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PERFORMANCE OF A 1.15-PRESSURE-RATIO AXIAL-FLOW FAN STAGE WITH A BLADE TIP SOLIDITY OF 0.5

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SUMMARY

The overall and blade-element performance of a low-solidity, low-pressure-ratio, low-tip-speed fan stage is presented. Detailed radial and circumferential (behind stators) surveys of the flow conditions were made over the stable operating range at rotative speeds from 90 to 120 percent of design speed. At design speed a stage peak efficiency of 0.836 was obtained at a pressure ratio of 1.111 and a weight flow of 30.27 kilograms per second (177.80 (kg/sec)/m^2 of annulus area). The design weight flow was 29.94 kilograms per second, the design efficiency was 0.863, and the pressure ratio was 1.151. The rotor peak efficiency of 0.891 was also less than design efficiency of 0.909. Stall margin, for this stage at design speed was approximately 13 percent, based on weight flow and total-pressure ratio at peak efficiency and near stall.

The lower than design total pressure ratio was attributed to the failure to obtain the design energy input into the rotor. A mismatch of the rotor and stator blade elements is indicated and probably results from the lower than design pressure ratio over the entire blade span of the rotor blades.

INTRODUCTION

The Lewis research program on axial-flow fans and compressors for advanced air-breathing engines is directed primarily toward providing the technology to permit the reduction of the size and weight of the fans and compressors while maintaining a high level of performance.

Within the overall program, a series of fans has been designed to obtain definitive information for the selection of fans for propulsion systems for short-haul aircraft using the externally blown flap (EBF) as the powered lift system. The externally blown flap concept will require a large flow of low-velocity air for effective lift and low noise during takeoff and landing (ref. 1). Thus, fans with high air bypass ratios, low pressure ratios, and low tip speeds are indicated. The choice of fan pressure-ratio and other parameters may depend on compromises between fan aerodynamic performance and low noise considerations. Performance data must be obtained on suitable fans over a range of pressure-ratios and speeds to optimize propulsion systems for the EBF short-haul aircraft.

The experimental performance for one of the fans in this series is presented in reference 2. The fan stage was designed for a tip speed of 213.3 meters per second with a pressure ratio of 1.2 at a weight flow of 31.2 kilograms per second. The rotor was designed with a mechanism that allowed manual adjustment of the rotor blade angle. Performance data are presented for several rotor blade setting angles. Such adjustable rotor blades could be used for better performance matching from takeoff to cruise conditions and also for obtaining reverse thrust for reducing the landing roll.

This report presents the experimental performance for a fan in the series, designated fan stage 51A. The 12-bladed, 50.8-centimeter-diameter fan was designed for a tip-speed of 243.8 meters per second. The design stage pressure ratio was 1.15 at a weight flow of 29.9 kilograms per second. The fan blade angles can be manually reset. Overall performance for both the rotor and the stage along with the blade-element performances of both rotor and stator are presented for the design rotor blade setting angle. The data are presented over the stable operating flow range of the stage at rotative speeds that varied from 90 to 120 percent of design speed. Blade-element survey data were obtained at nine radial positions. The data are presented in machine tabulated and plotted form. The symbols and equations are defined in appendixes A and B. The abbreviations and units used in the tables are defined in appendix C.

FAN STAGE DESIGN

The design objectives for fan stage 51A were to obtain at a tip speed of 243.8 meters per second (1) a weight flow of 29.9 kilograms per second (175.8 (kg/sec)/m^2 of annulus area), (2) an overall pressure ratio of 1.15 with high efficiency, (3) quiet operation, (4) reverse fan thrust by rotating the rotor blades through either the "feathered" pitch position (trailing edge becomes leading edge) or the "flat" pitch position (leading edge remains leading edge), and (5) a mechanically sound stage at speeds as high as 20 percent above design speed. To meet the last three objectives, compromises had to be made to the aerodynamic parameters. The final fan stage design evolved from an iteration of the mechanical, aerodynamic, and acoustic parameters. A discussion of some aspects of the stage design is given in this section.

Mechanical and General Design Considerations

The overall design parameters for fan stage 51A are listed in table I, and the flow path is shown in figure 1. The low hub to tip radius ratio value of 0.4 (rotor and stator) was chosen to obtain a low loss flow path (hub streamline) into the core compressor and to increase weight flow per unit frontal area.

A low number of rotor blades (12) was selected to facilitate the design of a mechanism for obtaining variable pitch blading. A rotor hub solidity of less than 1.0 was necessary to rotate the blades through the "flat" pitch position to obtain reverse fan thrust. A hub solidity of 0.96 was chosen, and the tip solidity was set at 0.50. The aspect ratio based on the chord at the hub was 2.9. Thick blade sections at the hub were necessary to satisfy stress and vibration requirements as the blade camber at the hub was relatively low, and midspan blade vibration dampers could not be used with variable pitch blading. A cubic (with inflection point at 50 percent blade span) distribution of thickness to chord ratio from 0.20 at the blade hub to 0.05 at the blade tip was necessary to obtain the required mechanical and vibrational frequency margin.

Thirty-two stator blades were selected, and the stator blade row was located four rotor blade chord lengths downstream of the rotor (fig. 1). The stator tip solidity is 0.99 and the aspect ratio is 3.08.

Aerodynamic Design

A composite computer design program, which consists of a streamline analysis subprogram, a blade geometry subprogram, and a blade coordinate subprogram, was used in the design of fan stage 51A. Details of each subprogram are presented in references 3 to 5; thus only a brief description of each is presented in this report.

The streamline analysis subprogram (ref. 3) calculates the velocity vector diagrams at several axial locations, including planes approximating the blade leading and trailing edges. This program accounts for streamline curvatures, entropy gradients, and boundary-layer blockage. Weight flow, rotor speed, flow path geometry, and radial distribution of total pressure and temperature are the inputs to this program.

The results from the streamline analysis subprogram are then used in the blade geometry subprogram (ref. 3). This program calculates the blade geometry that will satisfy the vector diagrams.

After the blade geometry is defined for both the rotor and stator, the blade coordinate subprogram presented in reference 5 is used to compute the blade elements on conical surfaces approximating the stream surfaces passing through the blade. The program then stacks these blade elements on a radial line about their center of gravity and computes the Cartesian blade coordinates for fabrication.

The blade-element design parameters for rotor 51A and stator 51 are presented in tables II and III, respectively. The blade geometry is presented in table IV for the rotor and table V for the stator. Double circular arc blade sections were used for both the rotor and stator.

Acoustic Design

For fans in general, the blade passing frequency noise appears to dominate because of its high sound pressure level and because it usually occurs in the audible noise region. The chief cause of this blade noise and its harmonics appears to be an interaction of the rotor wakes with the downstream stator blades, rather than rotor-alone noise. A model of this noise generation mechanism is presented in reference 6 and was used in the design of fan stage 51A to reduce its blade passing frequency noise. The model includes a description of the rotor wakes and the response of the stator blades to these wakes. At the present time the model gives only relative numbers between two fans. Thus, a previously tested fan stage (ref. 7) was chosen as a base. Although absolute levels for the blade passing frequency noise are not obtained, comparisons between different fans may be made. Some of the aerodynamic design parameters for which values were selected in order to lower the theoretical noise level of fan stage 51A are as follows: (1) a low tip speed was chosen to reduce broad band noise (negligible shock losses), (2) the stator blades were spaced four rotor blade chord lengths downstream of the rotor to reduce the velocity gradients in the rotor blade wakes as they impinge on the stator blades, (3) the theoretical pressure ratio was reduced quadratically from the rotor tip to the rotor hub to reduce the blade loadings near the hub and, thus, reduce the size of the rotor wakes where the rotor blades are thickest, and (4) the stator incidence angles were chosen to cancel the lift fluctuating components and thus minimize the fluctuating lift experienced by the stator blades due to the rotor wakes.

Some of the mechanical considerations that were necessary but that tended to increase the noise level of fan stage 51A are as follows: (1) a low number of rotor blades, which tends to increase the rotor alone generated blade-passing-frequency noise and lowers the frequency of the blade passing tone, which results in more harmonics of this tone falling in the audible noise range, (2) the low rotor solidity, (3) the large blade tip clearance required for resetting the blades for reverse thrust, and (4) the thick rotor blade hub sections required to reduce stress and vibration.

The iterations of the aerodynamic, acoustic, and mechanical parameters in the design procedure resulted in a final design for fan stage 51A that was theoretically 4 decibels quieter than the base fan of reference 7.

APPARATUS AND PROCEDURE

Compressor Test Facility

The compressor stage was tested in the Lewis single-stage compressor facility (ref. 3). Atmospheric air enters the test facility (fig. 2) at an inlet located on the roof of the building and flows through the flow measuring orifice and into the plenum chamber upstream of the test stage. The air then passes through the experimental compressor stage into the collector and is exhausted to the vacuum exhaust system.

Test Stage

Photographs of the rotor and stator are shown in figures 3 and 4, respectively. The rotor blades are mounted in a split disk, which enables the blades to be rotated to obtain the blade setting angle desired for testing. Friction pins in each half of the disk were compressed against the blade bases preventing the blades from turning. The compression of the friction pins is adjustable from the upstream (front) side of the rotor disk. Thus, the blade angle can be reset without disassembling the rotor.

With the rotor blades in the flat pitch position, the blade tips were machined 0.050 centimeter less than the contour of the outer casing. This enables the blades to be rotated in all directions. With the blades at their design setting angle, the nonrotating radial tip clearance at the stacking plane of the blade was a nominal 0.050 centimeter at ambient conditions. However, the tip clearance at the leading and trailing edges of the blades was approximately three times greater due to the convex contour of the blade tip.

Instrumentation

The compressor weight flow was determined from measurements on a calibrated thin-plate orifice. The temperature at the orifice was measured with two chromel-constantan thermocouples. Pressures at the orifice were measured by calibrated transducers.

Radial surveys of the flow were made upstream of the rotor, between the rotor and stator, and downstream of the stator (fig. 1). Photographs of the survey probes are shown in figure 5. Total pressure, total temperature, and flow angle were measured with a combination probe (fig. 5(a)). The thermocouple material was chromel-constantan. The static pressure was measured with an 8° C-shaped wedge probe (fig. 5(b)). Each probe was positioned with a null-balancing, stream-direction-sensitive control system that automatically alined the probe to the direction of flow. The probes were angularly alined in an air tunnel. Two combination probes and two wedge static probes were used at each of the three measuring stations. The temperatures at stations 2 and 3 were recorded as temperature differences referenced to the temperature at station 1.

Inner and outer wall static-pressure taps were located at the same axial stations as the survey probes. The circumferential locations of both types of survey probes along with inner and outer wall static pressure taps are shown in figure 6. The combination probe downstream of the stator (station 3) was circumferentially traversed one stator blade passage (11.2°) counterclockwise from the nominal value shown.

For monitoring the fan performance during the run, four six-element total-pressure and temperature rakes were located downstream of the stator (station 4, fig. 1). The circumferential locations of the rakes are shown in figure 6. The data from these rakes were used in conjunction with an on-line computer located in the facility. An electronic speed counter, in conjunction with a magnetic pickup, was used to measure rotative speed (rpm). The estimated errors of the data based on inherent accuracies of the instrumentation and recording system are as follows:

Weight flow, kg/sec	±0.3
Rotative speed, rpm	±30
Flow angle, deg	±1
Temperature, K	±0.6
Rotor-inlet total pressure, N/cm^2	±0.01
Rotor-outlet total pressure, N/cm^2	±0.10
Stator-outlet total pressure, N/cm^2	±0.10
Rotor-inlet static pressure, N/cm^2	±0.04
Rotor-outlet static pressure, N/cm^2	±0.07
Stator-outlet static pressure, N/cm^2	±0.07

An indication of the consistency of the data can be observed by comparing the integrated weight flow at each measuring station to the orifice weight flow.

Test Procedure

The stage survey data were taken over a range of weight flows from maximum flow to the near-stall conditions at 90, 100, 110, and 120 percent of design speed. Data were recorded at nine radial positions for each speed and weight flow. At each radial position the two combination probes behind the stator were circumferentially traversed to nine different locations across the stator gap. The two wedge probes were set at midgap because previous studies showed that the static pressure across the stator gap was constant. Values of pressure, temperature, and flow angle were recorded at each circumferential position. At the last circumferential position values of pressure, temperature, and flow angle were also recorded at stations 1 and 2. All probes were then traversed to the next radial position, and the circumferential traverse procedure repeated.

At each of the four rotative speeds, the back pressure on the stage was increased by closing the sleeve valve in the collector until a drop in total pressure at the blade tip was detected. This was accomplished by comparing the radial distribution of discharge total pressure between succeeding computer (on-line) printouts obtained as the valve was closed. This point was arbitrarily taken as the limit of stable operation at the low end of the weight flow range and usually occurred before any definite indications of stall were observed such as change in noise level or increase in blade stress.

Calculation Procedure

Measured total temperatures and total pressures were corrected for Mach number and streamline slope. These corrections were based on instrument probe calibrations given in reference 8. The stream static pressure was corrected for Mach number and streamline slope based on an average calibration for the type of probe used.

Due to the physical size of the C-shaped static pressure wedges, it was not possible to obtain static-pressure measurements at 5, 10, and 95 percent of span. The static pressure at 95 percent span was obtained by assuming a linear variation in static pressure between the values at the inner wall and the probe measurement at 90 percent span. A similar variation was assumed between measurements at the outer wall and the 15 percent span to obtain the static pressure at 5 and 10 percent span.

At each radial position, averaged values of the nine circumferential measurements of pressure, temperature, and flow angle downstream of the stator (station 3) were obtained. The nine values of total temperature were mass averaged to obtain the stator outlet total temperature. The nine values of total pressure were energy averaged. The measured values of pressure, temperature, and flow angle were used to calculate axial and tangential velocities at each circumferential position. The flow angles presented for each radial position are calculated based on these mass-averaged axial and tangential velocities. To obtain the overall performance, the radial values of total temperature were mass averaged and the values of total pressure were energy averaged. At each measuring station, the integrated weight flow was computed based on the radial survey data.

The data, measured at the three measuring stations, were translated to the rotor and stator blade leading and trailing edges by the method presented in reference 5. Orifice weight flow, total pressures, static pressures, and temperatures were all corrected to sea-level conditions based on the rotor inlet conditions.

RESULTS AND DISCUSSION

The overall performances for the rotor and the stage are presented first. Radial distributions of several performance parameters are then presented for both the rotor and the stator, followed by blade-element data. Finally, a brief discussion of the data is given.

All the plotted data, together with some additional performance parameters, are listed in tabular form. The overall performance data are presented in table VI. The blade-element data are given first for the rotor and then for the stator in tables VII to XIV. The abbreviations and units for the tabular data are defined in appendix C.

Overall Performance

The overall performance for rotor 51A is presented in figure 7, and the overall performance for stage 51A is presented in figure 8. For both machine-plotted figures, data are presented for speeds from 90 to 120 percent of design speed. Data are presented at several weight flows from choke to the near-stall conditions. Stall conditions occurred gradually with only a small drop off in pressure rise and no indication of operational instability, particularly at 90 and 100 percent speeds. Thus, it would be difficult to establish a specific stall line for this stage and none are shown in figures 7 and 8. The stall condition (minimum flow point) was arbitrarily taken as the point where a drop off in total pressure at the blade tip was first detected downstream of the stator. Data for the minimum flow points (near stall) shown in figures 7 and 8 were taken at flow rates just slightly greater than the point of drop-off in total pressure in the blade tip region. Design-point values are shown as solid symbols in both figures.

The peak efficiency for rotor 51A at design speed was 0.891 (design peak efficiency, 0.909), and it occurred at a weight flow of 32.3 kilograms per second (189.3 (kg/sec)/m^2 of annulus area). Design weight flow was 29.94 kilograms per second (175.8 (kg/sec)/m^2 of annulus area). The measured total-pressure ratio was 1.104 and the temperature ratio was 1.032; the design values were 1.159 and 1.047, respectively. At 90 percent of design speed, a peak efficiency of 0.952 was measured.

The stage overall performance trends with respect to design values were similar to those for the rotor. The stage peak efficiency was 0.836 (design stage efficiency, 0.863). At peak efficiency the weight flow was 30.27 kilograms per second (the design value was 29.94 kilograms per second). The measured pressure ratio of 1.111 was less than the design value of 1.151; and the temperature ratio of 1.037 was also lower than the design value of 1.047. At 90 percent of design speed, a peak efficiency of 0.850 was measured.

The peak efficiency for the rotor occurred at a weight flow that was 2 kilograms per second greater than that for the stage. This difference indicates a mismatch of the rotor and stator.

Radial Distributions

The radial distributions of several parameters for 100 percent of design speed are presented in figure 9 for rotor 51A and in figure 10 for stator 51. In each figure data are presented for three weight flows: near choke, stage peak efficiency, and near stall. The design values are shown by the solid symbols. Temperature-rise efficiency, temperature ratio, pressure ratio, suction-surface incidence angle, meridional velocity ratio, deviation angle, total-loss parameter, total-loss coefficient, and diffusion factor are presented as functions of percent span from the blade tip.

Rotor. - In general, as the weight flow was reduced, the pressure ratio, temperature ratio, and blade loading (diffusion factor) increased across blade span but remained lower than design values. However, at the lowest weight flow point (26.4 kg/sec), a decrease in pressure ratio and an increase in diffusion factor in the blade tip region indicate that the rotor is partially stalled (by definition). Operation at this weight flow was stable during the tests, and the near stall weight flow is probably only slightly greater. If the near stall weight flow were say 26.9 kilograms per second (instead of 26.4 kg/sec), the stall margin for stage 51A would be approximately 13 percent. The deviation angles were greater than design values except near the rotor tip for the choke weight flow. The rotor losses were close to design values for choke and peak efficiency weight flows but were higher than design values for the lowest weight flow, which appears to be partially in stall.

At the stage peak efficiency weight flow (30.3 kg/sec), the efficiency was less than design values in the midportion of the blade span and near the end walls (hub and tip). The suction-surface incidence angles agreed with design values at the peak efficiency weight flow. The diffusion factor was lower than design values but the rotor losses agreed closely with design values. Thus, the loss-diffusion factor relation used in the rotor design was not achieved.

Stator. - At the stage peak efficiency weight flow of 30.3 kilograms per second, the stator blade loading (diffusion factor) was lower than design values over the entire blade span. The measured losses were lower than design values from 15 to 85 percent span from tip but higher than design near the blade hub and tip. The suction-surface incidence angles were approximately 5° to 7° lower than design values. The deviation angles agreed well with design values from 30 to 70 percent blade span but were higher than design for the remainder of the blade.

Variations with Incidence Angle

The variations of selected blade-element parameters with suction-surface incidence angle are presented for the rotor and the stator in figures 11 and 12. The data are presented for 90, 100, and 120 percent of design speed for blade-element locations of 5, 10, 30, 50, 70, 90, and 95 percent of span from the blade tip. Design values are shown by solid symbols. In addition to the parameters shown in the radial distribution plots, inlet relative Mach number is presented. The various curves as a function of incidence angle are presented primarily for future correlation in comparing the performance of these blades with other blade designs. Thus, only a few brief observations will be made from the curves.

Rotor. - The rotor blades were designed for minimum loss to occur at a varying incidence angle (table II) from blade tip (-1.5°) to hub (-13.0°). At design speed the measured incidence angle associated with minimum loss was defined at all spans except the 95 percent span. At this span the losses continued to decrease as the flow was increased (decreasing incidence angle) to the maximum flow condition. At the other blade spans the measured suction-surface incidence angle corresponding to minimum loss varied from -4.5° from the design value at the 5-percent span to being equal to the design value at the 70 and 90 percent blade spans. The experimental minimum loss values were less than or equal to the design loss values. In general, the pressure ratio, efficiency, temperature ratio, and D-factor were less than design values. The deviation angles were greater than design values.

The high loss values shown at 120-percent speed are probably as[illegible]d with shock losses as the inlet relative Mach number is above 1.0 at this speed for 5- and 10-percent blade spans.

Stator. - The incidence angle associated with minimum loss was defined at all stator blade spans except 5 percent. At the 5-percent span the minimum loss value was nearly constant for all test points except the choke point and thus covered a [illegible] range of incidence angles. At the 95-percent span the minimum loss incidence [illegible] as within 2° of the design incidence angle (0°). However, at the other spans the ang[illegible]ried from -6° to -14° from the design incidence angle. The experimental loss values were greater than design for the 5-, 10-, 90-, and 95-percent spans but were lower than design values in the midspan portions of the blade. The deviation angle agreed well with the design value except at the 90- and 95-percent blade span positions.

Discussion of Performance

At design speed the stage peak efficiency weight flow is 30.27 kilograms per second, which is close to the design value of 29.94 kilograms per second. The peak efficiency of the rotor occurred at a higher weight flow (32.3 kg/sec) than for the stage and indicates a mismatch of the rotor and stator. The rotor and stage peak efficiencies are only 3 percentage points lower than the design values. However, both the rotor and stage total-pressure ratios are much lower than design values.

The radial distribution of efficiency for the rotor agrees well with the design distribution except in the hub and tip regions. However, the spanwise distribution of total-pressure ratio is considerably lower than design values over the entire blade span. The design energy input for the rotor has not been achieved as is shown by the lower than design spanwise distribution of total-temperature ratio. The spanwise experimental losses agree well with design values but the diffusion factors are lower than design values. The deviation angles are much greater than design values. Thus, the rotor blade-element data indicate that rotor 51A should have a higher blade camber, a redistribution of deviation angle, and a reappraisal of the loss-diffusion factor relation in order to improve its performance. However, even with these changes, better performance might not be obtained because of the low solidity of the rotor (poor flow guidance). Although this rotor is restricted to a solidity of less than 1 at the blade hub, the aerodynamic blade chords could be increased toward the tip to obtain better flow guidance and the input design conditions.

The stator incidence angles associated with minimum loss are considerably different from the design values in the midspan portions of the stator blades. This difference probably results from the much lower than design pressure ratio of the rotor over the entire blade span and indicates a mismatch of the rotor and stator. This stage probably would benefit some by opening the stator blades approximately 5^{o}. However, it was considered that a change in stator setting angle alone would not be sufficient to enable the stage to meet its design pressure ratio since the rotor pressure ratio was considerably less than the design stage pressure ratio.

SUMMARY OF RESULTS

This report presents both the aerodynamic design parameters and the overall and blade-element performance of a low-pressure-ratio, low-tip-speed fan stage suitable for short-haul aircraft using the externally blown flap as a powered lift system. The fan was designed for low blade passing frequency noise, which resulted in some compromises in the aerodynamic design. Detailed radial surveys of the flow conditions in front of and behind the rotor and behind the stator were made over the stable operating flow range of the stage at rotative speeds from 90 to 120 percent of design speed. Flow and performance parameters were calculated across nine blade elements. The following principal results were obtained from this investigation:

1. For the rotor at design speed, the peak efficiency was 0.891, the pressure ratio 1.104, and the weight flow 32.2 kilograms per second. Design pressure ratio was 1.159, and the weight flow was 29.94 kilograms per second. Design energy input into the rotor was not achieved.

2. For the stage at design speed, the peak efficiency was 0.836, the pressure ratio 1.111, and the weight flow 30.27 kilograms per second. Design pressure ratio was 1.151, and the weight flow was 29.94 kilograms per second. A mismatch of the rotor and stator is indicated.

3. Stall margin for this stage at design speed is approximately 13 percent, based on weight flow and total pressure at peak efficiency and near stall.

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APPENDIX A

SYMBOLS

A_{an} annulus area at rotor leading edge, 0.171 m^2

A_f frontal area at rotor leading edge, 0.203 m^2

C_p specific heat at constant pressure, 1004 (J/kg) K

c aerodynamic chord, cm

D diffusion factor

g acceleration of gravity, 9.81 m/sec^2

i_{mc} mean incidence angle, angle between inlet air direction and line tangent to blade mean camber line at leading edge, deg

i_{ss} suction-surface incidence angle, angle between inlet air direction and line tangent to blade suction surface at leading edge, deg

J mechanical equivalent of heat

N rotative speed, rpm

P total pressure, N/cm^2

p static pressure, N/cm^2

r radius, cm

SM stall margin

T total temperature, K

U wheel speed, m/sec

V air velocity, m/sec

W weight flow, kg/sec

Z axial distance referenced from rotor blade hub leading edge, cm

α_c cone angle, deg

α_s slope of streamline, deg

β air angle, angle between air velocity and axial direction, deg

β_c' relative meridional air angle based on cone angle, arctan $(\tan \beta_m' \cos \alpha_c / \cos \alpha_s)$, deg

γ ratio of specific heats (1.40)

γ_b blade setting angle, deg

δ ratio of rotor inlet total pressure to standard pressure of 10.13 N/cm^2

δ^o deviation angle, angle between exit air direction and tangent to blade mean camber line at trailing edge, deg

η efficiency

θ ratio of rotor inlet total temperature to standard temperature of 288.2 K

κ_{mc} angle between blade mean camber line and meridional plane, deg

κ_{ss} angle between blade suction-surface camber line at leading edge and meridional plane, deg

σ solidity, ratio of chord to spacing

$\bar{\omega}$ total loss coefficient

$\bar{\omega}_p$ profile loss coefficient

$\bar{\omega}_s$ shock loss coefficient

Subscripts:

ad adiabatic (temperature rise)

id ideal

LE blade leading edge

m meridional direction

mom momentum-rise

p polytropic

r radial direction

ref reference

TE blade trailing edge

z axial direction

θ tangential direction

1 instrumentation plane upstream of rotor

2 instrumentation plane between rotor and stator

3 instrumentation plane downstream of stator

Superscript:

' relative to blade

APPENDIX B

EQUATIONS

Suction-surface incidence angle:

$$i_{ss} = (\beta_c')_{LE} - \kappa_{ss} \tag{B1}$$

Mean incidence angle:

$$i_{mc} = (\beta_c')_{LE} - (\kappa_{mc})_{LE} \tag{B2}$$

Deviation angle:

$$\delta^o = (\beta_c')_{TE} - (\kappa_{mc})_{TE} \tag{B3}$$

Diffusion factor:

$$D = 1 - \frac{V_{TE}'}{V_{LE}'} + \left| \frac{(rV_\theta)_{TE} - (rV_\theta)_{LE}}{(r_{TE} + r_{LE})\sigma(V_{LE}')} \right| \tag{B4}$$

Total loss coefficient:

$$\bar{\omega} = \frac{(P_{id}')_{TE} - P_{TE}'}{P_{LE}' - p_{LE}} \tag{B5}$$

Profile loss coefficient:

$$\bar{\omega}_p = \bar{\omega} - \bar{\omega}_s \tag{B6}$$

Total loss parameter:

$$\frac{\bar{\omega} \cos (\beta_m')_{TE}}{2\sigma} \tag{B7}$$

Profile loss parameter:

$$\frac{\bar{\omega}_p \cos (\beta'_m)_{TE}}{2\sigma} \tag{B8}$$

Adiabatic (temperature rise) efficiency:

$$\eta_{ad} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{T_{TE}}{T_{LE}} - 1} \tag{B9}$$

Momentum-rise efficiency:

$$\eta_{mom} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{(UV_\theta)_{TE} - (UV_\theta)_{LE}}{T_{LE} gJC_p}} \tag{B10}$$

Equivalent weight flow:

$$\frac{w\sqrt{\theta}}{\delta} \tag{B11}$$

Equivalent rotative speed:

$$\frac{N}{\sqrt{\theta}} \tag{B12}$$

Weight flow per unit annulus area:

$$\frac{\frac{w\sqrt{\theta}}{\delta}}{A_{an}} \tag{B13}$$

Weight flow per unit frontal area:

$$\frac{\frac{W\sqrt{\theta}}{\delta}}{A_f} \tag{B14}$$

Head-rise coefficient:

$$\frac{gJC_pT_{LE}}{U_{tip}^2}\left[\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1\right] \tag{B15}$$

Flow coefficient:

$$\left(\frac{V_z}{U_{tip}}\right)_{LE} \tag{B16}$$

Stall margin:

$$SM = \left[\frac{\left(\frac{P_{TE}}{P_{LE}}\right)_{stall}}{\left(\frac{P_{TE}}{P_{LE}}\right)_{ref}} \times \frac{\left(\frac{W\sqrt{\theta}}{\delta}\right)_{ref}}{\left(\frac{W\sqrt{\theta}}{\delta}\right)_{stall}} - 1\right] \times 100 \tag{B17}$$

Polytropic efficiency:

$$\eta_p = \frac{\ln\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma}}{\ln\left(\frac{T_{TE}}{T_{LE}}\right)} \tag{B18}$$

APPENDIX C

DEFINITIONS AND UNITS USED IN TABLES

ABS	absolute
AERO CHORD	aerodynamic chord, cm
BETAM	meridional air angle, deg
CHOKE MARGIN	ratio of actual flow area minus critical area to critical area (where local Mach number is 1)
CONE ANGLE	angle between axial direction and conical surface representing blade element, deg
DELTA INC	difference between mean camber blade angle and suction surface blade angle at leading edge, deg
DEV	deviation angle (defined by eq. (B3)), deg
D-FACT	diffusion factor (defined by eq. (B4))
EFF	adiabatic efficiency (defined by eq. (B9))
IN	inlet (leading edge of blade)
INCIDENCE	incidence angle (suction surface defined by eq. (B1) and mean surface by eq. (B2))
KIC	angle between blade mean camber line at leading edge and meridional plane, deg
KOC	angle between blade mean camber line at trailing edge and meridional plane, deg
KTC	angle between blade mean camber line at transition point and meridional plane, deg
LOSS COEFF	loss coefficient (total defined by eq. (B5) and profile by eq. (B6))
LOSS PARAM	loss parameter (total defined by eq. (B7) and profile by eq. (B8))
MERID	meridional
MERID VEL R	meridional velocity ratio
OUT	outlet (trailing edge of blade)
PERCENT SPAN	percent of blade span from tip at rotor outlet
PHISS	suction-surface camber ahead of assumed shock location, deg

PRESS	pressure, N/cm^2
PROF	profile
RADII	radius, cm
REL	relative to blade
RI	inlet radius (leading edge of blade), cm
RO	outlet radius (trailing edge of blade), cm
RP	radial position
RPM	equivalent rotative speed, rpm
SETTING ANGLE	angle between aerodynamic chord and meridional plane, deg
SOLIDITY	ratio of aerodynamic chord to blade spacing
SPEED	speed, m/sec
SS	suction surface
STREAMLINE SLOPE	slope of streamline, deg
TANG	tangential
TEMP	temperature, K
TI	thickness of blade at leading edge, cm
TM	thickness of blade at maximum thickness, cm
TO	thickness of blade at trailing edge, cm
TOT	total
TOTAL CAMBER	difference between inlet and outlet blade mean camber lines, deg
VEL	velocity, m/sec
WT FLOW	equivalent weight flow, kg/sec
X FACTOR	ratio of suction-surface camber ahead of assumed shock location of multiple-circular-arc blade section to that of double-circular-arc blade section
ZIC	axial distance to blade leading edge from inlet, cm
ZMC	axial distance to blade maximum thickness point from inlet, cm
ZOC	axial distance to blade trailing edge from inlet, cm
ZTC	axial distance to transition point from inlet, cm

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TABLE I. - DESIGN OVERALL PARAMETERS

FOR STOL FAN 51A

ROTOR TOTAL PRESSURE RATIO	1.159
STAGE TOTAL PRESSURE RATIO	1.151
ROTOR TOTAL TEMPERATURE RATIO	1.047
STAGE TOTAL TEMPERATURE RATIO	1.047
ROTOR ADIABATIC EFFICIENCY	0.909
STAGE ADIABATIC EFFICIENCY	0.863
ROTOR POLYTROPIC EFFICIENCY	0.911
STAGE POLYTROPIC EFFICIENCY	0.866
ROTOR HEAD RISE COEFFICIENT	0.210
STAGE HEAD RISE COEFFICIENT	0.199
FLOW COEFFICIENT	0.682
WT FLOW PER UNIT FRONTAL AREA	147.704
WT FLOW PER UNIT ANNULUS AREA	175.838
WT FLOW	29.937
RPM	9167.300
TIP SPEED	243.839

TABLE II. - DESIGN BLADE-ELEMENT PARAMETERS FOR ROTOR 51A

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	25.400	25.400	0.	24.5	55.2	48.9	288.2	1.058	10.14	1.184
1	24.648	24.638	-0.	24.6	54.4	47.5	288.2	1.057	10.14	1.183
2	23.872	23.876	0.	24.7	53.6	46.0	288.2	1.056	10.14	1.183
3	23.093	23.114	0.	24.9	52.7	44.5	288.2	1.055	10.14	1.182
4	20.744	20.828	0.	25.6	49.8	39.5	288.2	1.051	10.14	1.175
5	17.623	17.780	0.	27.2	45.6	31.6	288.2	1.046	10.14	1.159
6	14.545	14.732	0.	29.0	40.6	22.0	288.2	1.040	10.14	1.134
7	12.300	12.446	0.	30.1	36.3	14.1	288.2	1.034	10.14	1.111
8	11.569	11.684	0.	30.3	34.7	11.5	288.2	1.032	10.14	1.102
9	10.847	10.922	0.	30.4	33.0	8.9	288.2	1.030	10.14	1.092
HUB	10.160	10.160	-0.	30.4	31.4	6.3	288.2	1.028	10.14	1.083

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	169.2	167.4	296.8	231.6	169.2	152.3	0.	69.4	243.8	243.6
1	169.3	168.0	290.9	226.1	169.3	152.8	-0.	69.9	236.6	236.5
2	169.2	168.6	284.9	220.6	169.2	153.2	0.	70.5	229.2	229.2
3	169.1	169.1	278.8	215.1	169.1	153.4	0.	71.1	221.7	221.9
4	168.3	170.0	260.7	198.6	168.3	153.2	0.	73.6	199.1	199.9
5	166.0	170.0	237.0	177.5	166.0	151.2	0.	77.7	169.2	170.7
6	162.9	168.6	214.5	159.0	162.9	147.4	0.	81.8	139.6	141.4
7	160.9	166.2	199.6	148.2	160.9	143.7	0.	83.4	118.1	119.5
8	160.5	165.0	195.2	145.4	160.5	142.4	0.	83.2	111.1	112.2
9	160.2	163.6	191.1	142.8	160.2	141.1	0.	82.7	104.1	104.9
HUB	160.0	162.2	187.4	140.6	160.0	139.8	-0.	82.2	97.5	97.5

