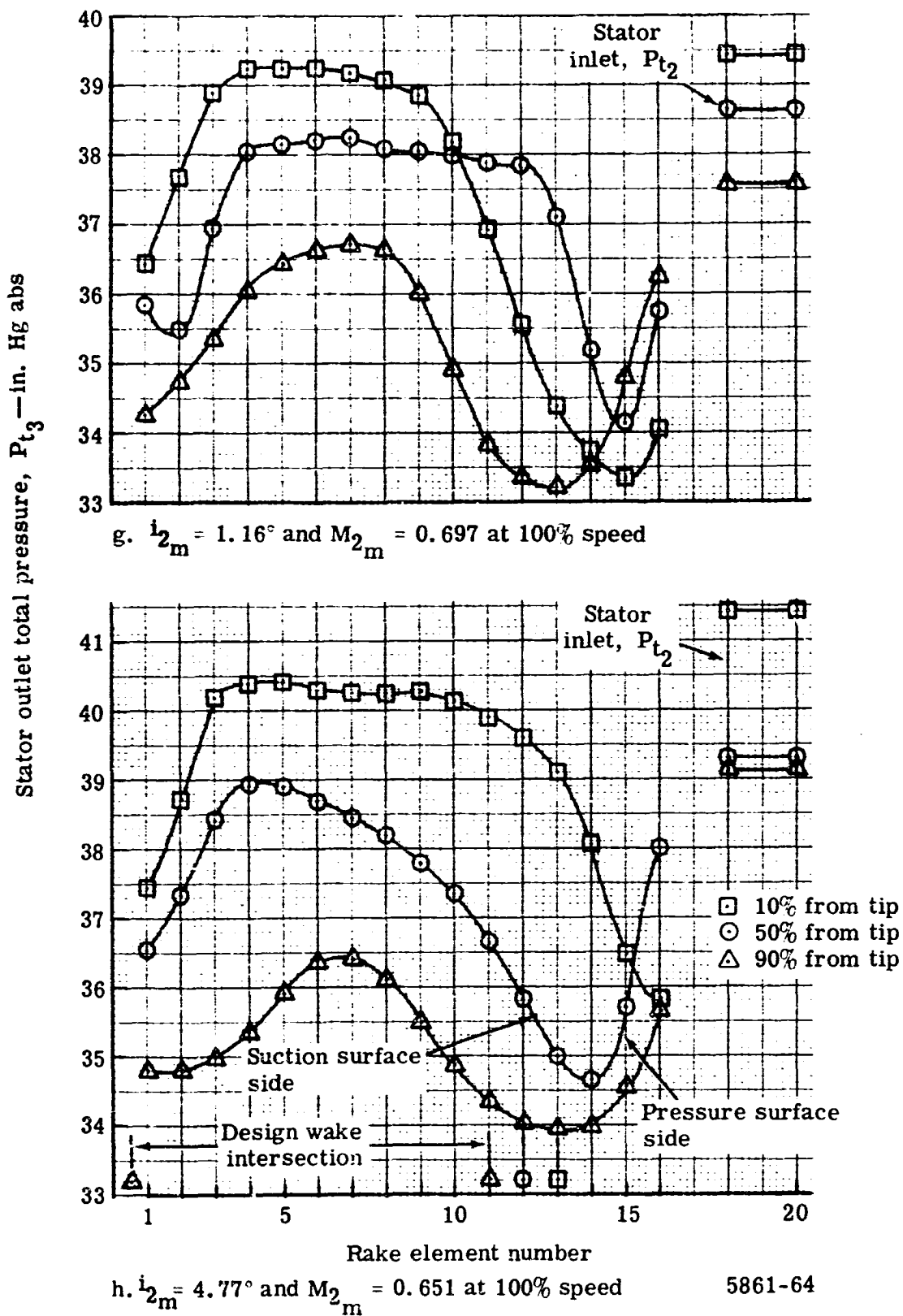
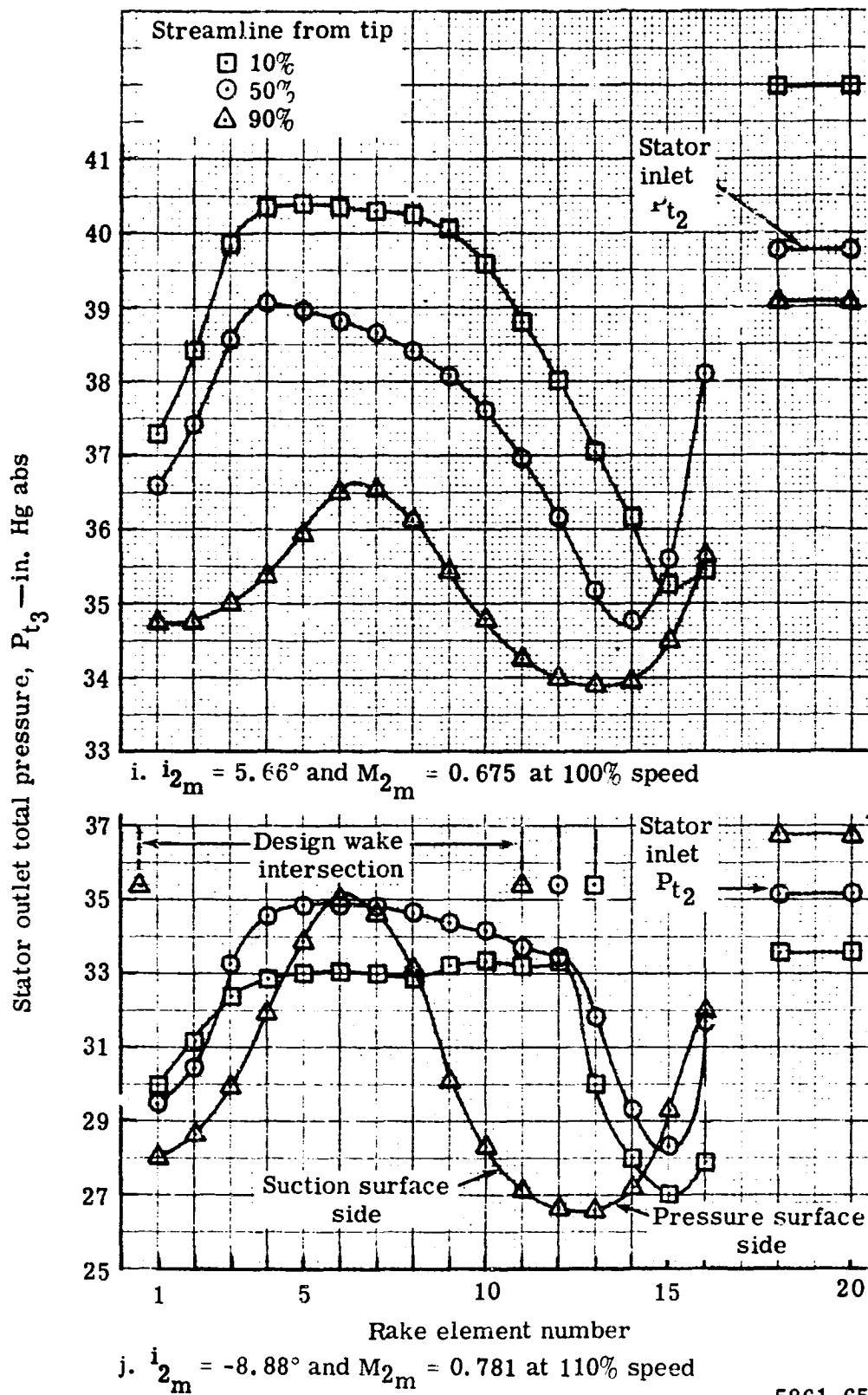
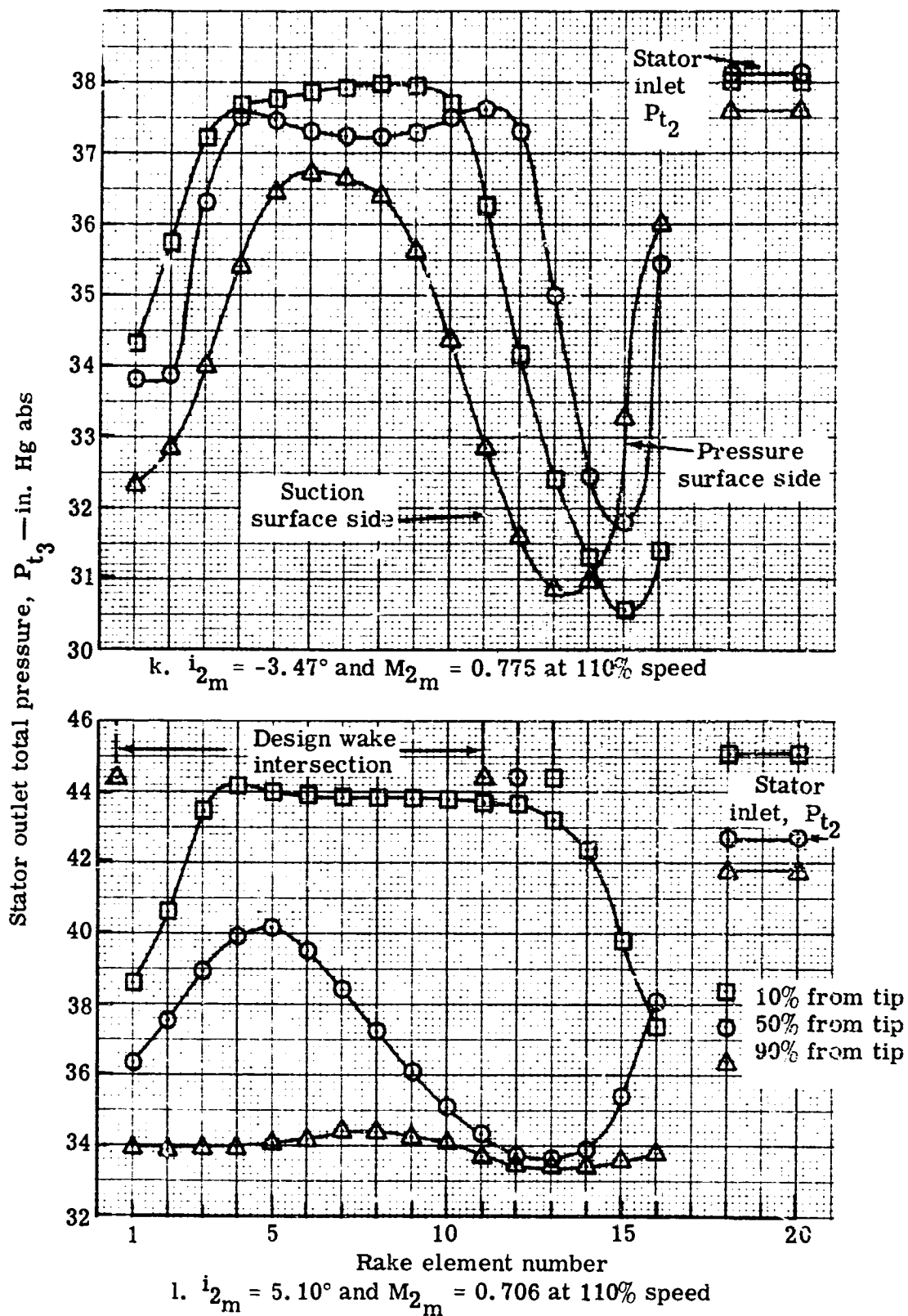


Figure 28. Double slotted stator wake surveys.



5861-65

Figure 28. Double slotted stator wake surveys.



5861-66

Figure 28. Double slotted stator wake surveys.



Table I.

Blade and vane geometry summary.

| Blade row                                                              | Exit radius (in.) * | $\kappa_1$ (degrees) | $\kappa_2$ (degrees) | $\phi$ ( $\kappa_1 - \kappa_2$ ) | c (in.) | $\bar{\sigma}$ | t/c   | $\delta^\circ$ | $i_{des}$ (degrees) | $\alpha_{des}$ (degrees) | n  |
|------------------------------------------------------------------------|---------------------|----------------------|----------------------|----------------------------------|---------|----------------|-------|----------------|---------------------|--------------------------|----|
| Design inlet guide vane (63-006 Series)                                | 10.49               | —                    | —                    | —                                | 2.733   | 1.41           | 0.06  | —              | —                   | 17.80                    | 34 |
|                                                                        | 11.51               | —                    | —                    | —                                | 2.733   | 1.29           | 0.06  | —              | —                   | 16.25                    |    |
|                                                                        | 12.53               | —                    | —                    | —                                | 2.733   | 1.18           | 0.06  | —              | —                   | 15.16                    |    |
|                                                                        | 13.54               | —                    | —                    | —                                | 2.733   | 1.09           | 0.06  | —              | —                   | 14.36                    |    |
|                                                                        | 14.58               | —                    | —                    | —                                | 2.733   | 1.02           | 0.06  | —              | —                   | 13.30                    |    |
| Rotor blade (double-circular arc)                                      | 10.97               | 43.1                 | 9.1                  | 34.0                             | 2.875   | 1.89           | 0.078 | 7.81           | 0                   | —                        | 45 |
|                                                                        | 11.86               | 49.2                 | 21.0                 | 28.2                             | 2.875   | 1.74           | 0.052 | 7.38           | 0                   | —                        |    |
|                                                                        | 12.76               | 53.4                 | 31.2                 | 22.2                             | 2.875   | 1.61           | 0.039 | 6.34           | 0                   | —                        |    |
|                                                                        | 13.65               | 56.7                 | 39.1                 | 17.6                             | 2.875   | 1.51           | 0.033 | 5.52           | 0                   | —                        |    |
|                                                                        | 14.54               | 59.6                 | 44.4                 | 15.2                             | 2.875   | 1.42           | 0.032 | 4.85           | 0                   | —                        |    |
| Stator blade 0.75 L <sub>f</sub> H (65 Series - circular arc meanline) | 11.02               | 56.16                | -17.80               | 73.96                            | 3.0     | 1.65           | 0.10  | 17.82          | -3                  | —                        | 38 |
|                                                                        | 11.94               | 54.15                | -17.70               | 71.85                            | 3.0     | 1.52           | 0.10  | 17.70          | -3                  | —                        |    |
|                                                                        | 12.84               | 52.14                | -17.75               | 70.49                            | 3.0     | 1.41           | 0.10  | 17.74          | -3                  | —                        |    |
|                                                                        | 13.71               | 52.12                | -18.05               | 70.17                            | 3.0     | 1.32           | 0.10  | 18.06          | -3                  | —                        |    |
|                                                                        | 14.58               | 50.09                | -18.96               | 69.05                            | 3.0     | 1.24           | 0.10  | 19.03          | -3                  | —                        |    |

\*Radii listed represent those for instrumentation (see Figure 6)

Table II.

Rotor incidence at minimum and maximum  
flow for flow generation rotor and  
slotted stator stage tests.

|                                 |                                     | Flow generation<br>rotor test            |                                          | Slotted stator<br>stage test             |                                          |
|---------------------------------|-------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| Corrected<br>speed<br>(percent) | Streamline<br>from tip<br>(percent) | i <sub>max</sub><br>(stall)<br>(degrees) | i <sub>min</sub><br>(choke)<br>(degrees) | i <sub>max</sub><br>(stall)<br>(degrees) | i <sub>min</sub><br>(choke)<br>(degrees) |
| 60                              | 10                                  | 6.2                                      | - 8.0                                    | 7.4                                      | -3.1                                     |
|                                 | 50                                  | 6.0                                      | -12.0                                    | 8.0                                      | -4.5                                     |
|                                 | 90                                  | 7.6                                      | -13.0                                    | 14.8                                     | -3.0                                     |
| 80                              | 10                                  | 5.4                                      | - 8.0                                    | 5.9                                      | -3.5                                     |
|                                 | 50                                  | 5.4                                      | - 7.5                                    | 6.3                                      | -4.5                                     |
|                                 | 90                                  | 8.0                                      | - 8.0                                    | 8.3                                      | -5.2                                     |
| 100                             | 10                                  | 4.0                                      | - 3.0                                    | 3.1                                      | -2.5                                     |
|                                 | 50                                  | 4.0                                      | - 4.3                                    | 3.4                                      | -4.2                                     |
|                                 | 90                                  | 4.7                                      | - 5.0                                    | 5.3                                      | -4.8                                     |

Table III.

Rotating stall results for the double slotted stator stage test.

| Corrected speed (percent) | Corrected airflow (lb/sec) | Number of stall cells at streamline from tip |     | Rotative cell speed in (percent rpm) | Stall cell frequency (cps) | Comment                                                                                                          |
|---------------------------|----------------------------|----------------------------------------------|-----|--------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------|
|                           |                            | 10%                                          | 90% |                                      |                            |                                                                                                                  |
| 60                        | 46.85                      | 1                                            | 1   | 27                                   | 23                         | Abrupt stall at first hysteresis point; stress = 13,600 psi.                                                     |
| 60                        | 46.37                      | 1                                            | 1   | 27                                   | 23                         | Abrupt stall; maximum stress = 12,800 psi.                                                                       |
| 80                        | 64.03                      | 1                                            | 1   | 36                                   | 50                         | Abrupt stall; maximum stress = 14,800 psi.                                                                       |
| 90                        | 72.43                      | 1                                            | 1   | 43                                   | 56                         | Abrupt stall with maximum stress = 16,800 psi.                                                                   |
| 100                       | 84.00                      | 1                                            | 1   |                                      |                            | Intermittent stall with no specific pattern; stress = 14,800 psi.                                                |
| 100                       | 81.00                      | 2                                            | 2   | 36                                   | 100                        | Intermittent stall; maximum stress of 18,000 psi peaks exceed the transient limit.                               |
| 110                       | 94.70                      |                                              |     |                                      |                            | Stall cells appearing without a definite pattern; maximum stress = 6,950 psi.                                    |
| 110                       | 89.50                      |                                              |     |                                      |                            | Intermittent stall with no definite pattern; stress = 10,150 psi.                                                |
| 110                       | 83.20                      |                                              |     |                                      |                            | No data recorded; stall is abrupt and the maximum stress is considerably higher than the transient stress limit. |

Table IVa.

REPORT 1

Table IVb.  
BLADE ELEMENT PERFORMANCE -- SLOTTED STATOR STAGE

|                                  |  | STATION 1 -- STATION 2 |        |        |        | STATION 2 -- STATION 3 |       |        |        |
|----------------------------------|--|------------------------|--------|--------|--------|------------------------|-------|--------|--------|
|                                  |  | ROTOR 1                |        |        |        | ROTOR 2                |       |        |        |
|                                  |  | 10                     | 30     | 50     | 70     | 90                     | 10    | 30     | 50     |
| UIA 1                            |  | 29.150                 | 27.000 | 25.060 | 23.020 | 20.988                 | UIA 3 | 29.164 | 27.422 |
| UIA 2                            |  | 29.080                 | 27.302 | 25.516 | 23.730 | 21.944                 | UIA 2 | 42.124 | 44.070 |
| UIA 1                            |  | 20.421                 | 20.422 | 22.766 | 23.934 | 23.844                 | UIA 3 | 0.001  | 0.001  |
| UIA 2                            |  | 42.124                 | 44.070 | 47.023 | 49.298 | 51.086                 | UIA 2 | 40.000 | 40.000 |
| UIA(PK) 1                        |  | 59.206                 | 56.758 | 52.686 | 49.149 | 45.449                 | UIA 1 | 44.000 | 44.000 |
| UIA(PK) 2                        |  | 40.851                 | 41.299 | 33.257 | 23.977 | 14.733                 | UIA 2 | 44.000 | 44.000 |
| V 1                              |  | 339.59                 | 346.00 | 351.29 | 352.28 | 352.34                 | UIA 3 | 44.000 | 44.000 |
| V 2                              |  | 445.36                 | 460.26 | 484.56 | 506.77 | 520.73                 | UIA 2 | 44.000 | 44.000 |
| V 3                              |  | 516.25                 | 524.25 | 523.93 | 321.99 | 322.27                 | UIA 1 | 44.000 | 44.000 |
| V-THETA 1                        |  | 330.32                 | 327.32 | 330.33 | 330.48 | 327.09                 | UIA 2 | 44.000 | 44.000 |
| V-THETA 2                        |  | 118.43                 | 120.73 | 135.23 | 142.91 | 142.43                 | UIA 3 | 44.000 | 44.000 |
| V(PK) 1                          |  | 278.72                 | 323.57 | 354.52 | 384.15 | 405.18                 | UIA 2 | 44.000 | 44.000 |
| V(PK) 2                          |  | 621.0                  | 583.8  | 534.4  | 492.3  | 459.4                  | UIA 1 | 44.000 | 44.000 |
| V-THETA PK1                      |  | 483.0                  | 435.7  | 395.0  | 351.7  | 338.2                  | UIA 2 | 44.000 | 44.000 |
| V-THETA PK2                      |  | 534.0                  | 485.4  | 425.0  | 372.4  | 327.4                  | UIA 3 | 44.000 | 44.000 |
| U 1                              |  | 352.4                  | 287.5  | 216.5  | 147.0  | 86.0                   | UIA 2 | 44.000 | 44.000 |
| U 2                              |  | 652.49                 | 606.15 | 560.94 | 515.27 | 469.79                 | UIA 1 | 44.000 | 44.000 |
| U 3                              |  | 651.10                 | 611.12 | 571.14 | 531.17 | 491.19                 | UIA 2 | 44.000 | 44.000 |
| M 1                              |  | 0.3005                 | 0.3081 | 0.3109 | 0.3117 | 0.3118                 | UIA 3 | 44.000 | 44.000 |
| M(PK) 1                          |  | 0.3887                 | 0.4023 | 0.4243 | 0.4448 | 0.4374                 | UIA 2 | 44.000 | 44.000 |
| M(PK) 2                          |  | 0.5497                 | 0.5164 | 0.4729 | 0.4353 | 0.4065                 | UIA 1 | 44.000 | 44.000 |
| TURN(PK)                         |  | 0.4215                 | 0.3808 | 0.3459 | 0.3175 | 0.2971                 | UIA 2 | 44.000 | 44.000 |
| LOSS COEFF.                      |  | 12.356                 | 14.929 | 19.429 | 25.172 | 30.716                 | UIA 3 | 44.000 | 44.000 |
| OFAC                             |  | 0.0706                 | 0.0825 | 0.0780 | 0.0321 | 0.0798                 | UIA 2 | 44.000 | 44.000 |
| EFF                              |  | 0.9028                 | 0.8655 | 0.8304 | 0.7953 | 0.7606                 | UIA 1 | 44.000 | 44.000 |
| EFF                              |  | 0.9011                 | 0.8942 | 0.9144 | 0.9499 | 0.9335                 | UIA 2 | 44.000 | 44.000 |
| LOSS PARA.                       |  | 0.0170                 | 0.0205 | 0.0200 | 0.0083 | 0.0201                 | UIA 3 | 44.000 | 44.000 |
| INCID                            |  | -0.39                  | -0.64  | -1.01  | -0.65  | 0.45                   | UIA 2 | 44.000 | 44.000 |
| DEV                              |  | 1.751                  | 2.499  | 2.457  | 3.277  | 6.033                  | UIA 1 | 44.000 | 44.000 |
| CORRECTED WEIGHT FLOW            |  |                        |        |        |        |                        |       |        |        |
| UPSTREAM OF ROTOR                |  |                        |        |        |        |                        |       |        |        |
| UPSTREAM OF STATOR               |  |                        |        |        |        |                        |       |        |        |
| DOWNSTREAM OF STATOR             |  |                        |        |        |        |                        |       |        |        |
| PERCENT DESIGN SPEED = 59.9%     |  |                        |        |        |        |                        |       |        |        |
| CORRECTED WEIGHT FLOW = 59.52    |  |                        |        |        |        |                        |       |        |        |
| CORRECTED ROTOR SPEED = 5017.09  |  |                        |        |        |        |                        |       |        |        |
| PRESSURE RATIO = 1.1190          |  |                        |        |        |        |                        |       |        |        |
| AERODYNAMIC EFFICIENCY = 90.3040 |  |                        |        |        |        |                        |       |        |        |

Table IVc.

## BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

ROTOR 1

| STATION 1 - STATION 2 |        |        |        |        |        |
|-----------------------|--------|--------|--------|--------|--------|
|                       | 10     | 30     | 50     | 70     | 90     |
| DIA 1                 | 29.150 | 27.080 | 25.060 | 23.020 | 20.988 |
| DIA 2                 | 29.088 | 27.302 | 25.516 | 23.730 | 21.944 |
| BETA 1                | 19.304 | 20.905 | 22.434 | 23.630 | 23.928 |
| BETA 2                | 43.290 | 45.916 | 48.781 | 51.189 | 52.815 |
| BETA(PRI) 1           | 60.407 | 57.465 | 54.525 | 51.017 | 46.539 |
| BETA(PRI) 2           | 47.311 | 41.909 | 34.723 | 25.617 | 15.964 |
| V 1                   | 328.77 | 334.13 | 335.46 | 337.46 | 344.22 |
| V 2                   | 443.20 | 456.90 | 474.31 | 493.86 | 508.57 |
| VZ 1                  | 310.28 | 312.13 | 310.07 | 309.16 | 314.64 |
| VZ 2                  | 322.60 | 317.87 | 312.54 | 309.53 | 307.38 |
| V-THETA 1             | 108.68 | 119.23 | 128.02 | 135.26 | 139.61 |
| V-THETA 2             | 303.90 | 326.20 | 356.77 | 384.82 | 405.17 |
| V(PRI) 1              | 628.3  | 580.4  | 534.3  | 491.4  | 451.4  |
| V(PRI) 2              | 475.8  | 427.1  | 380.3  | 343.3  | 319.7  |
| VTHETA PRI 1          | 546.3  | 489.3  | 435.1  | 382.0  | 332.0  |
| VTHETA PRI 2          | 349.7  | 285.3  | 216.6  | 148.4  | 87.9   |
| U 1                   | 655.03 | 608.52 | 563.12 | 517.28 | 471.62 |
| U 2                   | 653.64 | 613.50 | 573.37 | 533.24 | 493.10 |
| M 1                   | 0.2893 | 0.2941 | 0.2953 | 0.2970 | 0.3031 |
| M 2                   | 0.3842 | 0.3969 | 0.4127 | 0.4303 | 0.4436 |
| M(PRI) 1              | 0.5528 | 0.5108 | 0.4702 | 0.4326 | 0.4028 |
| M(PRI) 2              | 0.4125 | 0.3710 | 0.3309 | 0.2991 | 0.2788 |
| TURN(PRI)             | 13.096 | 15.556 | 19.803 | 25.401 | 30.575 |
| LOSS COEF.            | 0.0884 | 0.0856 | 0.0832 | 0.0973 | 0.1616 |
| DFAC                  | 0.3531 | 0.3800 | 0.4137 | 0.4365 | 0.4400 |
| EFFP                  | 0.8874 | 0.9011 | 0.9157 | 0.9155 | 0.8776 |
| EFF                   | 0.8852 | 0.8993 | 0.9141 | 0.9140 | 0.8755 |
| LOSS PARA.            | 0.0211 | 0.0210 | 0.0210 | 0.0249 | 0.0405 |
| INCID                 | 0.81   | 0.56   | 0.83   | 1.22   | 1.54   |
| DEV                   | 2.211  | 3.109  | 3.923  | 4.917  | 7.264  |
| CORRECTED WEIGHT FLOW |        |        |        |        |        |
| UPSTREAM OF ROTOR     |        |        | 56.47  |        |        |
| UPSTREAM OF STATOR    |        |        | 56.47  |        |        |
| DOWNSTREAM OF STATOR  |        |        | 52.84  |        |        |

|                       |        |        |        |        |        |
|-----------------------|--------|--------|--------|--------|--------|
| STATION 2 - STATION 3 |        |        |        |        |        |
|                       | 10     | 30     | 50     | 70     | 90     |
| DIA 3                 | 20.164 | 27.422 | 45.672 | 23.874 | 22.034 |
| BETA 4                | 43.290 | 45.916 | 48.781 | 51.189 | 52.815 |
| BETA 3                | -1.287 | -0.550 | -0.918 | -2.770 | -9.298 |
| V 4                   | 443.20 | 456.90 | 474.31 | 493.86 | 508.57 |
| V 3                   | 331.48 | 325.03 | 319.31 | 307.94 | 276.83 |
| VZ 2                  | 322.60 | 317.87 | 312.54 | 309.53 | 307.38 |
| VZ 1                  | 331.40 | 325.02 | 319.31 | 307.94 | 276.83 |
| V-THETA 4             | 903.90 | 448.20 | 356.77 | 284.82 | 405.17 |
| V-THETA 3             | -7.45  | -3.12  | -5.14  | -14.88 | -44.73 |
| M 2                   | 0.3842 | 0.3969 | 0.4127 | 0.4303 | 0.4436 |
| M 3                   | 0.2893 | 0.2941 | 0.2953 | 0.2970 | 0.3031 |
| TURN                  | 44.458 | 46.406 | 49.699 | 53.958 | 62.112 |
| LOSS COEF.            | 0.0142 | 0.0174 | 0.0421 | 0.0891 | 0.0891 |
| DFAC                  | 0.5242 | 0.5018 | 0.5551 | 0.6411 | 0.7229 |
| LOSS PARA.            | 0.0121 | 0.0054 | 0.0061 | 0.0137 | 0.0266 |
| INCID                 | -8.79  | -6.22  | -3.92  | -2.81  | -3.14  |
| DEV                   | 17.675 | 17.490 | 16.332 | 14.910 | 8.502  |

Table IVd.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

ROTOR 1

STATION 1 - STATION 2

|             | 10     | 30     | 50     | 70     | 90     |
|-------------|--------|--------|--------|--------|--------|
| DIA 1       | 29.150 | 27.080 | 25.060 | 23.020 | 20.988 |
| DIA 2       | 29.088 | 27.302 | 25.516 | 23.730 | 21.944 |
| BETA 1      | 20.634 | 20.510 | 22.377 | 23.372 | 23.747 |
| BETA 2      | 48.847 | 51.406 | 55.861 | 58.200 | 59.677 |
| BETA(PK) 1  | 64.051 | 61.755 | 58.571 | 55.090 | 51.938 |
| BETA(PK) 2  | 48.020 | 42.642 | 34.335 | 24.774 | 12.956 |
| V 1         | 287.97 | 290.74 | 297.46 | 302.26 | 303.41 |
| V 2         | 440.53 | 452.60 | 473.65 | 488.02 | 503.70 |
| V 2 1       | 269.50 | 272.31 | 275.06 | 277.46 | 277.72 |
| V 2 2       | 289.90 | 282.33 | 265.81 | 257.17 | 254.30 |
| V-THETA 1   | 101.48 | 101.86 | 113.24 | 119.90 | 122.16 |
| V-THETA 2   | 331.70 | 353.74 | 392.03 | 414.76 | 434.79 |
| V(PK) 1     | 615.9  | 575.4  | 527.5  | 484.8  | 446.5  |
| V(PK) 2     | 433.4  | 383.8  | 321.9  | 283.2  | 240.9  |
| V-THETA PK1 | 553.8  | 506.9  | 450.1  | 397.6  | 349.6  |
| V-THETA PK2 | 322.2  | 260.0  | 181.6  | 118.7  | 58.5   |
| U 1         | 655.28 | 608.75 | 563.34 | 517.48 | 471.80 |
| U 2         | 653.89 | 613.74 | 573.59 | 533.44 | 493.30 |
| M 1         | 0.2528 | 0.2552 | 0.2612 | 0.2655 | 0.2665 |
| M 2         | 0.3813 | 0.3922 | 0.4111 | 0.4240 | 0.4381 |
| M(PK) 1     | 0.5406 | 0.5051 | 0.4632 | 0.4258 | 0.3922 |
| M(PK) 2     | 0.3752 | 0.3326 | 0.2794 | 0.2461 | 0.2269 |
| TURN(PK)    | 16.031 | 19.112 | 24.236 | 30.316 | 38.582 |
| LOSS COEF.  | 0.0327 | 0.0490 | 0.0669 | 0.1066 | 0.1532 |
| DFAC        | 0.4289 | 0.4746 | 0.5459 | 0.5792 | 0.5856 |
| EFFP        | 0.9624 | 0.9490 | 0.9404 | 0.9182 | 0.8985 |
| EFF         | 0.9616 | 0.9480 | 0.9392 | 0.9166 | 0.8965 |
| LUSS PARA.  | 0.0077 | 0.0119 | 0.0170 | 0.0275 | 0.0394 |
| INCID       | 4.45   | 4.85   | 4.87   | 5.29   | 6.54   |
| DEV         | 2.920  | 3.842  | 3.535  | 4.074  | 4.256  |

CORRECTED WEIGHT FLOW

|                      |       |
|----------------------|-------|
| UPSTREAM OF ROTOR    | 51.32 |
| UPSTREAM OF STATOR   | 51.32 |
| DOWNSTREAM OF STATOR | 47.61 |

STATOR 1

STATION 2 - STATION 3

|            | 10     | 30     | 50     | 70     | 90      |
|------------|--------|--------|--------|--------|---------|
| DIA 3      | 29.164 | 27.422 | 25.672 | 23.874 | 22.034  |
| DIA 4      | 29.047 | 27.406 | 25.861 | 24.000 | 22.077  |
| BETA 3     | -4.128 | -0.734 | -2.027 | -4.075 | -11.924 |
| V 3        | 440.53 | 452.60 | 473.65 | 488.02 | 503.70  |
| V 4        | 303.34 | 295.98 | 290.12 | 273.28 | 253.27  |
| V 4 1      | 289.90 | 282.33 | 265.81 | 257.17 | 254.30  |
| V 4 2      | 303.07 | 295.96 | 289.94 | 272.59 | 258.23  |
| V-THETA 2  | 331.70 | 353.74 | 392.03 | 414.76 | 434.79  |
| V-THETA 3  | -12.69 | -3.79  | -10.26 | -19.42 | -48.20  |
| M 2        | 0.3813 | 0.3922 | 0.4111 | 0.4240 | 0.4381  |
| M 3        | 0.2600 | 0.2542 | 0.2492 | 0.2348 | 0.2001  |
| TURN       | 51.245 | 52.140 | 57.889 | 62.275 | 71.602  |
| LOSS COEF. | 0.0307 | 0.0077 | 0.0286 | 0.0455 | 0.1057  |
| DFAC       | 0.6254 | 0.6437 | 0.6861 | 0.7310 | 0.8266  |
| LUSS PARA. | 0.0123 | 0.0029 | 0.0100 | 0.0148 | 0.0312  |
| INCID      | -3.23  | -0.73  | 3.16   | 4.20   | 3.73    |
| DEV        | 16.542 | 17.306 | 15.723 | 13.605 | 5.876   |

Table IVe.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |        |        |        |         |         |  |  |  |  |
|-----------------------|--------|--------|--------|---------|---------|--|--|--|--|
|                       | 10     | 30     | 50     | 70      | 90      |  |  |  |  |
| DIA 1                 | 29.150 | 27.060 | 25.060 | 23.029  | 20.988  |  |  |  |  |
| DIA 2                 | 29.088 | 27.302 | 25.516 | 23.730  | 21.944  |  |  |  |  |
| BETA 1                | 18.580 | 19.120 | 21.460 | 20.920  | 21.280  |  |  |  |  |
| BETA 2                | 56.934 | 57.483 | 59.708 | 60.234  | 59.321  |  |  |  |  |
| BETA(PK) 1            | 67.036 | 64.354 | 61.720 | 62.992  | 59.777  |  |  |  |  |
| BETA(PK) 2            | 47.436 | 40.579 | 31.965 | 21.440  | 10.337  |  |  |  |  |
| V 1                   | 255.52 | 264.27 | 267.86 | 235.50  | 239.57  |  |  |  |  |
| V 2                   | 454.99 | 469.15 | 485.12 | 500.06  | 515.76  |  |  |  |  |
| VZ 1                  | 242.20 | 249.69 | 249.29 | 219.98  | 223.24  |  |  |  |  |
| VZ 2                  | 248.25 | 252.19 | 244.70 | 248.26  | 263.15  |  |  |  |  |
| V-THETA 1             | 81.41  | 86.56  | 98.00  | 84.09   | 86.95   |  |  |  |  |
| V-THETA 2             | 381.30 | 395.60 | 418.89 | 434.09  | 443.58  |  |  |  |  |
| V(PK) 1               | 620.3  | 576.9  | 526.2  | 484.4   | 443.5   |  |  |  |  |
| V(PK) 2               | 367.0  | 332.0  | 288.4  | 266.7   | 267.5   |  |  |  |  |
| V-THETA PK1           | 571.6  | 520.1  | 463.4  | 431.6   | 383.2   |  |  |  |  |
| V-THETA PK2           | 270.3  | 216.0  | 152.7  | 97.5    | 48.0    |  |  |  |  |
| U 1                   | 652.99 | 606.62 | 561.37 | 515.68  | 470.16  |  |  |  |  |
| U 2                   | 651.61 | 611.60 | 571.59 | 531.58  | 491.57  |  |  |  |  |
| M 1                   | 0.2249 | 0.2327 | 0.2359 | 0.2071  | 0.2107  |  |  |  |  |
| M 2                   | 0.3930 | 0.4073 | 0.4219 | 0.4360  | 0.4501  |  |  |  |  |
| M(PK) 1               | 0.5463 | 0.5079 | 0.4633 | 0.4260  | 0.3901  |  |  |  |  |
| M(PK) 2               | 0.3170 | 0.2883 | 0.2509 | 0.2325  | 0.2334  |  |  |  |  |
| TURN(PK)              | 19.600 | 23.775 | 29.754 | 41.552  | 49.441  |  |  |  |  |
| LOSS COEFF.           | 0.1982 | 0.0762 | 0.0780 | -0.0504 | -0.0138 |  |  |  |  |
| DFAC                  | 0.5799 | 0.5984 | 0.6329 | 0.6453  | 0.5937  |  |  |  |  |
| EFF                   | 0.8176 | 0.9299 | 0.9382 | 1.0374  | 1.0093  |  |  |  |  |
| EFF                   | 0.8133 | 0.9283 | 0.9368 | 1.0383  | 1.0095  |  |  |  |  |
| LGSS PARA.            | 0.0473 | 0.0191 | 0.0203 | -0.0133 | -0.0035 |  |  |  |  |
| INCID                 | 7.44   | 7.45   | 8.02   | 13.19   | 14.78   |  |  |  |  |
| DEV                   | 2.336  | 1.779  | 1.165  | 0.740   | 1.637   |  |  |  |  |
| CORRECTED WEIGHT FLOW |        |        |        |         |         |  |  |  |  |
| UPSTREAM OF ROTOR     |        |        | 47.47  |         |         |  |  |  |  |
| UPSTREAM OF STATOR    |        |        | 47.47  |         |         |  |  |  |  |
| DWNSTREAM OF STATOR   |        |        | 43.57  |         |         |  |  |  |  |

| STATION 2 - STATION 3 |         |        |        |        |         |    |  |  |  |
|-----------------------|---------|--------|--------|--------|---------|----|--|--|--|
|                       | 10      | 20     | 30     | 50     | 70      | 90 |  |  |  |
| DIA 3                 | 29.164  | 27.422 | 25.672 | 23.674 | 22.034  |    |  |  |  |
| BETA 2                | 56.934  | 57.483 | 59.708 | 60.234 | 59.321  |    |  |  |  |
| BETA 3                | -13.954 | -3.014 | -1.287 | -4.075 | -14.355 |    |  |  |  |
| V 2                   | 454.99  | 465.15 | 485.12 | 500.06 | 515.76  |    |  |  |  |
| V 3                   | 263.57  | 285.12 | 274.13 | 256.51 | 215.92  |    |  |  |  |
| VZ 2                  | 248.25  | 254.15 | 244.70 | 248.26 | 263.15  |    |  |  |  |
| VZ 3                  | 253.42  | 284.58 | 279.06 | 255.87 | 209.16  |    |  |  |  |
| V-THETA 2             | 381.30  | 395.60 | 418.89 | 434.09 | 443.58  |    |  |  |  |
| V-THETA 3             | -72.45  | -17.48 | -6.27  | -16.23 | -55.53  |    |  |  |  |
| M 2                   | 0.3930  | 0.4073 | 0.4219 | 0.4360 | 0.4501  |    |  |  |  |
| M 3                   | 0.2250  | 0.2452 | 0.2403 | 0.2208 | 0.1856  |    |  |  |  |
| TURN                  | 74.888  | 60.957 | 60.555 | 64.509 | 73.675  |    |  |  |  |
| LGSS COEFF.           | 0.1607  | 0.0952 | 0.0916 | 0.1177 | 0.1675  |    |  |  |  |
| DFAC                  | 0.8212  | 0.7246 | 0.7328 | 0.7828 | 0.8725  |    |  |  |  |
| LOSS PARA.            | 0.0698  | 0.0373 | 0.0322 | 0.0384 | 0.0490  |    |  |  |  |
| INCID                 | 4.65    | 5.54   | 7.01   | 6.23   | 3.37    |    |  |  |  |
| DEV                   | 3.006   | 14.526 | 16.463 | 13.605 | 3.445   |    |  |  |  |

|                         |         |
|-------------------------|---------|
| PERCENT DESIGN SPEED =  | 59.96   |
| CORRECTED WEIGHT FLOW = | 47.47   |
| CORRECTED ROTOR SPEED = | 5016.54 |
| PRESSURE RATIO =        | 1.1527  |
| ADIABATIC EFFICIENCY =  | 84.6168 |

|             |         |
|-------------|---------|
| DIA 3       | 29.164  |
| BETA 2      | 56.934  |
| BETA 3      | -13.954 |
| V 2         | 454.99  |
| V 3         | 263.57  |
| VZ 2        | 248.25  |
| VZ 3        | 253.42  |
| V-THETA 2   | 381.30  |
| V-THETA 3   | -72.45  |
| M 2         | 0.3930  |
| M 3         | 0.2250  |
| TURN        | 74.888  |
| LGSS COEFF. | 0.1607  |
| DFAC        | 0.8212  |
| LOSS PARA.  | 0.0698  |
| INCID       | 4.65    |
| DEV         | 3.006   |

Table IVf.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

|                         |         | STATION 1 - STATION 2 |        |        |        | STATION 2 - STATION 3 |                      |    |    |
|-------------------------|---------|-----------------------|--------|--------|--------|-----------------------|----------------------|----|----|
|                         |         | ROTOR 1               |        |        |        | STATION 1             |                      |    |    |
|                         |         | 10                    | 30     | 50     | 70     | 90                    | 10                   | 30 | 50 |
| PERCENT DESIGN SPEED =  | 79.93   |                       |        |        |        |                       |                      |    |    |
| CORRECTED WEIGHT FLOW = | 83.92   |                       |        |        |        |                       |                      |    |    |
| CORRECTED ROTOR SPEED = | 6687.66 |                       |        |        |        |                       |                      |    |    |
| PRESSURE RATIO =        | 1.1632  |                       |        |        |        |                       |                      |    |    |
| ADIABATIC EFFICIENCY =  | 81.8163 |                       |        |        |        |                       |                      |    |    |
| STATION 1 - STATION 2   |         |                       |        |        |        |                       |                      |    |    |
| U/A 1                   |         | 29.150                | 27.080 | 25.060 | 23.020 | 20.980                | U/A 1                |    |    |
| U/A 2                   |         | 29.088                | 27.302 | 25.516 | 23.730 | 21.944                | U/A 2                |    |    |
| BETA 1                  |         | 18.940                | 20.740 | 21.820 | 23.800 | 24.340                | BETA 1               |    |    |
| BETA 2                  |         | 37.860                | 40.364 | 42.495 | 44.370 | 46.435                | BETA 2               |    |    |
| BETA(PK) 1              |         | 56.162                | 52.545 | 49.180 | 44.444 | 39.821                | BETA(PK) 1           |    |    |
| BETA(PK) 2              |         | 46.726                | 39.684 | 32.215 | 23.158 | 14.492                | BETA(PK) 2           |    |    |
| V 1                     |         | 501.56                | 513.46 | 517.34 | 528.40 | 534.82                | V 1                  |    |    |
| V 2                     |         | 598.08                | 637.00 | 668.29 | 705.04 | 725.88                | V 2                  |    |    |
| VZ 1                    |         | 474.41                | 480.19 | 480.28 | 483.46 | 487.29                | VZ 1                 |    |    |
| VZ 2                    |         | 472.19                | 485.36 | 492.76 | 503.99 | 500.26                | VZ 2                 |    |    |
| V-THETA 1               |         | 162.80                | 181.83 | 192.29 | 213.23 | 220.43                | V-THETA 1            |    |    |
| V-THETA 2               |         | 367.06                | 412.54 | 451.44 | 493.03 | 525.96                | V-THETA 2            |    |    |
| V(PK) 1                 |         | 852.0                 | 789.6  | 734.7  | 677.2  | 634.4                 | V(PK) 1              |    |    |
| V(PK) 2                 |         | 688.8                 | 630.7  | 582.4  | 548.2  | 516.7                 | V(PK) 2              |    |    |
| VTHETA PK1              |         | 707.7                 | 626.8  | 556.0  | 474.2  | 406.3                 | VTHETA PK1           |    |    |
| VTHETA PK2              |         | 501.5                 | 402.7  | 310.5  | 215.6  | 129.3                 | VTHETA PK2           |    |    |
| U 1                     |         | 870.45                | 808.63 | 748.32 | 687.40 | 626.72                | U 1                  |    |    |
| U 2                     |         | 868.60                | 815.26 | 761.93 | 708.60 | 655.27                | U 2                  |    |    |
| M 1                     |         | 0.4480                | 0.4590 | 0.4627 | 0.4730 | 0.4790                | M 1                  |    |    |
| M 2                     |         | 0.5240                | 0.5602 | 0.5890 | 0.6232 | 0.6428                | M 2                  |    |    |
| M(PK) 1                 |         | 0.7609                | 0.7059 | 0.6571 | 0.6062 | 0.5682                | M(PK) 1              |    |    |
| M(PK) 2                 |         | 0.6035                | 0.5546 | 0.5134 | 0.4845 | 0.4575                | M(PK) 2              |    |    |
| TURN(PK)                |         | 9.436                 | 12.861 | 16.965 | 21.286 | 25.329                | TURN(PK)             |    |    |
| LCSS COEF.              |         | 0.0801                | 0.0612 | 0.0568 | 0.0551 | 0.0765                | LCSS COEF.           |    |    |
| DFAC                    |         | 0.2768                | 0.2949 | 0.3098 | 0.2990 | 0.2993                | DFAC                 |    |    |
| EFFP                    |         | 0.8604                | 0.9067 | 0.9258 | 0.9399 | 0.9267                | EFFP                 |    |    |
| EFF                     |         | 0.8573                | 0.9045 | 0.9239 | 0.9383 | 0.9247                | EFF                  |    |    |
| LCSS PARA.              |         | 0.0194                | 0.0155 | 0.0147 | 0.0144 | 0.0193                | LCSS PARA.           |    |    |
| INCID                   |         | -3.44                 | -4.36  | -4.52  | -5.36  | -5.18                 | INCID                |    |    |
| DEV                     |         | 1.626                 | 0.884  | 1.415  | 2.458  | 5.792                 | DEV                  |    |    |
| CORRECTED WEIGHT FLOW   |         |                       |        |        |        |                       |                      |    |    |
| UPSTREAM OF ROTOR       |         |                       |        | 83.92  |        |                       | UPSTREAM OF ROTOR    |    |    |
| UPSTREAM OF STATOR      |         |                       |        | 83.92  |        |                       | UPSTREAM OF STATOR   |    |    |
| DOWNSTREAM OF STATOR    |         |                       |        | 80.71  |        |                       | DOWNSTREAM OF STATOR |    |    |