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	0.510	0.489	0.895	0.677	0.510	0.445	-0.26	-0.32	0.900	1.202
1	0.510	0.492	0.877	0.662	0.510	0.447	-0.10	-0.16	0.903	1.190
2	0.510	0.494	0.859	0.646	0.510	0.449	0.07	0.02	0.905	1.178
3	0.510	0.496	0.840	0.630	0.510	0.450	0.27	0.22	0.907	1.165
4	0.507	0.499	0.786	0.583	0.507	0.450	0.89	0.85	0.911	1.129
5	0.500	0.500	0.714	0.523	0.500	0.445	1.56	1.57	0.911	1.083
6	0.490	0.498	0.645	0.469	0.490	0.435	1.76	1.86	0.905	1.041
7	0.484	0.492	0.600	0.438	0.484	0.425	1.35	1.52	0.893	1.007
8	0.483	0.488	0.587	0.430	0.483	0.422	1.06	1.23	0.887	0.994
9	0.482	0.485	0.574	0.423	0.482	0.418	0.71	0.85	0.881	0.981
HUB	0.481	0.481	0.563	0.417	0.481	0.414	0.36	0.47	0.874	0.968

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	0.	3.1	-1.5	5.3	0.454	0.845	0.073	0.073	0.048	0.048
1	5.00	3.2	-1.5	5.4	0.459	0.864	0.065	0.065	0.043	0.043
2	10.00	3.3	-1.7	5.5	0.464	0.881	0.057	0.057	0.038	0.038
3	15.00	3.4	-2.0	5.6	0.469	0.895	0.051	0.051	0.034	0.034
4	30.00	3.7	-4.0	6.1	0.486	0.928	0.037	0.037	0.025	0.025
5	50.00	4.2	-7.7	6.7	0.508	0.939	0.032	0.032	0.021	0.021
6	70.00	4.7	-11.2	7.2	0.519	0.918	0.045	0.045	0.028	0.028
7	85.00	5.1	-12.7	7.1	0.507	0.684	0.062	0.062	0.036	0.036
8	90.00	5.2	-12.9	6.9	0.497	0.869	0.069	0.069	0.038	0.038
9	95.00	5.4	-12.9	6.6	0.485	0.852	0.075	0.075	0.040	0.040
HUB	100.00	5.5	-13.0	6.3	0.471	0.830	0.082	0.082	0.041	0.041

TABLE III. - DESIGN BLADE-ELEMENT PARAMETERS FOR STATOR 51

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	25.400	25.400	23.4	-0.	23.4	-0.	305.1	1.000	12.00	0.993
1	24.595	24.607	23.5	0.	23.5	0.	304.6	1.000	11.99	0.994
2	23.861	23.887	23.7	-0.	23.7	-0.	304.3	1.000	11.99	0.994
3	23.130	23.169	23.9	-0.	23.9	-0.	303.9	1.000	11.98	0.994
4	20.924	21.000	24.7	-0.	24.7	-0.	302.8	1.000	11.91	0.994
5	17.964	18.089	26.6	-0.	26.6	-0.	301.4	1.000	11.74	0.993
6	14.953	15.117	29.1	-0.	29.1	-0.	299.7	1.000	11.50	0.992
7	12.651	12.792	30.8	-0.	30.8	-0.	298.1	1.000	11.26	0.990
8	11.873	11.971	31.1	-0.	31.1	-0.	297.5	1.000	11.17	0.989
9	11.090	11.128	31.4	-0.	31.4	-0.	296.9	1.000	11.07	0.987
HUB	10.160	10.160	31.6	0.	31.6	0.	296.0	1.000	10.96	0.986

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	174.7	161.8	174.7	161.8	160.3	161.8	69.5	-0.	0.	0.
1	175.3	161.7	175.3	161.7	160.7	161.7	70.0	0.	0.	0.
2	175.7	161.5	175.7	161.5	160.9	161.5	70.5	-0.	0.	0.
3	175.8	161.0	175.8	161.0	160.8	161.0	71.1	-0.	0.	0.
4	175.2	158.4	175.2	158.4	159.1	158.4	73.2	-0.	0.	0.
5	171.7	151.7	171.7	151.7	153.6	151.7	76.9	-0.	0.	0.
6	165.8	140.8	165.8	140.8	144.9	140.8	80.6	-0.	0.	0.
7	160.2	128.1	160.2	128.1	137.6	128.1	82.1	-0.	0.	0.
8	158.4	122.3	158.4	122.3	135.5	122.3	81.9	-0.	0.	0.
9	156.5	115.6	156.5	115.6	133.6	115.6	81.5	-0.	0.	0.
HUB	154.3	107.8	154.3	107.8	131.4	107.8	81.0	0.	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	0.512	0.472	0.512	0.472	0.470	0.472	-0.07	-0.03	1.010	0.850
1	0.514	0.472	0.514	0.472	0.471	0.472	0.09	0.13	1.006	0.884
2	0.515	0.472	0.515	0.472	0.472	0.472	0.24	0.27	1.004	0.898
3	0.516	0.471	0.516	0.471	0.472	0.471	0.38	0.40	1.001	0.891
4	0.515	0.464	0.515	0.464	0.468	0.464	0.78	0.80	0.995	0.896
5	0.506	0.444	0.506	0.444	0.452	0.444	1.28	1.28	0.988	0.897
6	0.489	0.412	0.489	0.412	0.427	0.412	1.67	1.60	0.971	0.889
7	0.473	0.375	0.473	0.375	0.406	0.375	1.44	1.31	0.931	0.874
8	0.468	0.358	0.468	0.358	0.401	0.358	1.02	0.91	0.902	0.866
9	0.463	0.338	0.463	0.338	0.395	0.338	0.44	0.35	0.865	0.858
HUB	0.457	0.316	0.457	0.316	0.389	0.316	-0.26	-0.31	0.820	0.847

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	0.	9.2	0.0	4.1	0.274	0.	0.040	0.040	0.020	0.020
1	5.00	9.2	-0.0	4.1	0.272	0.	0.038	0.038	0.019	0.019
2	10.00	9.2	-0.0	4.0	0.271	0.	0.038	0.038	0.018	0.018
3	15.00	9.2	0.0	4.0	0.270	0.	0.037	0.037	0.017	0.017
4	30.00	9.2	-0.0	4.0	0.269	0.	0.038	0.038	0.016	0.016
5	50.00	9.2	-0.0	4.1	0.276	0.	0.045	0.045	0.016	0.016
6	70.00	9.1	-0.0	4.3	0.295	0.	0.056	0.056	0.017	0.017
7	85.00	9.1	0.0	4.2	0.329	0.	0.072	0.072	0.018	0.018
8	90.00	9.1	0.0	4.1	0.350	0.	0.081	0.081	0.019	0.019
9	95.00	9.1	0.0	4.0	0.376	0.	0.092	0.092	0.020	0.020
HUB	100.00	9.1	0.0	3.9	0.407	0.	0.105	0.105	0.021	0.021

TABLE IV. - BLADE GEOMETRY FOR ROTOR 51A

RP	PERCENT SPAN	RADII RI	RO	BLADE ANGLES KIC	KTC	KOC	DELTA INC	CONE ANGLE
TIP	0.	25.400	25.400	52.15	47.86	[illegible]	4.59	0.057
1	5.	24.648	24.638	51.23	46.66	43.09	4.69	-0.130
2	10.	23.872	23.876	50.26	45.38	40.50	4.96	0.057
3	15.	23.093	23.114	49.26	44.06	38.86	5.43	0.258
4	30.	20.744	20.828	46.06	39.75	33.43	7.72	0.997
5	50.	17.623	17.780	41.34	[illegible]	24.87	11.89	1.805
6	70.	14.545	14.732	35.92	[illegible]	14.83	15.84	2.090
7	85.	12.500	12.446	31.20	[illegible]	7.05	17.75	1.619
8	90.	11.569	11.684	29.46	[illegible]	4.63	18.09	1.274
9	95.	10.847	10.922	27.65	14.98	2.31	18.29	0.834
HUB	100.	10.160	10.160	25.91	13.02	0.01	18.46	0.057

RP	BLADE THICKNESSES TI	TM	TO	AXIAL DIMENSIONS ZI	ZMC	ZTC	ZO
TIP	0.066	0.330	0.066	0.353	2.496	2.496	4.820
1	0.064	0.330	0.064	0.330	2.496	2.496	4.851
2	0.068	0.348	0.068	0.304	2.495	2.495	4.882
3	0.077	0.380	0.077	0.277	2.494	2.494	4.911
4	0.099	0.521	0.099	0.197	2.488	2.488	4.994
5	0.151	0.765	0.149	0.102	2.485	2.485	5.096
6	0.195	0.978	0.196	0.030	2.488	2.488	5.163
7	0.211	1.057	0.211	0.002	2.495	2.495	5.170
8	0.213	1.064	0.213	-0.001	2.498	2.498	5.163
9	0.212	1.062	0.213	-0.001	2.501	2.501	5.150
HUB	0.212	1.060	0.212	0.000	2.504	2.504	5.138

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	X FACTOR	PHISS	CHOKE MARGIN
TIP	6.627	47.87	8.53	0.498	1.000	8.88	0.
1	6.559	46.66	9.15	0.508	1.000	9.26	-0.
2	6.489	45.38	9.76	0.519	1.000	9.84	0.
3	6.419	44.06	10.40	0.531	1.000	10.63	0.
4	6.211	39.75	12.63	0.571	1.000	14.03	0.210
5	5.937	33.11	16.46	0.641	1.000	20.12	0.206
6	5.665	25.40	21.09	0.739	1.000	26.39	0.196
7	5.460	19.14	24.17	0.843	1.000	29.83	0.182
8	5.393	17.06	24.83	[illegible]	1.000	30.50	0.172
9	5.326	14.99	25.33	0.954	1.000	30.95	0.160
HUB	5.267	12.99	25.90	0.990	1.000	31.36	0.148

TABLE V. - BLADE GEOMETRY FOR STATOR 51

RP	PERCENT SPAN	RADII RI	RO	BLADE ANGLES KIC	KTC	KOC	DELTA INC	CONE ANGLE
TIP	0.	25.400	25.400	14.23	5.05	-4.13	9.21	0.057
1	5.	24.595	24.607	14.32	5.12	-4.08	9.21	0.144
2	10.	23.861	23.887	14.46	5.21	-4.04	9.21	0.306
3	15.	23.130	23.169	14.64	5.31	-4.02	9.21	0.448
4	30.	20.924	21.000	15.52	5.76	-4.01	9.19	0.885
5	50.	17.964	18.089	17.43	6.65	-4.12	9.17	1.459
6	70.	14.953	15.117	19.96	7.85	-4.26	9.13	1.913
7	85.	12.651	12.792	21.69	8.74	-4.21	9.11	1.644
8	90.	11.873	11.971	22.02	8.95	-4.13	9.11	1.143
9	95.	11.090	11.128	22.24	9.12	-4.00	9.12	0.442
HUB	100.	10.160	10.160	22.50	9.33	-3.85	9.13	0.057

RP	BLADE THICKNESSES TI	TM	TO	AXIAL DIMENSIONS ZI	ZMC	ZTC	ZO
TIP	0.099	0.495	0.099	25.466	27.912	27.912	30.393
1	0.099	0.495	0.099	25.469	27.914	27.914	30.395
2	0.099	0.495	0.099	25.470	27.914	27.914	30.395
3	0.099	0.495	0.099	25.469	27.913	27.913	30.394
4	0.099	0.495	0.099	25.472	27.911	27.911	30.392
5	0.099	0.495	0.099	25.480	27.910	27.910	30.392
6	0.099	0.495	0.099	25.493	27.908	27.908	30.393
7	0.099	0.495	0.099	25.504	27.907	27.907	30.393
8	0.099	0.495	0.099	25.507	27.907	27.907	30.393
9	0.099	0.495	0.099	25.509	27.907	27.907	30.393
HUB	0.099	0.494	0.099	25.511	27.907	27.907	30.393

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	X FACTOR	PHISS	CHOKE MARGIN
TIP	4.945	5.05	18.37	0.992	1.000	18.40	0.272
1	4.945	5.12	18.40	1.024	1.000	18.41	0.265
2	4.945	5.21	18.50	1.055	1.000	18.46	0.260
3	4.945	5.32	18.66	1.088	1.000	18.54	0.257
4	4.945	5.76	19.53	1.202	1.000	18.96	0.252
5	4.946	6.67	21.55	1.397	1.000	19.94	0.259
6	4.948	7.87	24.22	1.676	1.000	21.24	0.281
7	4.947	8.76	25.90	1.981	1.000	22.06	0.305
8	4.946	8.97	26.15	2.113	1.000	22.19	0.300
9	4.946	9.13	26.24	2.267	1.000	22.24	0.288
HUB	4.946	9.32	26.35	2.479	1.000	22.31	0.274

TABLE VI. - OVERALL PERFORMANCE FOR STAGE 51A

(a) Percent of design speed, 100

	Reading				
	1532	1400	1402	1404	1405
ROTOR TOTAL PRESSURE RATIO	1.058	1.104	1.119	1.127	1.125
STAGE TOTAL PRESSURE RATIO	1.040	1.096	1.111	1.117	1.114
ROTOR TOTAL TEMPERATURE RATIO	1.022	1.032	1.037	1.041	1.044
STAGE TOTAL TEMPERATURE RATIO	1.021	1.032	1.037	1.040	1.042
ROTOR TEMP. RISE EFFICIENCY	0.749	0.891	0.881	0.848	0.779
STAGE TEMP. RISE EFFICIENCY	0.529	0.828	0.836	0.802	0.741
ROTOR MOMENTUM RISE EFFICIENCY	0.770	0.877	0.859	0.829	0.745
ROTOR HEAD RISE COEFFICIENT	0.079	0.139	0.157	0.168	0.167
STAGE HEAD RISE COEFFICIENT	0.055	0.128	0.147	0.156	0.151
FLOW COEFFICIENT	0.857	0.740	0.677	0.621	0.572
WT FLOW PER UNIT FRONTAL AREA	171.66	159.04	149.35	139.07	130.25
WT FLOW PER UNIT ANNULUS AREA	204.36	189.33	177.80	165.56	155.06
WT FLOW AT ORIFICE	34.79	32.23	30.27	28.19	26.40
WT FLOW AT ROTOR INLET	35.00	31.89	29.97	27.91	26.10
WT FLOW AT ROTOR OUTLET	34.98	32.16	30.20	28.22	26.56
WT FLOW AT STATOR OUTLET	35.12	32.29	30.32	28.24	26.55
ROTATIVE SPEED	9174.4	9213.9	9233.3	9188.1	9186.3
PERCENT OF DESIGN SPEED	100.1	100.5	100.7	100.2	100.2

(b) Percent of design speed, 90

	Reading				
	1540	1411	1412	1413	1415
ROTOR TOTAL PRESSURE RATIO	1.052	1.080	1.090	1.100	1.102
STAGE TOTAL PRESSURE RATIO	1.038	1.072	1.084	1.093	1.094
ROTOR TOTAL TEMPERATURE RATIO	1.017	1.023	1.027	1.031	1.035
STAGE TOTAL TEMPERATURE RATIO	1.014	1.024	1.027	1.031	1.035
ROTOR TEMP. RISE EFFICIENCY	0.842	0.952	0.930	0.886	0.798
STAGE TEMP. RISE EFFICIENCY	0.775	0.847	0.850	0.817	0.745
ROTOR MOMENTUM RISE EFFICIENCY	0.809	0.902	0.896	0.857	0.751
ROTOR HEAD RISE COEFFICIENT	0.088	0.133	0.150	0.165	0.169
STAGE HEAD RISE COEFFICIENT	0.065	0.121	0.140	0.153	0.155
FLOW COEFFICIENT	0.917	0.754	0.697	0.632	0.556
WT FLOW PER UNIT FRONTAL AREA	167.61	149.12	140.22	129.86	116.52
WT FLOW PER UNIT ANNULUS AREA	199.54	177.53	166.93	154.60	138.71
WT FLOW AT ORIFICE	33.97	30.22	28.42	26.32	23.62
WT FLOW AT ROTOR INLET	34.18	29.87	28.08	25.98	23.32
WT FLOW AT ROTOR OUTLET	34.04	30.12	28.38	26.32	23.73
WT FLOW AT STATOR OUTLET	34.05	30.19	28.44	26.28	23.80
ROTATIVE SPEED	8245.7	8259.4	8244.7	8263.0	8267.3
PERCENT OF DESIGN SPEED	89.9	90.1	89.9	90.1	90.2

TABLE VI. - Concluded. OVERALL PERFORMANCE FOR STAGE 51A

(c) Percent of design speed, 110

	Reading				
	1533	1534	1418	1420	1421
ROTOR TOTAL PRESSURE RATIO	1.069	1.118	1.140	1.161	1.161
STAGE TOTAL PRESSURE RATIO	1.046	1.107	1.128	1.147	1.146
ROTOR TOTAL TEMPERATURE RATIO	1.027	1.039	1.044	1.051	1.052
STAGE TOTAL TEMPERATURE RATIO	1.028	1.036	1.044	1.051	1.052
ROTOR TEMP. RISE EFFICIENCY	0.702	0.829	0.875	0.852	0.836
STAGE TEMP. RISE EFFICIENCY	0.466	0.816	0.796	0.788	0.769
ROTOR MOMENTUM RISE EFFICIENCY	0.683	0.805	0.843	0.823	0.800
ROTOR HEAD RISE COEFFICIENT	0.077	0.130	0.153	0.174	0.174
STAGE HEAD RISE COEFFICIENT	0.052	0.118	0.141	0.160	0.159
FLOW COEFFICIENT	0.803	0.744	0.694	0.631	0.605
WT FLOW PER UNIT FRONTAL AREA	174.36	166.59	161.68	151.19	146.56
WT FLOW PER UNIT ANNULUS AREA	207.57	198.32	192.48	179.99	174.48
WT FLOW AT ORIFICE	35.34	33.76	32.77	30.64	29.71
WT FLOW AT ROTOR INLET	35.59	34.03	32.55	30.44	29.50
WT FLOW AT ROTOR OUTLET	35.66	34.08	33.05	30.93	29.98
WT FLOW AT STATOR OUTLET	35.68	34.14	32.89	30.75	29.81
ROTATIVE SPEED	10075.9	10090.0	10111.9	10119.7	10130.3
PERCENT OF DESIGN SPEED	109.9	110.1	110.3	110.4	110.5

(d) Percent of design speed, 120

	Reading			
	1538	1537	1536	1535
ROTOR TOTAL PRESSURE RATIO	1.084	1.138	1.172	1.190
STAGE TOTAL PRESSURE RATIO	1.069	1.124	1.155	1.169
ROTOR TOTAL TEMPERATURE RATIO	1.036	1.050	1.061	1.067
STAGE TOTAL TEMPERATURE RATIO	1.032	1.045	1.055	1.062
ROTOR TEMP. RISE EFFICIENCY	0.640	0.754	0.761	0.761
STAGE TEMP. RISE EFFICIENCY	0.593	0.751	0.759	0.740
ROTOR MOMENTUM RISE EFFICIENCY	0.612	0.735	0.743	0.735
ROTOR HEAD RISE COEFFICIENT	0.079	0.128	0.157	0.173
STAGE HEAD RISE COEFFICIENT	0.065	0.116	0.142	0.155
FLOW COEFFICIENT	0.760	0.706	0.649	0.599
WT FLOW PER UNIT FRONTAL AREA	176.98	168.98	159.97	151.10
WT FLOW PER UNIT ANNULUS AREA	210.70	201.17	190.44	179.88
WT FLOW AT ORIFICE	35.87	34.25	32.42	30.63
WT FLOW AT ROTOR INLET	36.17	34.6[illegible]	32.90	31.11
WT FLOW AT ROTOR OUTLET	36.16	34.83	32.98	31.19
WT FLOW AT STATOR OUTLET	36.15	34.47	32.79	31.31
ROTATIVE SPEED	10976.0	10980.1	10996.3	10996.8
PERCENT OF DESIGN SPEED	119.7	119.8	120.0	120.0

TABLE VII. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

ROTOR 51A. 100 PERCENT DESIGN SPEED

(a) Reading 1532

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	8.2	49.0	46.9	288.9	1.023	10.05	1.061
2	23.871	23.876	0.0	8.0	47.5	45.4	288.7	1.023	10.13	1.061
3	23.094	23.114	-0.0	7.5	46.4	44.6	288.5	1.022	10.14	1.061
4	20.744	20.828	-0.0	8.4	43.0	40.4	288.1	1.021	10.14	1.059
5	17.623	17.780	-0.0	10.4	38.7	33.5	287.9	1.023	10.14	1.061
6	14.544	14.732	-0.0	12.0	34.0	26.1	287.8	1.022	10.14	1.058
7	12.299	12.446	-0.0	13.4	30.0	20.4	287.8	1.018	10.14	1.042
8	11.570	11.684	0.0	14.0	28.6	17.9	287.7	1.018	10.14	1.041
9	10.846	10.922	-0.0	15.7	27.6	14.3	287.8	1.019	10.07	1.048

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	206.4	197.7	314.3	286.1	206.4	195.7	0.0	28.2	237.0	236.9
2	210.1	200.7	311.1	283.1	210.1	198.8	0.0	27.8	229.4	229.4
3	211.0	200.4	306.0	279.0	211.0	198.7	-0.0	26.0	221.6	221.8
4	213.9	202.6	292.3	263.2	213.9	200.4	-0.0	29.5	199.3	200.1
5	211.3	205.4	270.7	242.2	211.3	202.0	-0.0	37.2	169.3	170.8
6	207.4	206.5	250.2	224.9	207.4	202.0	-0.0	42.8	139.9	141.7
7	205.3	201.8	237.0	209.4	205.3	196.3	-0.0	46.9	118.3	119.8
8	203.6	202.0	231.9	205.9	203.6	196.0	0.0	48.9	111.1	112.2
9	199.1	203.0	224.7	201.7	199.1	195.4	-0.0	54.9	104.0	104.7

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.629	0.594	0.958	0.859	0.629	0.588	0.948	1.098
2	0.642	0.604	0.950	0.851	0.642	0.598	0.946	1.082
3	0.645	0.603	0.936	0.839	0.645	0.598	0.942	1.074
4	0.655	0.611	0.895	0.793	0.655	0.604	0.937	1.062
5	0.647	0.620	0.829	0.731	0.647	0.610	0.956	1.060
6	0.634	0.624	0.765	0.679	0.634	0.610	0.974	1.061
7	0.627	0.610	0.724	0.632	0.627	0.593	0.956	1.059
8	0.621	0.610	0.708	0.622	0.621	0.592	0.963	1.054
9	0.607	0.613	0.684	0.609	0.607	0.590	0.981	1.043

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-2.3	-7.0	4.8	0.178	0.750	0.043	0.043	0.029	0.029
2	10.00	-2.8	-7.7	4.9	0.176	0.758	0.042	0.042	0.029	0.028
3	15.00	-2.9	-8.3	5.7	0.169	0.757	0.043	0.043	0.029	0.029
4	30.00	-3.1	-10.8	7.0	0.188	0.776	0.040	0.040	0.027	0.027
5	50.00	-2.6	-14.5	8.6	0.213	0.760	0.051	0.051	0.033	0.033
6	70.00	-1.9	-17.8	11.2	0.218	0.748	0.058	0.058	0.035	0.035
7	85.00	-1.2	-19.0	13.3	0.235	0.648	0.074	0.074	0.041	0.041
8	90.00	-0.8	-18.9	13.3	0.232	0.629	0.081	0.081	0.044	0.044
9	95.00	-0.1	-18.4	12.0	0.234	0.698	0.074	0.074	0.038	0.038

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 100 PERCENT DESIGN SPEED

(b) Reading 1400

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	16.9	52.5	47.4	289.1	1.040	10.07	[illegible]
2	23.871	23.876	-0.0	15.6	51.3	45.7	289.0	1.039	10.13	[illegible]
3	23.094	23.114	-0.0	16.0	50.4	44.5	288.7	1.038	10.14	1.128
4	20.744	20.828	0.0	16.4	47.2	40.6	287.9	1.035	10.14	1.115
5	17.623	17.780	0.0	16.7	42.9	35.3	287.8	1.030	10.14	1.096
6	14.544	14.732	-0.0	17.4	38.2	28.8	287.7	1.026	10.14	1.079
7	12.299	12.446	0.0	19.6	34.1	21.1	287.9	1.024	10.14	1.075
8	11.570	11.684	0.0	20.5	32.6	17.6	288.3	1.024	10.14	1.078
9	10.846	10.922	-0.0	24.2	31.2	13.0	287.9	1.026	10.10	1.066

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	181.7	178.1	298.9	251.8	181.7	170.4	0.0	51.9	237.3	237.2
2	184.1	182.9	294.3	252.2	184.1	176.2	-0.0	49.1	229.5	229.6
3	183.7	182.4	288.3	245.8	183.7	175.3	-0.0	50.2	222.2	222.4
4	184.7	181.3	271.7	229.1	184.7	174.0	0.0	51.1	199.3	200.1
5	182.2	177.3	248.9	208.1	182.2	169.8	0.0	50.9	169.5	171.1
6	178.3	172.8	226.9	188.1	178.3	164.9	-0.0	51.7	140.4	142.2
7	175.8	172.0	212.2	173.8	175.8	162.1	0.0	57.6	118.8	120.2
8	175.6	175.2	208.5	172.1	175.6	164.0	0.0	61.4	112.4	113.5
9	173.9	170.9	203.4	159.9	173.9	155.8	-0.0	70.2	105.5	106.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.549	0.526	0.903	0.744	0.549	0.504	0.938	1.164
2	0.557	0.542	0.890	0.747	0.557	0.522	0.957	1.148
3	0.556	0.541	0.872	0.729	0.556	0.520	0.954	1.140
4	0.560	0.539	0.824	0.681	0.560	0.517	0.942	1.108
5	0.552	0.528	0.754	0.620	0.552	0.506	0.932	1.077
6	0.540	0.515	0.687	0.560	0.540	0.491	0.925	1.051
7	0.531	0.513	0.641	0.518	0.531	0.483	0.922	1.028
8	0.530	0.522	0.630	0.513	0.530	0.489	0.934	1.022
9	0.525	0.509	0.614	0.476	0.525	0.464	0.896	1.012

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.3	-3.4	5.3	0.328	0.856	0.047	0.047	0.031	0.031
2	10.00	1.0	-4.0	5.2	0.304	0.921	0.025	0.025	0.017	0.017
3	15.00	1.2	-4.3	5.6	0.312	0.933	0.022	0.022	0.015	0.015
4	30.00	1.1	-6.6	7.2	0.322	0.910	0.029	0.029	0.020	0.020
5	50.00	1.6	-10.3	10.4	0.324	0.893	0.034	0.034	0.022	0.022
6	70.00	2.3	-13.6	13.9	0.326	0.852	0.048	0.048	0.029	0.029
7	85.00	2.8	-14.9	14.1	0.343	0.872	0.043	0.043	0.024	0.024
8	90.00	3.2	-14.9	13.0	0.342	0.890	0.039	0.039	0.021	0.021
9	95.00	3.6	-14.7	10.7	0.399	0.707	0.116	0.116	0.060	0.060

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 100 PERCENT DESIGN SPEED

(c) Reading 1402

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	22.2	53.2	48.8	[illegible]	1.048	10.07	1.140
2	23.871	23.876	0.0	19.7	53.9	46.7	288.9	1.045	10.13	1.149
3	23.094	23.114	0.0	19.3	52.9	45.5	288.6	1.044	10.14	1.146
4	20.744	20.828	0.0	20.1	49.7	41.7	287.9	1.040	10.14	1.131
5	17.623	17.780	0.0	20.5	45.5	36.2	287.8	1.034	10.14	1.110
6	14.544	14.732	0.0	21.8	40.7	28.8	287.8	1.029	10.14	1.093
7	12.299	12.446	0.0	23.4	36.4	20.7	287.9	1.027	10.14	1.088
8	11.570	11.684	0.0	24.2	34.8	17.1	287.9	1.026	10.14	1.088
9	10.846	10.922	0.0	28.5	33.4	13.0	287.9	1.027	10.10	1.068

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	165.9	166.2	290.7	233.7	165.9	153.9	0.0	62.7	238.7	238.6
2	168.6	172.9	285.9	237.5	168.6	162.9	0.0	58.2	231.0	231.0
3	168.8	172.2	279.9	231.4	168.8	162.1	0.0	58.2	223.2	223.4
4	170.0	170.6	262.9	214.6	170.0	160.2	0.0	58.6	200.6	201.4
5	167.5	165.9	238.9	192.5	167.5	155.3	0.0	58.2	170.4	171.9
6	163.4	161.8	215.6	171.4	163.4	150.3	0.0	60.0	140.7	142.5
7	160.9	161.8	200.0	158.7	160.9	148.5	0.0	64.3	118.8	120.2
8	160.5	163.5	195.5	156.0	160.5	149.1	0.0	67.1	111.7	112.8
9	159.1	155.0	190.5	139.8	159.1	136.2	0.0	74.1	104.8	105.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.499	0.487	0.874	0.686	0.499	0.451	0.928	1.210
2	0.508	0.509	0.861	0.699	0.508	0.480	0.966	1.190
3	0.508	0.508	0.843	0.682	0.508	0.478	0.960	1.176
4	0.513	0.504	0.793	0.634	0.513	0.473	0.942	1.137
5	0.505	0.491	0.720	0.570	0.505	0.460	0.927	1.092
6	0.492	0.480	0.649	0.508	0.492	0.446	0.919	1.049
7	0.484	0.480	0.602	0.471	0.484	0.441	0.923	1.013
8	0.483	0.486	0.588	0.463	0.483	0.443	0.929	1.000
9	0.478	0.459	0.573	0.414	0.478	0.403	0.856	0.985

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.0	-0.7	6.7	0.408	0.787	0.087	0.087	0.056	0.056
2	10.00	3.6	-1.4	6.2	0.365	0.894	0.042	0.042	0.028	0.028
3	15.00	3.6	-1.8	6.7	0.369	0.902	0.039	0.039	0.025	0.025
4	30.00	3.7	-4.1	8.3	0.379	0.905	0.037	0.037	0.024	0.024
5	50.00	4.1	-7.7	11.3	0.385	0.888	0.044	0.044	0.028	0.028
6	70.00	4.8	-11.1	13.9	0.394	0.894	0.042	0.042	0.025	0.025
7	85.00	5.2	-12.5	13.6	0.398	0.912	0.037	0.037	0.020	0.020
8	90.00	5.4	-12.7	12.4	0.397	0.928	0.031	0.031	0.017	0.017
9	95.00	5.7	-12.6	10.7	0.475	0.704	0.136	0.136	0.071	0.071

TABLE VII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 100 PERCENT DESIGN SPEED

(d) Reading 1404

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	28.7	57.8	50.7	288.9	1.056	10.08	1.141
2	23.871	23.876	0.0	23.8	56.3	47.8	288.8	1.051	10.13	1.153
3	23.094	23.114	0.0	23.2	55.3	46.2	288.4	1.049	10.13	1.154
4	20.744	20.828	-0.0	23.4	52.2	42.4	288.0	1.044	10.14	1.140
5	17.623	17.780	-0.0	24.0	47.9	36.7	287.9	1.037	10.14	1.120
6	14.544	14.732	-0.0	24.9	43.1	29.2	287.9	1.031	10.14	1.100
7	12.299	12.446	0.0	26.5	38.8	20.7	287.9	1.028	10.14	1.095
8	11.570	11.684	0.0	27.3	37.1	17.1	288.0	1.027	10.14	1.092
9	10.846	10.922	0.0	32.0	35.6	13.0	288.0	1.028	10.11	1.074

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	149.8	153.1	280.9	212.0	149.8	134.3	0.0	73.5	237.6	237.5
2	153.0	162.5	276.1	221.5	153.0	148.7	0.0	65.6	229.8	229.8
3	153.6	164.4	269.9	218.2	153.6	151.1	0.0	64.7	222.0	222.2
4	155.0	162.2	252.8	201.6	155.0	148.8	-0.0	64.5	199.8	200.6
5	153.1	157.4	228.4	179.2	153.1	143.8	-0.0	64.0	169.5	171.0
6	149.4	152.5	204.5	158.4	149.4	138.3	-0.0	64.3	139.7	141.5
7	147.4	152.8	189.0	146.2	147.4	136.8	0.0	68.1	118.4	119.8
8	147.2	153.3	184.6	142.6	147.2	136.2	0.0	70.4	111.3	112.4
9	145.6	144.8	179.1	126.1	145.6	122.9	0.0	76.6	104.3	105.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.448	0.446	0.841	0.618	0.448	0.391	0.897	1.238
2	0.459	0.476	0.827	0.648	0.459	0.435	0.972	1.214
3	0.461	0.482	0.810	0.640	0.461	0.443	0.984	1.197
4	0.465	0.477	0.759	0.593	0.465	0.438	0.960	1.153
5	0.460	0.464	0.686	0.529	0.460	0.424	0.939	1.096
6	0.448	0.451	0.613	0.468	0.448	0.409	0.926	1.040
7	0.442	0.452	0.567	0.433	0.442	0.405	0.928	0.999
8	0.441	0.454	0.553	0.422	0.441	0.403	0.925	0.982
9	0.436	0.427	0.537	0.372	0.436	0.363	0.844	0.964