Table IVg.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

|                       |  | STATION 1 - STATION 2 |        |        |         |        |
|-----------------------|--|-----------------------|--------|--------|---------|--------|
|                       |  | MOTOR 1               |        |        |         |        |
|                       |  | 10                    | 30     | 50     | 70      | 90     |
| DIA 1                 |  | 23.150                | 27.060 | 25.060 | 23.020  | 20.988 |
| DIA 2                 |  | 29.088                | 27.302 | 25.516 | 23.730  | 21.944 |
| BETA 1                |  | 13.610                | 20.421 | 23.124 | 25.014  | 24.024 |
| BETA 2                |  | 43.387                | 45.707 | 48.406 | 50.511  | 52.428 |
| BETA(PRI) 1           |  | 59.407                | 58.396 | 52.843 | 48.827  | 45.333 |
| BETA(PRI) 2           |  | 46.122                | 40.672 | 32.952 | 23.695  | 14.193 |
| V 1                   |  | 450.88                | 459.25 | 465.48 | 470.74  | 470.40 |
| V 2                   |  | 601.54                | 619.03 | 646.13 | 673.73  | 691.48 |
| VZ 1                  |  | 424.73                | 430.38 | 428.08 | 426.59  | 429.65 |
| VZ 2                  |  | 437.15                | 432.29 | 428.94 | 428.44  | 421.63 |
| V-THEIA 1             |  | 151.32                | 160.24 | 182.80 | 199.05  | 191.51 |
| V-THEIA 2             |  | 413.21                | 443.09 | 483.22 | 519.95  | 548.06 |
| V(PRI) 1              |  | 334.5                 | 777.6  | 708.7  | 648.0   | 611.2  |
| V(PRI) 2              |  | 630.7                 | 570.0  | 511.2  | 467.9   | 434.9  |
| VH-LTA PRI            |  | 718.4                 | 647.7  | 564.9  | 487.7   | 434.7  |
| VH-LTA PRI            |  | 454.6                 | 371.5  | 278.0  | 188.0   | 106.6  |
| U 1                   |  | 869.68                | 807.93 | 747.66 | 686.80  | 626.17 |
| U 2                   |  | 867.83                | 814.55 | 761.26 | 707.98  | 654.69 |
| M 1                   |  | 0.4015                | 0.4092 | 0.4149 | 0.4198  | 0.4195 |
| M 2                   |  | 0.5232                | 0.5403 | 0.5655 | 0.5922  | 0.6086 |
| M(PRI) 1              |  | 0.7431                | 0.6929 | 0.6318 | 0.5778  | 0.5450 |
| M(PRI) 2              |  | 0.5480                | 0.4975 | 0.4474 | 0.4113  | 0.3828 |
| TURN(PRI)             |  | 13.285                | 15.724 | 19.891 | 25.131  | 31.140 |
| LOSS COEF.            |  | 0.0471                | 0.0390 | 0.0452 | -0.0037 | 0.0338 |
| DFAC                  |  | 0.3557                | 0.3843 | 0.4029 | 0.4093  | 0.4282 |
| EFFP                  |  | 0.9401                | 0.9540 | 0.9543 | 1.0044  | 0.9733 |
| EFF                   |  | 0.9381                | 0.9526 | 0.9529 | 1.0046  | 0.9725 |
| LOSS PARA.            |  | 0.0115                | 0.0098 | 0.0116 | -0.0010 | 0.0085 |
| INCID                 |  | -0.19                 | -0.50  | -0.86  | -0.97   | 0.33   |
| DEV                   |  | 1.022                 | 1.872  | 2.152  | 2.995   | 5.493  |
| CORRECTED WEIGHT FLOW |  |                       |        |        |         |        |
| UPSTREAM OF ROTOR     |  |                       |        | 77.55  |         |        |
| UPSTREAM OF STATOR    |  |                       |        | 77.55  |         |        |
| DOWNSTREAM OF STATOR  |  |                       |        | 73.87  |         |        |

|            |  | STATION 2 - STATION 3 |        |        |        |         |
|------------|--|-----------------------|--------|--------|--------|---------|
|            |  | 10                    | 30     | 50     | 70     | 90      |
| DIA 3      |  | 27.164                | 27.422 | 25.672 | 23.874 | 22.034  |
| BETA 2     |  | 43.387                | 45.707 | 48.406 | 50.511 | 52.428  |
| BETA 3     |  | -4.075                | -0.916 | -1.487 | -3.142 | -11.750 |
| V 2        |  | 601.54                | 619.03 | 646.13 | 673.73 | 691.48  |
| V 3        |  | 442.21                | 440.47 | 435.83 | 419.43 | 391.73  |
| VZ 2       |  | 437.15                | 432.29 | 428.94 | 428.44 | 421.63  |
| VZ 3       |  | 441.10                | 440.41 | 433.72 | 418.80 | 383.53  |
| V-THEIA 2  |  | 412.21                | 443.09 | 483.22 | 519.95 | 548.06  |
| V-THEIA 3  |  | -21.42                | -7.06  | -5.75  | -22.99 | -79.78  |
| M 2        |  | 0.5232                | 0.5403 | 0.5655 | 0.5922 | 0.6086  |
| M 3        |  | 0.3801                | 0.3794 | 0.3757 | 0.3610 | 0.3368  |
| TURN       |  | 47.462                | 46.625 | 45.653 | 43.653 | 41.179  |
| LOSS COEF. |  | 0.0871                | 0.0520 | 0.0603 | 0.0894 | 0.1087  |
| DFAC       |  | 0.5617                | 0.5624 | 0.5768 | 0.6410 | 0.7078  |
| LOSS PARA. |  | 0.0349                | 0.0196 | 0.0212 | 0.0286 | 0.0322  |
| INCID      |  | -6.69                 | -6.43  | -4.29  | -3.49  | -3.52   |
| DEV        |  | 14.885                | 17.122 | 16.463 | 14.538 | 6.050   |

Table IVh.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |  |        |        |        |        |        |  |  |  |  |
|-----------------------|--|--------|--------|--------|--------|--------|--|--|--|--|
| ROTOR 1               |  |        |        |        |        |        |  |  |  |  |
|                       |  | 10     | 30     | 50     | 70     | 90     |  |  |  |  |
| DIA 1                 |  | 29.150 | 27.080 | 25.060 | 23.020 | 20.988 |  |  |  |  |
| DIA 2                 |  | 29.088 | 27.302 | 25.516 | 23.730 | 21.944 |  |  |  |  |
| BETA 1                |  | 19.160 | 20.331 | 22.944 | 24.204 | 23.214 |  |  |  |  |
| BETA 2                |  | 45.375 | 48.677 | 50.978 | 52.728 | 54.934 |  |  |  |  |
| BETA(PR) 1            |  | 60.576 | 57.591 | 54.305 | 50.517 | 47.030 |  |  |  |  |
| BETA(PR) 2            |  | 45.899 | 40.273 | 32.701 | 24.151 | 13.208 |  |  |  |  |
| V 1                   |  | 433.63 | 442.23 | 446.68 | 452.10 | 452.91 |  |  |  |  |
| V 2                   |  | 603.30 | 620.76 | 643.68 | 662.45 | 685.84 |  |  |  |  |
| VZ 1                  |  | 409.61 | 414.68 | 411.34 | 412.36 | 416.24 |  |  |  |  |
| VZ 2                  |  | 423.80 | 409.89 | 405.27 | 401.18 | 394.02 |  |  |  |  |
| V-THETA 1             |  | 142.32 | 153.65 | 174.13 | 185.36 | 178.52 |  |  |  |  |
| V-THETA 2             |  | 429.38 | 466.20 | 500.08 | 527.16 | 561.36 |  |  |  |  |
| V(PR) 1               |  | 833.8  | 773.7  | 705.0  | 648.5  | 610.7  |  |  |  |  |
| V(PR) 2               |  | 609.0  | 537.2  | 481.6  | 439.7  | 404.7  |  |  |  |  |
| VTHETA PR1            |  | 726.2  | 653.2  | 572.5  | 500.5  | 446.8  |  |  |  |  |
| VTHETA PR2            |  | 437.3  | 347.3  | 260.2  | 179.9  | 92.5   |  |  |  |  |
| U 1                   |  | 868.54 | 806.86 | 746.67 | 685.89 | 625.35 |  |  |  |  |
| U 2                   |  | 866.69 | 813.48 | 760.26 | 707.05 | 653.83 |  |  |  |  |
| M 1                   |  | 0.3866 | 0.3945 | 0.3986 | 0.4035 | 0.4043 |  |  |  |  |
| M 2                   |  | 0.5243 | 0.5416 | 0.5633 | 0.5814 | 0.6027 |  |  |  |  |
| M(PR) 1               |  | 0.7433 | 0.6901 | 0.6290 | 0.5789 | 0.5451 |  |  |  |  |
| M(PR) 2               |  | 0.5292 | 0.4687 | 0.4215 | 0.3859 | 0.3556 |  |  |  |  |
| TURN(PR)              |  | 14.677 | 17.318 | 21.604 | 26.366 | 33.822 |  |  |  |  |
| LOSS COEF.            |  | 0.0713 | 0.0521 | 0.0493 | 0.0511 | 0.1033 |  |  |  |  |
| UFAC                  |  | 0.3918 | 0.4362 | 0.4528 | 0.4625 | 0.4883 |  |  |  |  |
| EFFP                  |  | 0.9164 | 0.9433 | 0.9535 | 0.9572 | 0.9237 |  |  |  |  |
| EFF                   |  | 0.9135 | 0.9414 | 0.9519 | 0.9558 | 0.9212 |  |  |  |  |
| LOSS PARA.            |  | 0.0175 | 0.0131 | 0.0127 | 0.0132 | 0.0262 |  |  |  |  |
| INCID                 |  | 0.98   | 0.69   | 0.60   | 0.72   | 2.03   |  |  |  |  |
| DEV                   |  | 0.799  | 1.473  | 1.901  | 3.451  | 4.508  |  |  |  |  |
| CORRECTED WEIGHT FLOW |  |        |        |        |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |  |        |        | 75.13  |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |  |        |        | 75.13  |        |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |  |        |        | 71.35  |        |        |  |  |  |  |

| STATION 2 - STATION 3 |  |        |        |        |        |         |  |  |  |  |
|-----------------------|--|--------|--------|--------|--------|---------|--|--|--|--|
| STATOR 1              |  |        |        |        |        |         |  |  |  |  |
|                       |  | 10     | 30     | 50     | 70     | 90      |  |  |  |  |
| DIA 3                 |  | 29.104 | 27.422 | 25.572 | 23.874 | 22.034  |  |  |  |  |
| BETA 2                |  | 45.375 | 48.677 | 50.978 | 52.728 | 54.934  |  |  |  |  |
| BETA 3                |  | -4.637 | -1.472 | -1.103 | -4.637 | -14.355 |  |  |  |  |
| V 2                   |  | 603.30 | 620.76 | 643.68 | 662.45 | 685.84  |  |  |  |  |
| V 3                   |  | 416.64 | 420.12 | 412.27 | 391.54 | 341.39  |  |  |  |  |
| VZ 2                  |  | 423.80 | 405.89 | 405.27 | 401.18 | 394.02  |  |  |  |  |
| VZ 3                  |  | 415.28 | 419.90 | 412.20 | 390.26 | 330.73  |  |  |  |  |
| V-THETA 2             |  | 425.30 | 466.20 | 500.08 | 527.16 | 561.36  |  |  |  |  |
| V-THETA 3             |  | -23.68 | -10.75 | -7.93  | -31.65 | -84.64  |  |  |  |  |
| M 2                   |  | 0.5243 | 0.5416 | 0.5633 | 0.5814 | 0.6027  |  |  |  |  |
| M 3                   |  | 0.7433 | 0.6901 | 0.6290 | 0.5789 | 0.5451  |  |  |  |  |
| TURN                  |  | 50.012 | 50.145 | 52.081 | 57.365 | 65.289  |  |  |  |  |
| LOSS COEF.            |  | 0.1026 | 0.0925 | 0.0869 | 0.0691 | 0.1342  |  |  |  |  |
| UFAC                  |  | 0.4177 | 0.4127 | 0.4370 | 0.4648 | 0.787   |  |  |  |  |
| LOSS PARA.            |  | 0.0415 | 0.0213 | 0.0200 | 0.0225 | 0.0393  |  |  |  |  |
| INCID                 |  | -6.70  | -3.46  | -1.72  | -1.27  | -1.02   |  |  |  |  |
| DEV                   |  | 14.323 | 16.508 | 16.647 | 13.043 | 3.445   |  |  |  |  |

Table IVi.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

|                                 |        | STATION 1 - STATION 2 |        |        |        | STATION 2 - STATION 3 |        |        |        |
|---------------------------------|--------|-----------------------|--------|--------|--------|-----------------------|--------|--------|--------|
|                                 |        | 10                    | 30     | 50     | 70     | 90                    | 10     | 30     | 50     |
| PERCENT DESIGN SPEED = 79.90    |        |                       |        |        |        |                       |        |        |        |
| CORRECTED WEIGHT FLOW = 70.16   |        |                       |        |        |        |                       |        |        |        |
| CORRECTED ROTOR SPEED = 6685.44 |        |                       |        |        |        |                       |        |        |        |
| PRESSURE RATIO = 1.2621         |        |                       |        |        |        |                       |        |        |        |
| ADIABATIC EFFICIENCY = 88.4093  |        |                       |        |        |        |                       |        |        |        |
|                                 |        | STATION 1             |        |        |        | STATION 2             |        |        |        |
|                                 |        | 10                    | 30     | 50     | 70     | 90                    | 10     | 30     | 50     |
| UIA 3                           | 29.164 | 27.422                | 25.672 | 24.034 | 22.034 |                       | 29.150 | 27.080 | 25.060 |
| BETA 2                          | 20.122 | 20.631                | 20.062 | 19.942 | 19.807 |                       | 29.088 | 27.302 | 25.516 |
| BETA 3                          | 18.414 | 18.472                | 18.557 | 18.526 | 18.487 |                       | 18.350 | 21.052 | 22.764 |
| V 2                             | 66.54  | 61.26                 | 61.56  | 61.56  | 61.56  |                       | 50.122 | 53.031 | 56.082 |
| V 3                             | 54.72  | 58.56                 | 57.85  | 55.71  | 57.87  |                       | 63.263 | 60.414 | 57.140 |
| VZ 2                            | 50.85  | 57.162                | 52.41  | 34.88  | 33.34  |                       | 45.849 | 40.618 | 33.765 |
| VZ 3                            | 50.50  | 58.45                 | 52.75  | 32.92  | 27.18  |                       | 394.68 | 402.54 | 411.21 |
| V-THEIA 2                       | 465.46 | 492.59                | 524.10 | 557.08 | 583.91 |                       | 606.54 | 618.28 | 631.56 |
| V-THEIA 3                       | 50.29  | 50.73                 | 50.76  | 43.57  | 42.70  |                       | 374.61 | 375.68 | 379.18 |
| M 2                             | 0.2242 | 0.2269                | 0.2269 | 0.2269 | 0.2269 |                       | 388.89 | 371.82 | 352.41 |
| M 3                             | 0.2276 | 0.2276                | 0.2276 | 0.2276 | 0.2276 |                       | 124.25 | 144.60 | 159.11 |
| TURN                            | 0.1355 | 0.1355                | 0.1355 | 0.1355 | 0.1355 |                       | 465.46 | 493.99 | 524.10 |
| LUSS COEF.                      | 0.7112 | 0.6787                | 0.6787 | 0.6787 | 0.6787 |                       | 832.7  | 760.9  | 698.8  |
| LUSS PARA.                      | 0.6255 | 0.6270                | 0.6270 | 0.6270 | 0.6270 |                       | 558.3  | 489.8  | 423.9  |
| INCID                           | 1.50   | 1.50                  | 1.50   | 1.50   | 1.50   |                       | 743.5  | 661.7  | 587.0  |
| DEV                             | 10.546 | 10.546                | 10.546 | 10.546 | 10.546 |                       | 400.6  | 318.9  | 235.6  |
|                                 |        | STATION 1             |        |        |        | STATION 2             |        |        |        |
|                                 |        | 10                    | 30     | 50     | 70     | 90                    | 10     | 30     | 50     |
| UIA 1                           | 29.150 | 27.080                | 25.060 | 23.020 | 20.988 |                       | 29.150 | 27.080 | 25.060 |
| UIA 2                           | 29.088 | 27.302                | 25.516 | 23.730 | 21.944 |                       | 29.088 | 27.302 | 25.516 |
| BETA 1                          | 18.350 | 21.052                | 22.764 | 23.664 | 23.484 |                       | 18.350 | 21.052 | 22.764 |
| BETA 2                          | 50.122 | 53.031                | 56.082 | 57.942 | 60.502 |                       | 50.122 | 53.031 | 56.082 |
| BETA(PK) 1                      | 63.263 | 60.414                | 57.140 | 54.065 | 50.588 |                       | 63.263 | 60.414 | 57.140 |
| BETA(PK) 2                      | 45.849 | 40.618                | 33.765 | 23.189 | 11.872 |                       | 45.849 | 40.618 | 33.765 |
| V 1                             | 394.68 | 402.54                | 411.21 | 411.63 | 412.57 |                       | 394.68 | 402.54 | 411.21 |
| V 2                             | 606.54 | 618.28                | 631.56 | 657.31 | 670.87 |                       | 606.54 | 618.28 | 631.56 |
| VZ 1                            | 374.61 | 375.68                | 379.18 | 377.02 | 378.40 |                       | 374.61 | 375.68 | 379.18 |
| VZ 2                            | 388.89 | 371.82                | 352.41 | 348.88 | 330.34 |                       | 388.89 | 371.82 | 352.41 |
| V-THEIA 1                       | 124.25 | 144.60                | 159.11 | 165.22 | 164.41 |                       | 124.25 | 144.60 | 159.11 |
| V-THEIA 2                       | 465.46 | 493.99                | 524.10 | 557.08 | 583.91 |                       | 465.46 | 493.99 | 524.10 |
| V(PK) 1                         | 832.7  | 760.9                 | 698.8  | 642.4  | 596.0  |                       | 832.7  | 760.9  | 698.8  |
| V(PK) 2                         | 558.3  | 489.8                 | 423.9  | 379.5  | 337.6  |                       | 558.3  | 489.8  | 423.9  |
| VTHETA PR1                      | 743.5  | 661.7                 | 587.0  | 520.2  | 460.5  |                       | 743.5  | 661.7  | 587.0  |
| VTHETA PR2                      | 400.6  | 318.9                 | 235.6  | 149.5  | 69.4   |                       | 400.6  | 318.9  | 235.6  |
| U 1                             | 867.90 | 806.27                | 746.13 | 685.39 | 624.89 |                       | 867.90 | 806.27 | 746.13 |
| U 2                             | 866.06 | 812.88                | 759.70 | 706.53 | 653.35 |                       | 866.06 | 812.88 | 759.70 |
| M 1                             | 0.3508 | 0.3579                | 0.3659 | 0.3662 | 0.3671 |                       | 0.3508 | 0.3579 | 0.3659 |
| M 2                             | 0.5242 | 0.5369                | 0.5502 | 0.5742 | 0.5870 |                       | 0.5242 | 0.5369 | 0.5502 |
| A(PK) 1                         | 0.7401 | 0.6766                | 0.6218 | 0.5716 | 0.5303 |                       | 0.7401 | 0.6766 | 0.6218 |
| A(PK) 2                         | 0.4825 | 0.4254                | 0.3693 | 0.3315 | 0.2954 |                       | 0.4825 | 0.4254 | 0.3693 |
| TURN(PK)                        | 17.414 | 19.795                | 23.375 | 30.876 | 38.716 |                       | 17.414 | 19.795 | 23.375 |
| LUSS COEF.                      | 0.0906 | 0.0534                | 0.0523 | 0.0523 | 0.0925 |                       | 0.0906 | 0.0534 | 0.0523 |
| UFAC                            | 0.4748 | 0.5049                | 0.5476 | 0.5731 | 0.6045 |                       | 0.4748 | 0.5049 | 0.5476 |
| EFFP                            | 0.9067 | 0.9493                | 0.9551 | 0.9613 | 0.9389 |                       | 0.9067 | 0.9493 | 0.9551 |
| EFF                             | 0.9030 | 0.9474                | 0.9535 | 0.9599 | 0.9368 |                       | 0.9030 | 0.9474 | 0.9535 |
| LUSS PARA.                      | 0.0223 | 0.0134                | 0.0133 | 0.0136 | 0.0236 |                       | 0.0223 | 0.0134 | 0.0133 |
| INCID                           | 3.56   | 3.51                  | 3.44   | 4.27   | 5.59   |                       | 3.56   | 3.51   | 3.44   |
| DEV                             | 0.749  | 1.818                 | 2.965  | 2.489  | 3.172  |                       | 0.749  | 1.818  | 2.965  |
|                                 |        | CORRECTED WEIGHT FLOW |        |        |        |                       |        |        |        |
|                                 |        |                       |        |        |        |                       |        |        |        |
| UPSTREAM OF ROTOR               |        | 70.16                 |        |        |        |                       |        |        |        |
| UPSTREAM OF STATOR              |        | 70.16                 |        |        |        |                       |        |        |        |
| DOWNSTREAM OF STATOR            |        | 66.21                 |        |        |        |                       |        |        |        |

Table IVj.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| MOTOR 1               |         |        |        |         |         |  |  |  |  |
|-----------------------|---------|--------|--------|---------|---------|--|--|--|--|
| STATION 1 - STATION 2 |         |        |        |         |         |  |  |  |  |
|                       | 10      | 30     | 50     | 70      | 90      |  |  |  |  |
| DIA 1                 | 29.150  | 27.080 | 25.060 | 23.020  | 20.988  |  |  |  |  |
| DIA 2                 | 29.088  | 27.302 | 25.516 | 23.730  | 21.944  |  |  |  |  |
| BETA 1                | 18.260  | 20.421 | 20.963 | 22.494  | 23.034  |  |  |  |  |
| BETA 2                | 54.355  | 56.503 | 59.175 | 60.232  | 60.845  |  |  |  |  |
| BETA(PK) 1            | 65.457  | 63.335 | 60.043 | 56.881  | 53.313  |  |  |  |  |
| BETA(PK) 2            | 45.169  | 40.348 | 32.415 | 23.591  | 10.886  |  |  |  |  |
| V 1                   | 363.69  | 365.01 | 378.27 | 382.07  | 365.26  |  |  |  |  |
| V 2                   | 620.85  | 625.71 | 643.37 | 654.32  | 677.54  |  |  |  |  |
| VZ 1                  | 345.38  | 342.07 | 353.23 | 353.00  | 354.55  |  |  |  |  |
| VZ 2                  | 361.80  | 345.33 | 329.67 | 324.86  | 330.08  |  |  |  |  |
| V-THETA 1             | 113.95  | 127.36 | 135.33 | 146.18  | 150.75  |  |  |  |  |
| V-THETA 2             | 504.53  | 521.79 | 552.49 | 567.98  | 591.69  |  |  |  |  |
| V(PK) 1               | 831.5   | 762.2  | 707.4  | 646.1   | 593.4   |  |  |  |  |
| V(PK) 2               | 513.2   | 453.1  | 390.5  | 353.9   | 336.1   |  |  |  |  |
| VTHETA PR1            | 756.4   | 681.2  | 612.9  | 541.1   | 475.9   |  |  |  |  |
| VTHETA PR2            | 363.9   | 293.4  | 209.3  | 140.5   | 63.5    |  |  |  |  |
| U 1                   | 870.32  | 808.52 | 748.21 | 687.30  | 626.63  |  |  |  |  |
| U 2                   | 808.47  | 815.14 | 761.82 | 708.50  | 655.17  |  |  |  |  |
| M 1                   | 0.3219  | 0.3231 | 0.3351 | 0.3386  | 0.3415  |  |  |  |  |
| M 2                   | 0.5329  | 0.5407 | 0.5579 | 0.5689  | 0.5904  |  |  |  |  |
| M(PK) 1               | 0.7361  | 0.6748 | 0.6267 | 0.5725  | 0.5260  |  |  |  |  |
| M(PK) 2               | 0.4405  | 0.3916 | 0.3386 | 0.3078  | 0.2929  |  |  |  |  |
| TURN(PK)              | 20.289  | 22.987 | 27.628 | 33.491  | 42.427  |  |  |  |  |
| LUSS COEF.            | 0.1381  | 0.0441 | 0.0401 | 0.0412  | 0.0629  |  |  |  |  |
| DFAC                  | 0.5492  | 0.5735 | 0.6229 | 0.6283  | 0.6146  |  |  |  |  |
| EFFP                  | 0.8743  | 0.9618 | 0.9683 | 0.9712  | 0.9620  |  |  |  |  |
| EFF                   | 0.8689  | 0.9602 | 0.9671 | 0.9701  | 0.9605  |  |  |  |  |
| LCSS PARA.            | 0.0343  | 0.0111 | 0.0104 | 0.0107  | 0.0161  |  |  |  |  |
| INCID                 | 5.86    | 6.43   | 6.34   | 7.08    | 8.31    |  |  |  |  |
| DEV                   | 0.069   | 1.548  | 1.615  | 2.691   | 2.186   |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |        |        |         |         |  |  |  |  |
| UPSTREAM OF ROTOR     |         |        | 65.14  |         |         |  |  |  |  |
| UPSTREAM OF STATOR    |         |        | 65.14  |         |         |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |        | 61.11  |         |         |  |  |  |  |
| STATION 2 - STATION 3 |         |        |        |         |         |  |  |  |  |
|                       | 10      | 30     | 50     | 70      | 90      |  |  |  |  |
| DIA 3                 | 29.164  | 27.422 | 25.672 | 23.874  | 22.054  |  |  |  |  |
| BETA 2                | 54.355  | 56.503 | 59.175 | 60.232  | 60.845  |  |  |  |  |
| BETA 3                | -11.228 | -2.770 | -2.398 | -10.002 | -25.639 |  |  |  |  |
| V 2                   | 620.85  | 625.71 | 643.37 | 654.32  | 677.54  |  |  |  |  |
| V 3                   | 378.75  | 369.36 | 367.01 | 294.61  | 256.13  |  |  |  |  |
| VZ 2                  | 361.80  | 345.33 | 329.67 | 324.86  | 330.08  |  |  |  |  |
| VZ 3                  | 371.51  | 368.91 | 366.69 | 290.14  | 230.91  |  |  |  |  |
| V-THETA 2             | 504.53  | 521.79 | 552.49 | 567.98  | 591.69  |  |  |  |  |
| V-THETA 3             | -73.75  | -16.81 | -15.36 | -51.17  | -110.83 |  |  |  |  |
| M 2                   | 0.5329  | 0.5407 | 0.5579 | 0.5689  | 0.5904  |  |  |  |  |
| M 3                   | 0.5200  | 0.5316 | 0.5123 | 0.2501  | 0.2171  |  |  |  |  |
| TURN                  | 65.583  | 59.272 | 61.575 | 70.234  | 86.484  |  |  |  |  |
| LCSS COEF.            | 0.2178  | 0.1252 | 0.1408 | 0.2014  | 0.2298  |  |  |  |  |
| DFAC                  | 0.7640  | 0.7053 | 0.7599 | 0.8592  | 0.9352  |  |  |  |  |
| LUSS PARA.            | 0.0656  | 0.0466 | 0.0494 | 0.0649  | 0.0626  |  |  |  |  |
| INCID                 | 2.28    | 4.56   | 6.48   | 6.23    | 4.89    |  |  |  |  |
| DEV                   | 7.752   | 15.270 | 15.352 | 7.678   | -7.839  |  |  |  |  |

Table IVk.

107

Table IV1.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |        |        |        |         |        |            |        |        |        |        |         |
|-----------------------|--------|--------|--------|---------|--------|------------|--------|--------|--------|--------|---------|
| ROTOR 1               |        |        |        |         |        |            |        |        |        |        |         |
|                       | 10     | 30     | 50     | 70      | 90     |            | 10     | 30     | 50     | 70     | 90      |
| DATA 1                | 29.150 | 27.080 | 25.060 | 23.020  | 20.988 | DATA 3     | 29.164 | 27.422 | 25.672 | 23.874 | 22.034  |
| DATA 2                | 29.088 | 27.302 | 25.516 | 23.730  | 21.944 | BETA 2     | 43.324 | 46.103 | 48.015 | 49.821 | 52.068  |
| BETA 1                | 19.502 | 21.363 | 23.137 | 24.768  | 26.159 | BETA 3     | -9.474 | -2.212 | -1.842 | -4.824 | -14.887 |
| BETA 2                | 43.324 | 46.103 | 48.015 | 49.821  | 52.068 | V 1        | 678.53 | 697.12 | 731.47 | 760.06 | 776.22  |
| BETA(PRI) 1           | 58.135 | 54.884 | 51.360 | 47.221  | 42.456 | V 3        | 496.39 | 501.61 | 492.34 | 467.68 | 431.20  |
| BETA(PRI) 2           | 45.911 | 40.506 | 32.495 | 23.655  | 14.499 | VZ 2       | 493.62 | 483.36 | 489.31 | 490.37 | 477.16  |
| V 1                   | 528.13 | 537.62 | 544.38 | 551.13  | 557.49 | VZ 3       | 485.62 | 501.43 | 492.08 | 466.02 | 416.73  |
| V 2                   | 678.53 | 697.12 | 731.47 | 760.06  | 776.22 | V-THETA 2  | 465.56 | 502.34 | 543.72 | 580.71 | 612.24  |
| VZ 1                  | 497.83 | 500.66 | 500.59 | 500.43  | 500.38 | V-THETA 3  | -81.71 | -19.37 | -15.82 | -39.33 | -110.78 |
| VZ 2                  | 495.62 | 483.36 | 489.31 | 490.37  | 477.16 | M 2        | 0.5882 | 0.6079 | 0.6407 | 0.6685 | 0.6841  |
| V-THETA 1             | 176.31 | 195.84 | 213.90 | 230.89  | 245.78 | M 3        | 0.4241 | 0.4300 | 0.4221 | 0.4002 | 0.3685  |
| V-THETA 2             | 465.56 | 502.34 | 543.72 | 580.71  | 612.24 | TURN       | 52.798 | 46.316 | 45.857 | 54.646 | 66.956  |
| V(PRI) 1              | 709.4  | 635.7  | 580.1  | 535.3   | 492.9  | LOSS COEF. | 0.1133 | 0.0662 | 0.0861 | 0.1153 | 0.1305  |
| V(PRI) 2              | 800.9  | 712.0  | 626.2  | 540.8   | 457.8  | UFAC       | 0.5923 | 0.5622 | 0.5959 | 0.6514 | 0.7259  |
| V-THETA PRI1          | 509.6  | 412.9  | 311.7  | 214.8   | 123.4  | LOSS PARA. | 0.0449 | 0.0249 | 0.0303 | 0.0376 | 0.0381  |
| V-THETA PRI2          | 977.20 | 907.81 | 840.09 | 771.70  | 703.58 | INCID      | -6.76  | -6.04  | -4.68  | -4.18  | -3.88   |
| U 1                   | 975.12 | 915.25 | 855.38 | 795.51  | 735.63 | DEV        | 9.486  | 15.828 | 15.908 | 12.856 | 2.913   |
| U 2                   | 0.4725 | 0.4814 | 0.4877 | 0.4941  | 0.5001 |            |        |        |        |        |         |
| M 1                   | 0.5882 | 0.6079 | 0.6407 | 0.6685  | 0.6841 |            |        |        |        |        |         |
| M(PRI) 1              | 0.8437 | 0.7794 | 0.7183 | 0.6605  | 0.6083 |            |        |        |        |        |         |
| M(PRI) 2              | 0.6150 | 0.5543 | 0.5082 | 0.4708  | 0.4344 |            |        |        |        |        |         |
| TURN(PRI)             | 12.224 | 14.378 | 16.865 | 23.566  | 27.957 |            |        |        |        |        |         |
| LOSS COEF.            | 0.0719 | 0.0328 | 0.0101 | -0.0036 | 0.0419 |            |        |        |        |        |         |
| UFAC                  | 0.3566 | 0.3830 | 0.3967 | 0.3991  | 0.4017 |            |        |        |        |        |         |
| EFFP                  | 0.9109 | 0.9618 | 0.9903 | 1.0043  | 0.9666 |            |        |        |        |        |         |
| EFF                   | 0.9074 | 0.9603 | 0.9900 | 1.0045  | 0.9654 |            |        |        |        |        |         |
| LOSS PARA.            | 0.0176 | 0.0082 | 0.0026 | -0.0009 | 0.0106 |            |        |        |        |        |         |
| INCID                 | -1.46  | -2.02  | -2.34  | -2.58   | -2.54  |            |        |        |        |        |         |
| DEV                   | 0.811  | 1.706  | 1.695  | 2.955   | 5.799  |            |        |        |        |        |         |
| CORRECTED WEIGHT FLOW |        |        |        |         |        |            |        |        |        |        |         |
| UPSTREAM OF ROTOR     |        |        |        |         |        |            |        |        |        |        |         |
| UPSTREAM OF STATOR    |        |        |        |         |        |            |        |        |        |        |         |
| DOWNSTREAM OF STATOR  |        |        |        |         |        |            |        |        |        |        |         |

Table IVm.

## BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

ROTOR 1

## STATION 1 - STATION 2

|               | 10     | 30     | 50     | 70     | 90     |
|---------------|--------|--------|--------|--------|--------|
| DIA 1         | 29.150 | 27.080 | 25.060 | 23.020 | 20.988 |
| DIA 2         | 29.088 | 27.302 | 25.516 | 23.730 | 21.944 |
| BETA 1        | 19.315 | 21.254 | 22.913 | 24.704 | 24.441 |
| BETA 2        | 47.121 | 50.289 | 53.384 | 54.895 | 56.826 |
| BETA(PRI) 1   | 60.613 | 57.694 | 54.437 | 50.149 | 46.603 |
| BETA(PRI) 2   | 45.662 | 40.346 | 32.759 | 22.637 | 13.472 |
| V 1           | 487.97 | 495.30 | 501.74 | 513.31 | 512.12 |
| V 2           | 683.64 | 698.76 | 722.37 | 753.42 | 761.36 |
| VZ 1          | 460.51 | 461.61 | 462.15 | 466.33 | 466.22 |
| VZ 2          | 465.18 | 446.45 | 430.86 | 433.28 | 416.60 |
| V-THETA 1     | 161.40 | 179.55 | 195.34 | 214.53 | 211.89 |
| V-THETA 2     | 500.96 | 537.54 | 579.82 | 616.38 | 637.27 |
| V(PRI) 1      | 938.5  | 863.7  | 794.6  | 727.7  | 678.6  |
| V(PRI) 2      | 665.6  | 585.9  | 512.3  | 469.4  | 428.4  |
| V-THETA PRI   | 817.7  | 730.0  | 646.4  | 558.7  | 493.1  |
| V-THETA PRI 2 | 476.1  | 379.5  | 277.2  | 180.7  | 99.8   |
| U 1           | 979.11 | 909.58 | 841.73 | 773.21 | 704.96 |
| U 2           | 977.03 | 917.04 | 857.05 | 797.06 | 737.07 |
| M 1           | 0.4355 | 0.4423 | 0.4483 | 0.4590 | 0.4579 |
| M 2           | 0.5895 | 0.6057 | 0.6265 | 0.6583 | 0.6665 |
| M(PRI) 1      | 0.8376 | 0.7713 | 0.7099 | 0.6508 | 0.6068 |
| M(PRI) 2      | 0.5739 | 0.5079 | 0.4458 | 0.4102 | 0.3750 |
| TURN(PRI)     | 14.951 | 17.329 | 21.678 | 27.512 | 33.131 |
| LOSS COEF.    | 0.0852 | 0.0596 | 0.0615 | 0.0666 | 0.1118 |
| DFAC          | 0.4191 | 0.4555 | 0.4977 | 0.5025 | 0.5196 |
| EFFP          | 0.9086 | 0.9406 | 0.9452 | 0.9482 | 0.9205 |
| EFF           | 0.9044 | 0.9380 | 0.9429 | 0.9460 | 0.9173 |
| LUSS PARA.    | 0.0210 | 0.0150 | 0.0159 | 0.0175 | 0.0283 |
| INCID         | 1.01   | 0.79   | 0.74   | 0.35   | 1.60   |
| DEV           | 0.562  | 1.566  | 1.959  | 1.937  | 4.772  |

## CORRECTED WEIGHT FLOW

|                      |       |
|----------------------|-------|
| UPSTREAM OF ROTOR    | 82.27 |
| UPSTREAM OF STATOR   | 82.27 |
| DOWNSTREAM OF STATOR | 78.46 |

## STATOR 1

## STATION 2 - STATION 3

|            | 10     | 30     | 50     | 70     | 90      |
|------------|--------|--------|--------|--------|---------|
| DIA 3      | 29.164 | 27.422 | 25.072 | 23.874 | 22.034  |
| BETA 2     | 47.121 | 50.289 | 53.384 | 54.895 | 56.826  |
| BETA 3     | 11.053 | -1.842 | -1.842 | -6.992 | -18.450 |
| V 1        | 683.64 | 698.76 | 722.37 | 753.42 | 761.36  |
| V 2        | 453.38 | 456.30 | 441.31 | 423.25 | 360.81  |
| VZ 1       | 465.18 | 446.45 | 430.86 | 435.28 | 416.60  |
| VZ 2       | 444.97 | 458.06 | 441.08 | 420.10 | 342.26  |
| V-THETA 2  | 500.96 | 537.54 | 579.82 | 616.38 | 637.27  |
| V-THETA 3  | -86.92 | -14.73 | -14.18 | -51.52 | -114.19 |
| M 2        | 0.5895 | 0.6057 | 0.6265 | 0.6583 | 0.6665  |
| M 3        | 0.3839 | 0.3898 | 0.3758 | 0.3605 | 0.3064  |
| TURN       | 58.174 | 52.131 | 55.226 | 61.887 | 75.276  |
| LOSS COEF. | 0.1214 | 0.0690 | 0.0753 | 0.1025 | 0.1245  |
| DFAC       | 0.6822 | 0.6419 | 0.6782 | 0.7281 | 0.8243  |
| LUSS PARA. | 0.0478 | 0.0200 | 0.0264 | 0.0335 | 0.0357  |
| INCID      | -4.96  | -1.65  | 0.68   | 0.90   | 0.88    |
| DEV        | 7.907  | 16.196 | 15.908 | 10.688 | -0.050  |

Table IVn.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |        |        |        |        |        |  |  |  |  |
|-----------------------|--------|--------|--------|--------|--------|--|--|--|--|
| ROTOR 1               |        |        |        |        |        |  |  |  |  |
|                       | 10     | 30     | 50     | 70     | 90     |  |  |  |  |
| DIA 1                 | 29.133 | 27.080 | 25.060 | 23.020 | 20.998 |  |  |  |  |
| DIA 2                 | 29.088 | 27.302 | 25.516 | 23.730 | 21.944 |  |  |  |  |
| BETA 1                | 19.499 | 21.311 | 22.636 | 24.307 | 21.116 |  |  |  |  |
| BETA 2                | 50.943 | 54.444 | 56.315 | 58.005 | 56.796 |  |  |  |  |
| BETA(PR) 1            | 62.379 | 59.566 | 56.464 | 53.017 | 48.887 |  |  |  |  |
| BETA(PR) 2            | 45.313 | 40.239 | 33.280 | 23.500 | 11.355 |  |  |  |  |
| V 1                   | 458.12 | 466.22 | 473.14 | 476.33 | 481.78 |  |  |  |  |
| V 2                   | 690.57 | 701.73 | 715.85 | 738.38 | 767.59 |  |  |  |  |
| VZ 1                  | 431.85 | 434.33 | 436.69 | 434.11 | 426.23 |  |  |  |  |
| VZ 2                  | 435.12 | 408.06 | 397.03 | 391.23 | 397.67 |  |  |  |  |
| V-THEIA 1             | 152.92 | 169.44 | 182.10 | 196.07 | 204.49 |  |  |  |  |
| V-THEIA 2             | 536.24 | 570.89 | 595.66 | 626.22 | 656.54 |  |  |  |  |
| V(PR) 1               | 931.5  | 857.5  | 790.4  | 721.6  | 643.4  |  |  |  |  |
| V(PR) 2               | 618.7  | 534.6  | 474.9  | 426.6  | 405.6  |  |  |  |  |
| V-THEIA PR1           | 825.2  | 739.2  | 658.9  | 574.4  | 499.8  |  |  |  |  |
| V-THEIA PR2           | 439.9  | 345.3  | 260.6  | 170.1  | 79.9   |  |  |  |  |
| U 1                   | 978.22 | 908.75 | 849.97 | 772.51 | 704.52 |  |  |  |  |
| U 2                   | 976.14 | 916.20 | 856.27 | 796.33 | 736.40 |  |  |  |  |
| M 1                   | 0.4983 | 0.4157 | 0.4221 | 0.4251 | 0.4301 |  |  |  |  |
| M 2                   | 0.5937 | 0.6065 | 0.6211 | 0.6434 | 0.6704 |  |  |  |  |
| M(PR) 1               | 0.8301 | 0.7846 | 0.7052 | 0.6440 | 0.5923 |  |  |  |  |
| M(PR) 2               | 0.5320 | 0.4621 | 0.4121 | 0.3717 | 0.3543 |  |  |  |  |
| TURN(PR)              | 17.066 | 15.327 | 13.183 | 10.571 | 7.532  |  |  |  |  |
| LOSS COEF.            | 0.0924 | 0.0672 | 0.0713 | 0.0571 | 0.1081 |  |  |  |  |
| DFAC                  | 0.4616 | 0.5282 | 0.5537 | 0.5688 | 0.5335 |  |  |  |  |
| EFFP                  | 0.9095 | 0.9307 | 0.9406 | 0.9581 | 0.9319 |  |  |  |  |
| EFF                   | 0.9821 | 0.9356 | 0.9379 | 0.9363 | 0.9289 |  |  |  |  |
| LOSS PARA.            | 0.0229 | 0.0169 | 0.0183 | 0.0149 | 0.0276 |  |  |  |  |
| INCID                 | 2.78   | 2.67   | 2.76   | 3.22   | 3.89   |  |  |  |  |
| DEV                   | 0.213  | 1.439  | 2.480  | 2.800  | 2.655  |  |  |  |  |
| CORRECTED WEIGHT FLOW |        |        |        |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |        |        | 78.64  |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |        |        | 78.64  |        |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |        |        | 74.71  |        |        |  |  |  |  |

| STATION 2 - STATION 3 |         |        |        |        |         |  |  |  |  |
|-----------------------|---------|--------|--------|--------|---------|--|--|--|--|
|                       | 10      | 30     | 50     | 70     | 90      |  |  |  |  |
| DIA 3                 | 29.164  | 27.422 | 25.672 | 23.874 | 22.034  |  |  |  |  |
| BETA 2                | 50.943  | 54.444 | 56.315 | 58.005 | 56.796  |  |  |  |  |
| BETA 3                | -13.483 | -2.627 | -3.142 | -8.545 | -21.136 |  |  |  |  |
| V 2                   | 690.57  | 701.73 | 715.85 | 728.38 | 757.59  |  |  |  |  |
| V 3                   | 432.38  | 447.83 | 426.47 | 371.17 | 314.27  |  |  |  |  |
| VZ 2                  | 435.12  | 408.06 | 397.03 | 391.23 | 397.67  |  |  |  |  |
| VZ 3                  | 420.46  | 447.55 | 422.83 | 372.58 | 294.94  |  |  |  |  |
| V-THEIA 2             | 536.24  | 570.89 | 595.66 | 626.22 | 656.54  |  |  |  |  |
| V-THEIA 3             | -100.81 | -15.85 | -23.47 | -58.64 | -113.04 |  |  |  |  |
| M 2                   | 0.5937  | 0.6065 | 0.6211 | 0.6434 | 0.6704  |  |  |  |  |
| M 3                   | 0.3643  | 0.2798 | 0.3621 | 0.3198 | 0.2671  |  |  |  |  |
| TURN                  | 64.426  | 56.471 | 57.457 | 58.950 | 79.932  |  |  |  |  |
| LOSS COEF.            | 0.1794  | 0.0966 | 0.0847 | 0.1346 | 0.1978  |  |  |  |  |
| DFAC                  | 0.7449  | 0.6169 | 0.7083 | 0.7925 | 0.8913  |  |  |  |  |
| LOSS PARA.            | 0.0701  | 0.0345 | 0.0297 | 0.0435 | 0.0558  |  |  |  |  |
| INCID                 | -1.14   | 2.20   | 3.62   | 4.01   | 2.85    |  |  |  |  |
| DEV                   | 5.477   | 16.013 | 14.608 | 8.735  | -3.136  |  |  |  |  |