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.5	1.9	8.6	0.503	0.686	0.154	0.154	0.096	0.096
2	10.00	6.1	1.1	7.3	0.427	0.806	0.091	0.091	0.059	0.059
3	15.00	6.1	0.6	7.3	0.417	0.856	0.067	0.067	0.044	0.044
4	30.00	6.1	-1.6	9.0	0.426	0.866	0.062	0.062	0.040	0.040
5	50.00	6.6	-5.3	11.8	0.435	0.892	0.050	0.050	0.031	0.031
6	70.00	7.2	-8.7	14.3	0.440	0.899	0.047	0.047	0.028	0.028
7	85.00	7.6	-10.2	13.7	0.441	0.946	0.026	0.026	0.014	0.014
8	90.00	7.6	-10.5	12.5	0.444	0.933	0.033	0.033	0.018	0.018
9	95.00	8.0	-10.3	10.7	0.526	0.728	0.146	0.146	0.076	0.076

TABLE VII. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 100 PERCENT DESIGN SPEED

(e) READING 1405

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	43.5	60.2	53.0	288.8	1.069	10.09	1.122
2	23.871	23.876	0.0	33.8	58.9	49.9	288.7	1.060	10.13	1.125
3	23.094	23.114	0.0	27.6	58.0	46.9	288.5	1.055	10.13	1.140
4	20.744	20.828	0.0	25.7	54.6	41.8	288.0	1.048	10.14	1.147
5	17.623	17.780	0.0	25.7	50.0	36.3	287.9	1.039	10.14	1.128
6	14.544	14.732	0.0	26.5	44.9	28.8	287.9	1.032	10.14	1.107
7	12.299	12.446	0.0	28.1	40.5	20.5	287.9	1.029	10.14	1.099
8	11.570	11.684	0.0	29.1	38.9	16.6	288.0	1.028	10.14	1.097
9	10.846	10.922	0.0	33.7	37.4	12.5	287.9	1.029	10.11	1.079

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	135.8	143.7	273.5	173.3	135.8	104.3	-0.0	98.9	237.5	237.4
2	138.4	149.1	268.4	192.4	138.4	124.0	0.0	82.9	229.9	230.0
3	138.5	157.7	261.6	204.4	138.5	139.8	0.0	72.9	221.9	222.1
4	141.6	161.3	244.5	194.9	141.6	145.3	0.0	70.1	199.3	200.1
5	141.9	156.2	221.0	174.7	141.9	140.8	0.0	67.6	169.5	171.0
6	140.1	150.7	197.8	153.9	140.1	134.8	0.0	67.3	139.7	141.5
7	138.4	149.3	182.1	140.6	138.4	131.7	0.0	70.5	118.4	119.8
8	138.2	150.5	177.5	137.2	138.2	131.5	0.0	73.2	111.4	112.5
9	136.8	142.1	172.0	121.1	136.8	118.3	0.0	78.8	104.4	105.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.405	0.415	0.816	0.500	0.405	0.301	0.768	1.270
2	0.413	0.433	0.801	0.559	0.413	0.360	0.896	1.247
3	0.414	0.460	0.781	0.597	0.414	0.408	1.009	1.227
4	0.424	0.473	0.731	0.572	0.424	0.426	1.026	1.170
5	0.425	0.460	0.661	0.514	0.425	0.415	0.992	1.105
6	0.419	0.444	0.592	0.454	0.419	0.398	0.962	1.041
7	0.414	0.441	0.545	0.415	0.414	0.389	0.951	0.993
8	0.413	0.445	0.531	0.406	0.413	0.389	0.951	0.975
9	0.409	0.419	0.514	0.357	0.409	0.349	0.865	0.955

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	9.0	4.3	10.9	0.722	0.482	0.318	0.318	0.188	0.188
2	10.00	8.7	3.7	9.4	0.581	0.570	0.240	0.240	0.149	0.149
3	15.00	8.8	3.3	8.0	0.481	0.697	0.163	0.163	0.105	0.105
4	30.00	8.5	0.8	8.4	0.454	0.839	0.085	0.085	0.055	0.055
5	50.00	8.7	-3.2	11.4	0.450	0.905	0.048	0.048	0.030	0.030
6	70.00	9.0	-6.9	14.0	0.453	0.910	0.047	0.047	0.028	0.028
7	85.00	9.3	-8.4	13.5	0.459	0.948	0.028	0.028	0.016	0.016
8	90.00	9.4	-8.7	12.0	0.461	0.951	0.027	0.027	0.015	0.015
9	95.00	9.7	-8.6	10.2	0.542	0.760	0.142	0.142	0.074	0.074

TABLE VIII. - BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 90 PERCENT DESIGN SPEED

(a) Reading 1540

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	7.1	46.9	45.6	288.9	1.016	10.08	1.042
2	23.871	23.876	-0.0	7.5	45.6	43.8	288.7	1.016	10.13	1.048
3	23.094	23.114	-0.0	7.3	44.5	42.8	288.6	1.016	10.14	1.049
4	20.744	20.828	-0.0	8.5	41.1	38.1	288.0	1.017	10.14	1.053
5	17.623	17.780	-0.0	10.7	36.9	31.0	287.9	1.019	10.14	1.059
6	14.544	14.732	-0.0	12.8	32.2	22.9	287.8	1.019	10.14	1.060
7	12.299	12.446	-0.0	13.3	28.3	17.9	287.9	1.017	10.14	1.044
8	11.570	11.684	-0.0	13.4	27.0	16.3	287.9	1.016	10.14	1.036
9	10.846	10.922	-0.0	14.2	26.1	14.1	287.9	1.015	10.04	1.039

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	198.8	186.7	290.9	264.8	198.8	185.3	-0.0	23.1	212.3	212.2
2	202.2	190.7	288.8	262.1	202.2	189.1	-0.0	24.8	206.3	206.3
3	202.9	190.8	284.5	257.9	202.9	189.3	-0.1	24.4	199.4	199.6
4	205.5	195.2	272.7	245.2	205.5	193.1	-0.0	28.9	179.3	180.0
5	202.8	198.1	253.6	227.0	202.8	194.7	-0.0	36.7	152.2	153.5
6	199.4	200.7	235.7	212.5	199.4	195.7	-0.0	44.5	125.6	127.2
7	197.8	197.4	224.6	201.8	197.8	192.0	-0.0	45.6	106.3	107.6
8	196.4	195.1	220.4	197.7	196.4	189.7	-0.0	45.4	100.0	101.0
9	190.7	192.4	212.4	192.3	190.7	186.5	-0.0	47.2	93.5	94.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.605	0.561	0.885	0.795	0.605	0.556	0.932	0.910
2	0.616	0.573	0.880	0.788	0.616	0.569	0.935	0.904
3	0.618	0.574	0.867	0.776	0.618	0.569	0.933	0.908
4	0.627	0.588	0.833	0.739	0.627	0.582	0.940	0.917
5	0.619	0.597	0.774	0.684	0.619	0.587	0.960	0.935
6	0.608	0.606	0.718	0.641	0.608	0.591	0.981	0.951
7	0.602	0.596	0.684	0.609	0.602	0.579	0.971	0.961
8	0.598	0.589	0.671	0.597	0.598	0.572	0.966	0.961
9	0.579	0.580	0.645	0.580	0.579	0.562	0.978	0.951

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-4.4	-9.0	3.5	0.168	0.748	0.034	0.034	0.023	0.023
2	10.00	-4.7	-9.6	3.3	0.175	0.861	0.019	0.019	0.013	0.013
3	15.00	-4.8	-10.2	3.9	0.175	0.863	0.020	0.020	0.014	0.014
4	30.00	-4.9	-12.7	4.6	0.194	0.868	0.021	0.021	0.015	0.015
5	50.00	-4.5	-16.4	6.1	0.218	0.874	0.025	0.025	0.017	0.017
6	70.00	-3.7	-19.6	8.1	0.227	0.880	0.027	0.027	0.017	0.017
7	85.00	-2.9	-20.7	10.9	0.223	0.736	0.056	0.056	0.032	0.032
8	90.00	-2.5	-20.6	11.7	0.220	0.653	0.071	0.071	0.039	0.039
9	95.00	-1.5	-19.8	11.8	0.214	0.710	0.062	0.062	0.032	0.032

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 90 PERCENT DESIGN SPEED

(b) Reading 1411

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	13.9	52.2	47.7	289.0	1.030	10.08	1.094
2	23.871	23.876	0.0	13.3	50.9	45.8	288.8	1.028	10.13	1.098
3	23.094	23.114	0.0	13.0	50.0	44.7	288.7	1.028	10.14	1.100
4	20.744	20.828	0.0	15.1	46.7	39.9	287.8	1.025	10.14	1.090
5	17.623	17.780	-0.0	16.3	42.5	34.4	287.8	1.022	10.14	1.074
6	14.544	14.732	0.0	16.8	37.6	27.8	287.9	1.018	10.14	1.060
7	12.299	12.446	-0.0	18.7	33.5	20.8	287.9	1.016	10.14	1.052
8	11.570	11.684	0.0	19.7	31.9	17.3	287.8	1.017	10.14	1.054
9	10.846	10.922	0.0	21.8	30.8	13.1	288.1	1.017	10.07	1.059

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	165.5	163.4	270.1	235.6	165.5	158.7	0.0	39.2	213.5	213.4
2	167.9	167.8	266.2	234.3	167.9	163.3	0.0	38.6	206.6	206.7
3	167.4	168.3	260.7	230.7	167.4	164.0	0.0	37.8	199.9	200.0
4	168.6	168.4	245.9	212.0	168.6	162.6	0.0	43.7	179.0	179.8
5	166.8	164.3	226.2	191.2	166.8	157.7	-0.0	46.1	152.8	154.2
6	163.4	160.4	206.2	173.5	163.4	153.5	0.0	46.5	125.7	127.3
7	161.1	158.1	193.0	160.2	161.1	149.7	-0.0	50.8	106.4	107.7
8	160.8	160.0	189.3	157.8	160.8	150.7	0.0	53.9	99.9	100.9
9	157.3	160.6	183.1	153.1	157.3	149.1	0.0	59.6	93.7	94.4

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.498	0.484	0.812	0.697	0.498	0.469	0.958	1.037
2	0.505	0.498	0.801	0.695	0.505	0.484	0.972	1.022
3	0.504	0.499	0.785	0.685	0.504	0.487	0.979	1.015
4	0.508	0.501	0.742	0.631	0.508	0.484	0.964	0.985
5	0.503	0.489	0.682	0.569	0.503	0.470	0.946	0.964
6	0.492	0.478	0.621	0.517	0.492	0.457	0.939	0.937
7	0.485	0.471	0.581	0.477	0.485	0.446	0.930	0.919
8	0.484	0.477	0.569	0.471	0.484	0.449	0.937	0.910
9	0.473	0.478	0.550	0.456	0.473	0.444	0.947	0.897

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.0	-3.7	5.6	0.270	0.874	0.036	0.036	0.024	0.024
2	10.00	0.6	-4.3	5.3	0.260	0.950	0.014	0.014	0.009	0.009
3	15.00	0.8	-4.6	5.8	0.252	0.994	0.002	0.002	0.001	0.001
4	30.00	0.7	-7.1	6.5	0.294	0.989	0.003	0.003	0.002	0.002
5	50.00	1.2	-10.7	9.5	0.315	0.952	0.013	0.013	0.009	0.009
6	70.00	1.6	-14.2	12.9	0.312	0.934	0.018	0.018	0.011	0.011
7	85.00	2.2	-15.5	13.8	0.327	0.895	0.029	0.029	0.016	0.016
8	90.00	2.4	-15.7	12.7	0.328	0.901	0.029	0.029	0.016	0.016
9	95.00	3.1	-15.2	10.8	0.339	0.958	0.014	0.014	0.007	0.007

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 90 PERCENT DESIGN SPEED

(c) Reading 1412

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	17.2	54.4	48.7	288.9	1.036	10.07	1.106
2	23.871	23.876	0.0	16.1	53.0	46.5	288.8	1.033	10.13	1.113
3	23.094	23.114	0.0	16.4	52.2	45.4	288.3	1.032	10.14	1.110
4	20.744	20.828	0.0	18.3	49.0	40.6	288.0	1.029	10.14	1.104
5	17.623	17.780	0.0	19.5	44.7	35.2	287.9	1.024	10.14	1.083
6	14.544	14.732	0.0	19.9	39.8	28.8	287.9	1.020	10.14	1.065
7	12.299	12.446	0.0	21.8	35.6	20.6	287.9	1.019	10.14	1.062
8	11.570	11.684	0.0	23.0	34.1	16.9	287.8	1.019	10.14	1.063
9	10.846	10.922	0.0	25.4	32.7	12.9	288.1	1.019	10.09	1.061

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	152.2	153.5	261.2	222.1	152.2	146.6	0.0	45.4	212.3	212.2
2	154.9	159.5	257.4	222.5	154.9	153.2	0.0	44.2	205.5	205.6
3	154.6	158.8	252.1	216.8	154.6	152.3	0.0	45.0	199.1	199.3
4	156.0	159.7	237.8	199.7	156.0	151.6	0.0	50.2	179.5	180.2
5	153.9	153.7	216.5	177.4	153.9	144.9	0.0	51.3	152.3	153.7
6	150.7	148.2	196.2	159.1	150.7	139.4	0.0	50.5	125.6	127.2
7	148.5	149.2	182.6	147.9	148.5	138.5	0.0	55.5	106.2	107.5
8	148.0	150.6	178.7	144.9	148.0	138.6	0.0	58.9	100.1	101.1
9	145.7	148.4	173.2	137.5	145.7	134.0	0.0	63.7	93.7	94.4

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.456	0.452	0.782	0.653	0.456	0.431	0.964	1.060
2	0.465	0.471	0.772	0.657	0.465	0.452	0.989	1.043
3	0.464	0.469	0.756	0.641	0.464	0.450	0.986	1.036
4	0.468	0.473	0.714	0.591	0.468	0.449	0.972	1.007
5	0.462	0.456	0.650	0.526	0.462	0.430	0.942	0.968
6	0.452	0.440	0.588	0.472	0.452	0.413	0.925	0.933
7	0.445	0.443	0.547	0.439	0.445	0.411	0.932	0.905
8	0.444	0.448	0.536	0.431	0.444	0.412	0.936	0.896
9	0.436	0.441	0.519	0.408	0.436	0.398	0.920	0.881

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.1	-1.5	6.6	0.321	0.821	0.065	0.065	0.042	0.042
2	10.00	2.7	-2.2	6.0	0.301	0.939	0.021	0.021	0.014	0.014
3	15.00	2.9	-2.5	6.5	0.308	0.943	0.020	0.020	0.013	0.013
4	30.00	3.0	-4.8	7.2	0.345	0.973	0.009	0.009	0.006	0.006
5	50.00	3.4	-8.5	10.4	0.366	0.939	0.021	0.021	0.013	0.013
6	70.00	3.9	-12.0	14.0	0.364	0.922	0.025	0.025	0.015	0.015
7	85.00	4.4	-13.4	13.5	0.371	0.934	0.023	0.023	0.013	0.013
8	90.00	4.6	-13.5	12.3	0.376	0.945	0.020	0.020	0.011	0.011
9	95.00	5.1	-13.2	10.6	0.404	0.905	0.037	0.037	0.019	0.019

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 90 PERCENT DES.[illegible]N SPEED

(d) Reading 1413

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	25.3	57.3	50.5	288.9	1.043	10.08	1.110
2	23.871	23.876	-0.0	21.0	55.9	47.6	288.7	1.040	10.13	1.123
3	23.094	23.114	0.0	20.7	55.1	46.2	288.3	1.038	10.14	1.125
4	20.744	20.828	-0.0	22.1	51.7	41.5	287.9	1.034	10.14	1.113
5	17.623	17.780	0.0	23.0	47.3	36.1	288.0	1.028	10.14	1.092
6	14.544	14.732	0.0	23.2	42.4	29.7	288.0	1.022	10.14	1.075
7	12.299	12.446	0.0	25.5	38.1	21.1	288.0	1.021	10.14	1.069
8	11.570	11.684	0.0	26.3	36.5	17.4	288.0	1.020	10.14	1.070
9	10.846	10.922	-0.0	29.0	35.3	12.8	288.0	1.021	10.09	1.069

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	136.8	139.9	253.5	198.8	136.8	126.4	-0.0	59.9	213.4	213.3
2	139.8	149.6	249.3	207.1	139.8	139.7	-0.0	53.5	206.4	206.4
3	139.7	151.0	244.2	204.0	139.7	141.2	0.0	53.4	200.4	200.6
4	141.5	150.5	228.4	186.2	141.5	139.5	-0.0	56.6	179.3	180.0
5	140.6	144.7	207.2	164.7	140.6	133.2	0.0	56.6	152.2	153.6
6	137.7	138.7	186.5	146.7	137.7	127.4	0.0	54.7	125.8	127.4
7	135.7	138.0	172.4	133.5	135.7	124.5	0.0	59.5	106.4	107.6
8	135.4	139.8	168.5	131.3	135.4	125.3	0.0	61.9	100.2	101.2
9	132.5	138.3	162.4	124.0	132.5	120.9	-0.0	67.1	93.9	94.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.408	0.409	0.756	0.581	0.408	0.369	0.924	1.103
2	0.418	0.439	0.744	0.608	0.418	0.410	0.999	1.081
3	0.417	0.444	0.730	0.600	0.417	0.415	1.011	1.074
4	0.424	0.444	0.684	0.549	0.424	0.411	0.985	1.027
5	0.421	0.427	0.620	0.486	0.421	0.393	0.947	0.977
6	0.412	0.410	0.557	0.434	0.412	0.377	0.925	0.953
7	0.405	0.408	0.515	0.395	0.405	0.368	0.918	0.896
8	0.405	0.414	0.503	0.389	0.405	0.371	0.925	0.884
9	0.396	0.409	0.485	0.367	0.396	0.358	0.912	0.866

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.1	1.4	8.4	0.448	0.695	0.139	0.139	0.087	0.087
2	10.00	5.6	0.7	7.1	0.376	0.841	0.069	0.069	0.045	0.045
3	15.00	5.9	0.4	7.3	0.371	0.888	0.048	0.048	0.031	0.031
4	30.00	5.6	-2.1	8.1	0.402	0.928	0.030	0.030	0.020	0.020
5	50.00	5.9	-6.0	11.2	0.419	0.928	0.030	0.030	0.019	0.019
6	70.00	6.5	-9.3	14.9	0.413	0.933	0.027	0.027	0.016	0.016
7	85.00	6.9	-10.9	14.1	0.431	0.938	0.027	0.027	0.015	0.015
8	90.00	7.0	-11.1	12.8	0.429	0.968	0.014	0.014	0.008	0.008
9	95.00	7.7	-10.6	10.5	0.458	0.918	0.039	0.039	0.021	0.021

TABLE VIII. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 90 PERCENT DESIGN SPEED

(e) Reading 1415

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	0.0	44.0	61.1	53.4	288.8	1.056	10.09	1.103
2	23.871	23.876	0.0	34.2	59.7	50.8	288.6	1.050	10.13	1.100
3	23.094	23.114	-0.0	27.3	58.8	47.5	288.3	1.045	10.14	1.113
4	20.744	20.828	0.0	26.0	55.4	41.8	288.0	1.038	10.14	1.122
5	17.623	17.790	-0.0	27.0	50.8	36.1	288.0	1.03[illegible]	10.14	1.104
6	14.544	14.732	0.0	27.2	45.7	29.9	288.0	1.025	10.14	1.083
7	12.299	12.446	-0.0	29.0	41.2	20.8	287.9	1.023	10.14	1.078
8	11.570	11.684	0.0	29.6	39.4	16.9	287.9	1.[illegible]2	10.13	1.077
9	10.846	10.922	0.0	32.8	38.2	12.2	288.0	1.[illegible]	10.10	1.074

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	117.7	128.1	243.6	154.7	117.7	92.2	0.0	89.0	213.3	213.2
2	121.0	131.2	239.7	171.9	121.0	108.6	0.0	73.8	206.9	207.0
3	121.1	140.0	233.8	184.2	121.1	124.3	-0.0	64.3	200.0	200.2
4	123.9	145.3	218.1	175.2	123.9	130.7	0.0	63.6	179.5	180.3
5	124.5	139.6	197.0	153.9	124.5	124.4	-0.0	63.4	152.7	154.0
6	123.1	132.0	176.2	135.4	123.1	117.4	0.0	60.3	126.1	127.7
7	121.6	131.8	161.6	123.4	121.6	115.3	-0.0	63.8	106.5	107.7
8	121.4	133.1	157.2	120.9	121.4	115.7	0.0	65.8	99.9	100.9
9	119.3	130.9	151.8	112.6	119.3	110.0	0.0	70.9	93.9	94.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.350	0.371	0.724	0.448	0.350	0.267	0.783	1.148
2	0.360	0.382	0.713	0.500	0.360	0.316	0.897	1.127
3	0.360	0.409	0.696	0.538	0.360	0.363	1.027	1.111
4	0.369	0.427	0.650	0.514	0.369	0.384	1.054	1.057
5	0.371	0.411	0.587	0.453	0.371	0.366	0.999	0.996
6	0.367	0.389	0.525	0.399	0.367	0.346	0.954	0.937
7	0.362	0.389	0.481	0.364	0.362	0.340	0.948	0.889
8	0.362	0.393	0.468	0.357	0.362	0.342	0.953	0.870
9	0.355	0.386	0.452	0.332	0.355	0.325	0.923	0.853

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	9.9	5.2	11.3	0.724	0.502	0.306	0.306	0.179	0.179
2	10.00	9.4	4.5	10.3	0.579	0.555	0.249	0.249	0.152	0.152
3	15.00	9.5	4.1	8.7	0.471	0.696	0.162	0.162	0.103	0.103
4	30.00	9.3	1.6	8.3	0.453	0.873	0.066	0.066	0.043	0.043
5	50.00	9.5	-2.4	11.2	0.471	0.927	0.037	0.037	0.023	0.023
6	70.00	9.8	-6.1	15.0	0.465	0.934	0.033	0.033	0.019	0.019
7	85.00	10.0	-7.8	13.8	0.472	0.957	0.023	0.023	0.013	0.013
8	90.00	10.0	-8.1	12.2	0.469	0.985	0.008	0.008	0.004	0.004
9	95.00	10.6	-7.7	[illegible]	0.509	0.930	0.040	0.040	0.021	0.021

TABLE IX. - BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 110 PERCENT DESIGN SPEED

(a) Reading 1533

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.648	24.638	-0.0	10.1	50.6	47.7	288.8	1.032	10.07	1.075
2	23.871	23.876	-0.0	10.0	49.3	46.1	288.7	1.032	10.14	1.079
3	23.094	23.114	0.0	9.9	48.2	45.2	288.5	1.031	10.14	1.078
4	20.744	20.828	-0.0	10.3	44.8	41.3	288.1	1.028	10.14	1.074
5	17.623	17.780	-0.0	11.4	40.5	35.7	287.9	1.025	10.14	1.063
6	14.544	14.732	-0.0	13.5	35.8	27.5	287.8	1.024	10.14	1.065
7	12.299	12.446	-0.0	14.5	31.6	22.0	287.9	1.022	10.14	1.044
8	11.570	11.684	-0.0	15.5	30.3	18.4	287.6	1.023	10.14	1.056
9	10.846	10.922	-0.0	17.6	29.5	14.1	287.9	1.026	10.04	1.074

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	213.0	206.5	335.9	302.1	213.0	203.3	-0.1	36.0	259.7	259.6
2	216.4	209.9	331.8	298.3	216.4	206.7	-0.1	36.4	251.5	251.5
3	217.7	209.6	326.8	293.2	217.7	206.5	0.0	35.9	243.8	244.0
4	220.3	210.5	310.5	275.8	220.3	207.1	-0.0	37.6	218.8	219.7
5	217.3	207.8	285.8	250.7	217.3	203.7	-0.1	41.2	185.7	187.3
6	213.2	210.5	262.7	230.7	213.2	204.7	-0.0	49.1	153.5	155.5
7	210.9	204.4	247.6	213.4	210.9	197.9	-0.0	51.3	129.7	131.2
8	208.8	209.5	241.8	212.8	208.8	201.9	-0.1	56.0	122.0	123.2
9	203.2	213.9	233.5	210.[illegible]	203.2	203.8	-0.0	64.7	115.1	115.9

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID PEAK SS	
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.651	0.619	1.027	0.906	0.651	0.609	0.955	1.225
2	0.663	0.630	1.016	0.896	0.663	0.621	0.955	1.218
3	0.667	0.630	1.002	0.881	0.667	0.621	0.949	1.224
4	0.677	0.634	0.954	0.831	0.677	0.624	0.940	1.200
5	0.667	0.627	0.877	0.756	0.667	0.614	0.937	1.179
6	0.653	0.636	0.805	0.697	0.653	0.618	0.961	1.165
7	0.645	0.617	0.758	0.644	0.645	0.597	0.938	1.151
8	0.639	0.633	0.740	0.643	0.639	0.610	0.967	1.144
9	0.620	0.646	0.712	0.635	0.620	0.616	1.003	1.132

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-0.6	-5.3	5.6	0.206	0.648	0.078	0.074	0.052	0.049
2	10.00	-1.0	-5.9	5.6	0.207	0.690	0.069	0.065	0.046	0.044
3	15.00	-1.0	-6.5	6.4	0.207	0.703	0.066	0.062	0.044	0.041
4	30.00	-1.3	-9.0	7.9	0.218	0.731	0.058	0.057	0.038	0.037
5	50.00	-0.8	-12.7	10.8	0.236	0.704	0.064	0.064	0.041	0.041
6	70.00	-0.2	-16.0	12.6	0.249	0.743	0.061	0.061	0.037	0.037
7	85.00	0.4	-17.4	15.0	0.262	0.571	0.100	0.100	0.055	0.055
8	90.00	0.9	-17.2	13.8	0.251	0.671	0.086	0.086	0.046	0.046
9	95.00	1.9	-16.4	11.8	0.249	0.801	0.060	0.060	0.031	0.031

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 110 PERCENT DESIGN SPEED

(b) Reading 1534

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	18.2	53.0	49.	288.8	1.043	10.06	1.115
2	23.871	23.876	-0.0	15.9	51.5	46.8	288.7	1.046	10.14	1.154
3	23.094	23.114	-0.0	15.9	50.3	45.6	288.7	1.045	10.1[illegible]	1.136
4	20.74	20.828	-0.[illegible]	16.7	47.0	40.8	28[illegible].1	1.043	10.14	1.135
5	17.623	17.780	-0.0	17.8	42.7	34.7	287.9	1.037	10.14	1.118
6	[illegible].544	14.732	-0.0	18.6	37.9	28.0	287.8	1.030	10.14	1.096
7	12.299	12.446	-0.0	20.1	33.6	20.6	287.3	1.028	10.14	1.088
8	11.570	11.684	-0.0	20.7	32.3	17.3	287.8	1.028	10.14	1.090
9	10.846	10.922	-0.0	24.1	31.3	13.2	287.5	1.029	10.06	1.079

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	196.1	184.1	326.1	267.8	196.1	174.9	-0.0	57.5	260.5	260.4
2	201.1	194.4	322.8	273.3	201.1	187.0	-0.0	[illegible].2	252.5	252.5
3	202.4	194.4	317.1	[illegible]67.2	202.4	187.0	-0.0	53.4	244.1	244.3
4	204.4	197.3	299.7	249.7	204.4	188.9	-0.0	56.8	219.2	220.0
5	202.0	195.2	274.9	226.0	202.0	185.9	-0.0	59.6	186.5	188.1
6	197.6	189.0	250.3	202.9	197.6	179.1	-0.0	60.2	153.6	155.6
7	195.4	188.9	234.7	189.5	195.4	177.4	0.0	64.9	129.9	131.5
8	193.7	191.2	229.0	187.3	193.7	178.8	-0.0	67.7	122.2	123.4
9	188.6	185.2	220.6	173.6	188.6	169.0	-0.0	75.7	114.4	115.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.596	0.543	0.991	0.790	0.596	0.516	0.892	[illegible].295
2	0.612	0.576	0.983	0.810	0.612	0.554	0.930	1.275
3	0.616	0.577	0.966	0.793	0.616	0.565	0.924	1.259
4	0.624	0.587	0.914	0.743	0.624	0.562	0.925	1.225
5	0.616	0.582	0.838	0.674	0.616	0.555	0.920	1.192
6	0.602	0.565	0.762	0.606	0.602	0.535	0.907	1.158
7	0.595	0.565	0.714	0.567	0.595	0.531	0.908	1.134
8	0.589	0.572	0.697	0.561	0.589	0.535	0.923	1.123
9	0.573	0.553	0.670	0.518	0.573	0.505	0.896	1.103

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.8	-2.9	7.[illegible]	0.352	0.660	0.115	0.108	0.074	0.070
2	10.00	1.2	-3.7	6.3	0.312	0.789	0.070	0.066	0.046	0.043
3	15.00	1.1	-4.3	6.7	0.316	0.819	0.060	0.057	0.040	0.038
4	30.00	0.9	-6.8	7.4	0.333	0.867	0.045	0.044	0.030	0.029
5	50.00	1.4	-10.5	9.8	0.348	0.869	0.045	0.045	0.029	0.029
6	70.00	1.9	-13.9	13.2	0.353	0.871	0.042	0.042	0.025	0.025
7	85.00	2.4	-15.3	13.5	0.358	0.860	.047	0.047	0.026	0.026
8	90.00	2.8	-15.3	12.7	0.350	0.898	0.035	0.035	0.019	0.019
9	95.0[illegible]	3.6	-14.7	10.9	0.397	0.747	0.097	0.097	0 050	0.050

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 110 PERCENT DESIGN SPEED

(c) Reading 148

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	22.7	54.7	50.0	289.2	[illegible]	10.06	1.139
2	23.871	23.876	-0.0	17.9	53.3	46.9	289.0	[illegible]	10.14	1.173
3	23.094	23.114	-0.0	18.3	52.2	45.4	288.6	1.052	10.14	1.172
4	20.744	20.828	-0.0	19.7	49.0	40.5	288.0	1.048	10.14	1.167
5	17.623	17.780	-0.0	21.2	44.8	35.1	287.8	1.040	10.14	1.132
6	14.544	14.732	0.0	21.5	39.9	29.0	287.7	1.032	10.14	1.102
7	12.299	12.446	0.0	23.4	35.7	20.4	287.7	1.030	10.14	1.099
8	11.570	11.684	-0.0	24.2	34.0	16.7	287.7	1.030	10.14	1.099
9	10.846	10.922	0.0	27.0	32.9	12.7	287.7	1.030	10.06	1.095

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	184.3	175.3	319.1	251.5	184.3	161.7	-0.0	67.7	260.4	[illegible]
2	188.5	191.4	315.8	266.5	188.5	182.1	-0.0	58.9	253.3	253.4
3	189.2	191.4	308.8	258.7	189.2	181.7	-0.0	60.0	243.9	[illegible]
4	191.2	193.3	291.4	239.3	191.2	181.9	-0.0	65.3	219.9	220.8
5	188.4	185.3	265.5	211.2	188.4	172.7	-0.0	67.1	187.0	188.7
6	184.2	176.9	240.1	188.3	184.2	164.6	0.0	64.7	154.1	156.0
7	181.3	178.7	223.2	175.0	181.3	164.0	0.0	70.8	130.3	131.9
8	181.0	180.5	218.4	171.9	181.0	164.6	-0.0	74.0	122.2	123.4
9	177.5	176.9	211.4	161.5	177.5	157.5	0.0	80.4	114.9	115.8

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.557	0.513	0.965	0.736	0.557	0.473	0.877	1.319
2	0.571	0.564	0.956	0.785	0.571	0.537	0.966	1.305
3	0.574	0.565	0.936	0.764	0.574	0.537	0.960	1.283
4	0.581	0.573	0.885	0.709	0.581	0.539	0.952	1.247
5	0.572	0.550	0.806	0.627	0.572	0.513	0.916	1.202
6	0.558	0.526	0.728	0.560	0.558	0.490	0.894	1.157
7	0.549	0.532	0.676	0.521	0.549	0.489	0.905	1.121
8	0.548	0.538	0.661	0.512	0.548	0.491	0.910	1.105
9	0.537	0.527	0.640	0.481	0.537	0.469	0.888	1.090

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.5	-1.2	7.9	0.421	0.653	0.145	0.139	0.092	0.088
2	10.00	3.1	-1.9	6.4	0.336	0.846	0.063	0.058	0.041	0.038
3	15.00	2.9	-2.5	6.5	0.345	0.896	0.042	0.038	0.027	0.025
4	30.00	2.9	-4.8	7.1	0.375	0.933	0.027	0.026	0.018	0.017
5	50.00	3.4	-8.4	10.3	0.403	0.909	0.035	0.035	0.022	0.022
6	70.00	4.0	-11.9	14.2	0.400	0.885	0.042	0.042	0.025	0.025
7	85.00	4.5	-13.3	13.4	0.405	0.921	0.030	0.030	0.017	0.017
8	90.00	4.6	-13.5	12.1	0.405	0.917	0.033	0.033	0.018	0.018
9	95.00	5.3	-13.0	10.3	0.441	0.881	0.050	0.050	0.026	0.026

TABLE IX. - Continued. BLADE-ELEMENT DATA AT BLADE

EDGES FOR ROTOR 51A. 110 PERCENT DESIGN SPEED

(d) Reading 1420

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	32.7	57.4	50.8	289.0	1.077	10.08	1.166
2	23.871	23.876	-0.0	23.7	56.0	47.3	288.9	1.068	10.14	1.196
3	23.094	23.114	-0.0	23.3	55.0	45.4	288.5	1.062	10.14	1.203
4	20.744	20.828	-0.0	24.3	51.7	[illegible]	288.0	1.055	10.14	1.188
5	17.623	17.780	-0.0	25.1	47.5	36.5	287.8	1.044	10.14	1.148
6	14.544	14.732	-0.0	25.6	42.6	[illegible]	287.8	1.037	10.14	1.121
7	12.299	12.446	-0.0	27.0	38.2	[illegible]	287.7	1.032	10.14	1.112
8	11.570	11.684	-0.0	27.7	36.5	17.0	287.8	1.032	10.14	1.111
9	10.846	10.922	-0.0	31.5	35.4	12.2	287.9	1.033	10.07	1.104

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	166.9	166.3	310.3	221.5	166.9	140.0	-0.0	89.8	261.5	261.4
2	170.6	181.0	304.9	244.6	170.6	165.8	-0.0	72.8	252.6	252.7
3	171.9	184.6	299.4	241.6	171.9	169.5	-0.0	73.1	245.1	245.3
4	174.0	183.9	280.9	221.9	174.0	167.6	-0.0	75.8	220.4	221.3
5	171.6	172.8	254.0	194.6	171.6	156.5	-0.0	73.2	187.3	188.9
6	167.6	166.7	227.6	172.3	167.6	150.4	-0.0	71.9	154.0	155.9
7	165.4	166.6	210.4	158.5	165.4	148.3	-0.0	75.7	129.9	131.5
8	165.0	168.1	205.4	155.6	165.0	148.8	-0.0	78.0	122.3	123.5
9	161.8	163.8	198.5	143.0	161.8	139.7	-0.0	85.5	115.0	115.8

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.502	0.481	0.933	0.641	0.502	0.405	0.839	1.364
2	0.514	0.528	0.918	0.714	0.514	0.484	0.971	1.336
3	0.518	0.541	0.903	0.708	0.518	0.497	0.986	1.323
4	0.525	0.541	0.848	0.653	0.525	0.493	0.963	1.274
5	0.518	0.510	0.767	0.574	0.518	0.462	0.912	1.214
6	0.505	0.493	0.686	0.510	0.505	0.445	0.897	1.152
7	0.498	0.494	0.634	0.470	0.498	0.440	0.897	1.104
8	0.497	0.498	0.619	0.462	0.497	0.441	0.902	1.087
9	0.487	0.485	0.597	0.423	0.487	0.414	0.864	1.068

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.2	1.5	8.7	0.571	0.585	0.232	0.225	0.144	0.140
2	10.00	5.7	0.7	6.8	0.428	0.775	0.117	0.112	0.076	0.073
3	15.00	5.7	0.3	6.6	0.423	0.868	0.065	0.062	0.043	0.041
4	30.00	5.7	-2.1	7.5	0.447	0.912	0.043	0.042	0.028	0.028
5	50.00	6.2	-5.7	11.6	0.460	0.912	0.040	0.040	0.025	0.025
6	70.00	6.6	-9.2	14.3	0.458	0.908	0.042	0.042	0.025	0.025
7	85.00	7.0	-10.8	13.6	0.461	0.953	0.022	0.022	0.012	0.012
8	90.00	7.1	-11.0	12.4	0.458	0.952	0.023	0.023	0.012	0.012
9	95.00	7.7	-10.5	9.9	0.511	0.873	0.066	0.066	0.034	0.034

TABLE IX. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES FOR ROTOR 51A. 110 PERCENT DESIGN SPEED

(e) Reading 1421

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	37.0	58.6	51.4	289.0	1.080	10.08	1.168
2	23.871	23.876	-0.0	26.7	57.3	48.4	288.8	1.069	10.14	1.187
3	23.094	23.114	-0.0	24.2	56.1	46.0	288.5	1.064	10.14	1.199
4	20.744	20.828	-0.0	25.0	52.8	41.6	288.0	1.056	10.14	1.187
5	17.623	17.780	-0.0	26.4	48.5	36.6	287.8	1.045	10.14	1.151
6	14.544	14.732	-0.0	27.2	43.6	29.3	287.8	1.037	10.14	1.124
7	12.299	12.446	-0.0	28.5	39.3	20.7	287.8	1.034	10.14	1.115
8	11.570	11.684	0.0	29.2	37.8	16.7	287.9	1.034	10.14	1.117
9	10.846	10.922	0.0	33.3	36.7	11.6	287.9	1.034	10.06	1.111

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	159.0	162.5	305.4	208.1	159.0	129.7	-0.0	97.9	260.8	260.7
2	162.7	174.2	301.1	234.2	162.7	155.6	-0.0	78.3	253.3	253.4
3	164.1	180.5	294.3	237.1	164.1	164.6	-0.0	74.0	244.3	244.6
4	166.9	180.0	276.3	218.4	166.9	163.2	-0.0	76.0	220.2	221.1
5	165.1	169.9	249.4	189.5	165.1	152.2	-0.0	75.6	186.9	188.6
6	161.7	163.3	223.5	166.6	161.7	145.3	-0.0	74.6	154.2	156.2
7	158.9	162.7	205.5	152.8	158.9	142.9	-0.0	77.7	130.2	131.8
8	158.6	165.9	200.7	151.2	158.6	144.9	0.0	80.9	123.1	124.3
9	154.9	161.4	193.3	137.8	154.9	135.0	0.0	88.5	115.5	116.3

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.477	0.469	0.916	0.600	0.477	0.374	0.816	1.377
2	0.489	0.507	0.905	0.682	0.489	0.453	0.956	1.357
3	0.494	0.528	0.885	0.694	0.494	0.482	1.003	1.332
4	0.503	0.529	0.832	0.642	0.503	0.480	0.978	1.282
5	0.497	0.501	0.751	0.559	0.497	0.449	0.922	1.217
6	0.487	0.482	0.673	0.492	0.487	0.429	0.898	1.154
7	0.478	0.481	0.618	0.452	0.478	0.423	0.899	1.101
8	0.477	0.491	0.603	0.448	0.477	0.429	0.914	1.087
9	0.465	0.477	0.580	0.408	0.465	0.399	0.871	1.065

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.4	2.7	9.4	0.634	0.569	0.256	0.248	0.157	0.152
2	10.00	7.0	2.1	7.9	0.473	0.725	0.147	0.142	0.094	0.091
3	15.00	6.9	1.4	7.2	0.431	0.833	0.087	0.084	0.057	0.055
4	30.00	6.8	-0.9	8.2	0.451	0.889	0.056	0.056	0.037	0.037
5	50.00	7.2	-4.7	11.7	0.478	0.910	0.044	0.044	0.027	0.027
6	70.00	7.7	-8.1	14.5	0.482	0.920	0.038	0.038	0.022	0.022
7	85.00	8.1	-9.6	13.7	0.482	0.935	0.033	0.033	0.018	0.018
8	90.00	8.4	-9.7	12.0	0.475	0.961	0.021	0.021	0.011	0.011
9	95.00	9.1	-9.2	9.3	0.533	0.905	0.053	0.053	0.028	0.028

TABLE X. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

ROTOR 51A. 120 PERCENT DESIGN SPEED

(a) Reading 1538

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	13.6	52.2	47.9	288.8	1.047	10.04	1.107
2	23.871	23.876	0.0	13.1	50.8	46.7	288.7	1.045	10.13	1.102
3	23.094	23.114	-0.0	12.8	49.8	45.8	288.4	1.043	10.14	1.101
4	20.744	20.828	-0.0	12.7	46.4	42.2	288.1	1.037	10.14	1.090
5	17.623	17.780	-0.0	13.1	42.1	37.1	287.9	1.033	10.15	1.070
6	14.544	14.732	-0.0	14.6	37.4	29.9	287.8	1.029	10.15	1.064
7	12.299	12.446	-0.0	16.2	33.0	22.5	287.8	1.027	10.15	1.062
8	11.570	11.684	-0.0	17.2	31.7	18.4	288.0	1.029	10.14	1.079
9	10.846	10.922	0.0	20.1	30.8	13.0	287.9	1.034	10.04	1.098

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	219.5	216.3	358.4	313.4	219.5	210.3	-0.1	50.8	283.3	283.2
2	223.1	217.5	353.4	308.9	223.1	211.9	0.0	49.4	274.1	274.1
3	224.2	217.1	347.3	303.5	224.2	211.7	-0.0	48.0	265.2	265.5
4	227.1	216.4	329.2	285.1	227.1	[illegible]	-0.0	47.7	238.3	239.2
5	224.1	212.3	302.0	259.2	224.1	206.8	-0.0	48.1	202.5	204.3
6	219.2	209.7	275.7	234.0	219.2	202.9	-0.1	52.9	167.2	169.4
7	217.5	211.7	259.4	220.0	217.5	203.3	-0.0	59.1	141.5	143.1
8	215.4	218.9	253.2	220.3	215.4	209.1	-0.0	64.9	133.1	134.4
9	209.1	223.8	243.5	215.7	209.1	210.2	0.0	76.9	124.8	125.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.673	0.646	1.099	0.936	0.673	0.628	0.958	1.326
2	0.685	0.651	1.085	0.924	0.685	0.634	0.949	1.313
3	0.689	0.650	1.068	0.909	0.689	0.634	0.944	1.312
4	0.699	0.650	1.014	0.857	0.699	0.634	0.929	1.319
5	0.689	0.639	0.929	0.780	0.689	0.622	0.923	1.301
6	0.673	0.632	0.847	0.705	0.673	0.611	0.926	1.272
7	0.667	0.639	0.796	0.664	0.667	0.613	0.935	1.248
8	0.660	0.662	0.776	0.666	0.660	0.632	0.971	1.237
9	0.640	0.676	0.745	0.652	0.640	0.635	1.005	1.216

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.0	-3.7	5.8	0.265	0.620	0.111	0.095	0.073	0.063
2	10.00	0.6	-4.4	6.2	0.261	0.629	0.105	0.091	0.069	0.060
3	15.00	0.5	-4.9	6.9	0.256	0.649	0.097	0.084	0.063	0.055
4	30.00	0.3	-7.4	8.8	0.261	0.661	0.088	0.079	0.057	0.051
5	50.00	0.8	-11.1	12.2	0.267	0.593	0.105	0.101	0.065	0.063
6	70.00	1.4	-14.4	15.0	0.282	0.622	0.098	0.097	0.058	0.057
7	85.00	1.8	-15.9	15.4	0.288	0.636	0.099	0.099	0.054	0.054
8	90.00	2.3	-15.8	13.8	0.275	0.757	0.072	0.072	0.039	0.039
9	95.00	3.2	-15.1	10.7	0.284	0.792	0.077	0.077	0.040	0.040

TABLE X. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR ROTOR 51A. 120 PERCENT DESIGN SPEED

(b) Reading 1537

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.648	24.638	-0.0	22.4	54.4	49.5	289.0	1.066	10.06	1.131
2	23.871	23.876	-0.0	18.2	53.0	47.3	288.9	1.060	10.13	1.161
3	23.094	23.114	-0.0	18.6	51.9	46.4	288.5	1.058	10.14	1.155
4	20.744	20.828	-0.0	18.3	48.5	42.7	288.1	1.051	10.14	1.146
5	17.623	17.780	-0.0	19.8	44.2	35.5	287.8	1.048	10.14	1.141
6	14.544	14.732	-0.0	21.0	39.4	27.9	287.8	1.040	10.14	1.123
7	12.299	12.446	-0.0	22.1	35.0	20.0	287.7	1.038	10.14	1.117
8	11.570	11.684	-0.0	22.7	33.6	16.6	287.7	1.037	10.14	1.119
9	10.846	10.922	-0.0	26.8	32.6	12.8	287.8	1.037	10.06	1.093

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	202.3	193.0	347.8	274.9	202.3	178.4	-0.1	73.6	282.9	282.8
2	206.6	204.4	343.3	286.4	206.6	194.2	-0.0	63.7	274.1	274.1
3	208.6	202.3	337.9	278.1	208.6	191.8	-0.1	64.5	265.7	265.9
4	211.2	201.3	318.7	260.0	211.2	191.1	-0.0	63.3	238.6	239.6
5	208.3	202.5	290.7	234.0	208.3	190.5	-0.0	68.7	202.8	204.6
6	204.0	199.2	264.0	210.3	204.0	185.9	-0.0	71.4	167.6	169.8
7	202.0	200.7	246.6	197.8	202.0	185.9	-0.0	75.5	141.3	143.0
8	200.3	[illegible]	240.4	195.4	200.3	187.2	-0.0	78.4	133.0	134.3
9	195.2	191.7	231.6	175.5	195.2	171.1	-0.0	86.6	124.7	125.6

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.616	0.566	1.059	0.806	0.616	0.523	0.882	1.379
2	0.630	0.603	1.047	0.846	0.630	0.573	0.940	1.367
3	0.637	0.598	1.032	0.822	0.637	0.567	0.919	1.368
4	0.646	0.597	0.975	0.771	0.646	0.567	0.905	1.357
5	0.637	0.602	0.889	0.696	0.637	0.567	0.914	1.310
6	0.623	0.594	0.806	0.627	0.623	0.555	0.911	1.267
7	0.616	0.600	0.752	0.591	0.616	0.556	0.920	1.229
8	0.611	0.607	0.733	0.585	0.611	0.560	0.935	1.214
9	0.594	0.572	0.705	0.523	0.594	0.510	0.877	1.193

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	3.2	-1.5	7.5	0.418	0.540	0.190	0.172	0.121	0.110
2	10.00	2.7	-2.2	6.8	0.345	0.725	0.107	0.091	0.070	0.060
3	15.00	2.6	-2.8	7.5	0.357	0.728	0.104	0.089	0.068	0.058
4	30.00	2.4	-5.3	9.3	0.358	0.770	0.085	0.076	0.055	0.049
5	50.00	2.9	-9.0	10.6	0.381	0.800	0.079	0.077	0.050	0.049
6	70.00	3.5	-12.4	13.0	0.388	0.843	0.061	0.061	0.036	0.036
7	85.00	3.8	-14.0	12.9	0.381	0.845	0.063	0.063	0.035	0.035
8	90.00	4.1	-14.0	12.0	0.372	0.877	0.051	0.051	0.028	0.028
9	95.00	4.9	-13.4	10.5	0.443	0.703	0.129	0.129	0.067	0.067

TABLE X. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR ROTOR 51A. 120 PERCENT DESIGN SPEED

(c) Reading 1536

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	38.6	57.3	52.1	288.9	1.093	10.08	1.140
2	23.871	23.876	-0.0	26.5	55.7	48.9	288.8	1.078	10.13	1.169
3	23.094	23.114	-0.0	23.2	54.4	47.0	288.6	1.071	10.14	1.187
4	20.744	20.828	-0.0	23.3	50.9	41.3	288.1	1.066	10.14	1.204
5	17.623	17.780	-0.0	24.6	46.5	34.0	287.9	1.058	10.14	1.188
6	14.544	14.732	-0.0	24.8	41.5	28.2	287.7	1.044	10.14	1.142
7	12.299	12.446	-0.0	25.9	37.0	19.6	287.8	1.040	10.14	1.134
8	11.570	11.684	-0.0	26.7	35.6	16.1	287.6	1.040	10.13	1.133
9	10.846	10.922	-0.0	31.5	34.5	12.5	287.7	1.040	10.08	1.100

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	182.3	174.5	337.3	221.6	182.3	136.3	-0.0	108.9	283.8	283.7
2	187.4	186.9	332.7	254.2	187.4	167.3	-0.0	83.5	274.9	274.9
3	190.9	193.4	327.8	260.6	190.9	177.8	-0.1	76.1	266.4	266.6
4	194.2	199.9	308.2	244.1	194.2	183.5	-0.0	79.2	239.2	240.2
5	192.7	199.1	280.0	218.4	192.7	181.1	-0.0	82.9	203.1	204.9
6	189.3	187.1	252.8	192.8	189.3	169.9	-0.1	78.4	167.4	169.6
7	187.5	188.8	234.9	180.2	187.5	169.7	-0.0	82.6	141.4	143.1
8	185.8	190.0	228.5	176.6	185.8	169.7	-0.0	85.5	133.0	134.4
9	181.7	176.6	220.4	154.2	181.7	150.5	-0.0	92.4	124.8	125.7

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.551	0.502	1.020	0.638	0.551	0.392	0.748	1.461
2	0.568	0.544	1.008	0.740	0.568	0.487	0.893	1.4[illegible]
3	0.579	0.566	0.994	0.763	0.579	0.521	0.931	1.438
4	0.590	0.588	0.937	0.719	0.590	0.540	0.945	1.382
5	0.586	0.589	0.851	0.646	0.586	0.535	0.939	1.319
6	0.575	0.555	0.768	0.572	0.575	0.504	0.897	1.261
7	0.569	0.561	0.713	0.536	0.569	0.504	0.905	1.214
8	0.564	0.565	0.693	0.525	0.564	0.505	0.913	1.196
9	0.550	0.523	0.668	0.457	0.550	0.446	0.828	1.173

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.1	1.4	10.0	0.661	0.411	0.340	0.316	0.206	0.191
2	10.00	5.5	0.5	8.4	0.478	0.586	0.212	0.191	0.135	0.121
3	15.00	5.1	-0.3	8.1	0.424	0.711	0.140	0.121	0.090	0.078
4	30.00	4.9	-2.9	7.8	0.433	0.825	0.087	0.078	0.057	0.051
5	50.00	5.2	-6.7	9.1	0.452	0.873	0.064	0.062	0.041	0.040
6	70.00	5.6	-10.3	13.4	0.449	0.876	0.057	0.057	0.034	0.034
7	85.00	5.8	-11.9	12.6	0.443	0.904	0.046	0.046	0.025	0.025
8	90.00	6.2	-11.9	11.4	0.439	0.903	0.048	0.048	0.026	0.026
9	95.00	6.8	-11.5	10.1	0.526	0.697	0.154	0.154	0.081	0.081

TABLE X. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES

FOR ROTOR 51A. 120 PERCENT DESIGN SPEED

(d) Reading 1535

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.648	24.638	-0.0	48.0	59.9	53.9	288.8	1.105	10.08	1.175
2	23.871	23.876	-0.0	35.5	58.0	50.1	288.5	1.091	10.14	1.179
3	23.094	23.114	0.0	27.9	56.5	47.1	288.5	1.082	10.14	1.203
4	20.744	20.828	-0.0	27.2	53.0	39.9	288.1	1.075	10.14	1.239
5	17.623	17.780	-0.0	27.4	48.7	35.3	287.9	1.059	10.14	1.192
6	14.544	14.732	-0.0	27.8	43.7	28.4	287.9	1.048	10.13	1.157
7	12.299	12.446	-0.0	28.9	39.2	19.3	287.8	1.043	10.13	1.147
8	11.570	11.684	-0.0	30.1	37.8	15.4	287.8	1.043	10.13	1.144
9	10.846	10.922	-0.0	34.9	36.7	11.3	287.8	1.043	10.08	1.117

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	164.5	170.8	328.1	194.0	164.5	114.2	-0.0	127.0	283.9	283.8
2	171.5	176.3	323.5	223.9	171.5	143.5	-0.0	102.5	274.3	274.3
3	175.7	187.7	318.7	243.6	175.7	165.9	0.0	87.7	265.9	266.1
4	180.1	199.6	299.0	231.3	180.1	177.5	-0.0	91.3	238.6	239.6
5	178.6	188.1	270.4	204.6	178.6	167.0	-0.0	86.6	203.0	204.9
6	175.6	179.7	242.8	180.7	175.6	158.9	-0.0	83.9	167.7	169.9
7	173.7	181.[illegible]	224.0	167.9	173.7	158.5	-0.0	87.6	141.6	143.3
8	172.1	181.9	217.7	163.3	172.1	157.4	-0.0	91.2	133.4	134.7
9	168.0	170.8	209.4	142.8	168.0	140.1	-0.0	97.8	125.0	125.9

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.495	0.488	0.987	0.555	0.495	0.326	0.694	1.525
2	0.517	0.508	0.975	0.646	0.517	0.414	0.837	1.493
3	0.530	0.546	0.962	0.708	0.530	0.482	0.944	1.462
4	0.545	0.585	0.904	0.678	0.545	0.520	0.936	1.397
5	0.540	0.554	0.818	0.602	0.540	0.491	0.935	1.328
6	0.531	0.531	0.734	0.533	0.531	0.469	0.905	1.260
7	0.525	0.536	0.677	0.497	0.525	0.469	0.912	1.203
8	0.520	0.539	0.657	0.484	0.520	0.466	0.914	1.183
9	0.506	0.504	0.631	0.422	0.506	0.413	0.834	1.157

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	8.7	4.0	11.8	0.790	0.448	0.372	0.342	0.215	0.198
2	10.00	7.7	2.8	9.6	0.613	0.526	0.290	0.267	0.179	0.165
3	15.00	7.3	1.9	8.2	0.495	0.665	0.191	0.172	0.123	0.111
4	30.00	6.9	-0.8	6.4	0.494	0.840	0.094	0.086	0.063	0.058
5	50.00	7.3	-4.6	10.4	0.494	0.866	0.074	0.073	0.047	0.046
6	70.00	7.8	-8.1	13.6	0.491	0.897	0.054	0.054	0.032	0.032
7	85.00	8.0	-9.8	12.3	0.484	0.934	0.036	0.036	0.020	0.020
8	90.00	8.3	-9.8	10.8	0.488	0.921	0.045	0.045	0.024	0.024
9	95.00	9.0	-9.3	9.0	0.569	0.752	0.150	0.150	0.079	0.079

TABLE XI. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

STATOR 51. 100 PERCENT DESIGN SPEED

(a) Reading 1532

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	7.7	-1.4	7.7	-1.4	295.4	1.000	10.66	0.968
2	23.861	23.886	7.5	-2.0	7.5	-2.0	295.3	0.999	10.75	0.985
3	23.129	23.167	7.0	-2.6	7.0	-2.6	295.0	0.999	10.75	0.989
4	20.925	21.001	7.9	-2.9	7.9	-2.9	294.3	1.000	10.75	0.989
5	17.963	18.090	10.1	-2.2	10.1	-2.2	294.4	0.999	10.77	0.986
6	14.953	15.118	12.0	-2.2	12.0	-2.2	294.0	1.000	10.73	0.987
7	12.652	12.791	13.9	-1.4	13.9	-1.4	293.0	1.002	10.57	0.983
8	11.874	11.971	14.6	-0.2	14.6	-0.2	292.9	1.001	10.55	0.978
9	11.090	11.128	16.5	4.7	16.5	4.7	293.4	1.000	10.56	0.945

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	210.2	199.4	210.2	199.4	208.3	199.3	28.2	-4.7	0.	0.
2	213.4	208.4	213.4	208.4	211.6	208.3	27.8	-7.1	0.	0.
3	212.5	208.9	212.5	208.9	210.9	208.7	26.0	-9.4	0.	0.
4	212.4	210.4	212.4	210.4	210.4	210.1	29.4	-10.7	0.	0.
5	209.5	211.6	209.5	211.6	206.3	211.4	36.8	-8.2	0.	0.
6	202.3	212.5	202.3	212.5	197.9	212.3	42.2	-8.1	0.	0.
7	191.8	209.0	191.8	209.0	186.2	208.9	46.2	-5.0	0.	0.
8	190.6	208.1	190.6	208.1	184.5	208.1	48.1	-0.6	0.	0.
9	190.7	196.4	190.7	196.4	182.8	195.7	54.1	16.2	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.634	0.599	0.634	0.599	0.629	0.599	0.957	0.735
2	0.645	0.629	0.645	0.629	0.639	0.628	0.984	0.739
3	0.642	0.631	0.642	0.631	0.637	0.630	0.989	0.719
4	0.643	0.636	0.643	0.636	0.637	0.635	0.999	0.734
5	0.633	0.640	0.633	0.640	0.623	0.640	1.025	0.757
6	0.610	0.643	0.610	0.643	0.597	0.643	1.073	0.747
7	0.577	0.632	0.577	0.632	0.560	0.632	1.122	0.730
8	0.574	0.630	0.574	0.630	0.555	0.630	1.128	0.735
9	0.573	0.592	0.573	0.592	0.550	0.590	1.070	0.770

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-6.6	-15.8	2.7	0.128	0.	0.135	0.135	0.066	0.066
2	10.00	-7.0	-16.2	2.1	0.101	0.	0.063	0.063	0.030	0.030
3	15.00	-7.6	-16.8	1.4	0.094	0.	0.046	0.046	0.021	0.021
4	30.00	-7.6	-16.8	1.1	0.088	0.	0.045	0.045	0.019	0.019
5	50.00	-7.3	-16.5	1.9	0.067	0.	0.059	0.059	0.021	0.021
6	70.00	-7.9	-17.1	2.1	0.024	0.	0.060	0.060	0.018	0.018
7	85.00	-7.8	-16.9	2.8	-0.022	0.	0.083	0.083	0.021	0.021
8	90.00	-7.4	-16.5	4.0	-0.032	0.	0.108	0.108	0.026	0.026
9	95.00	-5.8	-14.9	8.7	0.014	0.	0.274	0.274	0.060	0.060

TABLE XI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 100 PERCENT DESIGN SPEED

(b) Reading 1400

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	16.1	1.0	16.1	1.0	300.8	1.000	11.34	0.979
2	23.861	23.886	14.8	0.6	14.8	0.6	300.1	1.000	11.45	0.986
3	23.129	23.167	15.2	0.3	15.2	0.3	299.5	1.000	11.44	0.992
4	20.925	21.001	15.7	-0.1	15.7	-0.1	297.9	1.000	11.31	0.998
5	17.963	18.090	16.2	-0.6	16.2	-0.6	296.3	1.000	11.11	1.000
6	14.953	15.118	17.4	-1.3	17.4	-1.3	295.1	1.000	10.94	0.998
7	12.652	12.791	20.1	-0.3	20.1	-0.3	294.7	1.000	10.90	0.990
8	11.874	11.971	21.2	1.2	21.2	1.2	295.3	1.000	10.93	0.983
9	11.090	11.128	25.1	5.4	25.1	5.4	295.4	1.000	10.77	0.971

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	187.2	172.9	187.2	172.9	179.9	172.9	51.9	3.0	0.	0.
2	192.4	179.5	192.4	179.5	186.0	179.4	49.2	2.0	0.	0.
3	191.3	180.9	191.3	180.9	184.6	180.9	50.1	0.8	0.	0.
4	188.3	179.8	188.3	179.8	181.3	179.8	50.9	-0.3	0.	0.
5	180.0	174.1	180.0	174.1	172.8	174.1	50.3	-1.9	0.	0.
6	169.9	166.8	169.9	166.8	162.0	166.8	50.9	-3.9	0.	0.
7	164.9	162.5	164.9	162.5	154.8	162.5	56.6	-0.9	0.	0.
8	166.9	161.7	166.9	161.7	155.6	161.7	60.4	3.4	0.	0.
9	162.6	148.7	162.6	148.7	147.2	148.1	69.1	14.0	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.555	0.510	0.555	0.510	0.533	0.510	0.961	0.815
2	0.572	0.531	0.572	0.531	0.553	0.531	0.965	0.813
3	0.569	0.536	0.569	0.536	0.549	0.536	0.980	0.814
4	0.561	0.534	0.561	0.534	0.540	0.534	0.992	0.804
5	0.536	0.518	0.536	0.518	0.515	0.518	1.007	0.762
6	0.506	0.496	0.506	0.496	0.482	0.496	1.029	0.719
7	0.490	0.483	0.490	0.483	0.461	0.483	1.049	0.726
8	0.496	0.480	0.496	0.480	0.463	0.480	1.039	0.751
9	0.483	0.440	0.483	0.440	0.437	0.438	1.006	0.792

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.8	-7.4	5.1	0.204	0.	0.109	0.109	0.053	0.053
2	10.00	0.3	-8.9	4.7	0.183	0.	0.072	0.072	0.034	0.034
3	15.00	0.6	-8.7	4.3	0.173	0.	0.043	0.043	0.020	0.020
4	30.00	0.2	-9.0	3.9	0.158	0.	0.011	0.011	0.005	0.005
5	50.00	-1.2	-10.4	3.5	0.136	0.	0.002	0.002	0.001	0.001
6	70.00	-2.5	-11.6	2.9	0.114	0.	0.013	0.013	0.004	0.004
7	85.00	-1.6	-10.7	3.9	0.102	0.	0.069	0.069	0.017	0.017
8	90.00	-0.8	-9.9	5.3	0.112	0.	0.110	0.110	0.026	0.026
9	95.00	2.9	-6.2	9.4	0.160	0.	0.195	0.195	0.043	0.043

TABLE XI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 100 PERCENT DESIGN SPEED

(c) Reading 1402

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	21.2	1.6	21.2	1.6	303.0	1.000	11.48	0.983
2	23.861	23.886	18.8	1.4	18.8	1.4	302.0	1.001	11.65	0.984
3	23.129	23.167	18.9	0.9	18.9	0.9	301.2	1.001	11.61	0.993
4	20.925	21.001	19.3	0.1	19.3	0.1	299.4	1.000	11.47	0.999
5	17.963	18.090	20.1	-0.0	20.1	-0.0	297.6	1.000	11.25	1.000
6	14.953	15.118	21.8	-0.5	21.8	-0.5	296.1	0.999	11.08	0.994
7	12.652	12.791	24.0	0.6	24.0	0.6	295.5	0.999	11.03	0.988
8	11.874	11.971	25.0	2.3	25.0	2.3	295.5	0.999	11.03	0.983
9	11.090	11.128	29.5	6.1	29.5	6.1	295.6	1.001	10.79	0.982

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	173.6	158.9	173.6	158.9	161.9	158.9	62.8	4.4	0.	0.
2	181.0	165.3	181.0	165.3	171.4	165.2	58.2	4.0	0.	0.
3	179.8	168.1	179.8	168.1	170.1	168.1	58.2	2.6	0.	0.
4	176.4	166.4	176.4	166.4	166.5	166.4	58.3	0.2	0.	0.
5	168.0	158.4	168.0	158.4	157.8	158.4	57.6	-0.0	0.	0.
6	159.2	147.6	159.2	147.6	147.8	147.6	59.1	-1.2	0.	0.
7	155.6	143.8	155.6	143.8	142.2	143.8	63.2	1.5	0.	0.
8	156.4	141.6	156.4	141.6	141.8	141.5	66.0	5.7	0.	0.
9	148.3	129.1	148.3	129.1	129.1	128.3	72.9	13.7	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.510	0.465	0.510	0.465	0.476	0.465	0.982	0.838
2	0.534	0.485	0.534	0.485	0.506	0.485	0.964	0.831
3	0.531	0.495	0.531	0.495	0.503	0.495	0.988	0.827
4	0.522	0.491	0.522	0.491	0.493	0.491	0.999	0.813
5	0.498	0.468	0.498	0.468	0.468	0.468	1.004	0.772
6	0.472	0.436	0.472	0.436	0.438	0.436	0.999	0.740
7	0.461	0.425	0.461	0.425	0.421	0.425	1.011	0.743
8	0.464	0.418	0.464	0.418	0.420	0.418	0.998	0.760
9	0.438	0.380	0.438	0.380	0.382	0.377	0.994	0.783

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.9	-2.3	5.7	0.249	0.	0.105	0.105	0.051	0.051
2	10.00	4.3	-4.9	5.4	0.229	0.	0.093	0.093	0.044	0.044
3	15.00	4.2	-5.0	4.9	0.207	0.	0.040	0.040	0.018	0.018
4	30.00	3.8	-5.4	4.1	0.194	0.	0.003	0.003	0.001	0.001
5	50.00	2.6	-6.6	4.1	0.180	0.	-0.003	-0.003	-0.001	-0.001
6	70.00	1.8	-7.3	3.8	0.185	0.	0.042	0.042	0.013	0.013
7	85.00	2.3	-6.8	4.8	0.175	0.	0.092	0.092	0.023	0.023
8	90.00	2.9	-6.2	6.4	0.185	0.	0.128	0.128	0.030	0.030
9	95.00	7.2	-1.9	10.1	0.217	0.	0.145	0.145	0.032	0.032

TABLE XI. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 100 PERCENT DESIGN SPEED

(d) Reading 1404

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.595	24.608	27.6	3.3	27.6	3.3	305.0	1.000	11.50	0.985
2	23.861	23.886	22.8	2.5	22.8	2.5	303.6	1.002	11.68	0.980
3	23.129	23.167	22.2	1.5	22.2	1.5	302.5	1.001	11.70	0.987
4	20.925	21.001	22.6	0.2	22.6	0.2	300.7	0.998	11.56	0.999
5	17.963	18.090	23.5	0.4	23.5	0.4	298.5	0.998	11.36	0.997
6	14.953	15.118	25.0	0.2	25.0	0.2	296.8	0.999	11.16	0.993
7	12.652	12.791	27.1	1.3	27.1	1.3	295.9	0.999	11.10	0.987
8	11.874	11.971	28.1	3.2	28.1	3.2	295.9	1.000	11.08	0.984
9	11.090	11.128	32.9	6.7	32.9	6.7	296.1	1.001	10.85	0.986

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	158.9	145.3	158.9	145.3	140.8	145.1	73.6	8.4	0.	0.
2	169.3	150.4	169.3	150.4	156.0	150.2	65.7	6.5	0.	0.
3	171.0	154.7	171.0	154.7	158.3	154.6	64.7	4.0	0.	0.
4	167.3	154.8	167.3	154.8	154.4	154.8	64.2	0.6	0.	0.
5	159.2	145.0	159.2	145.0	146.0	145.0	63.4	0.9	0.	0.
6	150.1	133.4	150.1	133.4	136.1	133.4	63.4	0.5	0.	0.
7	147.2	128.7	147.2	128.7	131.1	128.7	67.0	2.9	0.	0.
8	147.1	126.4	147.1	126.4	129.8	126.2	69.3	7.0	0.	0.
9	138.9	113.9	138.9	113.9	116.7	113.1	75.5	13.3	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.464	0.422	0.464	0.422	0.411	0.422	1.030	0.863
2	0.496	0.438	0.496	0.438	0.458	0.438	0.963	0.841
3	0.503	0.452	0.503	0.452	0.465	0.452	0.977	0.839
4	0.493	0.455	0.493	0.455	0.455	0.455	1.002	0.821
5	0.470	0.426	0.470	0.426	0.431	0.426	0.993	0.782
6	0.443	0.392	0.443	0.392	0.402	0.392	0.980	0.743
7	0.435	0.379	0.435	0.379	0.387	0.379	0.982	0.747
8	0.435	0.372	0.435	0.372	0.383	0.371	0.972	0.759
9	0.410	0.334	0.410	0.334	0.344	0.331	0.970	0.781