Table IVo.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

ROTOR 1

STATION 1 - STATION 2

|             | 10     | 30     | 50     | 70     | 90     |
|-------------|--------|--------|--------|--------|--------|
| U1A 1       | 29.150 | 27.080 | 25.060 | 23.020 | 20.988 |
| U1A 2       | 29.088 | 27.302 | 25.516 | 23.730 | 21.944 |
| WETA 1      | 18.973 | 20.445 | 22.756 | 23.996 | 23.022 |
| WETA 2      | 53.187 | 55.785 | 59.258 | 60.199 | 60.835 |
| WETA(PK) 1  | 63.739 | 60.890 | 58.364 | 54.786 | 51.773 |
| WETA(PK) 2  | 46.157 | 41.858 | 34.563 | 24.138 | 12.535 |
| V 1         | 433.58 | 444.36 | 443.61 | 451.24 | 448.74 |
| V 2         | 680.88 | 684.12 | 702.20 | 725.27 | 745.44 |
| VZ 1        | 410.02 | 416.37 | 409.08 | 412.24 | 413.00 |
| VZ 2        | 407.99 | 394.68 | 358.95 | 358.30 | 363.27 |
| V-THEIA 1   | 140.96 | 155.22 | 171.60 | 183.51 | 175.50 |
| V-THEIA 2   | 545.11 | 565.72 | 603.53 | 630.70 | 650.94 |
| V(PK) 1     | 926.7  | 855.8  | 779.9  | 714.9  | 667.5  |
| V(PK) 2     | 589.0  | 516.5  | 435.9  | 392.6  | 372.1  |
| V-THEIA PK1 | 831.0  | 747.7  | 664.0  | 584.1  | 524.2  |
| V-THEIA PK2 | 424.8  | 344.6  | 267.3  | 160.6  | 80.8   |
| U 1         | 971.98 | 902.96 | 835.61 | 767.58 | 699.83 |
| U 2         | 969.92 | 910.36 | 850.81 | 791.26 | 731.71 |
| M 1         | 0.3879 | 0.3978 | 0.3971 | 0.4042 | 0.4019 |
| M 2         | 0.5858 | 0.5929 | 0.6100 | 0.6326 | 0.6514 |
| M(PK) 1     | 0.6289 | 0.7662 | 0.6982 | 0.6403 | 0.5977 |
| M(PK) 2     | 0.5067 | 0.4476 | 0.3767 | 0.3424 | 0.3252 |
| TURN(PK)    | 17.581 | 19.032 | 23.800 | 30.647 | 39.238 |
| LOSS COEF.  | 0.1327 | 0.0705 | 0.0921 | 0.0946 | 0.1297 |
| OPAC        | 0.5190 | 0.5520 | 0.6050 | 0.6191 | 0.6155 |
| EFFP        | 0.8777 | 0.9365 | 0.9284 | 0.9351 | 0.9210 |
| EFF         | 0.8745 | 0.9334 | 0.9250 | 0.9321 | 0.9173 |
| LOSS PARA.  | 0.0324 | 0.0174 | 0.0233 | 0.0245 | 0.0330 |
| INCIO       | 4.14   | 3.99   | 4.66   | 4.99   | 6.77   |
| DEV         | 1.057  | 3.058  | 3.763  | 3.438  | 3.835  |

CORRECTED WEIGHT FLOW

|                      |       |
|----------------------|-------|
| UPSTREAM OF ROTOR    | 74.74 |
| UPSTREAM OF STATOR   | 74.74 |
| DOWNSTREAM OF STATOR | 70.63 |

STATOR 1

STATION 2 - STATION 3

|            | 10     | 30     | 50     | 70      | 90      |
|------------|--------|--------|--------|---------|---------|
| U1A 3      | 29.164 | 27.422 | 25.672 | 23.874  | 22.034  |
| WETA 2     | 53.187 | 55.785 | 59.258 | 60.199  | 60.835  |
| WETA 3     | -8.060 | -2.770 | -4.824 | -12.128 | -27.631 |
| V 2        | 680.88 | 684.12 | 702.20 | 725.27  | 745.44  |
| V 3        | 475.78 | 455.22 | 402.84 | 314.53  | 264.03  |
| VZ 2       | 407.99 | 384.68 | 358.95 | 358.30  | 363.27  |
| VZ 3       | 471.08 | 454.69 | 401.41 | 306.30  | 233.91  |
| V-THEIA 2  | 545.11 | 565.72 | 603.53 | 630.70  | 650.94  |
| V-THEIA 3  | -66.71 | -22.00 | -32.88 | -71.49  | -122.44 |
| M 2        | 0.5858 | 0.5929 | 0.6100 | 0.6326  | 0.6514  |
| M 3        | 0.4028 | 0.2875 | 0.2427 | 0.2669  | 0.2234  |
| TURN       | 61.247 | 58.555 | 64.082 | 73.537  | 84.467  |
| LOSS COEF. | 0.1326 | 0.0972 | 0.1549 | 0.2541  | 0.2762  |
| OPAC       | 0.6621 | 0.6583 | 0.7455 | 0.8829  | 0.9593  |
| LOSS PARA. | 0.0527 | 0.0466 | 0.0513 | 0.0809  | 0.0739  |
| INCIO      | 1.11   | 3.65   | 6.56   | 6.40    | 4.89    |
| DEV        | 10.900 | 15.270 | 12.926 | 4.542   | -9.831  |

Table IVp.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| ROTOR 1               |         |         |        |        |        |  |  |  |  |
|-----------------------|---------|---------|--------|--------|--------|--|--|--|--|
| STATION 1 - STATION 2 |         |         |        |        |        |  |  |  |  |
|                       | 10      | 30      | 50     | 70     | 90     |  |  |  |  |
| DIA 1                 | 29.150  | 27.080  | 25.060 | 23.020 | 20.988 |  |  |  |  |
| DIA 2                 | 29.088  | 27.302  | 25.516 | 23.730 | 21.944 |  |  |  |  |
| BETA 1                | 22.034  | 24.912  | 27.600 | 28.919 | 29.094 |  |  |  |  |
| BETA 2                | 39.802  | 41.762  | 44.370 | 45.167 | 46.489 |  |  |  |  |
| BETA(PRI) 1           | 57.152  | 53.569  | 49.451 | 44.856 | 40.245 |  |  |  |  |
| BETA(PRI) 2           | 50.805  | 40.987  | 32.337 | 24.203 | 15.549 |  |  |  |  |
| V 1                   | 601.24  | 613.02  | 624.39 | 634.79 | 639.50 |  |  |  |  |
| V 2                   | 686.65  | 775.99  | 827.42 | 863.82 | 894.02 |  |  |  |  |
| VZ 1                  | 557.33  | 555.98  | 553.34 | 555.64 | 558.81 |  |  |  |  |
| VZ 2                  | 527.53  | 578.82  | 591.47 | 609.04 | 615.53 |  |  |  |  |
| V-THETA 1             | 225.56  | 258.22  | 289.28 | 306.97 | 310.95 |  |  |  |  |
| V-THETA 2             | 439.55  | 516.83  | 578.61 | 612.59 | 648.37 |  |  |  |  |
| V(PRI) 1              | 1027.5  | 936.2   | 851.2  | 783.6  | 732.1  |  |  |  |  |
| V(PRI) 2              | 834.7   | 760.8   | 700.0  | 667.7  | 638.9  |  |  |  |  |
| VTHETA PRI 1          | 863.2   | 753.3   | 646.7  | 552.9  | 473.0  |  |  |  |  |
| VTHETA PRI 2          | 646.9   | 502.9   | 374.5  | 273.8  | 171.3  |  |  |  |  |
| U 1                   | 1088.79 | 1011.47 | 936.02 | 859.83 | 783.93 |  |  |  |  |
| U 2                   | 1086.47 | 1019.77 | 953.06 | 886.35 | 819.64 |  |  |  |  |
| M 1                   | 0.5425  | 0.5537  | 0.5647 | 0.5747 | 0.5792 |  |  |  |  |
| M 2                   | 0.5981  | 0.6821  | 0.7313 | 0.7660 | 0.7965 |  |  |  |  |
| M(PRI) 1              | 0.9271  | 0.8457  | 0.797  | 0.7096 | 0.6631 |  |  |  |  |
| M(PRI) 2              | 0.7270  | 0.6740  | 0.6107 | 0.5921 | 0.5692 |  |  |  |  |
| TURN(PRI)             | 0.347   | 12.582  | 17.113 | 20.653 | 24.696 |  |  |  |  |
| LOSS COEF.            | 0.2156  | 0.1438  | 0.1205 | 0.1352 | 0.0976 |  |  |  |  |
| DFAC                  | 0.2618  | 0.2692  | 0.2757 | 0.2493 | 0.2346 |  |  |  |  |
| EFFP                  | 0.6658  | 0.8145  | 0.8700 | 0.8766 | 0.9207 |  |  |  |  |
| EFF                   | 0.6566  | 0.8081  | 0.8651 | 0.8717 | 0.9174 |  |  |  |  |
| LUSS PARA.            | 0.0480  | 0.0358  | 0.0312 | 0.0350 | 0.0245 |  |  |  |  |
| INCIO                 | -2.45   | -3.33   | -4.25  | -4.94  | -4.76  |  |  |  |  |
| DEV                   | 5.705   | 2.187   | 1.537  | 3.503  | 6.849  |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |         |        |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |         |         | 96.21  |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |         |         |        | 96.21  |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |         |        |        | 93.29  |  |  |  |  |

Table IVq.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |         |         |        |        |        |  |  |  |  |  |
|-----------------------|---------|---------|--------|--------|--------|--|--|--|--|--|
| ROTOR 1               |         |         |        |        |        |  |  |  |  |  |
|                       | 10      | 30      | 50     | 70     | 90     |  |  |  |  |  |
| DIA 1                 | 29.150  | 27.080  | 25.060 | 23.020 | 20.988 |  |  |  |  |  |
| DIA 2                 | 29.088  | 27.302  | 25.516 | 23.730 | 21.944 |  |  |  |  |  |
| BETA 1                | 21.041  | 23.926  | 25.813 | 27.000 | 26.466 |  |  |  |  |  |
| BETA 2                | 46.127  | 48.799  | 50.680 | 52.611 | 55.576 |  |  |  |  |  |
| BETA(PK) 1            | 58.073  | 54.824  | 51.181 | 47.196 | 43.121 |  |  |  |  |  |
| BETA(PK) 2            | 45.988  | 40.456  | 32.972 | 24.170 | 14.767 |  |  |  |  |  |
| V 1                   | 586.48  | 594.26  | 602.35 | 607.35 | 610.60 |  |  |  |  |  |
| V 2                   | 755.59  | 776.19  | 804.67 | 830.85 | 841.81 |  |  |  |  |  |
| VZ 1                  | 547.37  | 543.20  | 542.25 | 541.15 | 546.69 |  |  |  |  |  |
| VZ 2                  | 523.67  | 511.28  | 509.88 | 504.51 | 475.88 |  |  |  |  |  |
| V-THETA 1             | 210.57  | 241.00  | 262.28 | 275.73 | 272.16 |  |  |  |  |  |
| V-THETA 2             | 544.68  | 584.00  | 622.51 | 660.14 | 694.39 |  |  |  |  |  |
| V(PK) 1               | 1035.1  | 942.9   | 865.0  | 796.4  | 749.0  |  |  |  |  |  |
| V(PK) 2               | 753.7   | 671.9   | 607.8  | 553.0  | 492.1  |  |  |  |  |  |
| V-THETA PR1           | 878.5   | 770.7   | 674.0  | 584.3  | 512.0  |  |  |  |  |  |
| V-THETA PR2           | 542.0   | 436.0   | 330.8  | 226.4  | 125.4  |  |  |  |  |  |
| U 1                   | 1084.05 | 1011.71 | 936.24 | 860.03 | 784.11 |  |  |  |  |  |
| U 2                   | 1086.73 | 1020.00 | 953.28 | 886.55 | 819.83 |  |  |  |  |  |
| M 1                   | 0.5280  | 0.5354  | 0.5431 | 0.5479 | 0.5511 |  |  |  |  |  |
| M 2                   | 0.6523  | 0.6743  | 0.7024 | 0.7289 | 0.7403 |  |  |  |  |  |
| M(PK) 1               | 0.9319  | 0.8495  | 0.7500 | 0.7185 | 0.6759 |  |  |  |  |  |
| M(PK) 2               | 0.6506  | 0.5838  | 0.5305 | 0.4851 | 0.4328 |  |  |  |  |  |
| TURN(PK)              | 12.085  | 14.367  | 18.209 | 23.026 | 28.354 |  |  |  |  |  |
| LUSS COEF.            | 0.0759  | 0.0471  | 0.0450 | 0.0316 | 0.0015 |  |  |  |  |  |
| UFAC                  | 0.3864  | 0.4045  | 0.4191 | 0.4333 | 0.4773 |  |  |  |  |  |
| EFFP                  | 0.9159  | 0.9523  | 0.9595 | 0.9747 | 0.9385 |  |  |  |  |  |
| EFF                   | 0.9115  | 0.9499  | 0.9575 | 0.9735 | 0.9357 |  |  |  |  |  |
| LUSS PARA.            | 0.0186  | 0.0118  | 0.0116 | 0.0082 | 0.0205 |  |  |  |  |  |
| INCID                 | -1.53   | -2.08   | -2.52  | -2.60  | -1.88  |  |  |  |  |  |
| DEV                   | 0.888   | 1.656   | 2.172  | 3.470  | 6.067  |  |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |         |        |        |        |  |  |  |  |  |
| UPSTREAM OF ROTOR     |         |         | 93.63  |        |        |  |  |  |  |  |
| UPSTREAM OF STATOR    |         |         | 93.63  |        |        |  |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |         | 89.86  |        |        |  |  |  |  |  |

| STATION 2 - STATION 3 |         |        |        |        |        |  |  |  |  |  |
|-----------------------|---------|--------|--------|--------|--------|--|--|--|--|--|
| ROTOR 2               |         |        |        |        |        |  |  |  |  |  |
|                       | 10      | 30     | 50     | 70     | 90     |  |  |  |  |  |
| DIA 3                 | 29.154  | 27.422 | 25.072 | 23.034 | 22.034 |  |  |  |  |  |
| BETA 2                | 48.159  | 48.759 | 50.050 | 52.011 | 55.576 |  |  |  |  |  |
| BETA 3                | -11.402 | -2.027 | -1.042 | -7.020 | 0.000  |  |  |  |  |  |
| V 2                   | 755.39  | 776.29 | 804.07 | 830.85 | 841.81 |  |  |  |  |  |
| V 3                   | 515.77  | 528.40 | 540.13 | 547.70 | 542.13 |  |  |  |  |  |
| VZ 2                  | 523.07  | 511.28 | 509.08 | 504.51 | 475.88 |  |  |  |  |  |
| VZ 3                  | 505.01  | 528.13 | 509.87 | 485.50 | 424.13 |  |  |  |  |  |
| V-THETA 2             | 544.08  | 564.00 | 522.51 | 600.14 | 694.39 |  |  |  |  |  |
| V-THETA 3             | -101.97 | -18.09 | -10.40 | -63.68 | 0.000  |  |  |  |  |  |
| M 2                   | 0.6223  | 0.6743 | 0.7024 | 0.7204 | 0.7403 |  |  |  |  |  |
| M 3                   | 0.4935  | 0.4487 | 0.4034 | 0.4142 | 0.3591 |  |  |  |  |  |
| TURN                  | 57.529  | 50.020 | 52.522 | 50.138 | 55.576 |  |  |  |  |  |
| LUSS COEF.            | 0.1330  | 0.0700 | 0.0003 | 0.0078 | 0.1253 |  |  |  |  |  |
| UFAC                  | 0.6011  | 0.6017 | 0.6452 | 0.6950 | 0.7454 |  |  |  |  |  |
| LUSS PARA.            | 0.0289  | 0.0289 | 0.0303 | 0.0317 | 0.0376 |  |  |  |  |  |
| INCID                 | -3.54   | -1.54  | -0.57  | -0.37  | -0.37  |  |  |  |  |  |
| DEV                   | 7.220   | 10.013 | 15.500 | 17.800 | 17.800 |  |  |  |  |  |

Table IVr.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| ROTOR 1               |         |         |        |        |         |                      |         |         |        |
|-----------------------|---------|---------|--------|--------|---------|----------------------|---------|---------|--------|
| STATION 1 - STATION 2 |         |         |        |        |         |                      |         |         |        |
|                       | 10      | 30      | 50     | 70     | 90      |                      |         |         |        |
| U1A 1                 | 29.150  | 27.080  | 25.060 | 23.020 | 20.988  | U1A 1                | 29.150  | 27.080  | 25.060 |
| U1A 2                 | 29.088  | 27.302  | 25.516 | 23.730 | 21.944  | U1A 2                | 29.088  | 27.302  | 25.516 |
| BETA 1                | 22.345  | 23.386  | 24.736 | 26.352 | 25.902  | BETA 1               | 22.345  | 23.386  | 24.736 |
| BETA 2                | 47.299  | 49.807  | 52.020 | 54.136 | 56.229  | BETA 2               | 47.299  | 49.807  | 52.020 |
| ALTA(PK) 1            | 58.576  | 55.529  | 52.076 | 47.876 | 44.186  | ALTA(PK) 1           | 58.576  | 55.529  | 52.076 |
| BETA(PK) 2            | 45.652  | 40.168  | 32.822 | 24.278 | 10.428  | BETA(PK) 2           | 45.652  | 40.168  | 32.822 |
| V 1                   | 574.86  | 583.37  | 590.88 | 599.27 | 597.89  | V 1                  | 574.86  | 583.37  | 590.88 |
| V 2                   | 700.47  | 779.26  | 804.17 | 824.77 | 877.97  | V 2                  | 700.47  | 779.26  | 804.17 |
| VZ 1                  | 531.69  | 535.45  | 536.66 | 537.00 | 537.83  | VZ 1                 | 531.69  | 535.45  | 536.66 |
| VZ 2                  | 515.73  | 502.90  | 494.88 | 483.20 | 488.04  | VZ 2                 | 515.73  | 502.90  | 494.88 |
| V-THETA 1             | 218.55  | 231.55  | 247.25 | 266.01 | 261.18  | V-THETA 1            | 218.55  | 231.55  | 247.25 |
| V-THETA 2             | 558.88  | 595.26  | 633.86 | 668.40 | 729.82  | V-THETA 2            | 558.88  | 595.26  | 633.86 |
| V(PK) 1               | 1019.8  | 946.0   | 873.2  | 800.6  | 750.0   | V(PK) 1              | 1019.8  | 946.0   | 873.2  |
| V(PK) 2               | 737.8   | 658.1   | 588.9  | 530.1  | 496.2   | V(PK) 2              | 737.8   | 658.1   | 588.9  |
| VTHETA PK1            | 870.2   | 779.9   | 688.8  | 593.8  | 522.8   | VTHETA PK1           | 870.2   | 779.9   | 688.8  |
| VTHETA PK2            | 527.6   | 424.5   | 319.2  | 217.9  | 89.8    | VTHETA PK2           | 527.6   | 424.5   | 319.2  |
| U 1                   | 1088.79 | 1011.47 | 936.02 | 859.83 | 783.93  | U 1                  | 1088.79 | 1011.47 | 936.02 |
| U 2                   | 1086.47 | 1019.77 | 953.06 | 886.35 | 819.64  | U 2                  | 1086.47 | 1019.77 | 953.06 |
| M 1                   | 0.5168  | 0.5249  | 0.5321 | 0.5400 | 0.5387  | M 1                  | 0.5168  | 0.5249  | 0.5321 |
| M 2                   | 0.6546  | 0.6753  | 0.7002 | 0.7211 | 0.7731  | M 2                  | 0.6546  | 0.6753  | 0.7002 |
| M(PK) 1               | 0.9169  | 0.8512  | 0.7862 | 0.7215 | 0.6758  | M(PK) 1              | 0.9169  | 0.8512  | 0.7862 |
| M(PK) 2               | 0.6351  | 0.5703  | 0.5128 | 0.4634 | 0.4370  | M(PK) 2              | 0.6351  | 0.5703  | 0.5128 |
| TURN(PK)              | 12.924  | 15.361  | 19.254 | 23.599 | 33.758  | TURN(PK)             | 12.924  | 15.361  | 19.254 |
| LOSS COEF.            | 0.0819  | 0.0503  | 0.0474 | 0.0687 | -0.0158 | LOSS COEF.           | 0.0819  | 0.0503  | 0.0474 |
| UFAC                  | 0.3950  | 0.4283  | 0.4554 | 0.4713 | 0.4887  | UFAC                 | 0.3950  | 0.4283  | 0.4554 |
| EFFP                  | 0.9154  | 0.9211  | 0.9583 | 0.9458 | 1.0123  | EFFP                 | 0.9154  | 0.9211  | 0.9583 |
| EFF                   | 0.9108  | 0.9485  | 0.9561 | 0.9431 | 1.0129  | EFF                  | 0.9108  | 0.9485  | 0.9561 |
| LOSS PARA.            | 0.0202  | 0.0127  | 0.0122 | 0.0178 | -0.0040 | LOSS PARA.           | 0.0202  | 0.0127  | 0.0122 |
| INC1U                 | -1.02   | -1.37   | -1.62  | -1.92  | -0.81   | INC1U                | -1.02   | -1.37   | -1.62  |
| DEV                   | 0.552   | 1.368   | 2.022  | 3.578  | 1.728   | DEV                  | 0.552   | 1.368   | 2.022  |
| CORRECTED WEIGHT FLOW |         |         |        |        |         |                      |         |         |        |
| UPSTREAM OF ROTOR     |         |         | 92.31  |        |         | UPSTREAM OF ROTOR    |         |         | 92.31  |
| UPSTREAM OF STATOR    |         |         |        | 92.31  |         | UPSTREAM OF STATOR   |         |         | 92.31  |
| DOWNSTREAM OF STATOR  |         |         |        |        | 88.44   | DOWNSTREAM OF STATOR |         |         | 88.44  |
| U1A 3                 | 29.104  | 27.422  | 25.072 | 23.674 | 22.034  | U1A 3                | 29.104  | 27.422  | 25.072 |
| BETA 4                | 47.299  | 49.807  | 52.020 | 54.136 | 56.229  | BETA 4               | 47.299  | 49.807  | 52.020 |
| BETA 5                | -12.272 | -1.472  | -2.212 | -8.591 | -20.598 | BETA 5               | -12.272 | -1.472  | -2.212 |
| V 2                   | 766.47  | 775.26  | 804.17 | 824.77 | 877.97  | V 2                  | 766.47  | 775.26  | 804.17 |
| V 3                   | 513.21  | 521.17  | 455.32 | 465.79 | 398.32  | V 3                  | 513.21  | 521.17  | 455.32 |
| VZ 2                  | 515.73  | 502.90  | 454.88 | 483.20 | 488.04  | VZ 2                 | 515.73  | 502.90  | 454.88 |
| VZ 3                  | 501.48  | 521.00  | 454.95 | 480.57 | 372.86  | VZ 3                 | 501.48  | 521.00  | 454.95 |
| V-THETA 2             | 558.88  | 595.26  | 623.86 | 668.40 | 729.82  | V-THETA 2            | 558.88  | 595.26  | 623.86 |
| V-THETA 3             | -105.08 | -13.39  | -19.12 | -89.58 | -140.13 | V-THETA 3            | -105.08 | -13.39  | -19.12 |
| M 2                   | 0.6546  | 0.6753  | 0.7002 | 0.7211 | 0.7731  | M 2                  | 0.6546  | 0.6753  | 0.7002 |
| M 3                   | 0.4319  | 0.4411  | 0.4193 | 0.3542 | 0.3361  | M 3                  | 0.4319  | 0.4411  | 0.4193 |
| TURN                  | 59.571  | 51.279  | 54.252 | 62.727 | 76.827  | TURN                 | 59.571  | 51.279  | 54.252 |
| LOSS COEF.            | 0.1258  | 0.0745  | 0.0880 | 0.0515 | 0.2226  | LOSS COEF.           | 0.1258  | 0.0745  | 0.0880 |
| UFAC                  | 0.6779  | 0.6255  | 0.6696 | 0.7273 | 0.8457  | UFAC                 | 0.6779  | 0.6255  | 0.6696 |
| LOSS PARA.            | 0.0480  | 0.0281  | 0.0311 | 0.0302 | 0.0629  | LOSS PARA.           | 0.0480  | 0.0281  | 0.0311 |
| INC1U                 | -4.78   | -6.33   | -0.68  | 0.14   | 0.28    | INC1U                | -4.78   | -6.33   | -0.68  |
| DEV                   | 6.688   | 16.506  | 15.558 | 9.089  | -2.798  | DEV                  | 6.688   | 16.506  | 15.558 |