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	13.3	4.1	7.4	0.286	0.	0.107	0.107	0.052	0.052
2	10.00	8.4	-0.8	6.5	0.277	0.	0.131	0.131	0.062	0.062
3	15.00	7.6	-1.6	5.5	0.258	0.	0.083	0.083	0.038	0.038
4	30.00	7.1	-2.1	4.2	0.233	0.	0.008	0.008	0.003	0.003
5	50.00	6.0	-3.1	4.5	0.229	0.	0.022	0.022	0.008	0.008
6	70.00	5.0	-4.1	4.5	0.236	0.	0.057	0.057	0.017	0.017
7	85.00	5.4	-3.7	5.5	0.235	0.	0.106	0.106	0.027	0.027
8	90.00	6.1	-3.0	7.3	0.241	0.	0.128	0.128	0.030	0.030
9	95.00	10.7	1.5	10.7	0.279	0.	0.129	0.129	0.028	0.028

TABLE XI. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 100 PERCENT DESIGN SPEED

(e) Reading 1405

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	42.3	5.5	42.3	5.5	308.9	0.990	11.32	0.988
2	23.861	23.886	32.6	4.1	32.6	4.1	306.0	0.996	11.40	0.986
3	23.129	23.167	26.5	2.6	26.5	2.6	304.3	0.999	11.56	0.980
4	20.925	21.001	24.8	0.9	24.8	0.9	301.7	0.999	11.62	0.994
5	17.963	18.090	25.1	0.4	25.1	0.4	299.0	0.998	11.43	0.994
6	14.953	15.118	26.5	0.5	26.5	0.5	297.2	0.998	11.22	0.991
7	12.652	12.791	28.8	1.7	28.8	1.7	296.2	0.999	11.14	0.988
8	11.874	11.971	29.9	3.7	29.9	3.7	296.1	1.000	11.12	0.984
9	11.090	11.128	34.6	7.1	34.6	7.1	296.2	1.001	10.91	0.986

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	147.3	130.3	147.3	130.3	108.9	129.7	99.1	12.4	0.	0.
2	153.9	132.8	153.9	132.8	129.6	132.5	82.9	9.5	0.	0.
3	163.3	137.1	163.3	137.1	146.2	137.0	72.9	6.2	0.	0.
4	166.0	148.4	166.0	148.4	150.7	148.4	69.7	2.4	0.	0.
5	157.8	138.9	157.8	138.9	143.0	138.9	66.9	1.0	0.	0.
6	148.3	126.8	148.3	126.8	132.7	126.8	66.3	1.2	0.	0.
7	144.1	121.7	144.1	121.7	126.3	121.7	69.3	3.6	0.	0.
8	144.6	118.8	144.6	118.8	125.3	118.6	72.0	7.6	0.	0.
9	136.5	106.3	136.5	106.3	112.3	105.5	77.6	13.1	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.426	0.377	0.426	0.377	0.315	0.375	1.190	1.029
2	0.448	0.385	0.448	0.385	0.377	0.384	1.022	0.912
3	0.478	0.399	0.478	0.399	0.427	0.398	0.937	0.868
4	0.488	0.434	0.488	0.434	0.443	0.434	0.985	0.851
5	0.465	0.408	0.465	0.408	0.421	0.408	0.972	0.800
6	0.437	0.372	0.437	0.372	0.391	0.372	0.956	0.756
7	0.425	0.358	0.425	0.358	0.373	0.357	0.964	0.755
8	0.427	0.349	0.427	0.349	0.370	0.348	0.946	0.771
9	0.402	0.311	0.402	0.311	0.331	0.309	0.939	0.792

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	28.0	18.8	9.5	0.403	0.	0.099	0.099	0.048	0.048
2	10.00	18.1	8.9	8.1	0.363	0.	0.111	0.111	0.053	0.053
3	15.00	11.9	2.7	6.6	0.348	0.	0.141	0.141	0.065	0.065
4	30.00	9.3	0.1	4.9	0.274	0.	0.042	0.042	0.017	0.017
5	50.00	7.7	-1.5	4.5	0.269	0.	0.045	0.045	0.016	0.016
6	70.00	6.6	-2.6	4.8	0.275	0.	0.076	0.076	0.023	0.023
7	85.00	7.1	-2.0	5.9	0.269	0.	0.106	0.106	0.027	0.027
8	90.00	7.9	-1.3	7.8	0.283	0.	0.135	0.135	0.032	0.032
9	95.00	12.4	3.3	11.1	0.326	0.	0.134	0.134	0.029	0.029

TABLE XII. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

STATOR 51. 90 PERCENT DESIGN SPEED

(a) Reading 1540

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.595	24.608	6.7	-2.0	6.7	-2.0	293.4	0.998	10.50	0.975
2	23.861	23.886	7.0	-2.0	7.0	-2.0	293.3	0.998	10.62	0.988
3	23.129	23.167	6.9	-2.5	6.9	-2.5	293.2	0.998	10.64	0.992
4	20.925	21.001	8.1	-3.2	8.1	-3.2	293.0	0.997	10.68	0.992
5	17.963	18.090	10.4	-2.6	10.4	-2.6	293.3	0.995	10.75	0.988
6	14.953	15.118	12.9	-2.6	12.9	-2.6	293.3	0.996	10.75	0.987
7	12.652	12.791	13.8	-1.7	13.8	-1.7	292.7	0.996	10.58	0.985
8	11.874	11.971	14.0	-0.5	14.0	-0.5	292.4	0.996	10.51	0.983
9	11.090	11.128	14.9	4.0	14.9	4.0	292.3	0.997	10.42	0.959

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	197.9	186.1	197.9	186.1	196.6	186.0	23.2	-6.6	0.	0.
2	202.0	195.4	202.0	195.4	200.5	195.3	24.8	-6.7	0.	0.
3	201.7	197.0	201.7	197.0	200.2	196.8	24.4	-8.5	0.	0.
4	204.3	200.0	204.3	200.0	202.2	199.7	28.7	-11.1	0.	0.
5	201.9	200.8	201.9	200.8	198.6	200.6	36.4	-9.1	0.	0.
6	196.8	201.5	196.8	201.5	191.8	201.3	43.8	-9.2	0.	0.
7	187.8	198.1	187.8	198.1	182.3	198.0	44.8	-6.0	0.	0.
8	184.4	195.7	184.4	195.7	178.9	195.6	44.6	-1.8	0.	0.
9	181.1	183.3	161.1	183.3	175.0	182.9	46.5	12.9	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID	PEAK SS
RP	IN	OUT	IN	OUT	IN	OUT	VEL R	MACH NO
1	0.597	0.559	0.597	0.559	0.593	0.559	0.946	0.664
2	0.610	0.589	0.610	0.589	0.605	0.589	0.974	0.686
3	0.609	0.595	0.609	0.595	0.605	0.594	0.983	0.679
4	0.618	0.605	0.618	0.605	0.611	0.604	0.988	0.709
5	0.610	0.607	0.610	0.607	0.600	0.607	1.010	0.735
6	0.593	0.610	0.593	0.610	0.578	0.609	1.050	0.745
7	0.565	0.599	0.565	0.599	0.548	0.599	1.086	0.711
8	0.554	0.592	0.554	0.592	0.538	0.591	1.093	0.698
9	0.544	0.552	0.544	0.552	0.526	0.551	1.045	0.699

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	-7.6	-16.8	2.0	0.133	0.	0.118	0.118	0.058	0.058
2	10.00	-7.4	-16.6	2.1	0.107	0.	0.056	0.056	0.026	0.026
3	15.00	-7.7	-16.9	1.5	0.096	0.	0.035	0.035	0.016	0.016
4	30.00	-7.4	-16.6	0.8	0.102	0.	0.033	0.033	0.014	0.014
5	50.00	-7.1	-16.2	1.5	0.086	0.	0.053	0.053	0.019	0.019
6	70.00	-7.1	-16.2	1.7	0.056	0.	0.062	0.062	0.018	0.018
7	85.00	-7.9	-17.0	2.5	0.013	0.	0.076	0.076	0.019	0.019
8	90.00	-8.0	-17.1	3.6	-0.002	0.	0.090	0.090	0.021	0.021
9	95.00	-7.4	-16.5	8.0	0.028	0.	0.223	0.223	0.049	0.049

TABLE XII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 90 PERCENT DESIGN SPEED

(b) Reading 1411

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	13.2	0.3	13.2	0.3	297.6	0.999	11.02	0.983
2	23.861	23.886	12.7	0.3	12.7	0.3	297.0	1.000	[illegible]	0.988
3	23.129	23.167	12.4	-0.2	12.4	-0.2	296.7	1.000	11.15	0.991
4	20.925	21.001	14.4	-0.7	14.4	-0.7	295.1	1.001	11.05	0.996
5	17.963	18.090	15.9	-1.1	15.9	-1.1	294.0	1.000	10.89	0.998
6	14.953	15.118	16.9	-1.6	16.9	-1.6	293.0	1.002	10.75	1.000
7	12.652	12.791	[illegible]	-0.9	[illegible]	-0.9	292.6	1.001	10.68	0.995
8	11.874	11.971	20.3	0.5	20.3	0.5	292.7	1.001	10.69	0.991
9	11.090	11.128	22.6	4.9	22.6	4.9	293.1	1.002	10.66	0.974

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	171.6	159.0	171.6	159.0	167.1	159.0	39.2	0.9	0.	0.
2	176.1	165.7	176.1	165.7	171.8	165.7	38.7	0.7	0.	0.
3	176.3	167.2	176.3	167.2	172.2	167.2	37.7	-0.5	0.	0.
4	174.7	167.0	174.7	167.0	169.2	167.0	43.5	-2.0	0.	0.
5	166.7	162.6	166.7	162.6	160.4	162.5	45.6	-3.2	0.	0.
6	157.8	157.4	157.8	157.4	151.0	157.4	45.8	-4.4	0.	0.
7	151.8	152.8	151.8	152.8	143.3	152.8	49.9	-2.4	0.	0.
8	152.8	151.6	152.8	151.6	143.3	151.6	53.0	1.2	0.	0.
9	152.8	142.3	152.8	142.3	141.0	141.8	58.7	12.2	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.509	0.470	0.509	0.470	0.496	0.470	0.952	0.697
2	0.524	0.491	0.524	0.491	0.511	0.491	0.964	0.705
3	0.525	0.496	0.525	0.496	0.512	0.496	0.971	0.699
4	0.521	0.496	0.521	0.496	[illegible]	0.496	0.987	0.724
5	0.497	0.484	0.497	0.484	[illegible]	0.484	1.014	0.700
6	0.470	0.468	0.470	0.468	0.450	0.468	1.042	0.658
7	0.452	0.454	0.452	0.454	0.426	0.454	[illegible]	0.655
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-1.1	-10.3	4.4	0.183	0.	0.105	0.105	0.051	[illegible]
2	10.00	-1.8	-11.0	4.3	0.161	0.	0.068	0.068	0.032	0.032
3	15.00	-2.3	-11.5	3.8	0.151	0.	0.052	0.052	0.024	0.024
4	30.00	-1.1	-10.3	3.3	0.152	0.	0.026	0.026	0.011	0.011
5	50.00	-1.5	-10.7	3.0	0.129	0.	0.010	0.010	0.004	[illegible]
6	70.00	-3.1	-12.2	2.7	0.097	0.	0.003	0.003	0.001	[illegible]
7	85.00	-2.5	-11.6	3.3	0.080	0.	0.036	0.036	0.009	0.009
8	90.00	-1.7	-10.8	4.6	0.087	0.	0.072	0.072	0.017	0.017
9	95.00	0.4	-8.8	8.9	0.136	0.	0.194	0.194	0.043	0.043

TABLE XII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 90 PERCENT DESIGN SPEED

(c) Reading 1412

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	16.4	1.1	16.4	1.1	299.2	0.998	11.14	0.986
2	23.861	23.886	15.4	0.9	15.4	0.9	298.4	1.000	11.27	0.986
3	23.129	23.167	15.7	0.5	15.7	0.5	297.6	1.001	11.26	0.993
4	20.925	21.001	17.6	-0.2	17.6	-0.2	296.4	1.000	11.19	0.995
5	17.963	18.090	19.0	-0.3	19.0	-0.3	294.9	1.001	10.98	1.000
	14.953	15.118	19.9	-1.1	19.9	-1.1	293.6	1.002	10.81	1.001
7	12.652	12.791	22.4	-0.1	22.4	-0.1	293.3	1.001	10.77	0.994
8	11.874	11.971	23.7	1.5	23.7	1.5	293.2	1.001	10.77	0.991
9	11.090	11.128	26.3	5.7	26.3	5.7	293.5	1.002	10.70	0.979

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	160.6	148.4	160.6	148.4	154.0	148.4	45.5	2.9	0.	0.
2	166.9	153.9	166.9	153.9	160.9	153.8	44.2	2.4	0.	0.
3	165.9	156.1	165.9	156.1	159.7	156.1	44.9	1.2	0.	0.
4	165.1	155.5	165.1	155.5	157.4	155.5	50.0	-0.5	0.	0.
5	155.7	149.5	155.7	149.5	147.2	149.5	50.8	-0.8	0.	0.
6	145.9	141.5	145.9	141.5	137.2	141.5	49.8	-2.6	0.	0.
7	143.5	137.1	143.5	137.1	132.7	137.1	54.6	-0.3	0.	0.
8	144.2	135.9	144.2	135.9	132.0	135.9	58.0	3.5	0.	0.
9	141.8	124.5	141.8	124.5	127.1	123.9	62.7	12.5	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.473	0.436	0.473	0.436	0.454	0.436	0.963	0.701
2	0.494	0.453	0.494	0.453	0.476	0.453	0.956	0.711
3	0.491	0.461	0.491	0.461	0.473	0.461	0.978	0.711
4	0.490	0.460	0.490	0.460	0.467	0.460	0.988	0.734
5	0.462	0.442	0.462	0.442	0.437	0.442	1.015	0.700
6	0.433	0.419	0.433	0.419	0.407	0.419	1.032	0.652
7	0.426	0.406	0.426	0.406	0.394	0.406	1.033	0.663
8	0.428	0.402	0.428	0.402	0.392	0.402	1.029	0.683
9	0.420	0.367	0.420	0.367	0.377	0.365	0.974	0.705

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	2.1	-7.1	5.2	0.206	0.	0.101	0.101	0.049	0.049
2	10.00	0.9	-8.3	4.9	0.197	0.	0.092	0.092	0.043	0.043
3	15.00	1.1	-8.1	4.5	0.179	.	0.046	0.046	0.021	0.021
4	30.00	2.1	-7.1	3.8	0.185	0.	0.031	0.031	0.013	0.013
5	50.00	1.6	-7.6	3.8	0.158	0.	-0.004	-0.004	-0.001	-0.001
6	70.00	-0.0	-9.2	3.2	0.137	0.	-0.007	-0.007	-0.002	-0.002
7	85.00	0.7	-8.4	4.1	0.141	0.	0.047	0.047	0.012	0.012
8	90.00	1.7	-7.4	5.6	0.147	0.	0.075	0.075	0.018	0.018
9	95.00	4.0	-5.1	9.7	0.200	0.	0.187	0.187	0.041	0.041

TABLE XII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 90 PERCENT DESIGN SPEED

(d) Reading 1413

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	24.4	2.7	24.4	2.7	301.4	0.999	11.19	0.988
2	23.861	23.886	20.1	1.8	20.1	1.8	300.3	1.001	11.38	0.980
3	23.129	23.167	19.8	0.9	19.8	0.9	299.3	1.001	11.40	0.989
4	20.925	21.001	21.3	0.3	21.3	0.3	297.6	1.000	11.29	0.998
5	17.963	18.090	22.5	-0.0	22.5	-0.0	295.9	1.000	11.08	0.999
6	14.953	15.118	23.3	-0.2	23.3	-0.2	294.4	1.001	10.90	0.998
7	12.652	12.791	26.1	0.9	26.1	0.9	293.9	1.000	10.84	0.995
8	11.874	11.971	27.0	2.7	27.0	2.7	293.8	1.001	10.84	0.991
9	11.090	11.128	29.9	6.3	29.9	6.3	294.0	1.002	10.78	0.980

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	145.4	132.8	145.4	132.8	132.4	132.7	60.0	6.2	0.	0.
2	155.9	137.9	155.9	137.9	146.4	137.8	53.5	4.3	0.	0.
3	157.1	142.9	157.1	142.9	147.7	142.9	53.3	2.2	0.	0.
4	155.2	144.0	155.2	144.0	144.6	144.0	56.3	0.9	0.	0.
5	146.3	135.8	146.3	135.8	135.2	135.8	56.0	-0.1	0.	0.
6	136.6	125.8	136.6	125.8	125.5	125.8	53.9	-0.4	0.	0.
7	133.1	121.8	133.1	121.8	119.6	121.8	58.5	1.8	0.	0.
8	134.2	119.9	134.2	119.9	119.5	119.8	60.9	5.7	0.	0.
9	132.5	108.1	132.5	108.1	114.9	107.5	66.1	11.8	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.425	0.388	0.425	0.388	0.387	0.387	1.002	0.744
2	0.458	0.403	0.458	0.403	0.430	0.403	0.941	0.733
3	0.463	0.419	0.463	0.419	0.435	0.419	0.967	0.735
4	0.458	0.424	0.458	0.424	0.427	0.424	0.996	0.743
5	0.432	0.400	0.432	0.400	0.399	0.400	1.005	0.706
6	0.403	0.371	0.403	0.371	0.371	0.371	1.003	0.653
7	0.393	0.359	0.393	0.359	0.353	0.359	1.018	0.662
8	0.397	0.353	0.397	0.353	0.353	0.353	1.002	0.678
9	0.391	0.317	0.391	0.317	0.339	0.315	0.936	0.705

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	10.0	0.8	6.7	0.267	0.	0.101	0.101	0.049	0.049
2	10.00	5.6	-3.6	5.8	0.265	0.	0.146	0.146	0.069	0.069
3	15.00	5.2	-4.0	4.9	0.239	0.	0.084	0.084	0.039	0.039
4	30.00	5.8	-3.4	4.4	0.220	0.	0.014	0.014	0.006	0.006
5	50.00	5.1	-4.1	4.1	0.208	0.	0.007	0.007	0.002	0.002
6	70.00	3.3	-5.8	4.1	0.197	0.	0.015	0.015	0.005	0.005
7	85.00	4.4	-4.7	5.1	0.192	0.	0.050	0.050	0.013	0.013
8	90.00	5.0	-4.1	6.9	0.203	0.	0.084	0.084	0.020	0.020
9	95.00	7.7	-1.5	10.3	0.274	0.	0.199	0.199	0.044	0.044

TABLE XII. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 90 PERCENT DESIGN SPEED

(e) Reading 1415

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.595	24.608	42.8	5.5	42.8	5.5	305.0	0.992	11.12	0.991
2	23.861	23.886	33.1	4.3	33.1	4.3	302.9	0.996	11.14	0.991
3	23.129	23.167	26.3	2.7	26.3	2.7	301.1	1.000	11.28	0.985
4	20.925	21.001	25.1	1.3	25.1	1.3	299.0	1.000	11.37	0.993
5	17.963	18.090	26.4	0.4	26.4	0.4	296.9	0.999	11.19	0.995
6	14.953	15.118	27.2	0.5	27.2	0.5	295.1	1.000	10.98	0.996
7	12.652	12.791	29.6	1.8	29.6	1.8	294.4	1.000	10.93	0.993
8	11.874	11.971	30.4	3.8	30.4	3.8	294.2	1.001	10.92	0.989
9	11.090	11.128	33.7	7.2	33.7	7.2	294.4	1.003	10.84	0.982

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	131.2	117.0	131.2	117.0	96.2	116.5	89.1	11.3	0.	0.
2	135.2	118.8	135.2	118.8	113.3	118.4	73.8	8.8	0.	0.
3	144.8	122.7	144.8	122.7	129.8	122.6	64.2	5.8	0.	0.
4	149.4	133.1	149.4	133.1	135.3	133.1	63.3	2.9	0.	0.
5	140.9	123.8	140.9	123.8	126.2	123.8	62.7	0.8	0.	0.
6	130.0	112.9	130.0	112.9	115.7	112.9	59.4	1.0	0.	0.
7	127.3	108.0	127.3	108.0	110.8	108.0	62.8	3.3	0.	0.
8	128.1	104.8	128.1	104.8	110.5	104.6	64.8	6.9	0.	0.
9	125.8	94.0	125.8	94.0	104.6	93.3	69.8	11.8	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.380	0.339	0.380	0.339	0.279	0.338	1.210	0.927
2	0.394	0.345	0.394	0.345	0.330	0.344	1.045	0.808
3	0.424	0.357	0.424	0.357	0.380	0.357	0.945	0.767
4	0.439	0.390	0.439	0.390	0.398	0.390	0.983	0.769
5	0.415	0.363	0.415	0.363	0.372	0.363	0.981	0.733
6	0.383	0.331	0.383	0.331	0.341	0.331	0.976	0.671
7	0.375	0.317	0.375	0.317	0.327	0.317	0.974	0.677
8	0.378	0.307	0.378	0.307	0.326	0.307	0.947	0.689
9	0.371	0.275	0.371	0.275	0.308	0.273	0.891	0.717

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	28.5	19.3	9.6	0.398	0.	0.100	0.100	0.049	0.049
2	10.00	18.6	9.4	8.3	0.349	0.	0.085	0.085	0.040	0.040
3	15.00	11.7	2.5	6.7	0.338	0.	0.127	0.127	0.058	0.058
4	30.00	9.6	0.4	5.3	0.277	0.	0.054	0.054	0.023	0.023
5	50.00	9.0	-0.2	4.5	0.278	0.	0.047	0.047	0.017	0.017
6	70.00	7.2	-1.9	4.8	0.265	0.	0.037	0.037	0.011	0.011
7	85.00	7.9	-1.2	6.0	0.269	0.	0.075	0.075	0.019	0.019
8	90.00	8.4	-0.7	7.9	0.288	0.	0.115	0.115	0.027	0.027
9	95.00	11.5	2.3	11.2	0.354	0.	0.195	0.195	0.043	0.043

TABLE XIII. - BLADE-ELEMENT DATA AT BLADE EDGES FOR STATOR 51. 110 PERCENT DESIGN SPEED

(a) Reading 1533

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	9.4	-0.5	9.4	-0.5	298.2	0.999	10.83	0.962
2	23.861	23.886	9.4	-0.9	9.4	-0.9	297.9	1.000	10.94	0.976
3	23.129	23.167	9.3	-1.5	9.3	-1.5	297.4	1.000	10.93	0.983
4	20.925	21.001	9.7	-2.3	9.7	-2.3	296.2	1.000	10.89	0.984
5	17.963	18.090	11.1	-2.1	11.1	-2.1	295.2	1.001	10.79	0.987
6	14.953	15.118	13.6	-1.6	13.6	-1.6	294.8	1.002	10.80	0.982
7	12.652	12.791	15.1	-0.9	15.1	-0.9	294.1	1.004	10.59	0.984
8	11.874	11.971	16.2	0.5	16.2	0.5	294.4	1.002	10.70	0.970
9	11.090	11.128	18.5	5.3	18.5	5.3	295.3	0.998	10.79	0.927

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	220.1	206.2	220.1	206.2	217.1	206.2	36.1	-1.9	0.	0.
2	223.8	214.6	223.8	214.6	220.8	214.5	36.4	-3.5	0.	0.
3	222.9	216.5	222.9	216.5	219.9	216.4	35.9	-5.8	0.	0.
4	221.1	216.6	221.1	216.6	217.9	216.4	37.4	-8.7	0.	0.
5	211.9	215.7	211.9	215.7	208.0	215.5	40.8	-7.7	0.	0.
6	206.2	215.9	206.2	215.9	200.5	215.8	48.4	-6.2	0.	0.
7	194.3	212.7	194.3	212.7	187.6	212.7	50.5	-3.2	0.	0.
8	197.5	213.3	197.5	213.3	189.7	213.3	55.1	1.8	0.	0.
9	200.5	200.4	200.5	200.4	190.1	199.5	63.7	18.6	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.663	0.618	0.663	0.618	0.654	0.618	0.949	0.816
2	0.676	0.646	0.676	0.646	0.667	0.646	0.972	0.827
3	0.673	0.652	0.673	0.652	0.664	0.652	0.984	0.819
4	0.669	0.654	0.669	0.654	0.659	0.654	0.993	0.814
5	0.640	0.652	0.640	0.652	0.628	0.651	1.036	0.790
6	0.622	0.653	0.622	0.653	0.605	0.653	1.077	0.798
7	0.584	0.643	0.584	0.643	0.564	0.643	1.134	0.762
8	0.594	0.645	0.594	0.645	0.571	0.645	1.124	0.796
9	0.603	0.603	0.603	0.603	0.572	0.601	1.050	0.853

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-4.9	-14.1	3.6	0.148	0.	0.150	0.150	0.073	0.073
2	10.00	-5.1	-14.3	3.1	0.126	0.	0.091	0.091	0.043	0.043
3	15.00	-5.4	-14.6	2.5	0.114	0.	0.066	0.066	0.030	0.030
4	30.00	-5.8	-15.0	1.7	0.107	0.	0.063	0.063	0.026	0.026
5	50.00	-6.3	-15.5	2.1	0.064	0.	0.052	0.052	0.019	0.019
6	70.00	-6.4	-15.5	2.6	0.031	0.	0.080	0.080	0.024	0.024
7	85.00	-6.6	-15.7	3.3	-0.026	0.	0.079	0.079	0.020	0.020
8	90.00	-5.8	-14.9	4.6	-0.016	0.	0.141	0.141	0.033	0.033
9	95.00	-3.7	-12.8	9.3	0.050	0.	0.337	0.337	0.074	0.074

TABLE XIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 110 PERCENT DESIGN SPEED

(b) Reading 1534

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	17.3	0.7	17.3	0.7	302.6	0.997	11.22	0.977
2	23.861	23.886	15.0	0.2	15.0	0.2	302.1	0.998	11.50	0.974
3	23.129	23.167	15.1	-0.5	15.1	-0.5	301.7	0.998	11.51	0.988
4	20.925	21.001	16.0	-0.3	16.0	-0.3	300.3	0.997	11.52	0.992
5	17.963	18.090	17.3	-0.5	17.3	-0.5	298.6	0.997	11.34	0.997
6	14.953	15.118	18.6	-1.5	18.6	-1.5	296.5	0.999	11.11	1.005
7	12.652	12.791	20.7	-0.5	20.7	-0.5	295.9	0.998	11.03	0.990
8	11.874	11.971	21.5	0.9	21.5	0.9	295.8	0.998	11.06	0.984
9	11.090	11.128	25.1	5.5	25.1	5.5	296.1	0.999	10.86	0.971

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	193.6	174.0	193.6	174.0	184.8	174.0	57.6	2.2	0.	0.
2	205.1	182.6	205.1	182.6	198.0	182.6	53.2	0.6	0.	0.
3	204.6	188.2	204.6	188.2	197.5	188.2	53.3	-1.5	0.	0.
4	205.5	190.9	205.5	190.9	197.5	190.9	56.5	-1.0	0.	0.
5	198.3	188.9	198.3	188.9	189.4	188.9	58.9	-1.5	0.	0.
6	185.5	191.0	185.5	191.0	175.8	190.9	59.3	-4.9	0.	0.
7	180.6	176.0	180.6	176.0	169.0	176.0	63.8	-1.4	0.	0.
8	181.7	174.2	181.7	174.2	169.0	174.2	66.6	2.6	0.	0.
9	175.8	159.6	175.8	159.6	159.2	158.9	74.5	15.2	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	PEAK SS MACH NO
1	0.573	0.513	0.573	0.513	0.547	0.513	0.942	0.865
2	0.610	0.540	0.610	0.540	0.589	0.540	0.922	0.872
3	0.609	0.558	0.609	0.558	0.588	0.558	0.953	0.870
4	0.613	0.568	0.613	0.568	0.590	0.568	0.966	0.885
5	0.592	0.563	0.592	0.563	0.566	0.563	0.997	0.863
6	0.554	0.571	0.554	0.571	0.525	0.571	1.086	0.810
7	0.539	0.525	0.539	0.525	0.504	0.525	1.041	0.809
8	0.542	0.519	0.542	0.519	0.505	0.519	1.031	0.825
9	0.523	0.473	0.523	0.473	0.474	0.471	0.998	0.857

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.0	-6.2	4.8	0.241	0.	0.115	0.115	0.056	0.056
2	10.00	0.6	-8.6	4.2	0.231	0.	0.117	0.117	0.055	0.055
3	15.00	0.5	-8.7	3.6	0.203	0.	0.052	0.052	0.024	0.024
4	30.00	0.4	-8.7	3.7	0.187	0.	0.035	0.035	0.014	0.014
5	50.00	-0.1	-9.3	3.7	0.157	0.	0.013	0.013	0.005	0.005
6	70.00	-1.3	-10.4	2.8	0.074	0.	-0.028	-0.028	-0.008	-0.008
7	85.00	-1.0	-10.1	3.8	0.116	0.	0.057	0.057	0.014	0.014
8	90.00	-0.5	-9.6	5.0	0.124	0.	0.088	0.088	0.021	0.021
9	95.00	2.8	-6.3	9.5	0.166	0.	0.171	0.171	0.037	0.037

TABLE XIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 110 PERCENT DESIGN SPEED

(c) Reading 1418

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	21.7	1.7	21.7	1.7	306.0	0.999	11.46	0.985
2	23.861	23.886	17.0	1.1	17.0	1.1	304.9	1.000	11.89	0.968
3	23.129	23.167	17.4	0.4	17.4	0.4	303.5	1.001	11.89	0.984
4	20.925	21.001	18.9	0.6	18.9	0.6	301.9	1.001	11.83	0.995
5	17.963	18.090	20.7	0.0	20.7	0.0	299.3	1.001	11.48	0.999
6	14.953	15.118	21.5	-0.3	21.5	-0.3	296.9	1.002	11.18	0.999
7	12.652	12.791	24.0	0.8	24.0	0.8	296.2	1.000	11.15	0.989
8	11.874	11.971	25.0	2.5	25.0	2.5	296.3	1.000	11.14	0.983
9	11.090	11.128	28.0	6.5	28.0	6.5	296.3	1.002	11.02	0.964

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	183.4	167.4	183.4	167.4	170.3	167.4	67.8	5.0	0.	0.
2	201.4	175.5	201.4	175.5	192.5	175.5	59.0	3.3	0.	0.
3	200.8	182.3	200.8	182.3	191.7	182.3	60.0	1.4	0.	0.
4	200.7	186.1	200.7	186.1	189.9	186.0	65.0	2.0	0.	0.
5	187.8	176.1	187.8	176.1	175.7	176.1	66.5	0.1	0.	0.
6	173.9	164.1	173.9	164.1	161.8	164.1	63.8	-0.9	0.	0.
7	171.4	159.7	171.4	159.7	156.6	159.7	69.7	2.1	0.	0.
8	172.3	157.6	172.3	157.6	156.1	157.5	72.8	6.9	0.	0.
9	168.5	142.1	168.5	142.1	148.8	141.2	79.2	16.2	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.538	0.489	0.538	0.489	0.500	0.489	0.982	0.892
2	0.595	0.515	0.595	0.515	0.569	0.514	0.912	0.891
3	0.595	0.536	0.595	0.536	0.568	0.536	0.951	0.896
4	0.596	0.550	0.596	0.550	0.564	0.550	0.980	0.920
5	0.558	0.521	0.558	0.521	0.522	0.521	1.002	0.878
6	0.517	0.486	0.517	0.486	0.481	0.486	1.014	0.806
7	0.510	0.473	0.510	0.473	0.466	0.473	1.020	0.822
8	0.512	0.467	0.512	0.467	0.464	0.466	1.009	0.840
9	0.500	0.418	0.500	0.418	0.442	0.416	0.949	0.869

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.4	-1.8	5.8	0.254	0.	0.082	0.082	0.040	0.040
2	10.00	2.6	-6.6	5.1	0.259	0.	0.151	0.151	0.072	0.072
3	15.00	2.7	-6.5	4.5	0.226	0.	0.076	0.076	0.035	0.035
4	30.00	3.4	-5.8	4.6	0.203	0.	0.023	0.023	0.009	0.009
5	50.00	3.3	-5.9	4.1	0.189	0.	0.004	0.004	0.001	0.001
6	70.00	1.6	-7.6	3.9	0.167	0.	0.008	0.008	0.002	0.002
7	35.00	2.3	-6.8	5.0	0.167	0.	0.070	0.070	0.018	0.018
8	90.00	3.0	-6.1	6.7	0.175	0.	0.106	0.106	0.025	0.025
9	95.00	5.8	-3.3	10.5	0.239	0.	0.227	0.227	0.050	0.050

TABLE XIII. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 110 PERCENT DESIGN SPEED

(d) Reading 1420

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	31.5	3.3	31.5	3.3	311.2	0.994	11.76	0.993
2	23.861	23.886	22.7	2.8	22.7	2.8	308.4	1.000	12.13	0.972
3	23.129	23.167	22.3	2.1	22.3	2.1	306.5	1.002	12.20	0.978
4	20.925	21.001	23.4	0.8	23.4	0.8	304.0	1.000	12.05	0.993
5	17.963	18.090	24.5	0.3	24.5	0.3	300.5	1.000	11.63	0.996
6	14.953	15.118	25.6	0.6	25.6	0.6	298.3	1.000	11.36	0.992
7	12.652	12.791	27.7	1.7	27.7	1.7	297.0	1.000	11.28	0.987
8	11.874	11.971	28.5	3.7	28.5	3.7	297.0	1.001	11.26	0.982
9	11.090	11.128	32.5	7.0	32.5	7.0	297.4	1.002	11.12	0.973

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	172.2	160.1	172.2	160.1	146.9	159.9	89.9	9.2	0.	0.
2	189.1	164.0	189.1	164.0	174.5	163.8	72.8	7.9	0.	0.
3	192.6	169.3	192.6	169.3	178.2	169.2	73.1	6.1	0.	0.
4	190.0	171.3	190.0	171.3	174.4	171.3	75.5	2.4	0.	0.
5	174.7	156.2	174.7	156.2	159.0	156.2	72.5	0.7	0.	0.
6	164.0	143.6	164.0	143.6	147.9	143.6	70.9	1.5	0.	0.
7	160.3	138.5	160.3	138.5	142.0	138.4	74.5	4.1	0.	0.
8	161.0	135.4	161.0	135.4	141.5	135.1	76.8	8.6	0.	0.
9	156.9	121.8	156.9	121.8	132.4	120.9	84.2	14.9	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.499	0.464	0.499	0.464	0.426	0.463	1.089	0.997
2	0.553	0.476	0.553	0.476	0.511	0.476	0.939	0.934
3	0.566	0.493	0.566	0.493	0.524	0.493	0.949	0.946
4	0.560	0.503	0.560	0.503	0.514	0.503	0.983	0.950
5	0.516	0.459	0.516	0.459	0.470	0.459	0.983	0.878
6	0.485	0.422	0.485	0.422	0.437	0.422	0.971	0.823
7	0.474	0.407	0.474	0.407	0.420	0.407	0.975	0.825
8	0.477	0.398	0.477	0.398	0.419	0.397	0.955	0.838
9	0.463	0.356	0.463	0.356	0.391	0.354	0.913	0.876

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	17.2	7.9	7.4	0.299	0.	0.047	0.047	0.023	0.023
2	10.00	8.2	-1.0	6.8	0.295	0.	0.148	0.148	0.070	0.070
3	15.00	7.7	-1.6	6.1	0.281	0.	0.111	0.111	0.051	0.051
4	30.00	7.9	-1.3	4.8	0.258	0.	0.039	0.039	0.016	0.016
5	50.00	7.1	-2.1	4.4	0.252	0.	0.027	0.027	0.010	0.010
6	70.00	5.6	-3.5	4.9	0.250	0.	0.052	0.052	0.015	0.015
7	85.00	6.0	-3.1	5.9	0.246	0.	0.090	0.090	0.023	0.023
8	90.00	6.5	-2.7	7.8	0.259	0.	0.124	0.124	0.029	0.029
9	95.00	10.2	1.1	11.0	0.321	0.	0.200	0.200	0.044	0.044

TABLE XIII. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 110 PERCENT DESIGN SPEED

(e) Reading 1421

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	35.8	4.1	35.8	4.1	312.1	0.993	11.78	0.991
2	23.861	23.886	25.6	3.3	25.6	3.3	308.7	1.000	12.03	0.975
3	23.129	23.167	23.1	2.2	23.1	2.2	307.0	1.002	12.16	0.975
4	20.925	21.001	24.0	0.9	24.0	0.9	304.2	0.999	12.03	0.991
5	17.963	18.090	25.8	0.3	25.8	0.3	300.8	0.999	11.67	0.993
6	14.953	15.118	27.2	0.7	27.2	0.7	298.5	1.000	11.40	0.994
7	12.652	12.791	29.2	1.9	29.2	1.9	297.5	1.000	11.30	0.989
8	11.874	11.971	30.0	4.0	30.0	4.0	297.5	1.001	11.33	0.981
9	11.090	11.128	34.3	7.1	34.3	7.1	297.6	1.002	11.18	0.972

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	167.6	154.3	167.6	154.3	135.9	153.9	98.1	11.0	0.	0.
2	181.2	156.9	181.2	156.9	163.4	156.6	78.3	8.9	0.	0.
3	188.0	161.6	188.0	161.6	172.9	161.4	73.9	6.2	0.	0.
4	185.8	165.4	185.8	165.4	169.7	165.3	75.6	2.6	0.	0.
5	171.8	151.2	171.8	151.2	154.6	151.2	74.9	0.9	0.	0.
6	160.7	139.3	160.7	139.3	142.9	139.3	73.5	1.7	0.	0.
7	156.8	133.3	156.8	133.3	136.9	133.2	76.5	4.4	0.	0.
8	159.1	130.0	159.1	130.0	137.8	129.7	79.6	9.1	0.	0.
9	154.8	116.0	154.8	116.0	127.9	115.1	87.2	14.3	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.484	0.446	0.484	0.446	0.393	0.444	1.132	1.046
2	0.529	0.454	0.529	0.454	0.477	0.454	0.958	0.946
3	0.551	0.470	0.551	0.470	0.507	0.469	0.934	0.938
4	0.547	0.484	0.547	0.484	0.500	0.484	0.974	0.938
5	0.507	0.444	0.507	0.444	0.456	0.444	0.978	0.885
6	0.474	0.409	0.474	0.409	0.422	0.409	0.975	0.832
7	0.463	0.391	0.463	0.391	0.404	0.391	0.973	0.829
8	0.470	0.381	0.470	0.381	0.407	0.380	0.941	0.852
9	0.457	0.339	0.457	0.339	0.378	0.336	0.900	0.894

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	21.5	12.5	8.2	0.333	0.	0.061	0.061	0.030	0.030
2	10.00	11.2	1.9	7.3	0.316	0.	0.143	0.143	0.068	0.068
3	15.00	8.5	-0.7	6.2	0.306	0.	0.134	0.134	0.062	0.062
4	30.00	8.5	-0.7	4.9	0.273	0.	0.049	0.049	0.020	0.020
5	50.00	8.4	-0.8	4.5	0.273	0.	0.042	0.042	0.015	0.015
6	70.00	7.3	-1.9	5.0	0.266	0.	0.043	0.043	0.013	0.013
7	85.00	7.5	-1.6	6.1	0.265	0.	0.077	0.077	0.019	0.019
8	90.00	8.0	-1.1	8.2	0.288	0.	0.136	0.136	0.032	0.032
9	95.00	12.0	2.9	11.1	0.354	0.	0.210	0.210	0.046	0.046

TABLE XIV. - BLADE-ELEMENT DATA AT BLADE EDGES FOR

STATOR 51. 120 PERCENT DESIGN SPEED

(a) Reading 1538

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	12.7	0.6	12.7	0.6	302.5	0.995	11.11	0.958
2	23.861	23.886	12.3	-0.0	12.3	-0.0	301.7	0.997	11.17	0.978
3	23.129	23.167	12.0	-0.5	12.0	-0.5	300.7	0.997	11.16	0.989
4	20.925	21.001	12.0	-1.3	12.0	-1.3	298.9	0.997	11.05	0.996
5	17.963	18.090	12.7	-2.3	12.7	-2.3	297.4	0.995	10.86	0.998
6	14.953	15.118	14.7	-1.9	14.7	-1.9	296.1	0.998	10.80	0.996
7	12.652	12.791	16.8	-0.6	16.8	-0.6	295.7	0.998	10.78	0.991
8	11.874	11.971	18.1	0.9	18.1	0.9	296.3	0.998	10.94	0.971
9	11.090	11.128	21.2	5.5	21.2	5.5	297.7	0.994	11.02	0.924

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	230.9	204.7	230.9	204.7	225.2	204.7	50.9	2.1	0.	0.
2	232.1	212.8	232.1	212.8	226.7	212.8	49.4	-0.1	0.	0.
3	231.0	215.9	231.0	215.9	225.9	215.9	48.0	-1.9	0.	0.
4	227.3	216.0	227.3	216.0	222.3	216.0	47.4	-5.0	0.	0.
5	216.5	212.8	216.5	212.8	211.2	212.7	47.6	-8.4	0.	0.
6	205.4	211.5	205.4	211.5	198.7	211.4	52.1	-7.1	0.	0.
7	201.0	212.1	201.0	212.1	192.4	212.1	58.1	-2.2	0.	0.
8	206.0	212.3	206.0	212.3	195.9	212.2	63.9	3.3	0.	0.
9	209.7	197.7	209.7	197.7	195.5	196.8	75.8	19.0	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.694	0.610	0.694	0.610	0.676	0.610	0.909	0.938
2	0.698	0.636	0.698	0.636	0.682	0.636	0.939	0.931
3	0.696	0.648	0.696	0.648	0.681	0.648	0.955	0.917
4	0.686	0.650	0.686	0.650	0.671	0.650	0.972	0.895
5	0.653	0.642	0.653	0.642	0.637	0.642	1.007	0.845
6	0.618	0.638	0.618	0.638	0.598	0.638	1.064	0.818
7	0.604	0.640	0.604	0.640	0.578	0.640	1.102	0.826
8	0.620	0.641	0.620	0.641	0.589	0.641	1.083	0.870
9	0.630	0.593	0.630	0.593	0.587	0.591	1.007	0.948

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-1.6	-10.8	4.7	0.217	0.	0.151	0.151	0.074	0.074
2	10.00	-2.2	-11.4	4.0	0.184	0.	0.080	0.080	0.038	0.038
3	15.00	-2.7	-11.9	3.5	0.164	0.	0.039	0.039	0.018	0.018
4	30.00	-3.5	-12.7	2.7	0.145	0.	0.015	0.015	0.006	0.006
5	50.00	-4.7	-13.9	1.9	0.109	0.	0.010	0.010	0.004	0.004
6	70.00	-5.3	-14.4	2.3	0.056	0.	0.018	0.018	0.006	0.006
7	85.00	-4.9	-14.0	3.6	0.020	0.	0.042	0.042	0.011	0.011
8	90.00	-4.0	-13.1	5.0	0.039	0.	0.125	0.125	0.030	0.030
9	95.00	-1.1	-10.2	9.5	0.117	0.	0.324	0.324	0.071	0.071

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 120 PERCENT DESIGN SPEED

(b) Reading 1537

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	21.3	1.4	21.3	1.4	308.1	0.994	11.37	0.975
2	23.861	23.886	17.2	0.8	17.2	0.8	306.2	0.999	11.76	0.961
3	23.129	23.167	17.6	0.1	17.6	0.1	305.2	0.998	11.71	0.983
4	20.925	21.001	17.5	-0.7	17.5	-0.7	302.9	0.996	11.62	0.998
5	17.963	18.090	19.3	-0.3	19.3	-0.3	301.7	0.995	11.58	0.998
6	14.953	15.118	21.1	-0.4	21.1	-0.4	299.3	0.997	11.40	C.995
7	12.652	12.791	22.8	0.1	22.8	0.1	298.7	0.995	11.33	0.985
8	11.874	11.971	23.6	1.5	23.6	1.5	298.4	0.996	11.35	0.978
9	11.090	11.128	27.9	5.5	27.9	5.5	298.3	0.998	10.99	0.972

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	202.5	175.1	202.5	175.1	188.6	175.0	73.7	4.3	0.	0.
2	215.7	181.4	215.7	181.4	206.1	181.4	63.7	2.4	0.	0.
3	212.8	187.9	212.8	187.9	202.8	187.9	64.5	0.2	0.	0.
4	209.6	191.7	209.6	191.7	199.9	191.7	63.0	-2.3	0.	0.
5	205.6	191.8	205.6	191.8	194.1	191.8	68.0	-1.0	0.	0.
6	195.5	185.0	195.5	185.0	182.3	185.0	70.4	-1.4	0.	0.
7	191.7	180.0	191.7	180.0	176.7	180.0	74.3	0.3	0.	0.
8	192.7	178.6	192.7	178.6	176.6	178.5	77.1	4.6	0.	0.
9	182.3	161.5	182.3	161.5	161.1	160.8	85.3	15.4	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.596	0.512	0.596	0.512	0.555	0.512	0.928	0.981
2	0.640	0.532	0.640	0.532	0.611	0.532	0.880	0.961
3	0.632	0.554	0.632	0.554	0.602	0.554	0.927	0.956
4	0.624	0.568	0.624	0.568	0.595	0.568	0.959	0.932
5	0.612	0.570	0.612	0.570	0.578	0.570	0.988	0.934
6	0.582	0.550	0.582	0.550	0.543	0.550	1.015	0.900
7	0.571	0.536	0.571	0.536	0.526	0.536	1.018	0.898
8	0.575	0.531	0.575	0.531	0.527	0.531	1.011	0.915
9	0.542	0.478	0.542	0.478	0.479	0.475	0.998	0.939

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.0	-2.2	5.5	0.303	0.	0.118	0.118	0.058	0.058
2	10.00	2.7	-6.5	4.8	0.294	0.	0.164	0.164	0.078	0.078
3	15.00	3.0	-6.2	4.1	0.256	0.	0.071	0.071	0.033	0.033
4	30.00	2.0	-7.2	3.3	0.215	0.	0.007	0.007	0.003	0.003
5	50.00	1.9	-7.3	3.8	0.187	0.	0.011	0.011	0.004	0.004
6	70.00	1.1	-8.0	3.8	0.162	0.	0.026	0.026	0.008	0.008
7	85.00	1.1	-8.0	4.3	0.158	0.	0.073	0.073	0.019	0.019
8	90.00	1.6	-7.5	5.6	0.162	0.	0.108	0.108	0.026	0.026
9	95.00	5.7	-3.5	9.5	0.198	0.	0.155	0.155	0.034	0.034

TABLE XIV. - Continued. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 120 PERCENT DESIGN SPEED

(c) Reading 1536

	RADII		ABS BETAM		REL BETAM		TOTAL TEMP		TOTAL PRESS	
RP	IN	OUT	IN	OUT	IN	OUT	IN	RATIO	IN	RATIO
1	24.595	24.608	37.4	3.6	37.4	3.6	315.7	0.984	11.49	0.994
2	23.861	23.886	25.4	2.2	25.4	2.2	31'.3	0.994	11.85	0.972
3	23.129	23.167	22.1	0.8	22.1	0.8	303.0	0.997	12.04	0.972
4	20.925	21.001	22.4	0.2	22.4	0.2	30'.2	0.996	12.21	0.990
5	17.963	18.090	24.0	0.5	24.0	0.5	304.5	0.994	12.04	0.990
6	14.953	15.118	24.8	-0.2	24.8	-0.2	300.5	0.997	11.58	0.994
7	12.652	12.791	26.7	0.5	26.7	0.5	299.4	0.996	11.49	0.986
8	11.874	11.971	27.6	2.6	27.6	2.6	299.2	0.997	11.47	0.980
9	11.090	11.128	32.6	5.8	32.6	5.8	299.1	0.999	11.09	0.983

	ABS VEL		REL VEL		MERID VEL		TANG VEL		WHEEL SPEED	
RP	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
1	179.8	159.1	179.8	159.1	142.9	158.8	109.1	10.0	0.	0.
2	194.9	162.5	194.9	162.5	176.1	162.3	83.5	6.3	0.	0.
3	202.1	169.3	202.1	169.3	187.2	169.3	76.1	2.5	0.	0.
4	207.1	183.7	207.1	183.7	191.5	183.7	78.8	0.5	0.	0.
5	201.7	178.2	201.7	178.2	184.3	178.2	82.0	1.4	0.	0.
6	183.8	163.2	183.8	163.2	166.8	163.2	77.2	-0.6	0.	0.
7	181.1	157.8	181.1	157.8	161.9	157.8	81.2	1.4	0.	0.
8	181.4	154.7	181.4	154.7	160.7	154.5	84.1	6.9	0.	0.
9	168.9	138.3	168.9	138.3	142.3	137.6	91.0	14.0	0.	0.

	ABS MACH NO		REL MACH NO		MERID MACH NO		MERID VEL R	PEAK SS MACH NO
RP	IN	OUT	IN	OUT	IN	OUT		
1	0.518	0.460	0.518	0.460	0.412	0.459	1.111	1.150
2	0.569	0.471	0.569	0.471	0.514	0.470	0.922	1.012
3	0.593	0.493	0.593	0.493	0.550	0.493	0.904	0.989
4	0.611	0.539	0.611	0.539	0.565	0.539	0.959	1.014
5	0.597	0.525	0.597	0.525	0.545	0.525	0.967	1.005
6	0.544	0.481	0.544	0.481	0.494	0.481	0.978	0.910
7	0.537	0.466	0.537	0.466	0.480	0.466	0.975	0.915
8	0.538	0.456	0.538	0.456	0.477	0.456	0.962	0.931
9	0.499	0.406	0.499	0.406	0.421	0.404	0.967	0.947

	PERCENT	INCIDENCE		DEV	D-FACT	EFF	LOSS COEFF		LOSS PARAM	
RP	SPAN	MEAN	SS				TOT	PROF	TOT	PROF
1	5.00	23.0	13.8	7.7	0.384	0.	0.037	0.037	0.018	0.018
2	10.00	10.9	1.7	6.3	0.354	0.	0.140	0.140	0.067	0.067
3	15.00	7.5	-1.7	4.9	0.329	0.	0.132	0.132	0.061	0.061
4	30.00	6.8	-2.3	4.2	0.270	0.	0.044	0.044	0.018	0.018
5	50.00	6.6	-2.6	4.6	0.259	0.	0.048	0.048	0.017	0.017
6	70.00	4.9	-4.2	4.1	0.238	0.	0.034	0.034	0.010	0.010
7	85.00	5.0	-4.1	4.7	0.239	0.	0.080	0.080	0.020	0.020
8	90.00	5.6	-3.5	6.7	0.247	0.	0.113	0.113	0.027	0.027
9	95.00	10.4	1.2	9.8	0.282	0.	0.110	0.110	0.024	0.024

TABLE XIV. - Concluded. BLADE-ELEMENT DATA AT BLADE EDGES

FOR STATOR 51. 120 PERCENT DESIGN SPEED

(d) Reading 1535

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.595	24.608	46.8	4.7	46.8	4.7	319.2	0.982	11.85	0.985
2	23.861	23.886	34.3	3.0	34.3	3.0	314.9	0.992	11.95	0.982
3	23.129	23.167	26.7	1.9	26.7	1.9	312.1	0.997	12.20	0.973
4	20.925	21.001	26.2	2.3	26.2	2.3	30[illegible].8	0.997	12.56	0.981
5	17.963	18.090	26.8	-0.3	26.8	-0.3	305.[illegible]	0.993	12.08	0.988
6	14.953	15.118	27.9	0.4	27.9	0.4	301.6	0.996	11.73	0.989
7	12.652	12.791	29.7	1.3	29.7	1.3	300.1	0.997	11.62	0.983
8	11.874	1[illegible].971	31.0	3.4	31.0	3.4	300.0	0.997	11.59	0.977
9	11.090	11.128	36.0	6.3	36.0	6.3	300.1	0.997	11.26	0.980

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	174.5	151.1	174.5	151.1	119.5	150.6	127.2	12.3	0.	0.
2	182.0	154.5	182.0	154.5	150.4	154.3	102.5	8.2	0.	0.
3	195.0	159.9	195.0	159.9	174.2	159.8	87.7	5.2	0.	0.
4	206.1	177.4	206.1	177.4	185.0	177.2	90.8	7.0	0.	0.
5	190.2	163.5	190.2	163.5	169.8	163.5	85.7	-1.0	0.	0.
6	176.7	149.9	176.7	149.9	156.1	149.9	82.7	1.0	0.	0.
7	174.2	143.3	174.2	143.3	151.4	143.3	86.2	3.2	0.	0.
8	174.3	139.1	174.3	139.1	149.4	138.8	89.8	8.3	0.	0.
9	163.9	123.1	163.9	123.1	132.6	122.4	96.3	13.5	0.	0.

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	0.499	0.434	0.499	0.434	0.342	0.432	[illegible].261	1.3[illegible]
2	0.526	0.445	0.526	0.445	0.434	0.444	1.026	1.103
3	0.568	0.462	0.568	0.462	0.508	0.461	0.917	1.036
4	0.605	0.517	0.605	0.517	0.543	0.516	0.958	1.083
5	0.560	0.479	0.560	0.479	0.500	0.479	0.963	0.996
6	0.521	0.440	0.521	0.440	0.461	0.440	0.960	0.926
7	0.515	0.421	0.515	0.421	0.447	0.421	0.947	0.930
8	0.515	0.408	0.515	0.408	0.442	0.407	0.929	0.951
9	0.483	0.360	0.483	0.360	0.391	0.357	0.923	0.974

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	32.5	23.3	8.7	0.455	0.	0.097	0.097	0.047	0.047
2	10.00	19.8	10.6	7.1	0.397	0.	0.103	0.103	0.049	0.049
3	15.00	12.1	2.9	5.9	0.374	0.	0.138	0.138	0.063	0.063
4	30.00	10.6	1.4	6.3	0.308	[illegible].	0.086	0.086	0.036	0.036
5	50.00	9.4	0.2	3.8	0.303	0.	0.062	0.062	0.022	0.022
6	70.00	7.9	-1.2	4.6	0.289	0.	0.063	0.063	0.019	0.019
7	85.00	8.0	-1.1	5.5	0.297	0.	0.105	0.105	0.027	0.027
8	90.00	9.0	-0.1	7.6	0.312	0.	0.139	0.139	0.033	0.033
9	95.00	13.7	4.6	10.3	0.360	0.	0.137	0.137	0.030	0.030

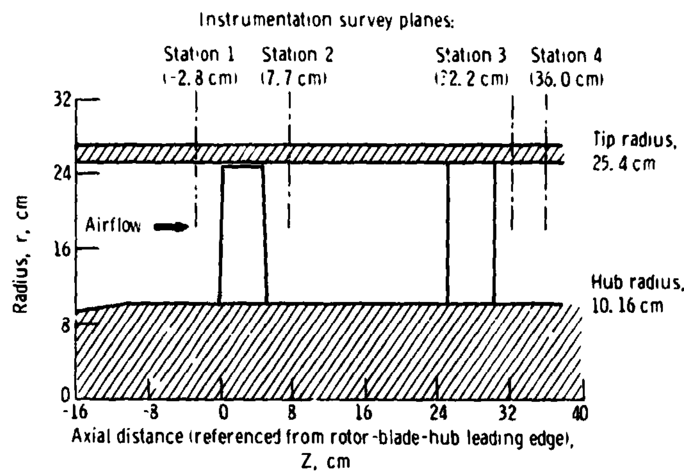


Figure 1. - Flow path for stage 51A, showing axial location of instrumentation.

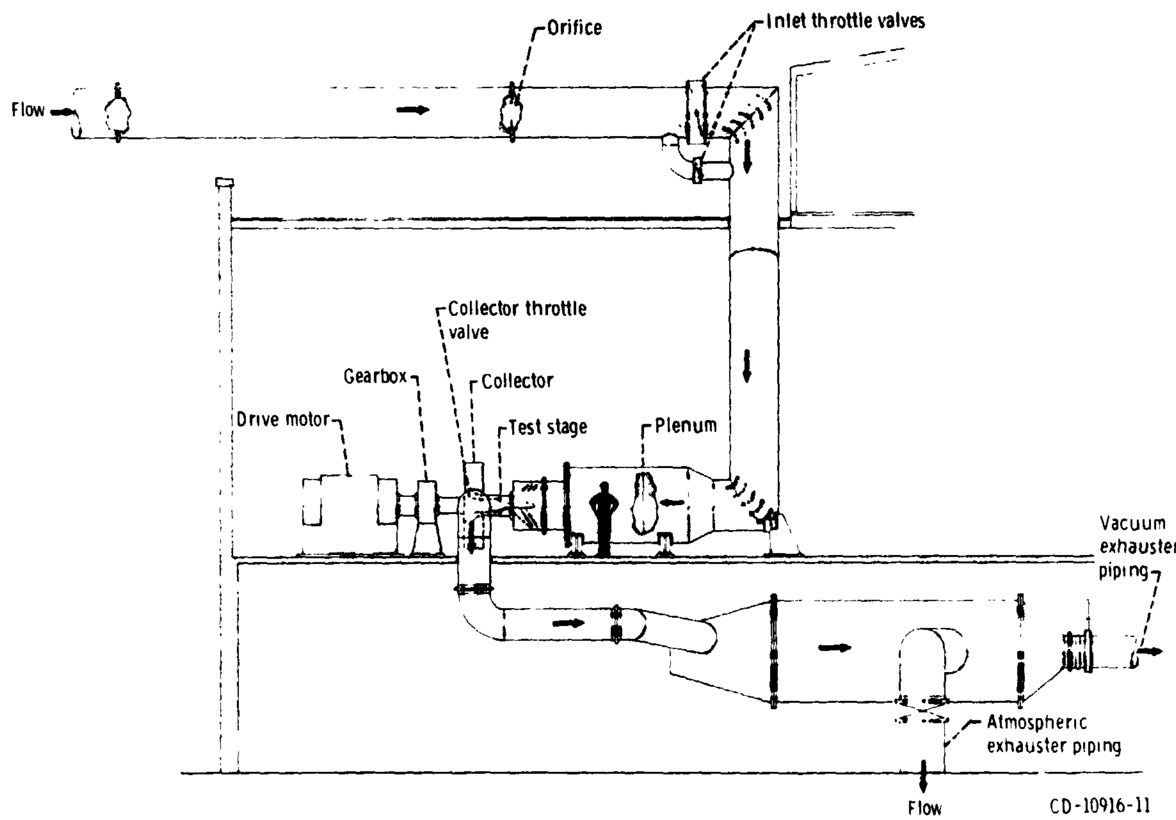


Figure 2. - Compressor test facility.

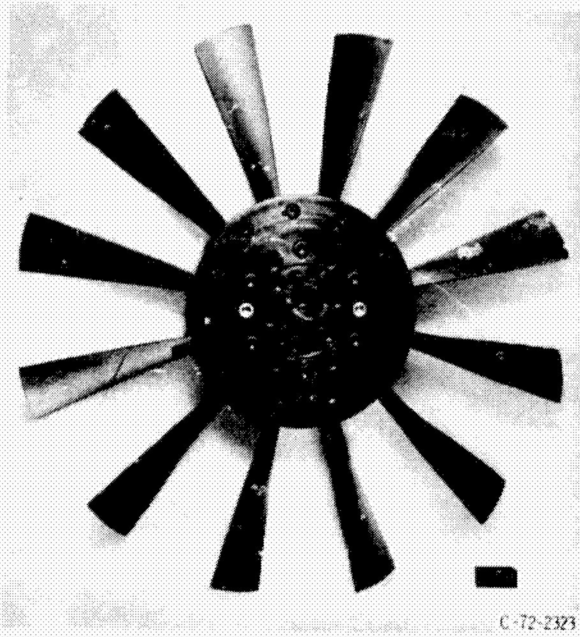


Figure 3. - Rotor 51A.

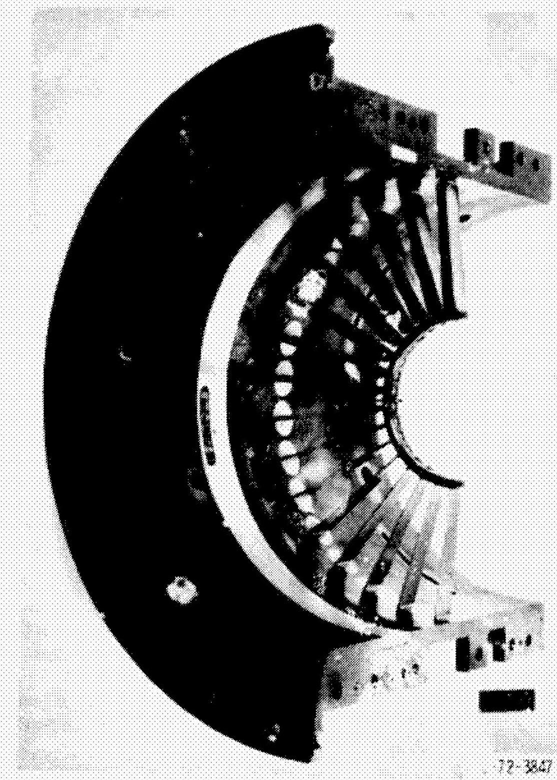
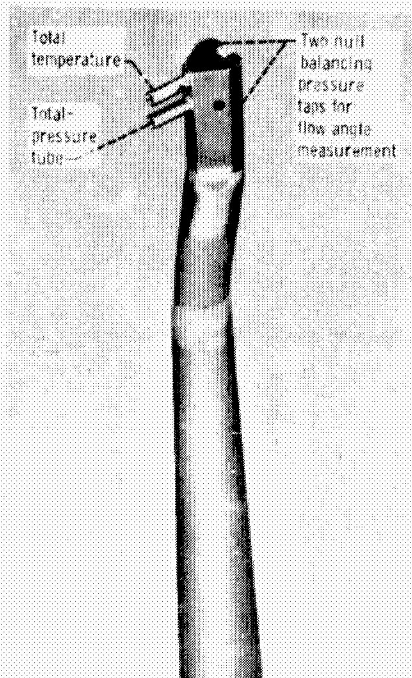


Figure 4. - Stator 51.



(a) Combination total pressure, total temperature, and flow angle probe (double barrel probe).

(b) Static pressure probe (8° wedge).

Figure 5. - Sensing probes.

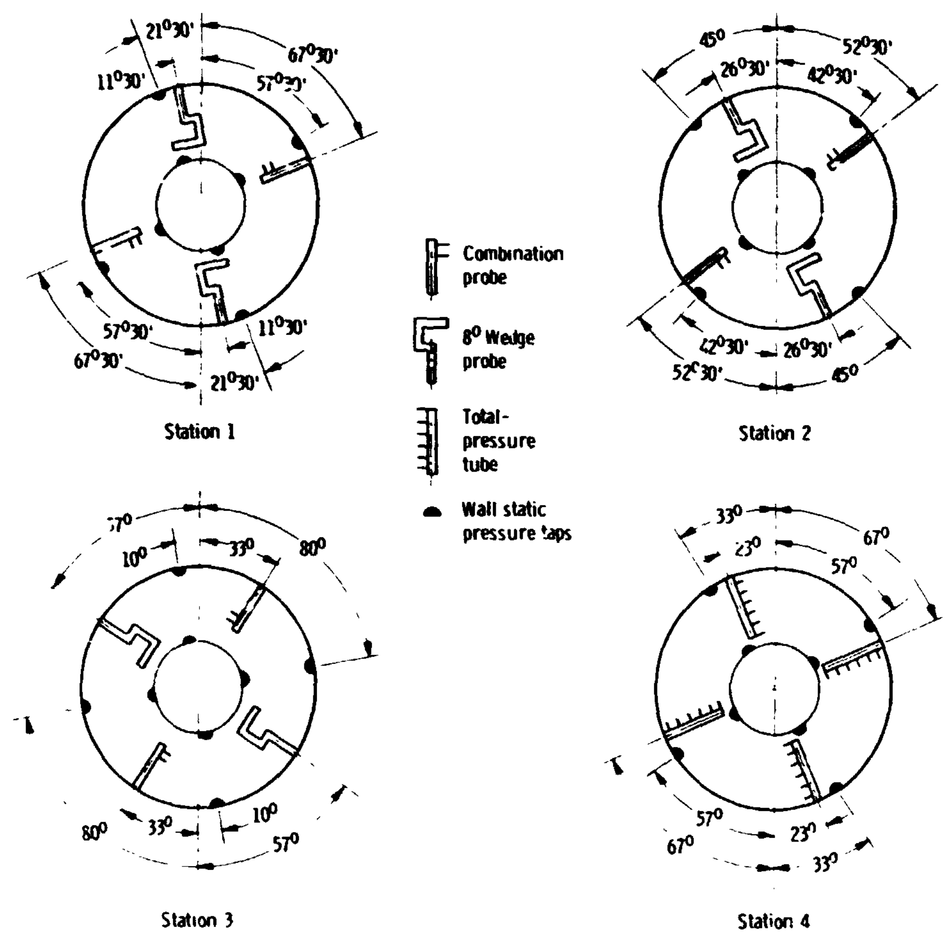


Figure 6. - Circumferential location of instrumentation at measuring stations (facing downstream).

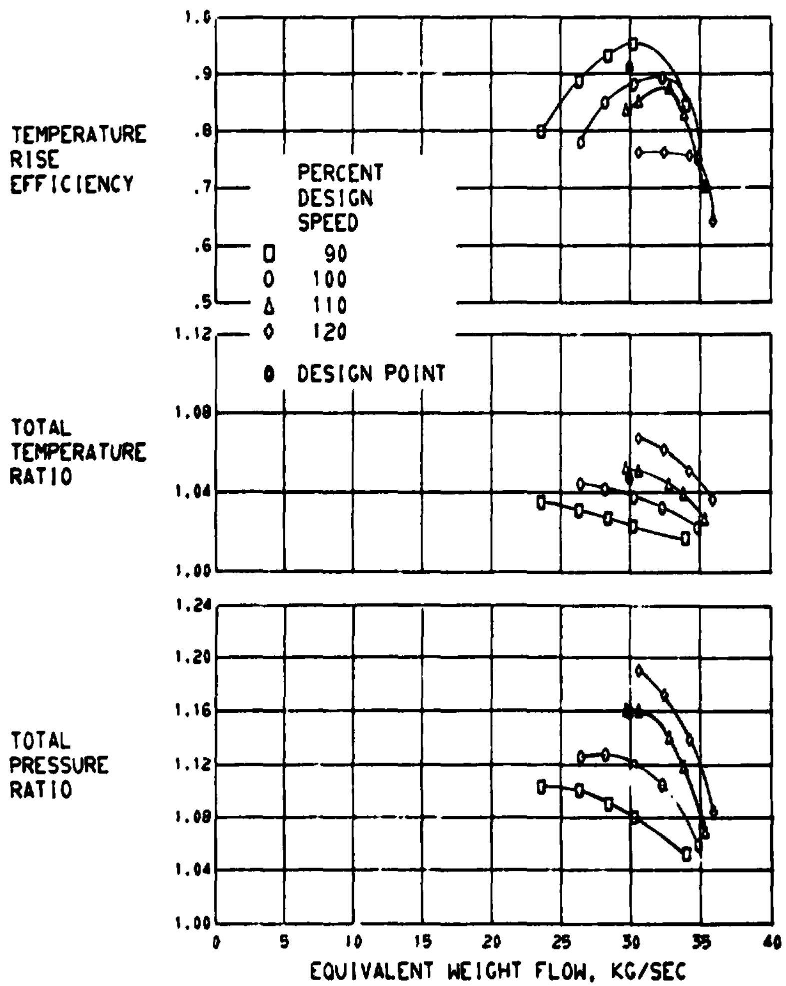


FIGURE 7. - OVERALL PERFORMANCE FOR ROTOR 51A.