Table IVs.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| ROTOR 1               |         |         |        |        |        |  |  |  |  |
|-----------------------|---------|---------|--------|--------|--------|--|--|--|--|
| STATION 1 - STATION 2 |         |         |        |        |        |  |  |  |  |
|                       | 10      | 30      | 50     | 70     | 90     |  |  |  |  |
| DIA 1                 | 29.150  | 27.080  | 25.060 | 23.020 | 20.988 |  |  |  |  |
| DIA 2                 | 29.088  | 27.302  | 25.516 | 23.730 | 21.944 |  |  |  |  |
| BETA 1                | 19.997  | 23.116  | 24.736 | 26.353 | 24.916 |  |  |  |  |
| BETA 2                | 48.591  | 51.207  | 53.863 | 56.467 | 58.585 |  |  |  |  |
| BETA(PK) 1            | 59.727  | 58.558  | 53.250 | 49.086 | 45.868 |  |  |  |  |
| BETA(PK) 2            | 45.642  | 39.964  | 32.711 | 24.594 | 13.154 |  |  |  |  |
| V 1                   | 557.89  | 586.65  | 572.65 | 581.87 | 578.13 |  |  |  |  |
| V 2                   | 751.76  | 781.85  | 803.44 | 815.94 | 840.56 |  |  |  |  |
| VZ 1                  | 524.26  | 521.16  | 520.11 | 521.40 | 524.33 |  |  |  |  |
| VZ 2                  | 503.85  | 489.84  | 473.80 | 450.74 | 438.13 |  |  |  |  |
| V-THETA 1             | 170.78  | 222.46  | 239.62 | 258.29 | 243.56 |  |  |  |  |
| V-THETA 2             | 571.33  | 809.39  | 848.86 | 680.14 | 717.34 |  |  |  |  |
| V(PK) 1               | 1039.9  | 945.7   | 869.3  | 796.1  | 753.0  |  |  |  |  |
| V(PK) 2               | 720.7   | 639.1   | 563.1  | 495.7  | 449.9  |  |  |  |  |
| VTHETA PK1            | 898.1   | 789.1   | 696.5  | 601.6  | 540.5  |  |  |  |  |
| VTHETA PK2            | 515.3   | 410.5   | 304.3  | 206.3  | 102.4  |  |  |  |  |
| U 1                   | 1088.92 | 1011.59 | 936.13 | 859.93 | 784.02 |  |  |  |  |
| U 2                   | 1086.60 | 1019.88 | 953.17 | 886.45 | 819.73 |  |  |  |  |
| M 1                   | 0.5002  | 0.5085  | 0.5141 | 0.5228 | 0.5193 |  |  |  |  |
| M 2                   | 0.6536  | 0.6752  | 0.6970 | 0.7107 | 0.7347 |  |  |  |  |
| M(PK) 1               | 0.9324  | 0.8486  | 0.7804 | 0.7154 | 0.6764 |  |  |  |  |
| M(PK) 2               | 0.6185  | 0.5519  | 0.4885 | 0.4318 | 0.3933 |  |  |  |  |
| TURN(PK)              | 14.085  | 16.594  | 20.539 | 24.492 | 32.714 |  |  |  |  |
| LOSS COEF.            | 0.0757  | 0.0559  | 0.0574 | 0.0845 | 0.0981 |  |  |  |  |
| DFAC                  | 0.4368  | 0.4563  | 0.4906 | 0.5184 | 0.5540 |  |  |  |  |
| EFFP                  | 0.9224  | 0.9480  | 0.9518 | 0.9354 | 0.9312 |  |  |  |  |
| EFF                   | 0.9181  | 0.9451  | 0.9492 | 0.9321 | 0.9278 |  |  |  |  |
| LOSS PARA.            | 0.0117  | 0.0141  | 0.0148 | 0.0218 | 0.0249 |  |  |  |  |
| INCID                 | 0.13    | -0.34   | -0.45  | -0.71  | 0.87   |  |  |  |  |
| DEV                   | 0.542   | 1.164   | 1.911  | 3.894  | 4.454  |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |         |        |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |         |         | 90.40  |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |         |         | 90.40  |        |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |         | 86.42  |        |        |  |  |  |  |

| STATOR 1              |         |        |        |        |         |  |  |  |  |
|-----------------------|---------|--------|--------|--------|---------|--|--|--|--|
| STATION 2 - STATION 3 |         |        |        |        |         |  |  |  |  |
|                       | 10      | 30     | 50     | 70     | 90      |  |  |  |  |
| DIA 3                 | 29.164  | 27.422 | 25.672 | 23.874 | 22.034  |  |  |  |  |
| BETA 2                | 48.591  | 51.207 | 53.863 | 56.467 | 58.585  |  |  |  |  |
| BETA 3                | -12.619 | -1.657 | -2.212 | -5.474 | -21.675 |  |  |  |  |
| V 2                   | 764.76  | 781.85 | 803.44 | 815.94 | 840.56  |  |  |  |  |
| V 3                   | 504.91  | 515.28 | 484.48 | 448.11 | 373.45  |  |  |  |  |
| VZ 2                  | 503.85  | 489.84 | 473.80 | 450.74 | 438.13  |  |  |  |  |
| VZ 3                  | 492.71  | 515.07 | 484.12 | 441.99 | 347.05  |  |  |  |  |
| V-THETA 2             | 571.33  | 605.35 | 648.86 | 690.14 | 717.34  |  |  |  |  |
| V-THETA 3             | -110.31 | -14.90 | -18.70 | -73.76 | -137.93 |  |  |  |  |
| M 2                   | 0.6538  | 0.6752 | 0.6970 | 0.7107 | 0.7347  |  |  |  |  |
| M 3                   | 0.4231  | 0.4344 | 0.4087 | 0.3780 | 0.3134  |  |  |  |  |
| TURN                  | 61.210  | 52.864 | 56.076 | 65.541 | 80.259  |  |  |  |  |
| LOSS COEF.            | 0.1258  | 0.0753 | 0.0895 | 0.0837 | 0.1475  |  |  |  |  |
| DFAC                  | 0.6963  | 0.6418 | 0.6891 | 0.7530 | 0.8231  |  |  |  |  |
| LOSS PARA.            | 0.0493  | 0.0264 | 0.0314 | 0.0270 | 0.0414  |  |  |  |  |
| INCID                 | -3.49   | -0.92  | 1.16   | 2.47   | 4.63    |  |  |  |  |
| DEV                   | 6.341   | 10.363 | 15.534 | 8.200  | -3.875  |  |  |  |  |

Table IVt.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| ROTOR 1                 |         |         |        |         |         |  |  |  |  |
|-------------------------|---------|---------|--------|---------|---------|--|--|--|--|
| STATION 1 - STATION 2   |         |         |        |         |         |  |  |  |  |
|                         | 10      | 30      | 50     | 70      | 90      |  |  |  |  |
| DIA 1                   | 29.150  | 27.080  | 25.060 | 23.020  | 20.988  |  |  |  |  |
| DIA 2                   | 29.088  | 27.302  | 25.516 | 23.730  | 21.944  |  |  |  |  |
| BETA 1                  | 19.375  | 20.714  | 21.974 | 23.271  | 23.130  |  |  |  |  |
| BETA 2                  | 52.650  | 54.886  | 58.363 | 60.226  | 61.543  |  |  |  |  |
| BETA(PRI) 1             | 62.551  | 59.852  | 56.786 | 53.429  | 50.068  |  |  |  |  |
| BETA(PRI) 2             | 44.158  | 39.971  | 35.068 | 24.889  | 12.367  |  |  |  |  |
| V 1                     | 501.94  | 509.90  | 517.62 | 520.61  | 520.47  |  |  |  |  |
| V 2                     | 777.29  | 776.64  | 773.78 | 799.04  | 825.08  |  |  |  |  |
| VZ 1                    | 473.52  | 476.94  | 480.02 | 477.18  | 478.63  |  |  |  |  |
| VZ 2                    | 471.57  | 446.72  | 405.87 | 396.79  | 393.15  |  |  |  |  |
| V-THETA 1               | 166.52  | 180.36  | 193.68 | 208.18  | 204.45  |  |  |  |  |
| V-THETA 2               | 617.90  | 635.30  | 658.79 | 693.55  | 725.39  |  |  |  |  |
| V(PRI) 1                | 1027.2  | 949.6   | 876.3  | 800.9   | 745.7   |  |  |  |  |
| V(PRI) 2                | 657.3   | 582.9   | 495.9  | 437.4   | 402.5   |  |  |  |  |
| V-THETA PRI 1           | 911.6   | 821.2   | 733.2  | 643.2   | 571.8   |  |  |  |  |
| V-THETA PRI 2           | 457.9   | 374.5   | 284.9  | 164.1   | 86.2    |  |  |  |  |
| U 1                     | 1078.10 | 1001.54 | 926.84 | 851.39  | 776.23  |  |  |  |  |
| U 2                     | 1075.81 | 1009.75 | 943.70 | 877.65  | 811.59  |  |  |  |  |
| M 1                     | 0.4523  | 0.4598  | 0.4670 | 0.4699  | 0.4697  |  |  |  |  |
| M 2                     | 0.6710  | 0.6756  | 0.6753 | 0.7006  | 0.7247  |  |  |  |  |
| M(PRI) 1                | 0.4256  | 0.8563  | 0.7907 | 0.7228  | 0.6730  |  |  |  |  |
| M(PRI) 2                | 0.5675  | 0.5071  | 0.4328 | 0.3835  | 0.3535  |  |  |  |  |
| TURN(PRI)               | 18.392  | 19.882  | 21.716 | 28.540  | 37.701  |  |  |  |  |
| LOSS COEF.              | 0.0427  | -0.0119 | 0.0114 | 0.0039  | 0.0679  |  |  |  |  |
| DFAC                    | 0.5158  | 0.5414  | 0.5910 | 0.6167  | 0.6298  |  |  |  |  |
| EFFP                    | 0.9611  | 1.0118  | 0.9910 | 0.9980  | 0.9560  |  |  |  |  |
| EFF                     | 0.9586  | 1.0126  | 0.9907 | 0.9979  | 0.9536  |  |  |  |  |
| LOSS PARA.              | 0.0108  | -0.0030 | 0.0029 | 0.0010  | 0.0173  |  |  |  |  |
| INCID                   | 2.95    | 2.95    | 3.09   | 3.63    | 5.07    |  |  |  |  |
| DEV                     | -0.942  | 1.171   | 4.268  | 4.189   | 3.667   |  |  |  |  |
| CORRECTED WEIGHT FLOW   |         |         |        |         |         |  |  |  |  |
| UPSTREAM OF ROTOR       |         |         | 84.93  |         |         |  |  |  |  |
| UPSTREAM OF STATOR      |         |         |        | 84.93   |         |  |  |  |  |
| DOWNSTREAM OF STATOR    |         |         |        |         | 80.79   |  |  |  |  |
| PERCENT DESIGN SPEED =  | 99.84   |         |        |         |         |  |  |  |  |
| CORRECTED WEIGHT FLOW = | 84.93   |         |        |         |         |  |  |  |  |
| CORRECTED ROTOR SPEED = | 9353.72 |         |        |         |         |  |  |  |  |
| PRESSURE RATIO =        | 1.4134  |         |        |         |         |  |  |  |  |
| ADIABATIC EFFICIENCY =  | 82.5660 |         |        |         |         |  |  |  |  |
| STATOR 1                |         |         |        |         |         |  |  |  |  |
| STATION 2 - STATION 3   |         |         |        |         |         |  |  |  |  |
|                         | 10      | 30      | 50     | 70      | 90      |  |  |  |  |
| DIA 3                   | 29.164  | 27.422  | 25.672 | 23.874  | 22.034  |  |  |  |  |
| BETA 2                  | 52.650  | 54.886  | 58.363 | 60.226  | 61.543  |  |  |  |  |
| BETA 3                  | -11.750 | -4.256  | -5.739 | -11.924 | -29.994 |  |  |  |  |
| V 4                     | 777.29  | 776.64  | 773.78 | 799.04  | 825.08  |  |  |  |  |
| V 3                     | 505.77  | 505.43  | 441.47 | 323.79  | 267.25  |  |  |  |  |
| VZ 2                    | 471.57  | 446.72  | 405.87 | 396.79  | 393.15  |  |  |  |  |
| VZ 3                    | 459.09  | 504.76  | 439.26 | 316.80  | 231.46  |  |  |  |  |
| V-THETA 2               | 617.90  | 635.30  | 658.79 | 693.55  | 725.39  |  |  |  |  |
| V-THETA 3               | -103.81 | -26.06  | -44.15 | -66.90  | -133.60 |  |  |  |  |
| M 2                     | 0.6710  | 0.6756  | 0.6753 | 0.7006  | 0.7247  |  |  |  |  |
| M 3                     | 0.4290  | 0.4282  | 0.3740 | 0.2730  | 0.2246  |  |  |  |  |
| TURN                    | 64.400  | 57.842  | 64.103 | 74.150  | 91.537  |  |  |  |  |
| LOSS COEF.              | 0.2429  | 0.1638  | 0.1634 | 0.2796  | 0.2889  |  |  |  |  |
| DFAC                    | 0.7171  | 0.6701  | 0.7483 | 0.9060  | 0.9906  |  |  |  |  |
| LOSS PARA.              | 0.0955  | 0.0617  | 0.0572 | 0.0895  | 0.0756  |  |  |  |  |
| INCID                   | 6.57    | 2.75    | 5.66   | 6.23    | 5.39    |  |  |  |  |
| DEV                     | 7.210   | 15.084  | 12.011 | 5.756   | -12.194 |  |  |  |  |

Table IVu.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |  |         |         |        |        |        |  |  |  |  |  |
|-----------------------|--|---------|---------|--------|--------|--------|--|--|--|--|--|
| ROTOR 1               |  |         |         |        |        |        |  |  |  |  |  |
|                       |  | 10      | 30      | 50     | 70     | 90     |  |  |  |  |  |
| DIA 1                 |  | 29.150  | 27.080  | 25.060 | 23.020 | 20.988 |  |  |  |  |  |
| DIA 2                 |  | 29.088  | 27.302  | 25.516 | 23.730 | 21.944 |  |  |  |  |  |
| BETA 1                |  | 19.552  | 21.160  | 22.658 | 24.094 | 22.756 |  |  |  |  |  |
| BETA 2                |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| BETA(PR) 1            |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| BETA(PR) 2            |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| V 1                   |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| V 2                   |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| VZ 1                  |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| VZ 2                  |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| V-THETA 1             |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| V-THETA 2             |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| V(PR) 1               |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| V(PR) 2               |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| VTHETA PR1            |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| VTHETA PR2            |  | 50.989  | 53.750  | 57.473 | 60.294 | 62.025 |  |  |  |  |  |
| U 1                   |  | 1073.90 | 997.64  | 923.23 | 848.07 | 773.21 |  |  |  |  |  |
| U 2                   |  | 1071.62 | 1005.82 | 940.02 | 874.23 | 808.43 |  |  |  |  |  |
| M 1                   |  | 0.4489  | 0.4580  | 0.4615 | 0.4691 | 0.4679 |  |  |  |  |  |
| M 2                   |  | 0.6539  | 0.6518  | 0.6513 | 0.6890 | 0.7081 |  |  |  |  |  |
| M(PR) 1               |  | 0.9236  | 0.8524  | 0.7839 | 0.7184 | 0.6753 |  |  |  |  |  |
| M(PR) 2               |  | 0.5857  | 0.5198  | 0.4427 | 0.3808 | 0.3431 |  |  |  |  |  |
| TURN(PR)              |  | 17.397  | 17.783  | 19.380 | 27.124 | 35.801 |  |  |  |  |  |
| LOSS CUEF.            |  | 0.1101  | 0.0614  | 0.0736 | 0.0373 | 0.0586 |  |  |  |  |  |
| UFAC                  |  | 0.4821  | 0.5101  | 0.5613 | 0.6119 | 0.6431 |  |  |  |  |  |
| EFFP                  |  | 0.9006  | 0.9460  | 0.9398 | 0.9737 | 0.9621 |  |  |  |  |  |
| EFF                   |  | 0.8944  | 0.9428  | 0.9365 | 0.9722 | 0.9601 |  |  |  |  |  |
| LOSS PARA.            |  | 0.0273  | 0.0150  | 0.0179 | 0.0095 | 0.0148 |  |  |  |  |  |
| INCID                 |  | 3.14    | 3.03    | 3.39   | 3.61   | 5.29   |  |  |  |  |  |
| DEV                   |  | 0.241   | 3.344   | 6.912  | 5.585  | 5.788  |  |  |  |  |  |
| CORRECTED WEIGHT FLOW |  |         |         |        |        |        |  |  |  |  |  |
| UPSTREAM OF ROTOR     |  |         |         | 84.82  |        |        |  |  |  |  |  |
| UPSTREAM OF STATOR    |  |         |         | 84.82  |        |        |  |  |  |  |  |
| DOWNSTREAM OF STATOR  |  |         |         | 80.81  |        |        |  |  |  |  |  |

| STATION 2 - STATION 3 |  |        |        |        |         |         |  |  |  |  |  |
|-----------------------|--|--------|--------|--------|---------|---------|--|--|--|--|--|
| STATOR 1              |  |        |        |        |         |         |  |  |  |  |  |
|                       |  | 10     | 30     | 50     | 70      | 90      |  |  |  |  |  |
| DIA 3                 |  | 29.154 | 27.422 | 25.672 | 23.874  | 22.034  |  |  |  |  |  |
| BETA 2                |  | 50.989 | 53.750 | 57.473 | 60.294  | 62.025  |  |  |  |  |  |
| BETA 3                |  | -8.945 | -2.398 | -6.098 | -13.656 | -31.452 |  |  |  |  |  |
| V 2                   |  | 757.84 | 749.75 | 746.70 | 785.24  | 804.92  |  |  |  |  |  |
| V 3                   |  | 542.65 | 515.63 | 442.24 | 324.14  | 276.58  |  |  |  |  |  |
| VZ 2                  |  | 477.04 | 443.34 | 401.50 | 389.12  | 377.57  |  |  |  |  |  |
| VZ 3                  |  | 536.05 | 515.18 | 439.74 | 314.98  | 235.94  |  |  |  |  |  |
| V-THETA 2             |  | 588.86 | 604.63 | 629.57 | 682.04  | 710.87  |  |  |  |  |  |
| V-THETA 3             |  | -84.37 | -21.57 | -46.98 | -76.53  | -144.32 |  |  |  |  |  |
| M 2                   |  | 0.6539 | 0.6518 | 0.6513 | 0.6890  | 0.7081  |  |  |  |  |  |
| M 3                   |  | 0.4588 | 0.4363 | 0.3750 | 0.2739  | 0.2333  |  |  |  |  |  |
| TURN                  |  | 59.933 | 56.148 | 63.571 | 73.950  | 93.478  |  |  |  |  |  |
| LOSS CUEF.            |  | 0.1626 | 0.1123 | 0.1464 | 0.3112  | 0.3196  |  |  |  |  |  |
| UFAC                  |  | 0.6407 | 0.6270 | 0.7263 | 0.9031  | 0.9774  |  |  |  |  |  |
| LOSS PARA.            |  | 0.0645 | 0.0423 | 0.0512 | 0.0589  | 0.0824  |  |  |  |  |  |
| INCID                 |  | -1.09  | 1.61   | 4.77   | 6.29    | 6.08    |  |  |  |  |  |
| DEV                   |  | 10.015 | 15.642 | 11.652 | 4.024   | -13.652 |  |  |  |  |  |

Table IVv.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

ROTOR 1

STATION 1 - STATION 2

|            | 10      | 30      | 50      | 70     | 90     |
|------------|---------|---------|---------|--------|--------|
| DIA 1      | 29.150  | 27.080  | 25.060  | 23.020 | 20.988 |
| DIA 2      | 29.088  | 27.302  | 25.516  | 23.730 | 21.944 |
| BETA 1     | 19.256  | 21.191  | 22.949  | 24.267 | 24.025 |
| BETA 2     | 39.931  | 41.436  | 43.816  | 45.744 | 47.524 |
| BETA(PR) 1 | 58.439  | 55.033  | 51.398  | 47.332 | 43.298 |
| BETA(PR) 2 | 49.438  | 42.688  | 34.111  | 26.833 | 14.890 |
| V 1        | 639.66  | 654.54  | 665.09  | 673.50 | 678.10 |
| V 2        | 774.82  | 811.62  | 884.92  | 909.06 | 980.09 |
| VZ 1       | 603.87  | 610.28  | 612.45  | 613.99 | 619.36 |
| VZ 2       | 594.15  | 608.46  | 638.53  | 634.40 | 661.83 |
| V-THETA 1  | 210.95  | 236.60  | 259.33  | 276.80 | 276.08 |
| V-THETA 2  | 497.34  | 537.12  | 612.67  | 651.09 | 722.88 |
| V(PR) 1    | 1153.7  | 1064.9  | 981.6   | 905.9  | 851.0  |
| V(PR) 2    | 913.7   | 841.4   | 771.2   | 711.0  | 664.8  |
| VTHETA PR1 | 983.1   | 872.6   | 767.2   | 666.1  | 583.6  |
| VTHETA PR2 | 694.4   | 581.2   | 432.5   | 320.9  | 176.0  |
| U 1        | 1194.02 | 1109.23 | 1026.49 | 942.93 | 859.69 |
| U 2        | 1191.48 | 1118.32 | 1045.16 | 972.01 | 898.85 |
| M 1        | 0.5802  | 0.5947  | 0.6049  | 0.6132 | 0.6177 |
| M 2        | 0.6752  | 0.7129  | 0.7807  | 0.8060 | 0.8765 |
| M(PR) 1    | 1.0465  | 0.9674  | 0.8929  | 0.8248 | 0.7752 |
| M(PR) 2    | 0.7962  | 0.7391  | 0.6803  | 0.6303 | 0.6124 |
| TURN(PR)   | 9.000   | 11.345  | 17.288  | 20.499 | 28.408 |
| LOSS COEF. | 0.2064  | 0.1772  | 0.1902  | 0.1900 | 0.0987 |
| DFAC       | 0.2964  | 0.3001  | 0.3139  | 0.3235 | 0.3200 |
| EFFP       | 0.6960  | 0.7553  | 0.7884  | 0.8089 | 0.9152 |
| EFF        | 0.6850  | 0.7464  | 0.7795  | 0.8009 | 0.9111 |
| LOSS PARA. | 0.0473  | 0.0423  | 0.0483  | 0.0482 | 0.0248 |
| INCID      | -1.16   | -1.87   | -2.30   | -2.47  | -1.70  |
| DEV        | 4.338   | 4.888   | 3.311   | 6.133  | 6.190  |