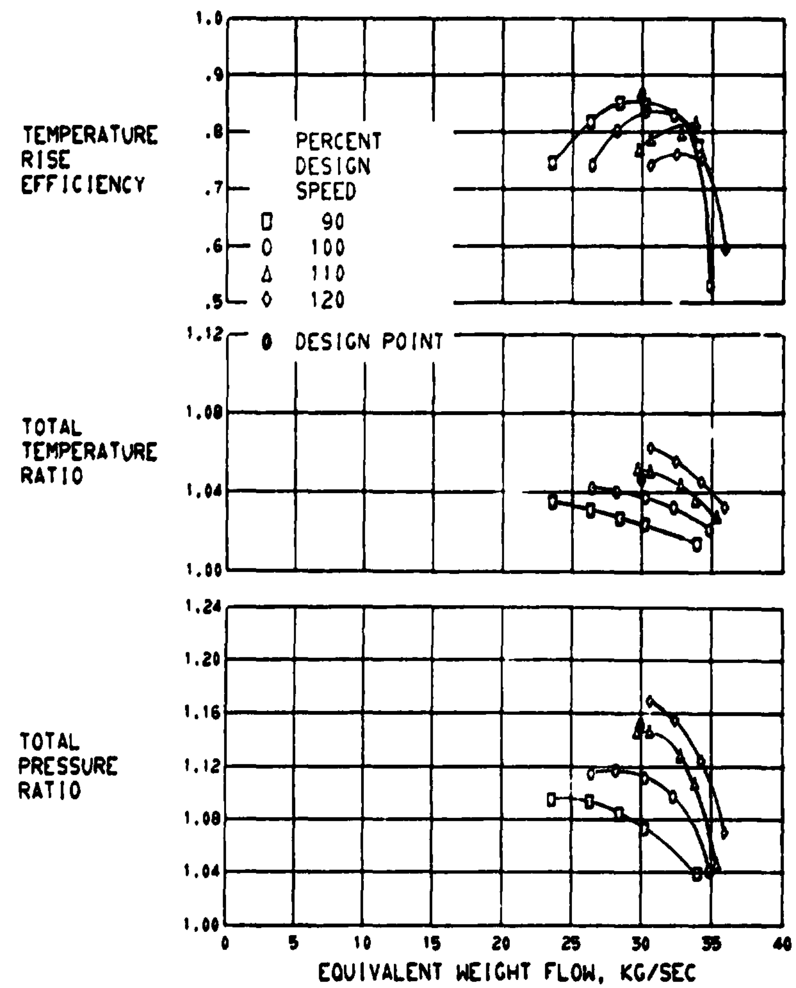
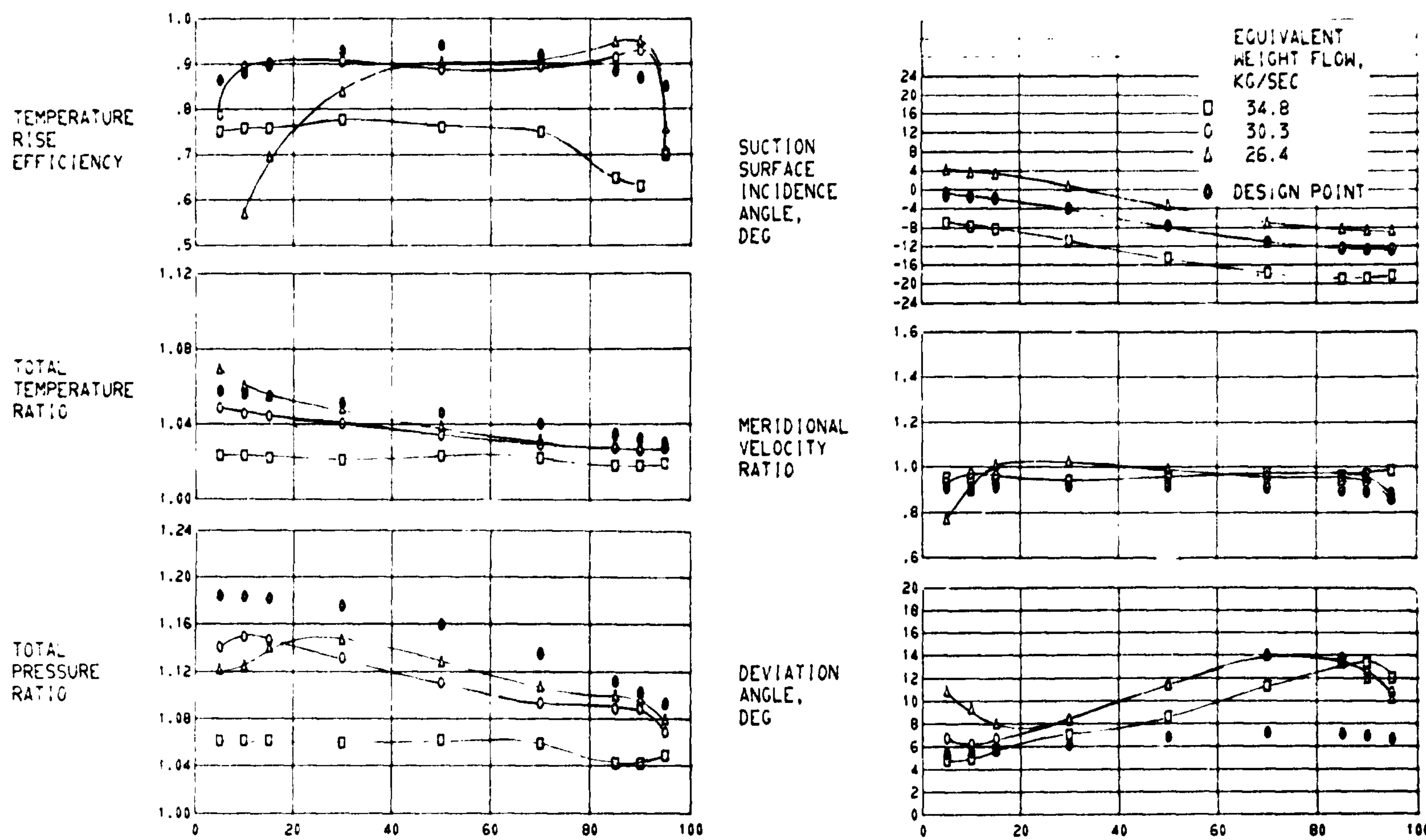


FIGURE 8. - OVERALL PERFORMANCE FOR ROTOR 51A.


TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
SUCTION SURFACE INCIDENCE ANGLE, DEG
MERIDIONAL VELOCITY RATIO
DEVIATION ANGLE, DEG
EQUIVALENT WEIGHT FLOW, KG/SEC
34.8
30.3
26.4
DESIGN POINT
1.0
.9
.8
.7
.6
.5
1.12
1.08
1.04
1.00
1.24
1.20
1.16
1.12
1.08
1.04
1.00
0
20
40
60
80
100
24
20
16
12
8
4
0
-4
-8
-12
-16
-20
-24
1.6
1.4
1.2
1.0
.8
.6
20
18
16
14
12
10
8
6
4
2
0

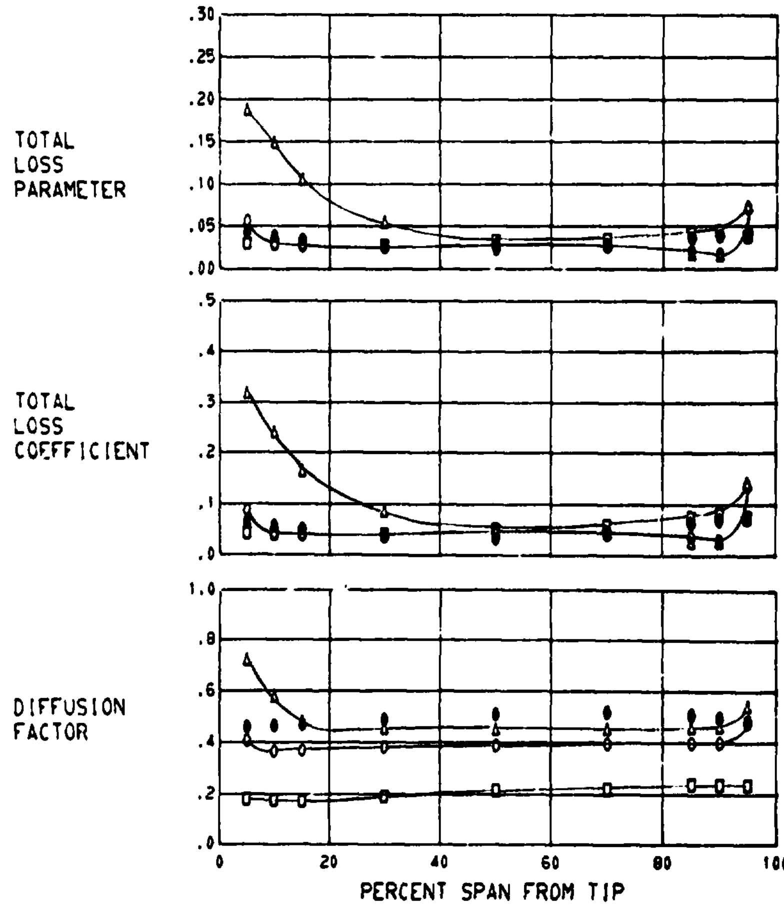


FIGURE 9. - RADIAL DISTRIBUTION OF PERFORMANCE FOR ROTOR 5JA. 100 PERCENT OF DESIGN SPEED.

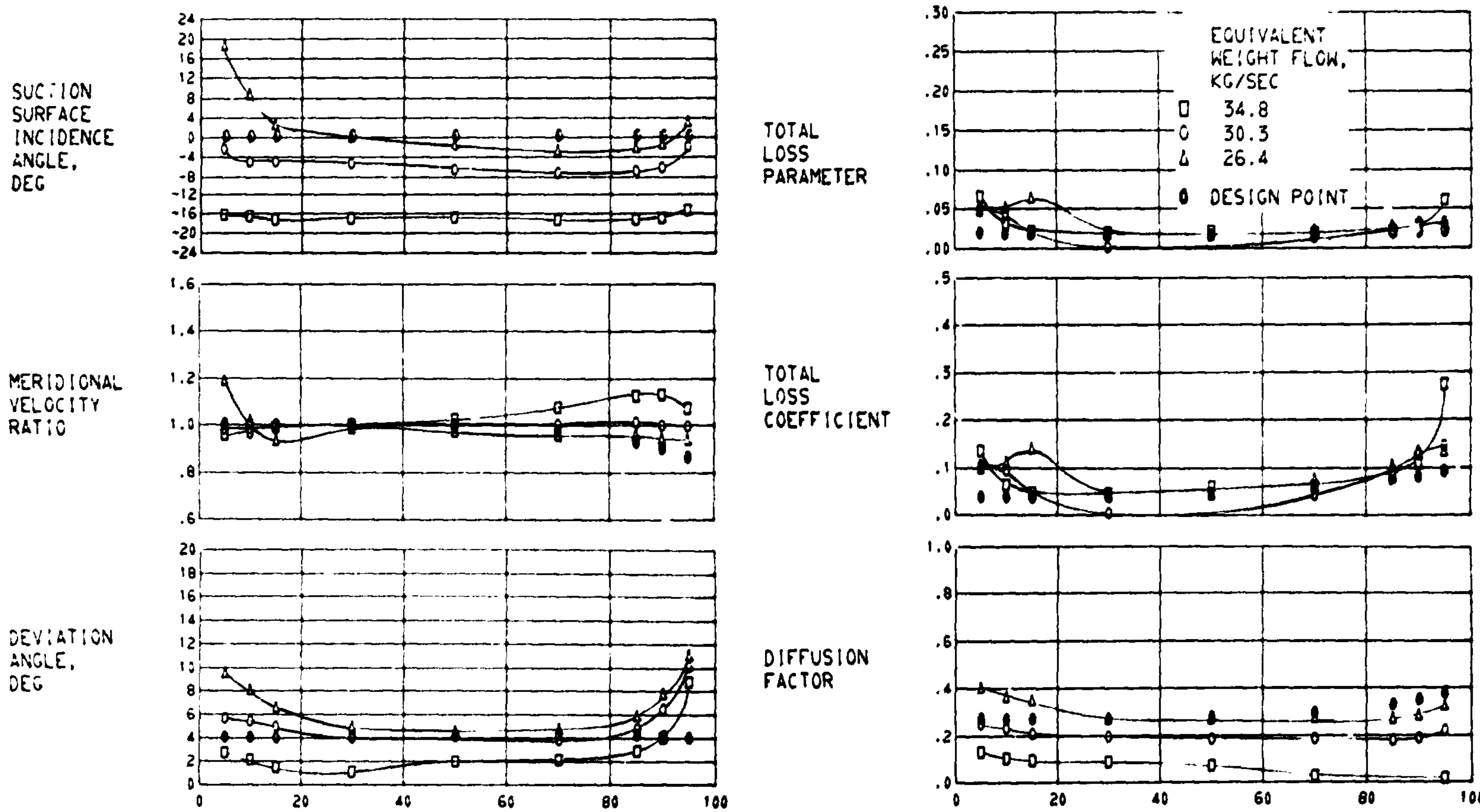
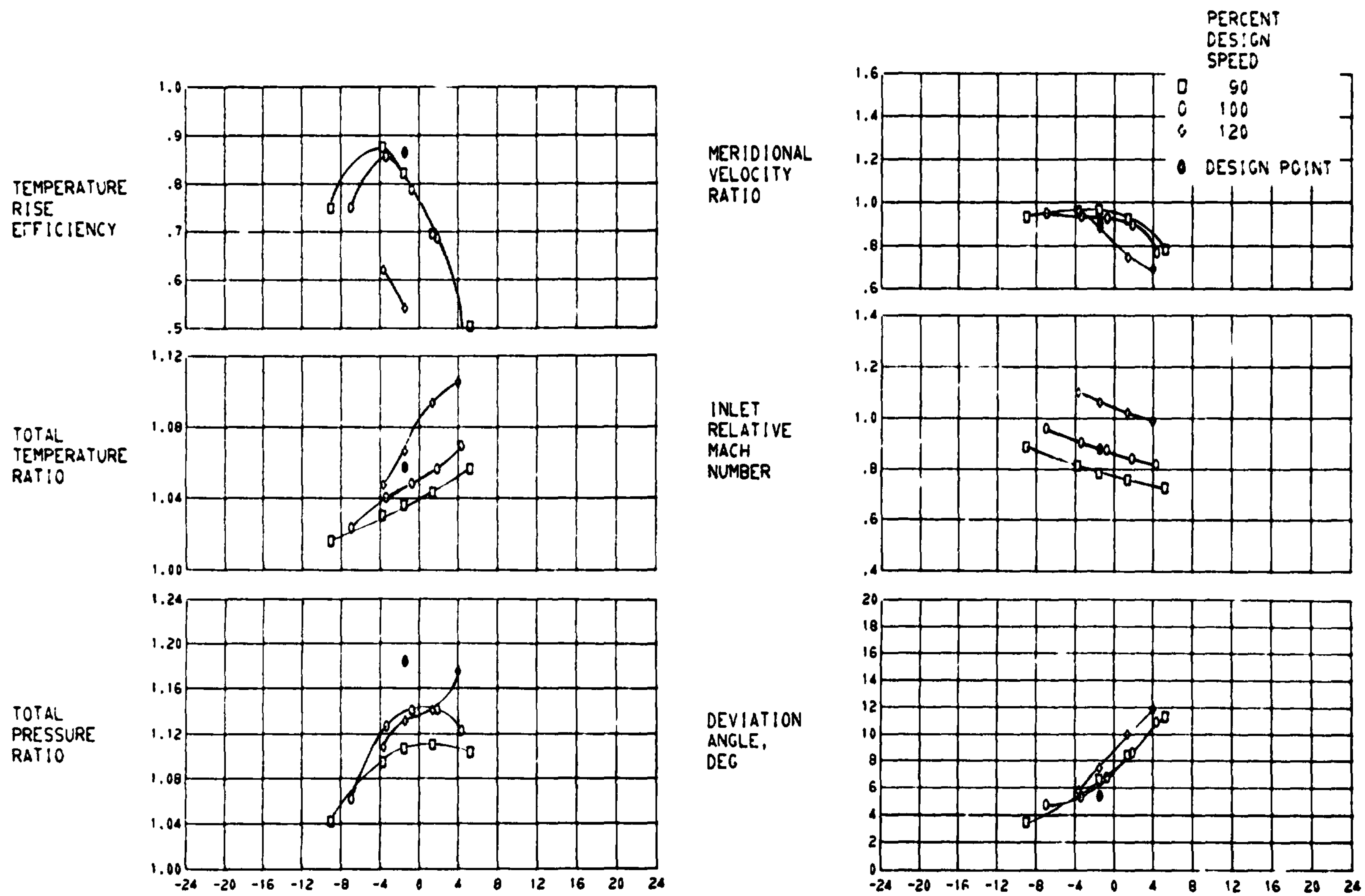
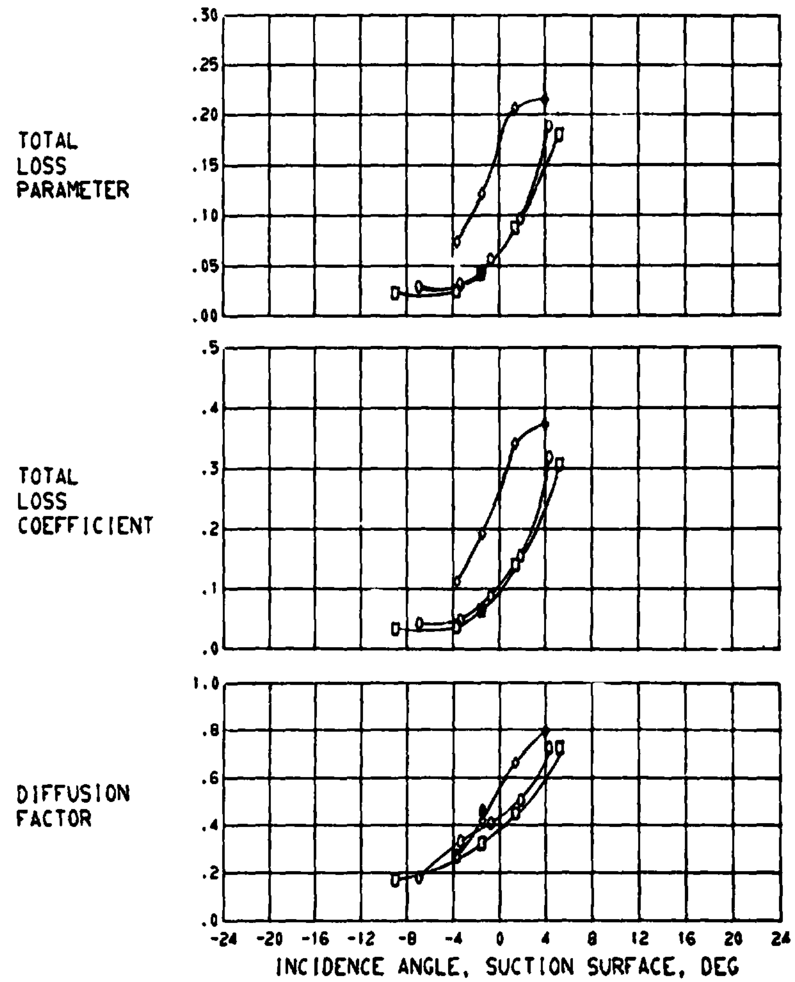


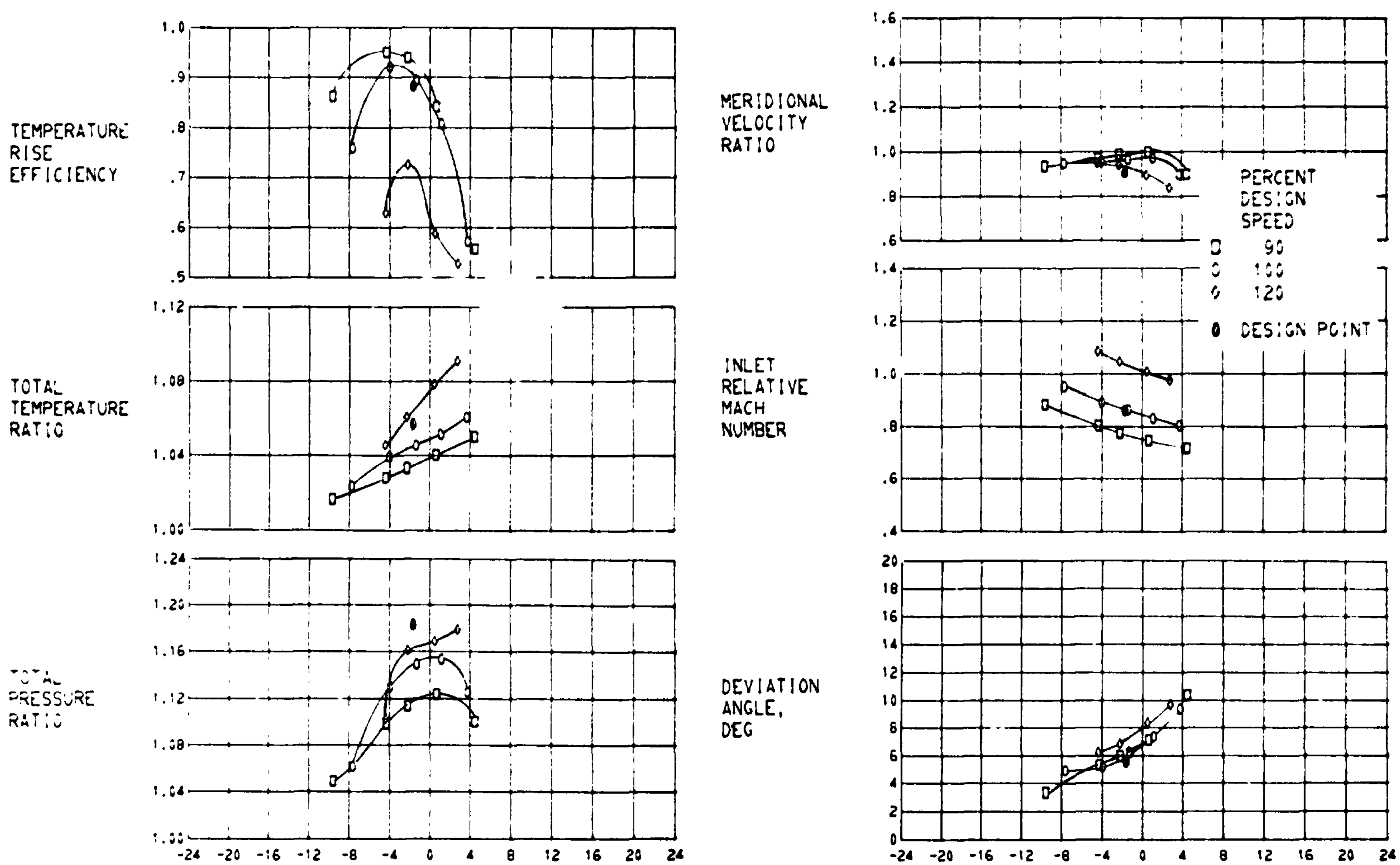
FIGURE 10. - RADIAL DISTRIBUTION OF PERFORMANCE FOR STATOR 51A. 100 PERCENT OF DESIGN SPEED.

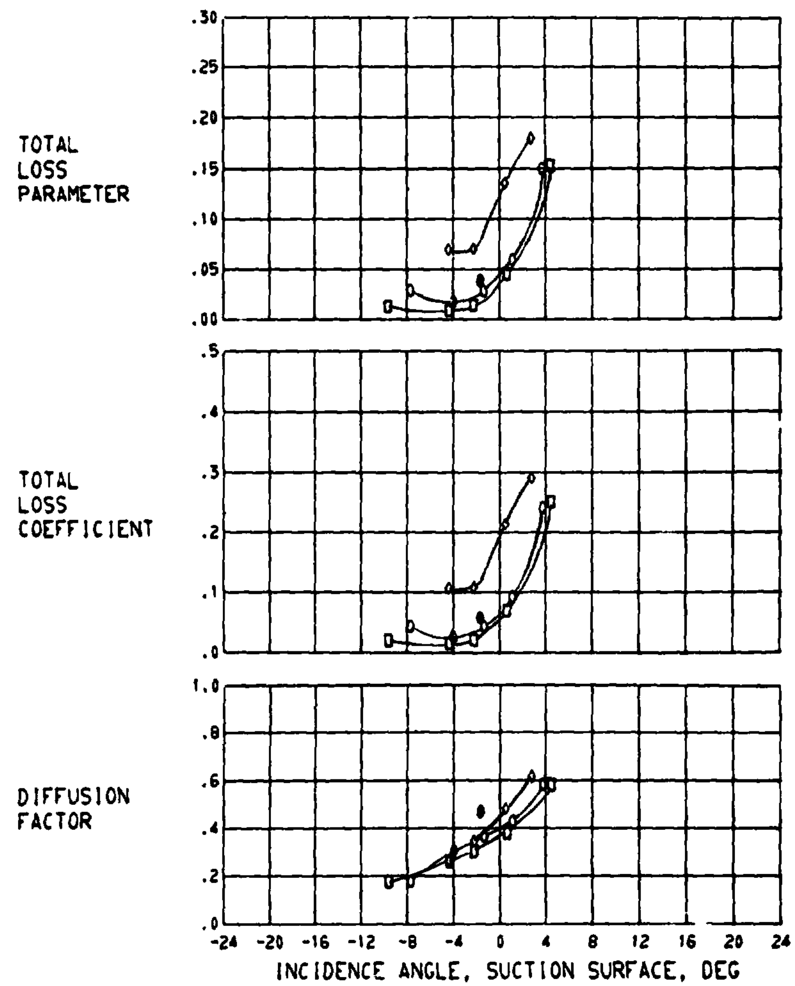

TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
INLET RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT
1.0
.9
.8
.7
.6
.5
1.12
1.08
1.04
1.00
1.24
1.20
1.16
1.12
1.08
1.04
1.00
-24 -20 -16 -12 -8 -4 0 4 8 12 16 20 24
1.6
1.4
1.2
1.0
.8
.6
1.4
1.2
1.0
.8
.6
.4
20
18
16
14
12
10
8
6
4
2
0
-24 -20 -16 -12 -8 -4 0 4 8 12 16 20 24



(A) 5.0 PERCENT SPAN.

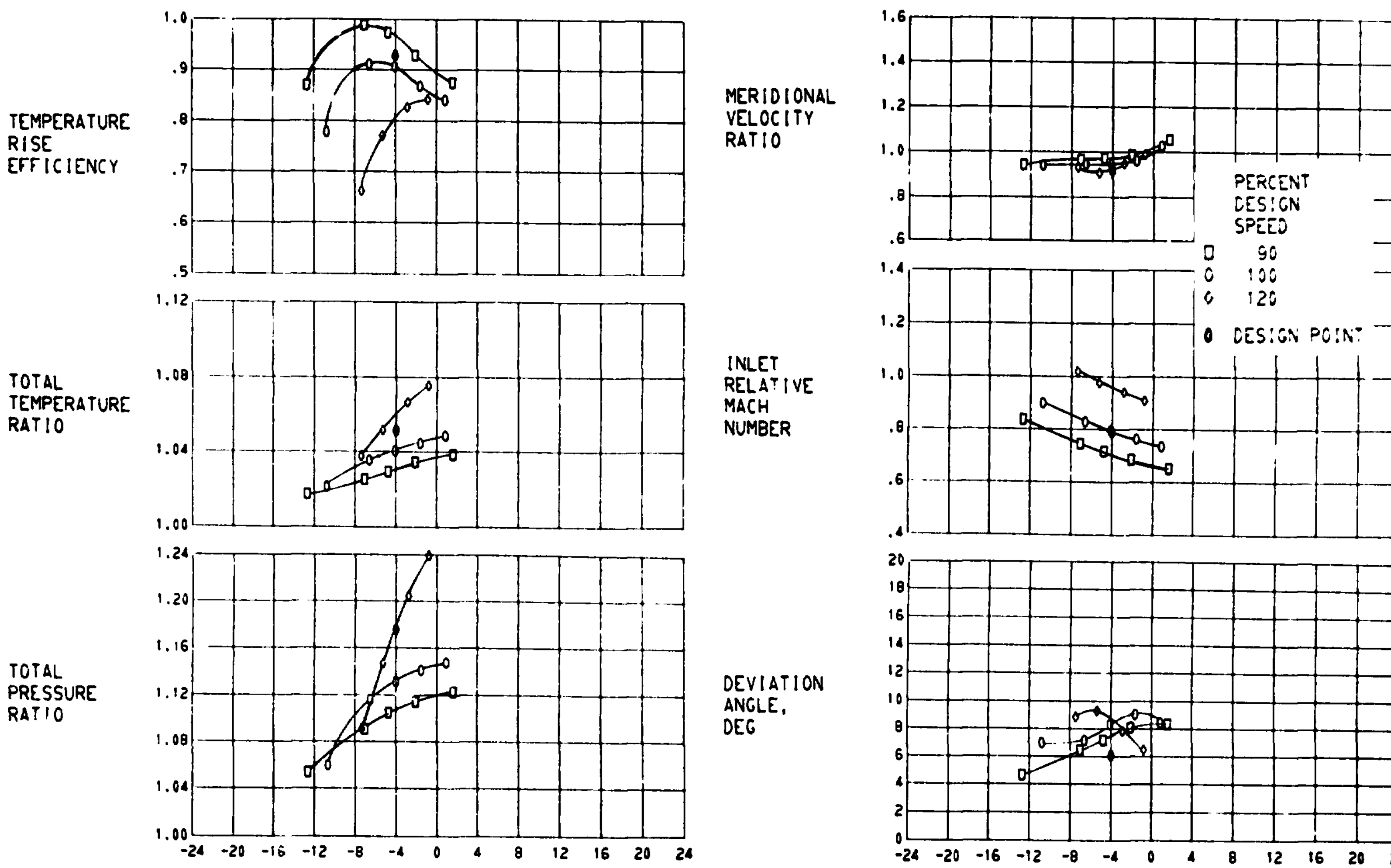
FIGURE 11. - BLADE-ELEMENT PERFORMANCE FOR ROTOR 5JA.

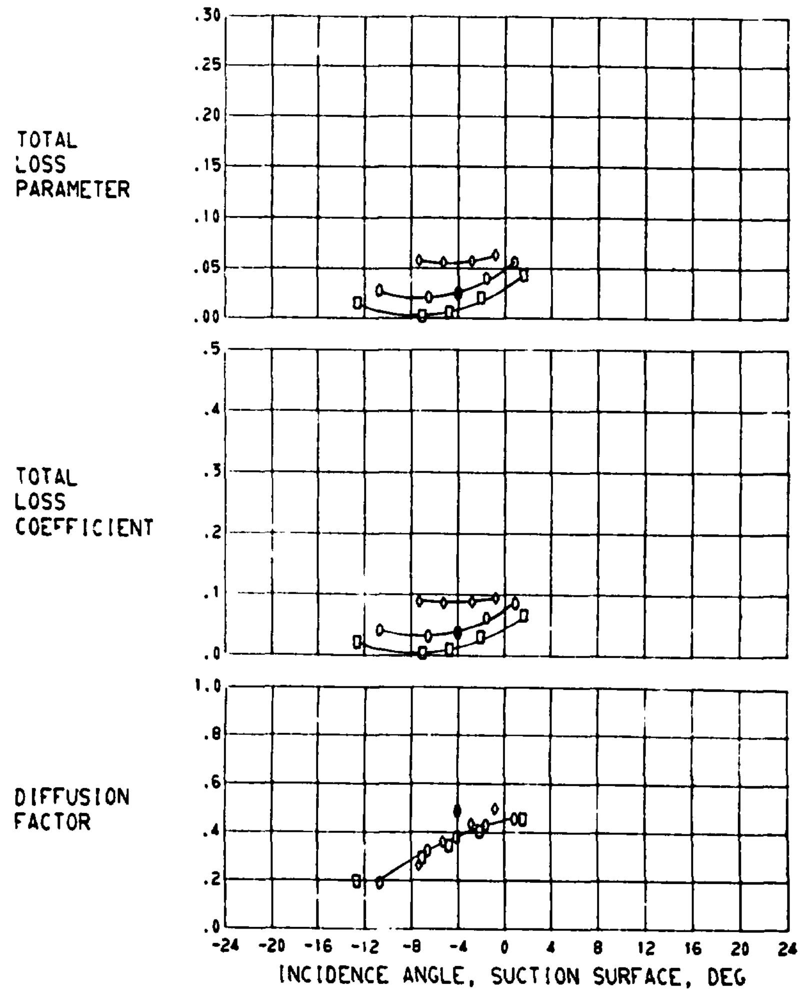

TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
INLET RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT



(B) 10.0 PERCENT SPAN.