CORRECTED WEIGHT FLOW

|                      |       |
|----------------------|-------|
| UPSTREAM OF ROTOR    | 99.90 |
| UPSTREAM OF STATOR   | 99.90 |
| DOWNSTREAM OF STATOR | 97.28 |

STATOR 1

STATION 2 - STATION 3

|            | 10      | 30     | 50     | 70     | 90      |
|------------|---------|--------|--------|--------|---------|
| DIA 3      | 29.164  | 27.422 | 25.672 | 23.874 | 22.034  |
| BETA 2     | 39.931  | 41.436 | 43.816 | 45.744 | 47.524  |
| BETA 3     | -10.703 | -4.262 | -3.328 | -5.200 | -20.777 |
| V 2        | 774.82  | 811.62 | 884.92 | 909.06 | 980.09  |
| V 3        | 607.67  | 626.15 | 674.93 | 665.15 | 578.04  |
| VZ 2       | 594.15  | 608.46 | 638.53 | 634.40 | 661.83  |
| VZ 3       | 597.10  | 624.41 | 673.79 | 662.41 | 540.45  |
| V-THETA 2  | 497.34  | 537.12 | 612.67 | 651.09 | 722.88  |
| V-THETA 3  | -112.86 | -46.53 | -39.18 | -60.28 | -205.05 |
| M 2        | 0.6752  | 0.7129 | 0.7807 | 0.8060 | 0.8765  |
| M 3        | 0.5207  | 0.5390 | 0.5812 | 0.5717 | 0.4917  |
| TURN       | 50.635  | 45.698 | 47.144 | 50.544 | 68.302  |
| LOSS COEF. | 0.1385  | 0.1179 | 0.1202 | 0.1256 | 0.3291  |
| DFAC       | 0.5320  | 0.4955 | 0.4963 | 0.5242 | 0.6963  |
| LOSS PARA. | 0.0546  | 0.0443 | 0.0422 | 0.0409 | 0.0929  |
| INCID      | -12.15  | -10.70 | -8.88  | -8.26  | -8.43   |
| DEV        | 6.257   | 13.778 | 14.422 | 12.490 | -2.977  |

Table IVw.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |         |         |         |        |        |  |  |  |  |
|-----------------------|---------|---------|---------|--------|--------|--|--|--|--|
| ROTOR 1               |         |         |         |        |        |  |  |  |  |
|                       | 10      | 30      | 50      | 70     | 90     |  |  |  |  |
| DIA 1                 | 29.150  | 27.080  | 25.060  | 23.020 | 20.988 |  |  |  |  |
| DIA 2                 | 29.086  | 27.302  | 25.516  | 23.730 | 21.944 |  |  |  |  |
| BETA 1                | 20.570  | 21.960  | 23.763  | 24.647 | 24.747 |  |  |  |  |
| BETA 2                | 46.043  | 47.943  | 49.231  | 50.522 | 51.773 |  |  |  |  |
| BETA(PR) 1            | 58.157  | 54.810  | 51.283  | 47.178 | 42.829 |  |  |  |  |
| BETA(PR) 2            | 46.736  | 41.126  | 32.805  | 23.462 | 15.460 |  |  |  |  |
| V 1                   | 643.45  | 657.78  | 665.68  | 675.73 | 683.22 |  |  |  |  |
| V 2                   | 818.94  | 843.94  | 868.54  | 929.24 | 941.14 |  |  |  |  |
| VZ 1                  | 602.43  | 610.06  | 609.23  | 614.16 | 620.48 |  |  |  |  |
| VZ 2                  | 568.44  | 565.33  | 580.23  | 590.79 | 582.36 |  |  |  |  |
| V-THETA 1             | 226.08  | 245.99  | 268.24  | 281.80 | 286.01 |  |  |  |  |
| V-THETA 2             | 589.53  | 626.60  | 672.94  | 717.25 | 739.32 |  |  |  |  |
| V(PR) 1               | 1141.8  | 1058.6  | 974.1   | 903.6  | 846.0  |  |  |  |  |
| V(PR) 2               | 829.4   | 750.5   | 690.3   | 644.0  | 604.2  |  |  |  |  |
| V-THETA PR1           | 970.0   | 865.1   | 762.7   | 662.7  | 575.2  |  |  |  |  |
| V-THETA PR2           | 604.0   | 493.6   | 374.0   | 256.4  | 161.1  |  |  |  |  |
| U 1                   | 1196.05 | 1111.12 | 1028.24 | 944.53 | 861.16 |  |  |  |  |
| U 2                   | 1193.51 | 1120.23 | 1046.95 | 973.67 | 900.38 |  |  |  |  |
| M 1                   | 0.5825  | 0.5964  | 0.6041  | 0.6139 | 0.6212 |  |  |  |  |
| M 2                   | 0.7048  | 0.7317  | 0.7753  | 0.8161 | 0.8298 |  |  |  |  |
| M(PR) 1               | 1.0237  | 0.9599  | 0.8840  | 0.8209 | 0.7693 |  |  |  |  |
| M(PR) 2               | 0.7138  | 0.6507  | 0.6023  | 0.5656 | 0.5327 |  |  |  |  |
| TURN(PR)              | 11.420  | 13.684  | 18.477  | 23.717 | 27.369 |  |  |  |  |
| LOSS COEF.            | 0.1626  | 0.1477  | 0.1374  | 0.1243 | 0.1582 |  |  |  |  |
| DFAC                  | 0.3866  | 0.4069  | 0.4128  | 0.4150 | 0.4133 |  |  |  |  |
| EFFP                  | 0.8172  | 0.8432  | 0.8711  | 0.8957 | 0.8759 |  |  |  |  |
| EFF                   | 0.8074  | 0.8350  | 0.8642  | 0.8900 | 0.8695 |  |  |  |  |
| LOSS PARA.            | 0.0393  | 0.0367  | 0.0354  | 0.0324 | 0.0397 |  |  |  |  |
| INCID                 | -1.44   | -2.09   | -2.42   | -2.62  | -2.17  |  |  |  |  |
| DEV                   | 1.636   | 2.326   | 2.005   | 2.762  | 6.746  |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |         |         |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |         |         | 99.74   |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |         |         |         | 99.74  |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |         |         |        | 96.29  |  |  |  |  |

| STATION 2 - STATION 3 |         |        |        |        |         |  |  |  |  |
|-----------------------|---------|--------|--------|--------|---------|--|--|--|--|
|                       | 10      | 30     | 50     | 70     | 90      |  |  |  |  |
| DIA 3                 | 29.164  | 27.422 | 25.672 | 23.674 | 22.034  |  |  |  |  |
| BETA 2                | 46.043  | 47.943 | 49.231 | 50.522 | 51.773  |  |  |  |  |
| BETA 3                | -11.828 | -2.956 | -1.842 | -9.650 | -20.777 |  |  |  |  |
| V 2                   | 818.94  | 843.94 | 868.54 | 929.24 | 941.14  |  |  |  |  |
| V 3                   | 586.53  | 613.58 | 592.95 | 562.42 | 511.05  |  |  |  |  |
| VZ 2                  | 568.44  | 565.33 | 580.23 | 590.79 | 582.36  |  |  |  |  |
| VZ 3                  | 569.53  | 612.76 | 592.65 | 554.46 | 477.82  |  |  |  |  |
| V-THETA 2             | 589.53  | 626.60 | 672.94 | 717.25 | 739.32  |  |  |  |  |
| V-THETA 3             | -140.18 | -31.64 | -19.06 | -94.28 | -181.29 |  |  |  |  |
| M 2                   | 0.7048  | 0.7317 | 0.7753 | 0.8161 | 0.8298  |  |  |  |  |
| M 3                   | 0.4944  | 0.5205 | 0.5029 | 0.4764 | 0.4316  |  |  |  |  |
| TURN                  | 59.871  | 50.696 | 51.073 | 60.172 | 72.550  |  |  |  |  |
| LOSS COEF.            | 0.1153  | 0.0456 | 0.1001 | 0.1486 | 0.1651  |  |  |  |  |
| DFAC                  | 0.6416  | 0.5668 | 0.6065 | 0.6803 | 0.7525  |  |  |  |  |
| LOSS PARA.            | 0.0450  | 0.0172 | 0.0352 | 0.0479 | 0.0466  |  |  |  |  |
| INCID                 | -6.94   | -4.20  | -3.47  | -3.48  | -4.18   |  |  |  |  |
| DEV                   | 5.132   | 15.084 | 15.908 | 8.030  | -2.977  |  |  |  |  |

Table IVx.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2           |         |         |         |         |         |                                 |         |         |         |
|---------------------------------|---------|---------|---------|---------|---------|---------------------------------|---------|---------|---------|
| ROTOR 1                         |         |         |         |         |         |                                 |         |         |         |
|                                 | 10      | 30      | 50      | 70      | 90      |                                 |         |         |         |
| UIA 1                           | 29.150  | 27.080  | 25.060  | 23.020  | 20.988  | UIA 1                           | 29.150  | 27.080  | 25.060  |
| UIA 2                           | 29.088  | 27.302  | 25.516  | 23.730  | 21.944  | UIA 2                           | 29.088  | 27.302  | 25.516  |
| BEIA 1                          | 20.278  | 21.617  | 22.924  | 24.534  | 24.177  | BEIA 1                          | 20.278  | 21.617  | 22.924  |
| BEIA 2                          | 48.560  | 51.218  | 52.402  | 53.447  | 55.824  | BEIA 2                          | 48.560  | 51.218  | 52.402  |
| Theta (PR) 1                    | 58.192  | 55.228  | 51.647  | 47.521  | 43.542  | Theta (PR) 1                    | 58.192  | 55.228  | 51.647  |
| Theta (PR) 2                    | 44.321  | 39.137  | 32.509  | 23.534  | 15.242  | Theta (PR) 2                    | 44.321  | 39.137  | 32.509  |
| V 1                             | 642.23  | 649.58  | 660.69  | 669.27  | 673.37  | V 1                             | 642.23  | 649.58  | 660.69  |
| V 2                             | 853.42  | 867.33  | 884.79  | 914.57  | 916.74  | V 2                             | 853.42  | 867.33  | 884.79  |
| VZ 1                            | 602.42  | 603.89  | 608.51  | 608.84  | 614.31  | VZ 1                            | 602.42  | 603.89  | 608.51  |
| VZ 2                            | 564.82  | 543.26  | 539.83  | 544.69  | 514.96  | VZ 2                            | 564.82  | 543.26  | 539.83  |
| V-THETA 1                       | 222.58  | 239.31  | 257.34  | 277.90  | 275.78  | V-THETA 1                       | 222.58  | 239.31  | 257.34  |
| V-THETA 2                       | 639.77  | 676.12  | 701.03  | 734.68  | 758.44  | V-THETA 2                       | 639.77  | 676.12  | 701.03  |
| V (PR) 1                        | 1143.0  | 1058.9  | 980.7   | 901.6   | 847.5   | V (PR) 1                        | 1143.0  | 1058.9  | 980.7   |
| V (PR) 2                        | 789.5   | 700.4   | 640.1   | 594.1   | 533.7   | V (PR) 2                        | 789.5   | 700.4   | 640.1   |
| VTHETA PR1                      | 971.3   | 869.8   | 769.0   | 664.9   | 583.8   | VTHETA PR1                      | 971.3   | 869.8   | 769.0   |
| VTHETA PR2                      | 551.6   | 442.1   | 344.0   | 237.2   | 140.3   | VTHETA PR2                      | 551.6   | 442.1   | 344.0   |
| U 1                             | 1193.89 | 1109.11 | 1026.38 | 942.83  | 859.60  | U 1                             | 1193.89 | 1109.11 | 1026.38 |
| U 2                             | 1191.35 | 1118.20 | 1045.05 | 971.90  | 898.76  | U 2                             | 1191.35 | 1118.20 | 1045.05 |
| M 1                             | 0.5824  | 0.5895  | 0.6003  | 0.6087  | 0.6127  | M 1                             | 0.5824  | 0.5895  | 0.6003  |
| M 2                             | 0.7325  | 0.7504  | 0.7706  | 0.8017  | 0.8053  | M 2                             | 0.7325  | 0.7504  | 0.7706  |
| M (PR) 1                        | 1.0364  | 0.9609  | 0.8910  | 0.8199  | 0.7711  | M (PR) 1                        | 1.0364  | 0.9609  | 0.8910  |
| M (PR) 2                        | 0.6777  | 0.6060  | 0.5575  | 0.5208  | 0.4689  | M (PR) 2                        | 0.6777  | 0.6060  | 0.5575  |
| TURN (PR)                       | 13.871  | 16.091  | 19.138  | 23.987  | 28.301  | TURN (PR)                       | 13.871  | 16.091  | 19.138  |
| LOSS COEF.                      | 0.1285  | 0.0965  | 0.0883  | 0.0782  | 0.1479  | LOSS COEF.                      | 0.1285  | 0.0965  | 0.0883  |
| DFAC                            | 0.4388  | 0.4719  | 0.4802  | 0.4758  | 0.5065  | DFAC                            | 0.4388  | 0.4719  | 0.4802  |
| EFFP                            | 0.8723  | 0.9084  | 0.9211  | 0.9370  | 0.8872  | EFFP                            | 0.8723  | 0.9084  | 0.9211  |
| EFF                             | 0.8640  | 0.9027  | 0.9164  | 0.9333  | 0.8811  | EFF                             | 0.8640  | 0.9027  | 0.9164  |
| LOSS PARA.                      | 0.0324  | 0.0247  | 0.0229  | 0.0204  | 0.0372  | LOSS PARA.                      | 0.0324  | 0.0247  | 0.0229  |
| INCID                           | -1.41   | -1.67   | -2.05   | -2.28   | -1.46   | INCID                           | -1.41   | -1.67   | -2.05   |
| DEV                             | -0.779  | 0.337   | 1.709   | 2.834   | 6.542   | DEV                             | -0.779  | 0.337   | 1.709   |
| CORRECTED WEIGHT FLOW           |         |         |         |         |         |                                 |         |         |         |
| UPSTREAM OF ROTOR               |         |         | 99.47   |         |         | UPSTREAM OF ROTOR               |         |         | 99.47   |
| UPSTREAM OF STATOR              |         |         | 99.47   |         |         | UPSTREAM OF STATOR              |         |         | 99.47   |
| DOWNSTREAM OF STATOR            |         |         | 95.74   |         |         | DOWNSTREAM OF STATOR            |         |         | 95.74   |
| PERCENT DESIGN SPEED = 109.85   |         |         |         |         |         | PERCENT DESIGN SPEED = 109.85   |         |         |         |
| CORRECTED WEIGHT FLOW = 99.47   |         |         |         |         |         | CORRECTED WEIGHT FLOW = 99.47   |         |         |         |
| CORRECTED ROTOR SPEED = 9191.22 |         |         |         |         |         | CORRECTED ROTOR SPEED = 9191.22 |         |         |         |
| PRESSURE RATIO = 1.4475         |         |         |         |         |         | PRESSURE RATIO = 1.4475         |         |         |         |
| ADIABATIC EFFICIENCY = 84.4773  |         |         |         |         |         | ADIABATIC EFFICIENCY = 84.4773  |         |         |         |
| STATION 2 - STATION 3           |         |         |         |         |         |                                 |         |         |         |
| STATOR 1                        |         |         |         |         |         |                                 |         |         |         |
|                                 | 10      | 30      | 50      | 70      | 90      |                                 |         |         |         |
| UIA 3                           | 29.164  | 27.422  | 25.672  | 23.874  | 22.034  | UIA 3                           | 29.164  | 27.422  | 25.672  |
| BEIA 2                          | 48.560  | 51.218  | 52.402  | 53.447  | 55.824  | BEIA 2                          | 48.560  | 51.218  | 52.402  |
| BEIA 3                          | -15.420 | -1.472  | -2.398  | -10.177 | -24.736 | BEIA 3                          | -15.420 | -1.472  | -2.398  |
| V 2                             | 653.42  | 667.33  | 684.79  | 694.57  | 716.74  | V 2                             | 653.42  | 667.33  | 684.79  |
| V 3                             | 556.42  | 574.50  | 542.51  | 502.37  | 433.51  | V 3                             | 556.42  | 574.50  | 542.51  |
| VZ 4                            | 564.82  | 543.26  | 539.83  | 544.69  | 514.96  | VZ 4                            | 564.82  | 543.26  | 539.83  |
| VZ 3                            | 536.39  | 574.31  | 542.03  | 494.46  | 393.74  | VZ 3                            | 536.39  | 574.31  | 542.03  |
| V-THETA 2                       | 639.77  | 676.12  | 701.03  | 734.68  | 758.44  | V-THETA 2                       | 639.77  | 676.12  | 701.03  |
| V-THETA 3                       | -147.95 | -14.76  | -22.70  | -88.77  | -181.60 | V-THETA 3                       | -147.95 | -14.76  | -22.70  |
| M 2                             | 0.7325  | 0.7504  | 0.7706  | 0.8017  | 0.8053  | M 2                             | 0.7325  | 0.7504  | 0.7706  |
| M 3                             | 0.4646  | 0.4842  | 0.4580  | 0.4238  | 0.3642  | M 3                             | 0.4646  | 0.4842  | 0.4580  |
| TURN                            | 63.580  | 52.690  | 54.800  | 63.624  | 80.560  | TURN                            | 63.580  | 52.690  | 54.800  |
| LOSS COEF.                      | 0.1980  | 0.1174  | 0.1129  | 0.1423  | 0.1415  | LOSS COEF.                      | 0.1980  | 0.1174  | 0.1129  |
| DFAC                            | 0.7187  | 0.6378  | 0.6745  | 0.7451  | 0.8368  | DFAC                            | 0.7187  | 0.6378  | 0.6745  |
| LOSS PARA.                      | 0.0767  | 0.0442  | 0.0396  | 0.0458  | 0.0388  | LOSS PARA.                      | 0.0767  | 0.0442  | 0.0396  |
| INCID                           | -3.52   | -0.92   | -0.30   | -0.55   | -0.13   | INCID                           | -3.52   | -0.92   | -0.30   |
| DEV                             | 3.540   | 16.568  | 15.352  | 7.503   | -6.936  | DEV                             | 3.540   | 16.568  | 15.352  |

Table IVy.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2           |         |         |         |         |         |               |         |         |         |         |         |
|---------------------------------|---------|---------|---------|---------|---------|---------------|---------|---------|---------|---------|---------|
| ROTOR 1                         |         |         |         |         |         |               |         |         |         |         |         |
|                                 | 10      | 30      | 50      | 70      | 90      |               | 10      | 30      | 50      | 70      | 90      |
| DIA 1                           | 29.150  | 27.080  | 25.060  | 23.020  | 20.988  | DIA 1         | 29.150  | 27.080  | 25.060  | 23.020  | 20.988  |
| DIA 2                           | 29.088  | 27.302  | 25.516  | 23.730  | 21.944  | DIA 2         | 29.088  | 27.302  | 25.516  | 23.730  | 21.944  |
| BETA 1                          | 20.041  | 21.601  | 23.042  | 25.140  | 24.662  | BETA 1        | 20.041  | 21.601  | 23.042  | 25.140  | 24.662  |
| BETA 2                          | 51.366  | 52.586  | 53.649  | 58.274  | 60.314  | BETA 2        | 51.366  | 52.586  | 53.649  | 58.274  | 60.314  |
| BETA(PRI) 1                     | 59.721  | 56.750  | 53.472  | 49.529  | 45.572  | BETA(PRI) 1   | 59.721  | 56.750  | 53.472  | 49.529  | 45.572  |
| BETA(PRI) 2                     | 45.021  | 39.720  | 34.602  | 27.125  | 15.923  | BETA(PRI) 2   | 45.021  | 39.720  | 34.602  | 27.125  | 15.923  |
| V 1                             | 610.67  | 619.85  | 627.17  | 633.46  | 638.31  | V 1           | 610.67  | 619.85  | 627.17  | 633.46  | 638.31  |
| V 2                             | 845.92  | 859.33  | 878.75  | 894.49  | 908.31  | V 2           | 845.92  | 859.33  | 878.75  | 894.49  | 908.31  |
| VZ 1                            | 573.69  | 576.32  | 577.14  | 573.45  | 580.08  | VZ 1          | 573.69  | 576.32  | 577.14  | 573.45  | 580.08  |
| VZ 2                            | 528.15  | 522.10  | 484.56  | 455.56  | 439.93  | VZ 2          | 528.15  | 522.10  | 484.56  | 455.56  | 439.93  |
| V-THETA 1                       | 209.27  | 228.19  | 245.48  | 269.11  | 266.35  | V-THETA 1     | 209.27  | 228.19  | 245.48  | 269.11  | 266.35  |
| V-THETA 2                       | 660.79  | 682.53  | 708.98  | 736.88  | 771.72  | V-THETA 2     | 660.79  | 682.53  | 708.98  | 736.88  | 771.72  |
| V(PRI) 1                        | 1137.8  | 1051.1  | 969.6   | 883.5   | 828.7   | V(PRI) 1      | 1137.8  | 1051.1  | 969.6   | 883.5   | 828.7   |
| V(PRI) 2                        | 747.2   | 678.8   | 588.7   | 511.9   | 457.5   | V(PRI) 2      | 747.2   | 678.8   | 588.7   | 511.9   | 457.5   |
| V-THETA PRI                     | 982.6   | 879.0   | 779.2   | 672.1   | 591.8   | V-THETA PRI   | 982.6   | 879.0   | 779.2   | 672.1   | 591.8   |
| V-THETA PRI 2                   | 528.5   | 433.8   | 334.3   | 233.4   | 125.5   | V-THETA PRI 2 | 528.5   | 433.8   | 334.3   | 233.4   | 125.5   |
| U 1                             | 1191.85 | 1107.22 | 1024.63 | 941.22  | 858.14  | U 1           | 1191.85 | 1107.22 | 1024.63 | 941.22  | 858.14  |
| U 2                             | 1189.32 | 1116.30 | 1043.27 | 970.25  | 897.22  | U 2           | 1189.32 | 1116.30 | 1043.27 | 970.25  | 897.22  |
| M 1                             | 0.5529  | 0.5617  | 0.5688  | 0.5749  | 0.5796  | M 1           | 0.5529  | 0.5617  | 0.5688  | 0.5749  | 0.5796  |
| M 2                             | 0.7231  | 0.7417  | 0.7448  | 0.7545  | 0.7760  | M 2           | 0.7231  | 0.7417  | 0.7448  | 0.7545  | 0.7760  |
| M(PRI) 1                        | 1.0301  | 0.9525  | 0.8793  | 0.8018  | 0.7524  | M(PRI) 1      | 1.0301  | 0.9525  | 0.8793  | 0.8018  | 0.7524  |
| M(PRI) 2                        | 0.6387  | 0.5859  | 0.5105  | 0.4458  | 0.3996  | M(PRI) 2      | 0.6387  | 0.5859  | 0.5105  | 0.4458  | 0.3996  |
| TURN(PRI)                       | 14.700  | 17.030  | 18.870  | 22.404  | 29.650  | TURN(PRI)     | 14.700  | 17.030  | 18.870  | 22.404  | 29.650  |
| LOSS COEF.                      | 0.1136  | 0.0505  | 0.0563  | 0.0759  | 0.1255  | LOSS COEF.    | 0.1136  | 0.0505  | 0.0563  | 0.0759  | 0.1255  |
| UFAC                            | 0.4840  | 0.4940  | 0.5336  | 0.5617  | 0.5945  | UFAC          | 0.4840  | 0.4940  | 0.5336  | 0.5617  | 0.5945  |
| EFFP                            | 0.8951  | 0.9555  | 0.9531  | 0.9424  | 0.9130  | EFFP          | 0.8951  | 0.9555  | 0.9531  | 0.9424  | 0.9130  |
| EFF                             | 0.8877  | 0.9524  | 0.9501  | 0.9389  | 0.9079  | EFF           | 0.8877  | 0.9524  | 0.9501  | 0.9389  | 0.9079  |
| LOSS PARA.                      | 0.0283  | 0.0128  | 0.0142  | 0.0192  | 0.0314  | LOSS PARA.    | 0.0283  | 0.0128  | 0.0142  | 0.0192  | 0.0314  |
| INCID                           | 0.12    | -0.15   | -0.23   | -0.27   | 0.57    | INCID         | 0.12    | -0.15   | -0.23   | -0.27   | 0.57    |
| DEV                             | -0.079  | 0.920   | 3.802   | 6.425   | 7.223   | DEV           | -0.079  | 0.920   | 3.802   | 6.425   | 7.223   |
| CORRECTED WEIGHT FLOW           |         |         |         |         |         |               |         |         |         |         |         |
| UPSTREAM OF ROTOR               |         |         |         |         |         |               |         |         |         |         |         |
| UPSTREAM OF STATOR              |         |         |         |         |         |               |         |         |         |         |         |
| DOWNSTREAM OF STATOR            |         |         |         |         |         |               |         |         |         |         |         |
| PERCENT DESIGN SPEED = 109.84   |         |         |         |         |         |               |         |         |         |         |         |
| CORRECTED WEIGHT FLOW = 96.65   |         |         |         |         |         |               |         |         |         |         |         |
| CORRECTED ROTOR SPEED = 9190.02 |         |         |         |         |         |               |         |         |         |         |         |
| PRESSURE RATIO = 1.4723         |         |         |         |         |         |               |         |         |         |         |         |
| ADIABATIC EFFICIENCY = 83.6033  |         |         |         |         |         |               |         |         |         |         |         |
| STATION 2 - STATION 3           |         |         |         |         |         |               |         |         |         |         |         |
| STATOR 1                        |         |         |         |         |         |               |         |         |         |         |         |
|                                 | 10      | 30      | 50      | 70      | 90      |               | 10      | 30      | 50      | 70      | 90      |
| DIA 3                           | 29.164  | 27.422  | 25.672  | 23.874  | 22.034  | DIA 3         | 29.164  | 27.422  | 25.672  | 23.874  | 22.034  |
| BETA 2                          | 51.366  | 52.586  | 55.649  | 58.274  | 60.314  | BETA 2        | 51.366  | 52.586  | 55.649  | 58.274  | 60.314  |
| BETA 3                          | -14.355 | -0.250  | -3.514  | -11.750 | -27.813 | BETA 3        | -14.355 | -0.250  | -3.514  | -11.750 | -27.813 |
| V 1                             | 845.92  | 859.33  | 878.75  | 894.49  | 908.31  | V 1           | 845.92  | 859.33  | 878.75  | 894.49  | 908.31  |
| V 2                             | 542.74  | 564.93  | 524.75  | 402.93  | 439.93  | V 2           | 542.74  | 564.93  | 524.75  | 402.93  | 439.93  |
| VZ 1                            | 528.15  | 524.10  | 484.50  | 455.56  | 439.93  | VZ 1          | 528.15  | 524.10  | 484.50  | 455.56  | 439.93  |
| VZ 2                            | 525.80  | 504.91  | 520.77  | 394.49  | 308.36  | VZ 2          | 525.80  | 504.91  | 520.77  | 394.49  | 308.36  |
| V-THETA 1                       | 660.79  | 682.53  | 708.98  | 736.88  | 771.72  | V-THETA 1     | 660.79  | 682.53  | 708.98  | 736.88  | 771.72  |
| V-THETA 2                       | -134.56 | -5.42   | -31.58  | -82.06  | -162.67 | V-THETA 2     | -134.56 | -5.42   | -31.58  | -82.06  | -162.67 |
| M 2                             | 0.7231  | 0.7417  | 0.7448  | 0.7545  | 0.7760  | M 2           | 0.7231  | 0.7417  | 0.7448  | 0.7545  | 0.7760  |
| M 3                             | 0.4517  | 0.4752  | 0.4394  | 0.3375  | 0.2009  | M 3           | 0.4517  | 0.4752  | 0.4394  | 0.3375  | 0.2009  |
| TURN                            | 65.721  | 53.136  | 55.164  | 70.025  | 68.126  | TURN          | 65.721  | 53.136  | 55.164  | 70.025  | 68.126  |
| LOSS COEF.                      | 0.2400  | 0.1008  | 0.1395  | 0.2246  | 0.2372  | LOSS COEF.    | 0.2400  | 0.1008  | 0.1395  | 0.2246  | 0.2372  |
| UFAC                            | 0.7300  | 0.6442  | 0.6958  | 0.8440  | 0.9253  | UFAC          | 0.7300  | 0.6442  | 0.6958  | 0.8440  | 0.9253  |
| LOSS PARA.                      | 0.0434  | 0.0005  | 0.0491  | 0.0719  | 0.0634  | LOSS PARA.    | 0.0434  | 0.0005  | 0.0491  | 0.0719  | 0.0634  |
| INCID                           | -0.71   | 0.45    | 2.95    | 4.27    | 4.36    | INCID         | -0.71   | 0.45    | 2.95    | 4.27    | 4.36    |
| DEV                             | 4.605   | 17.490  | 14.236  | 5.930   | -10.013 | DEV           | 4.605   | 17.490  | 14.236  | 5.930   | -10.013 |

Table IVz.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

NOTOR 1

STATION 1 - STATION 2

|             | 10      | 30      | 50      | 70     | 90     |
|-------------|---------|---------|---------|--------|--------|
| DIA 1       | 29.150  | 27.080  | 25.060  | 23.020 | 20.988 |
| DIA 2       | 29.088  | 27.302  | 25.516  | 23.730 | 21.944 |
| BETA 1      | 20.444  | 21.766  | 22.924  | 24.068 | 22.924 |
| BETA 2      | 51.655  | 52.721  | 56.184  | 59.317 | 62.273 |
| BETA(PRI) 1 | 60.292  | 57.126  | 54.181  | 50.581 | 47.022 |
| BETA(PRI) 2 | 45.723  | 41.015  | 36.658  | 28.350 | 19.321 |
| V 1         | 593.73  | 607.63  | 610.30  | 614.88 | 617.84 |
| V 2         | 830.61  | 837.41  | 831.23  | 847.83 | 849.12 |
| VZ 1        | 556.33  | 564.31  | 562.10  | 561.42 | 569.05 |
| VZ 2        | 515.30  | 507.22  | 462.61  | 432.64 | 395.07 |
| V-THETA 1   | 207.39  | 225.32  | 237.72  | 250.76 | 240.65 |
| V-THETA 2   | 651.44  | 666.33  | 690.61  | 729.14 | 751.62 |
| V(PRI) 1    | 1122.6  | 1039.6  | 960.5   | 884.1  | 834.7  |
| V(PRI) 2    | 738.1   | 672.2   | 576.7   | 491.6  | 418.6  |
| VTHETA PRI  | 975.1   | 873.1   | 778.8   | 683.0  | 610.7  |
| VTHETA PRI  | 528.5   | 441.2   | 344.4   | 233.4  | 138.5  |
| U 1         | 1182.44 | 1098.47 | 1016.53 | 933.78 | 851.36 |
| U 2         | 1179.92 | 1107.48 | 1035.03 | 962.56 | 890.14 |
| M 1         | 0.5412  | 0.5547  | 0.5573  | 0.5617 | 0.5646 |
| M 2         | 0.7156  | 0.7287  | 0.7264  | 0.7443 | 0.7459 |
| M(PRI) 1    | 1.0234  | 0.9490  | 0.8770  | 0.8077 | 0.7628 |
| M(PRI) 2    | 0.6359  | 0.5850  | 0.5040  | 0.4315 | 0.3677 |
| TURN(PRI)   | 14.569  | 10.111  | 17.512  | 22.230 | 27.701 |
| LOSS COEF.  | 0.0836  | 0.0116  | 0.0066  | 0.0016 | 0.0803 |
| UFAC        | 0.4828  | 0.4905  | 0.5383  | 0.5884 | 0.6456 |
| EFFV        | 0.9235  | 0.9904  | 0.9453  | 0.9998 | 0.9424 |
| EFF         | 0.9179  | 0.9897  | 0.9950  | 0.9997 | 0.9390 |
| LOSS PARA.  | 0.0206  | 0.0029  | 0.0016  | 0.0004 | 0.0197 |
| INCID       | 0.69    | 0.23    | 0.48    | 0.78   | 2.02   |
| DEV         | 0.623   | 2.215   | 5.868   | 7.650  | 10.621 |

CORRECTED WEIGHT FLOW

|                      |       |
|----------------------|-------|
| UPSTREAM OF ROTOR    | 94.72 |
| UPSTREAM OF STATOR   | 94.72 |
| DOWNSTREAM OF STATOR | 90.88 |

STATOR 1

STATION 2 - STATION 3

|            | 10      | 30     | 50     | 70      | 90      |
|------------|---------|--------|--------|---------|---------|
| DIA 3      | 29.164  | 27.422 | 25.672 | 23.874  | 22.034  |
| BETA 2     | 51.655  | 52.721 | 56.184 | 59.317  | 62.273  |
| BETA 3     | -14.532 | -0.918 | -4.075 | -12.272 | -30.540 |
| V 2        | 830.61  | 837.41 | 831.23 | 847.83  | 849.12  |
| V 3        | 573.21  | 601.46 | 489.44 | 325.48  | 237.00  |
| VZ 2       | 515.30  | 507.22 | 462.61 | 432.64  | 395.07  |
| VZ 3       | 554.87  | 601.39 | 488.20 | 318.04  | 204.12  |
| V-THETA 2  | 651.44  | 666.33 | 650.61 | 729.14  | 751.62  |
| V-THETA 3  | -143.83 | -5.64  | -34.78 | -69.16  | -120.43 |
| M 2        | 0.7150  | 0.7287 | 0.7264 | 0.7443  | 0.7459  |
| M 3        | 0.4800  | 0.5096 | 0.4130 | 0.2725  | 0.1980  |
| TURN       | 60.188  | 53.639 | 60.259 | 71.589  | 92.813  |
| LOSS COEF. | 0.2418  | 0.1350 | 0.2225 | 0.3880  | 0.3694  |
| UFAC       | 0.6944  | 0.5855 | 0.7180 | 0.9240  | 1.0312  |
| LOSS PARA. | 0.0940  | 0.0506 | 0.0780 | 0.1240  | 0.0961  |
| INCID      | -0.42   | 0.58   | 3.48   | 5.32    | 6.32    |
| DEV        | 4.428   | 17.122 | 13.675 | 5.408   | -12.740 |

Table IVaa.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |         |         |         |        |        |  |  |  |  |
|-----------------------|---------|---------|---------|--------|--------|--|--|--|--|
| ROTOR 1               |         |         |         |        |        |  |  |  |  |
|                       | 10      | 30      | 50      | 70     | 90     |  |  |  |  |
| U1A 1                 | 29.150  | 27.080  | 25.060  | 23.020 | 20.988 |  |  |  |  |
| U1A 2                 | 29.088  | 27.302  | 25.516  | 23.730 | 21.944 |  |  |  |  |
| UETA 1                | 20.444  | 21.586  | 23.366  | 24.608 | 24.324 |  |  |  |  |
| UETA 2                | 53.263  | 54.461  | 57.802  | 60.914 | 64.369 |  |  |  |  |
| UETA(PH) 1            | 63.090  | 60.191  | 57.156  | 53.782 | 50.156 |  |  |  |  |
| UETA(PH) 2            | 45.579  | 42.735  | 38.511  | 29.813 | 19.198 |  |  |  |  |
| V 1                   | 518.47  | 551.62  | 558.83  | 563.14 | 565.99 |  |  |  |  |
| V 2                   | 835.60  | 819.71  | 814.67  | 835.07 | 845.78 |  |  |  |  |
| VZ 1                  | 504.55  | 512.93  | 513.00  | 511.99 | 515.75 |  |  |  |  |
| VZ 2                  | 499.84  | 476.46  | 434.09  | 405.90 | 365.86 |  |  |  |  |
| V-THETA 1             | 188.09  | 202.94  | 221.63  | 234.50 | 233.13 |  |  |  |  |
| V-THETA 2             | 669.62  | 667.02  | 689.38  | 729.79 | 762.55 |  |  |  |  |
| V(PH) 1               | 1114.8  | 1031.8  | 945.9   | 866.5  | 805.0  |  |  |  |  |
| V(PH) 2               | 714.1   | 648.7   | 554.8   | 467.8  | 387.4  |  |  |  |  |
| VTHETA PH1            | 994.1   | 895.3   | 794.7   | 699.1  | 618.0  |  |  |  |  |
| VTHETA PH2            | 510.0   | 440.2   | 345.4   | 232.6  | 127.4  |  |  |  |  |
| U 1                   | 1182.18 | 1098.24 | 1016.31 | 933.58 | 851.17 |  |  |  |  |
| U 2                   | 1179.67 | 1107.24 | 1034.81 | 962.38 | 889.94 |  |  |  |  |
| M 1                   | 0.4881  | 0.5006  | 0.5075  | 0.5116 | 0.5143 |  |  |  |  |
| M 2                   | 0.7133  | 0.7066  | 0.7062  | 0.7276 | 0.7370 |  |  |  |  |
| M(PH) 1               | 1.0105  | 0.9364  | 0.8590  | 0.7872 | 0.7315 |  |  |  |  |
| M(PH) 2               | 0.6096  | 0.5592  | 0.4809  | 0.4076 | 0.3376 |  |  |  |  |
| TUNNIPR1              | 17.511  | 17.454  | 18.646  | 23.968 | 30.958 |  |  |  |  |
| LOSS CUEF.            | 0.1421  | 0.0690  | 0.0420  | 0.0129 | 0.0911 |  |  |  |  |
| DFAC                  | 0.5125  | 0.5169  | 0.5392  | 0.6131 | 0.6775 |  |  |  |  |
| EFFP                  | 0.8826  | 0.9435  | 0.9680  | 0.9919 | 0.9445 |  |  |  |  |
| EFF                   | 0.8736  | 0.9394  | 0.9659  | 0.9914 | 0.9409 |  |  |  |  |
| LOSS PARA.            | 0.0351  | 0.0167  | 0.0101  | 0.0032 | 0.0224 |  |  |  |  |
| INCID                 | 3.49    | 3.29    | 3.46    | 3.98   | 5.16   |  |  |  |  |
| DEV                   | 0.479   | 3.936   | 7.711   | 9.113  | 10.498 |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |         |         |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |         |         | 89.43   |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |         |         | 89.43   |        |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |         | 85.64   |        |        |  |  |  |  |

| STATION 2 - STATION 3 |        |        |        |         |         |  |  |  |  |
|-----------------------|--------|--------|--------|---------|---------|--|--|--|--|
| STATOR 1              |        |        |        |         |         |  |  |  |  |
|                       | 10     | 30     | 50     | 70      | 90      |  |  |  |  |
| U1A 3                 | 29.164 | 27.422 | 25.672 | 23.874  | 22.034  |  |  |  |  |
| UETA 2                | 53.260 | 54.461 | 57.802 | 60.918  | 64.369  |  |  |  |  |
| UETA 3                | -3.701 | -4.449 | -8.414 | -23.654 | -39.349 |  |  |  |  |
| V 2                   | 835.60 | 819.71 | 814.67 | 835.07  | 845.78  |  |  |  |  |
| V 3                   | 709.17 | 638.04 | 472.83 | 306.74  | 148.44  |  |  |  |  |
| VZ 2                  | 495.84 | 476.46 | 434.09 | 405.90  | 365.86  |  |  |  |  |
| VZ 3                  | 707.69 | 636.11 | 467.74 | 280.97  | 114.79  |  |  |  |  |
| V-THETA 2             | 669.62 | 667.02 | 689.38 | 729.79  | 762.55  |  |  |  |  |
| V-THETA 3             | -45.78 | -49.50 | -69.19 | -123.07 | -94.12  |  |  |  |  |
| M 2                   | 0.7133 | 0.7066 | 0.7062 | 0.7276  | 0.7370  |  |  |  |  |
| M 3                   | 0.5960 | 0.5393 | 0.3962 | 0.2550  | 0.1232  |  |  |  |  |
| TUNN                  | 55.962 | 58.911 | 66.216 | 84.572  | 103.719 |  |  |  |  |
| LOSS CUEF.            | 0.1431 | 0.1897 | 0.3860 | 0.5627  | 0.6009  |  |  |  |  |
| DFAC                  | 0.4951 | 0.5510 | 0.7470 | 0.9667  | 1.1305  |  |  |  |  |
| LOSS PARA.            | 0.0574 | 0.0712 | 0.1343 | 0.1685  | 0.1404  |  |  |  |  |
| INCID                 | 1.18   | 2.32   | 5.10   | 6.92    | 8.42    |  |  |  |  |
| DEV                   | 15.259 | 13.591 | 9.336  | -5.574  | -21.549 |  |  |  |  |

Table IVbb.  
BLADE ELEMENT PERFORMANCE - SLOTTED STATOR STAGE

| STATION 1 - STATION 2 |         |         |         |        |        |  |  |  |  |
|-----------------------|---------|---------|---------|--------|--------|--|--|--|--|
| ROTOR 1               |         |         |         |        |        |  |  |  |  |
|                       | 10      | 30      | 50      | 70     | 90     |  |  |  |  |
| DIA 1                 | 29.190  | 27.080  | 25.060  | 23.020 | 20.988 |  |  |  |  |
| DIA 2                 | 29.088  | 27.302  | 25.516  | 23.730 | 21.944 |  |  |  |  |
| BETA 1                | 19.916  | 21.278  | 23.599  | 24.966 | 24.242 |  |  |  |  |
| BETA 2                | 53.139  | 54.256  | 57.825  | 60.290 | 63.978 |  |  |  |  |
| BETA(PRI) 1           | 63.033  | 60.279  | 57.289  | 53.687 | 50.316 |  |  |  |  |
| BETA(PRI) 2           | 44.194  | 43.209  | 38.329  | 29.415 | 19.388 |  |  |  |  |
| V 1                   | 543.27  | 553.44  | 559.40  | 567.11 | 567.07 |  |  |  |  |
| V 2                   | 857.65  | 818.57  | 821.13  | 843.11 | 849.96 |  |  |  |  |
| VZ 1                  | 510.78  | 515.36  | 512.62  | 514.12 | 517.02 |  |  |  |  |
| VZ 2                  | 514.48  | 478.18  | 437.25  | 410.17 | 372.88 |  |  |  |  |
| V-TMETHA 1            | 185.06  | 201.74  | 223.93  | 239.37 | 232.88 |  |  |  |  |
| V-TMETHA 2            | 686.20  | 644.38  | 695.03  | 736.61 | 763.80 |  |  |  |  |
| V(PRI) 1              | 1126.3  | 1039.5  | 948.6   | 868.1  | 809.7  |  |  |  |  |
| V(PRI) 2              | 717.6   | 656.1   | 557.4   | 470.9  | 395.3  |  |  |  |  |
| VIMETHA PRI           | 1003.9  | 902.8   | 798.2   | 699.5  | 623.2  |  |  |  |  |
| VIMETHA PR2           | 500.2   | 449.2   | 345.7   | 231.3  | 131.2  |  |  |  |  |
| U 1                   | 1188.93 | 1104.50 | 1022.11 | 938.91 | 856.02 |  |  |  |  |
| U 2                   | 1186.40 | 1113.55 | 1040.71 | 967.87 | 895.02 |  |  |  |  |
| M 1                   | 0.4898  | 0.4994  | 0.5051  | 0.5124 | 0.5124 |  |  |  |  |
| M 2                   | 0.7280  | 0.7014  | 0.7070  | 0.7291 | 0.7341 |  |  |  |  |
| M(PRI) 1              | 1.0155  | 0.9381  | 0.8465  | 0.7844 | 0.7316 |  |  |  |  |
| M(PRI) 2              | 0.6091  | 0.5622  | 0.4999  | 0.4072 | 0.3414 |  |  |  |  |
| TURN(PRI)             | 16.839  | 17.070  | 18.960  | 24.272 | 30.929 |  |  |  |  |
| LOSS COEF.            | 0.1502  | 0.0796  | 0.0670  | 0.0427 | 0.1894 |  |  |  |  |
| DFAC                  | 0.5206  | 0.5129  | 0.5587  | 0.6109 | 0.6700 |  |  |  |  |
| EFFP                  | 0.8777  | 0.9342  | 0.9494  | 0.9582 | 0.9990 |  |  |  |  |
| EFF                   | 0.8882  | 0.9296  | 0.9460  | 0.9554 | 0.8925 |  |  |  |  |
| LOSS PARA.            | 0.0380  | 0.0191  | 0.0161  | 0.0155 | 0.0416 |  |  |  |  |
| INC10                 | 3.43    | 3.38    | 3.59    | 3.89   | 5.32   |  |  |  |  |
| DEV                   | -0.906  | 4.409   | 7.529   | 8.715  | 10.688 |  |  |  |  |
| CORRECTED WEIGHT FLOW |         |         |         |        |        |  |  |  |  |
| UPSTREAM OF ROTOR     |         |         | 88.93   |        |        |  |  |  |  |
| UPSTREAM OF STATOR    |         |         | 88.93   |        |        |  |  |  |  |
| DOWNSTREAM OF STATOR  |         |         | 85.13   |        |        |  |  |  |  |

STATOR 1

STATION 2 - STATION 3

|            | 10     | 30     | 50      | 70      | 90      |
|------------|--------|--------|---------|---------|---------|
| DIA 3      | 29.164 | 27.422 | 25.672  | 23.874  | 22.034  |
| BETA 2     | 53.139 | 54.256 | 57.825  | 60.890  | 63.978  |
| BETA 3     | -2.770 | -2.888 | -10.177 | -39.904 | -47.532 |
| V 2        | 857.65 | 818.57 | 821.13  | 843.11  | 849.96  |
| V 3        | 712.12 | 645.37 | 477.34  | 305.43  | 114.65  |
| VZ 2       | 514.48 | 478.18 | 437.25  | 410.17  | 372.88  |
| VZ 3       | 711.29 | 643.88 | 469.83  | 234.30  | 77.41   |
| V-TMETHA 2 | 686.20 | 464.38 | 655.03  | 736.61  | 763.80  |
| V-TMETHA 3 | -34.41 | -43.78 | -84.24  | -192.92 | -84.27  |
| M 2        | 0.7280 | 0.7014 | 0.7070  | 0.7291  | 0.7341  |
| M 3        | 0.5947 | 0.5418 | 0.5372  | 0.2520  | 0.0945  |
| TURN       | 55.909 | 58.144 | 68.003  | 100.794 | 111.511 |
| LOSS COEF. | 0.1638 | 0.1709 | 0.3872  | 0.5712  | 0.6134  |
| DFAC       | 0.5071 | 0.5375 | 0.7524  | 0.9994  | 1.1667  |
| LOSS PARA. | 0.0737 | 0.0642 | 0.1340  | 0.1432  | 0.1251  |
| INC10      | 1.06   | 2.12   | 5.13    | 6.89    | 8.03    |
| DEV        | 16.190 | 14.152 | 7.573   | -22.224 | -29.732 |