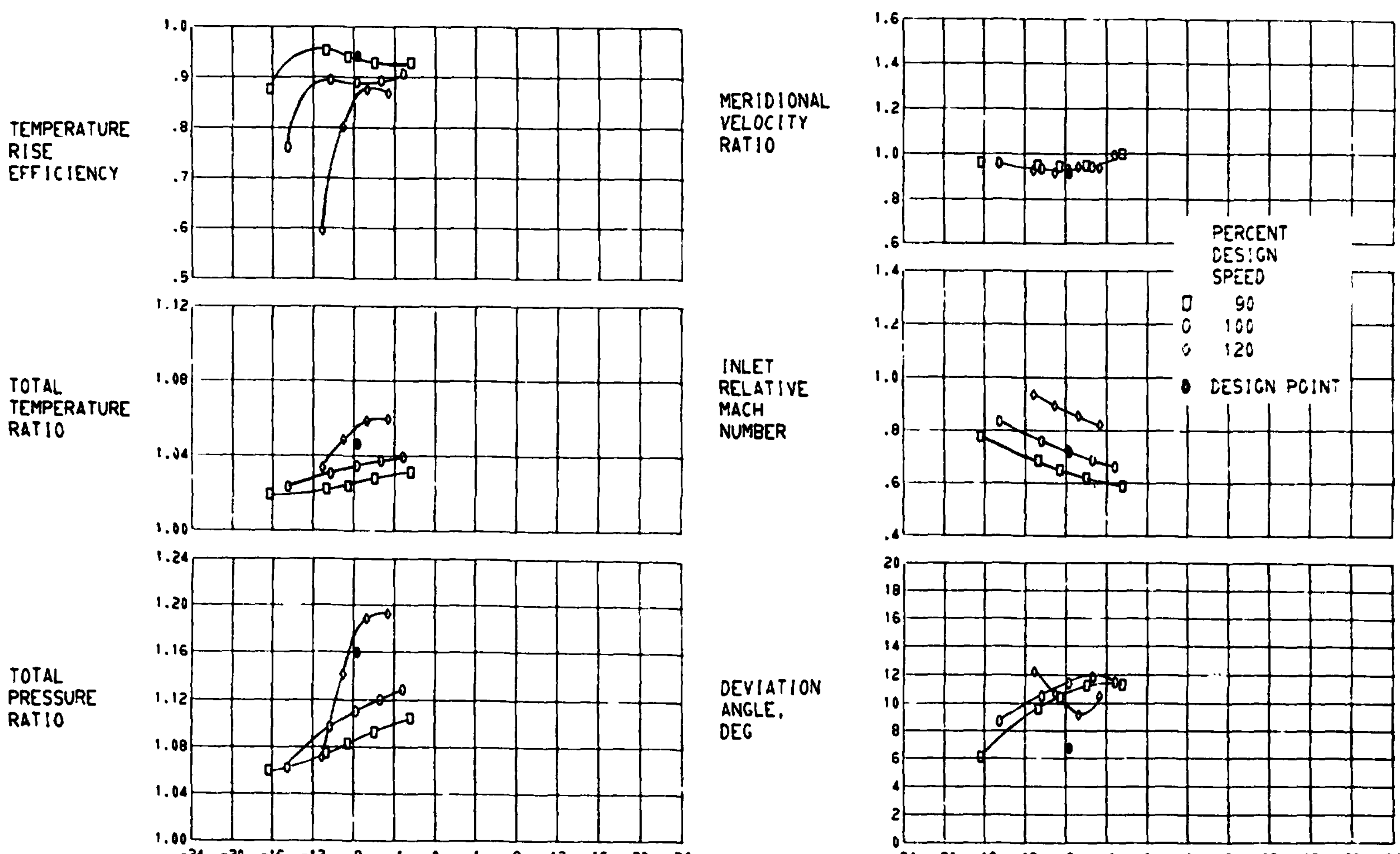
FIGURE 11. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR ROTOR 51A.

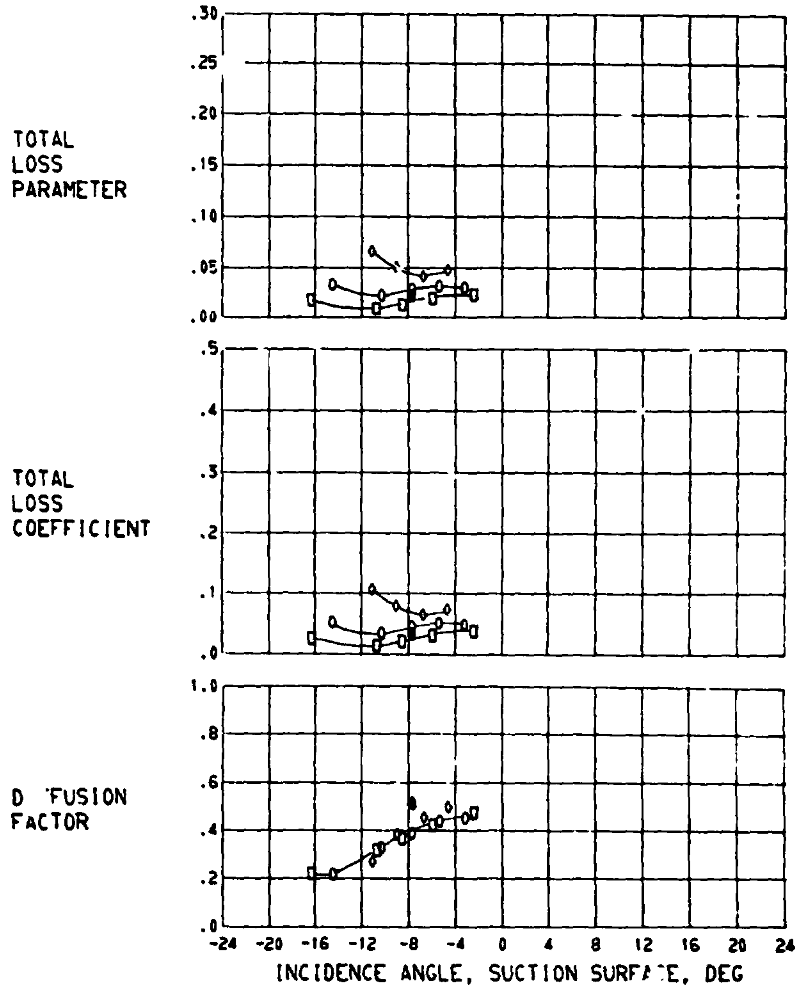

TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
INLET RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT
-24 -20 -16 -12 -8 -4 0 4 8 12 16 20 24



(C) 30.0 PERCENT SPAN.

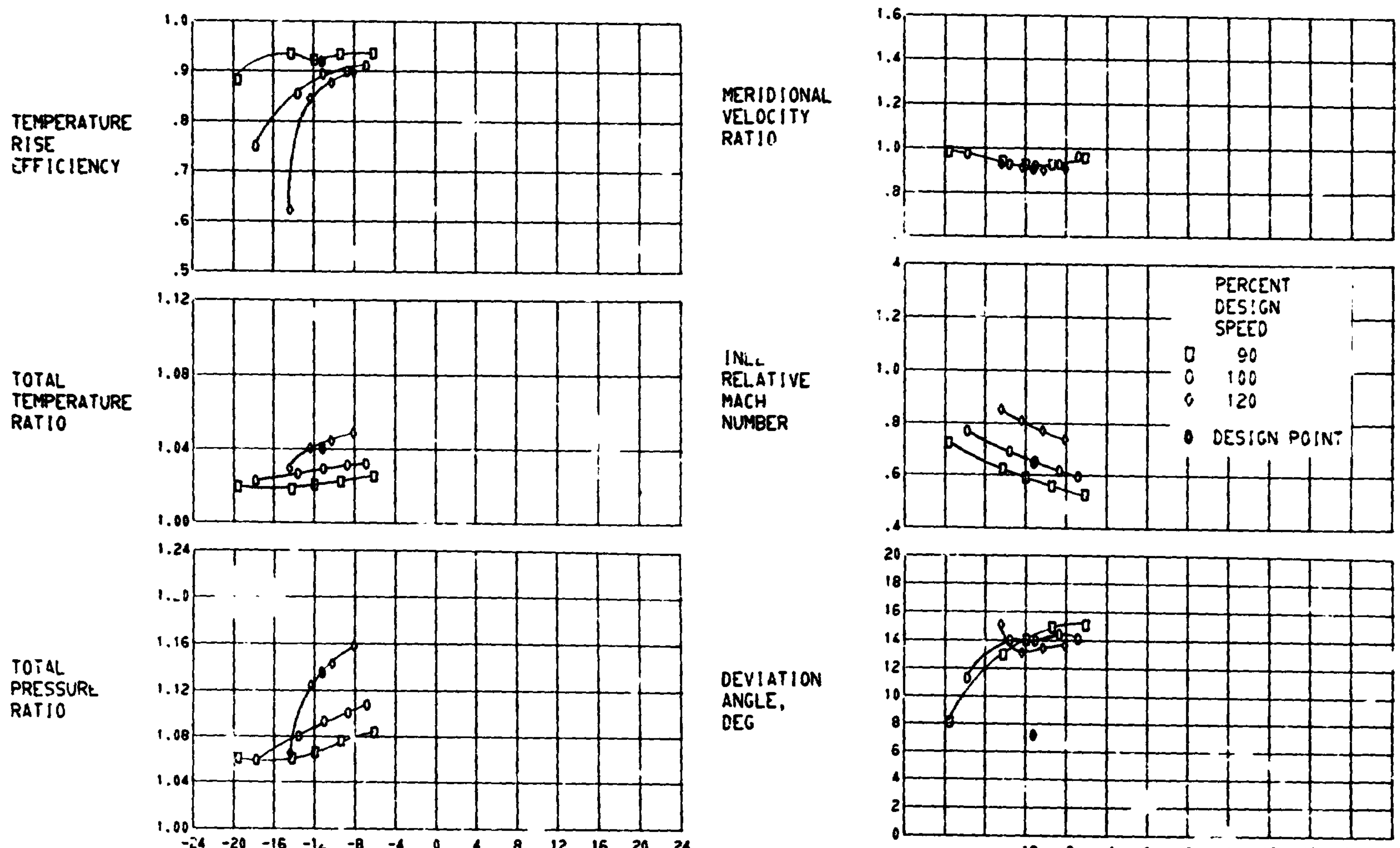
FIGURE 11. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR ROTOR 51A.

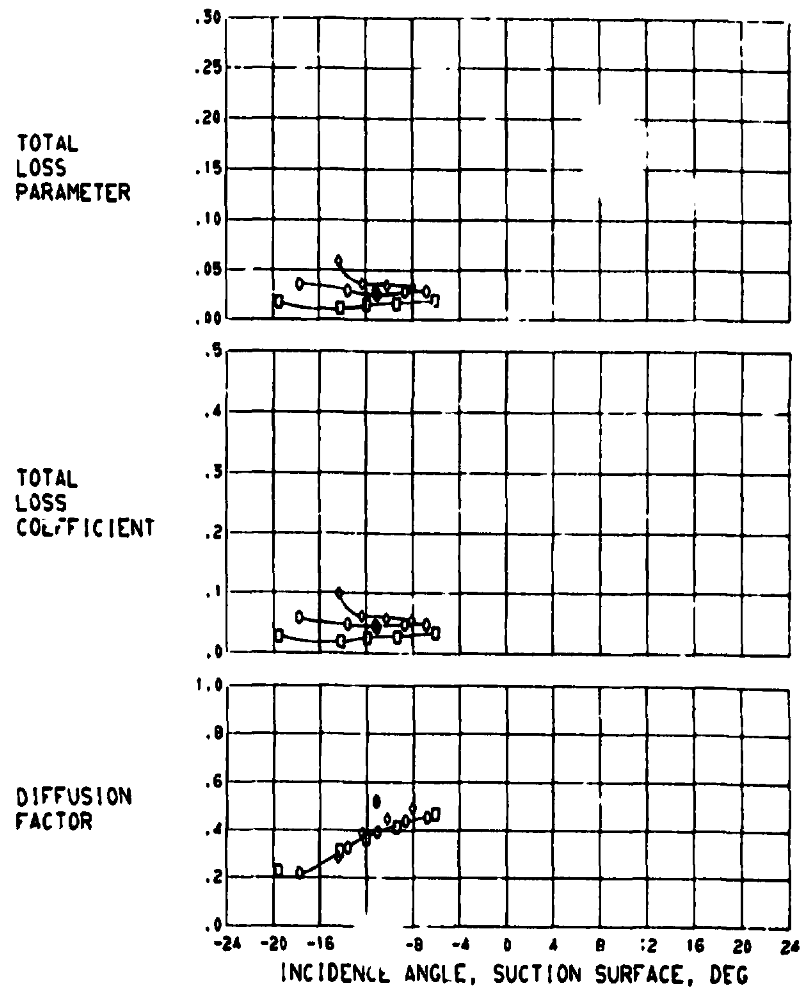

TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
INLET RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT
1.0
.9
.8
.7
.6
.5
1.12
1.08
1.04
1.00
1.24
1.20
1.16
1.12
1.08
1.04
1.00
1.6
1.4
1.2
1.0
.8
.6
1.4
1.2
1.0
.8
.6
.4
20
18
16
14
12
10
8
6
4
2
0
-24 -20 -16 -12 -8 -4 0 4 8 12 16 20 24



(D) 50.0 PERCENT SPAN.

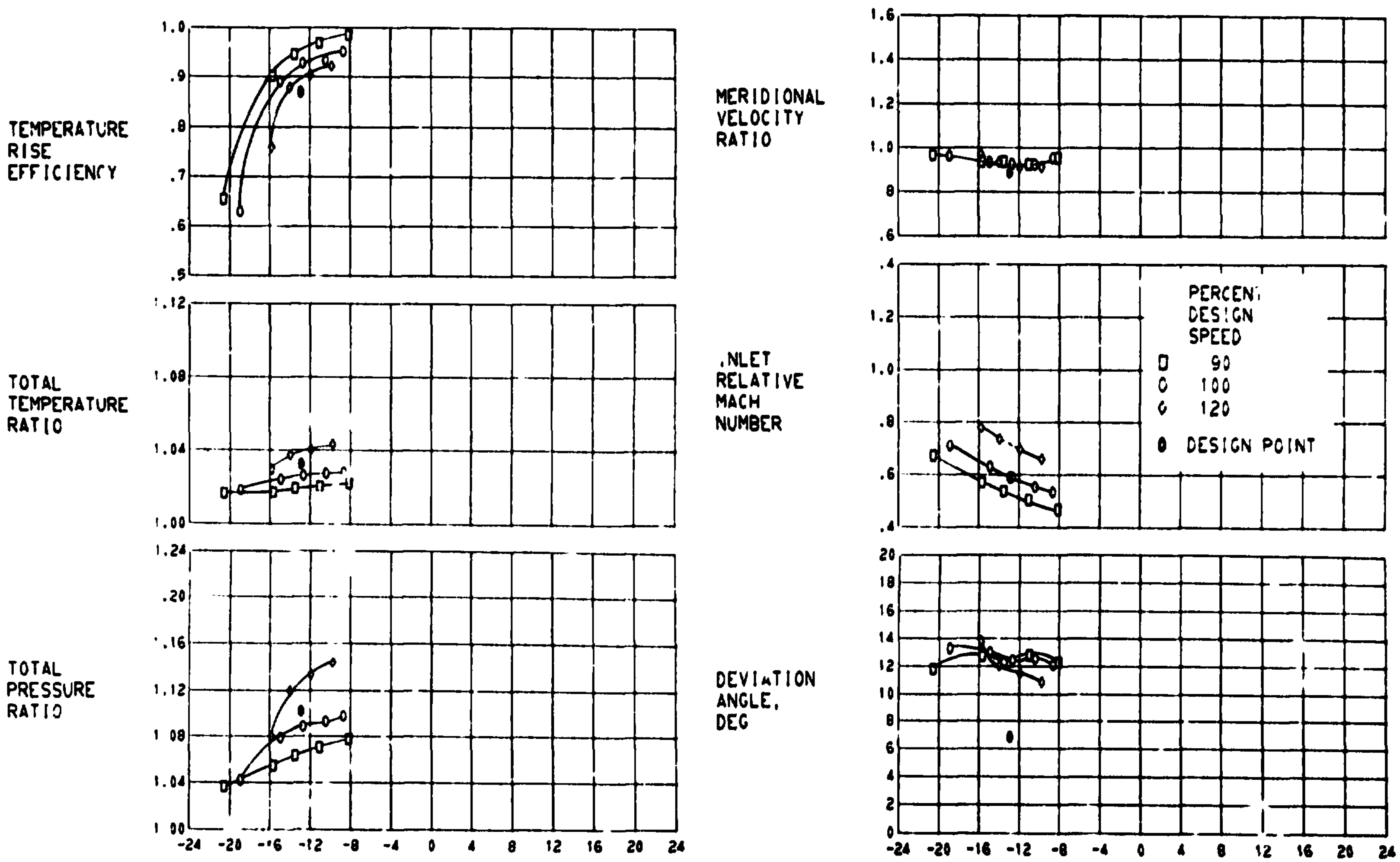
FIGURE 11. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR ROTOR 51A.

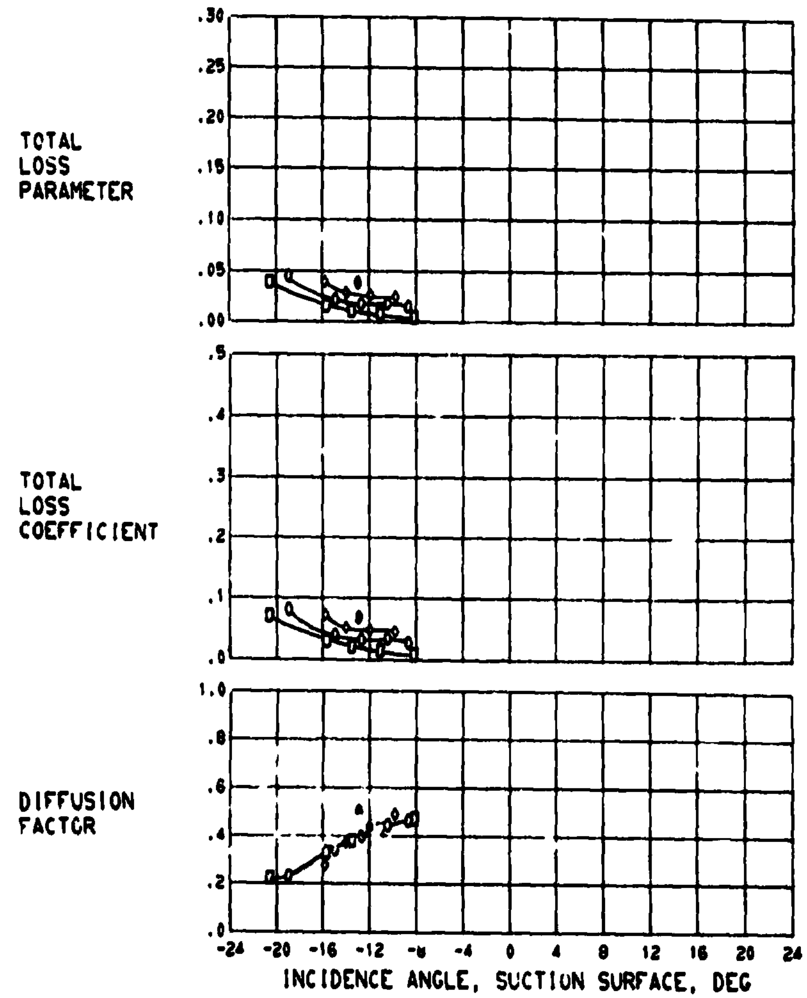

TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT
-20 -16 -8 -4 0 4 8 12 16 20 24



(E) 70.0 PERCENT SPAN.

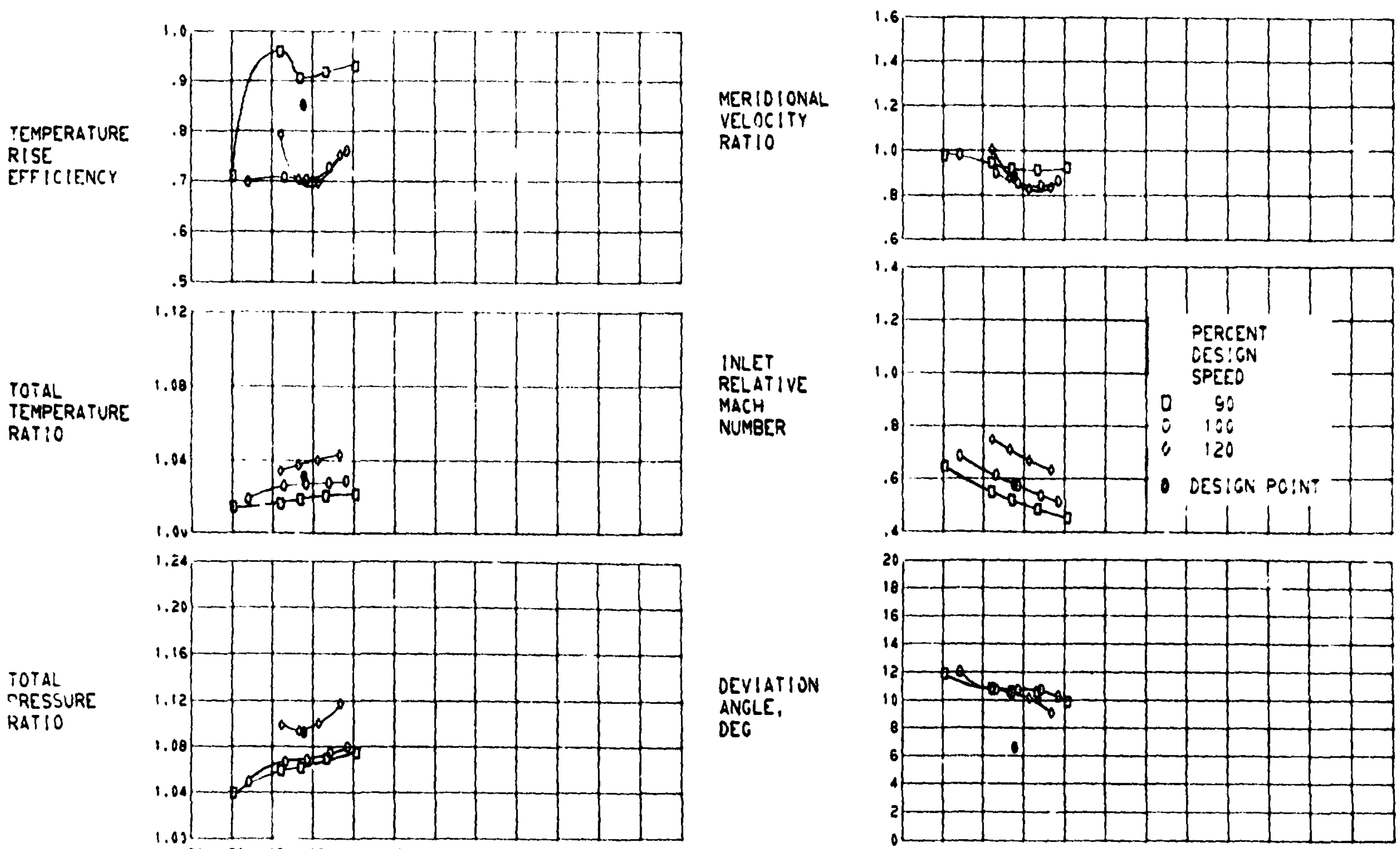
FIGURE 11. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR ROTOR 51A.

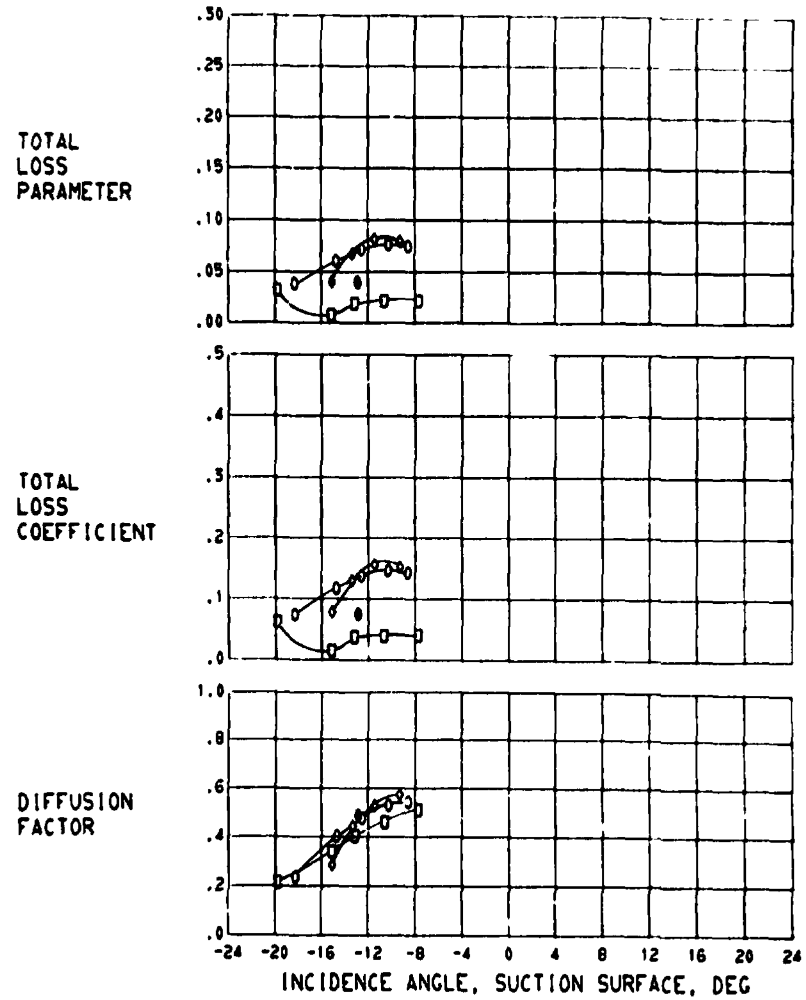

TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
INLET RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT



(F) 90.0 PERCENT SPAN.

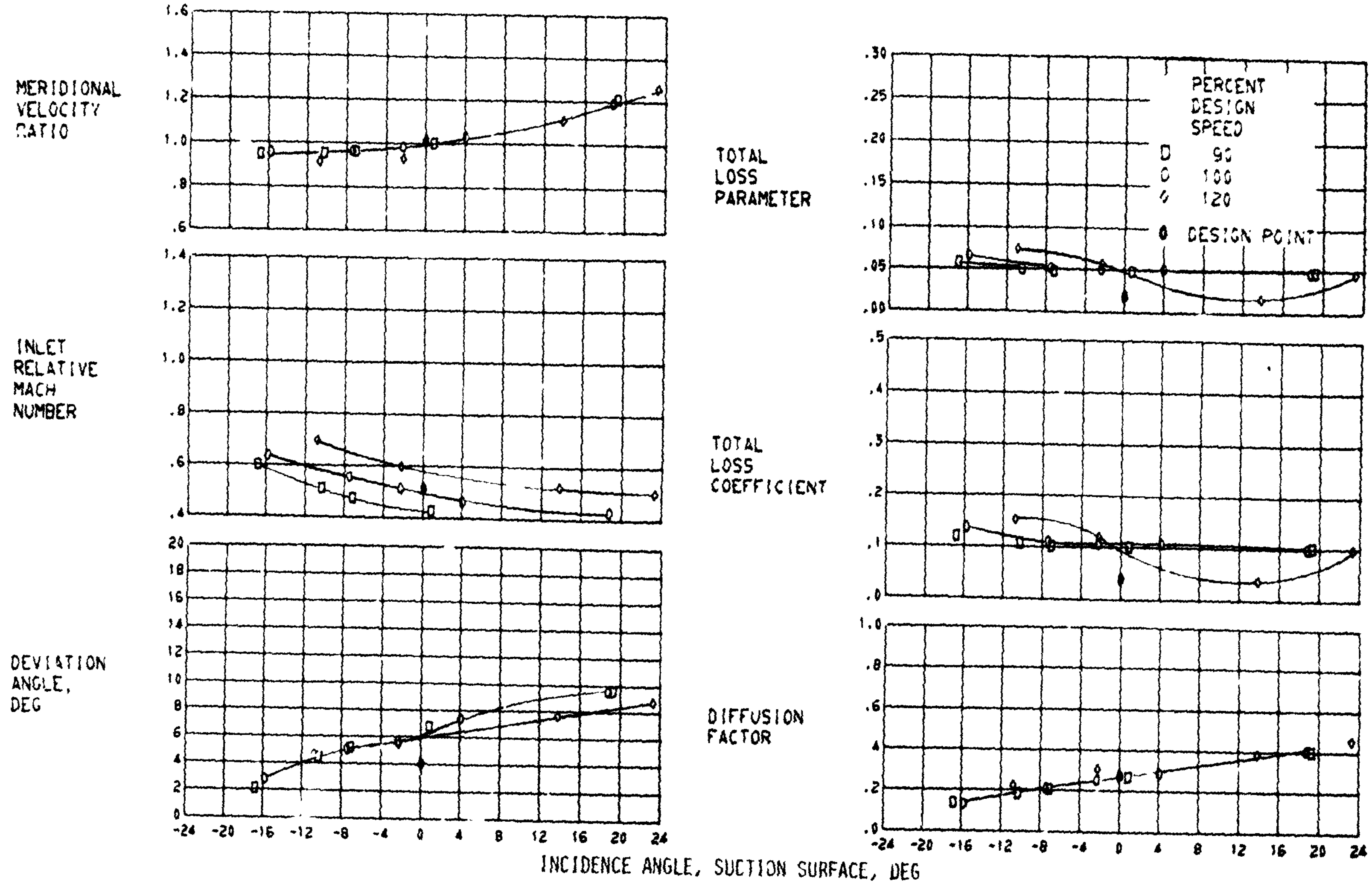
FIGURE 11. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR ROTOR 51A.


TEMPERATURE RISE EFFICIENCY
TOTAL TEMPERATURE RATIO
TOTAL PRESSURE RATIO
MERIDIONAL VELOCITY RATIO
INLET RELATIVE MACH NUMBER
DEVIATION ANGLE, DEG
PERCENT DESIGN SPEED
90
100
120
DESIGN POINT
-24 -20 -16 -12 -8 -4 0 4 8 12 16 20 24



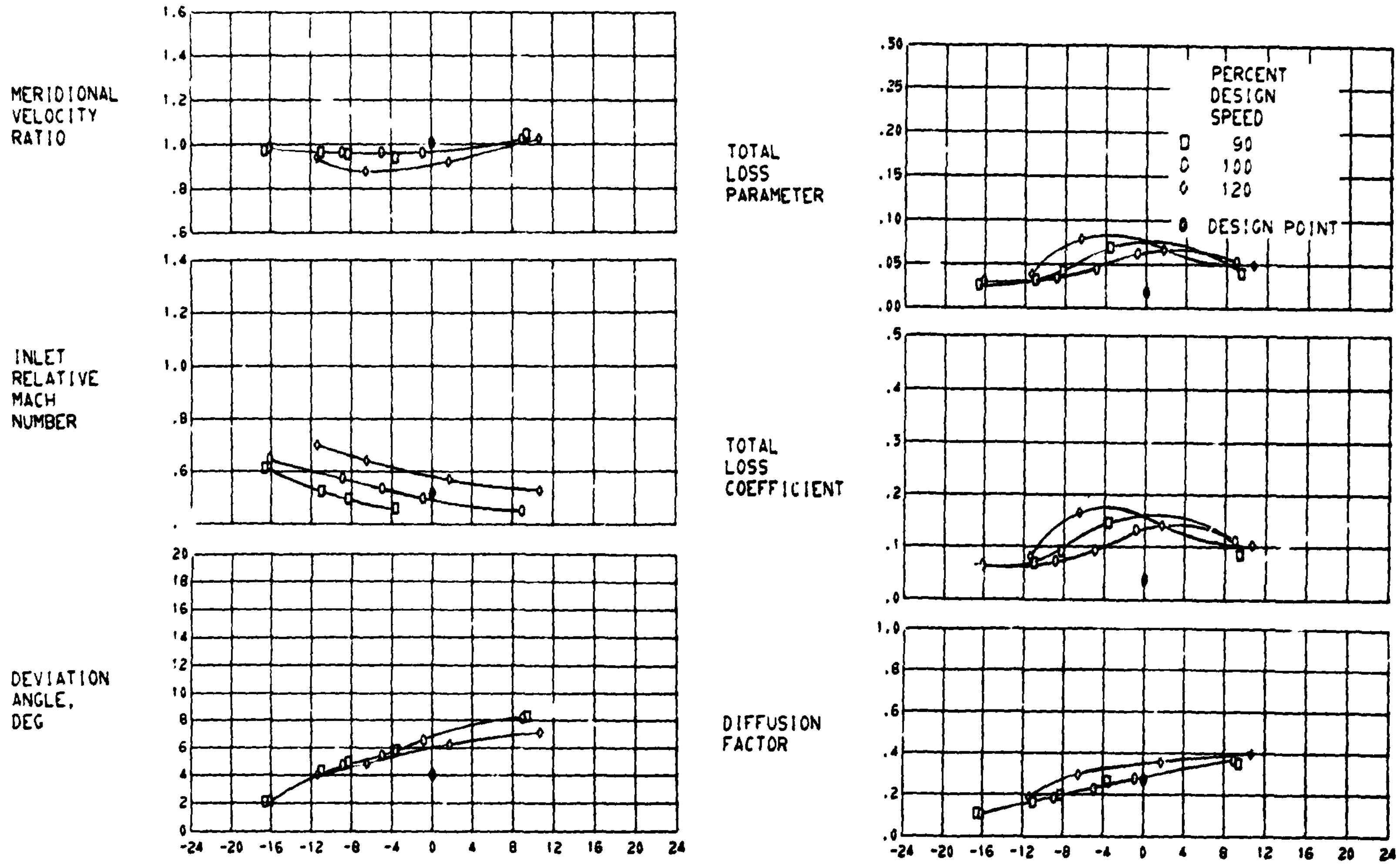
(G) 95.0 PERCENT SPAN.

FIGURE 11. - CONCLUDED. BLADE-ELEMENT PERFORMANCE FOR ROTOR 51A.



(A) 5.0 PERCENT SPAN.

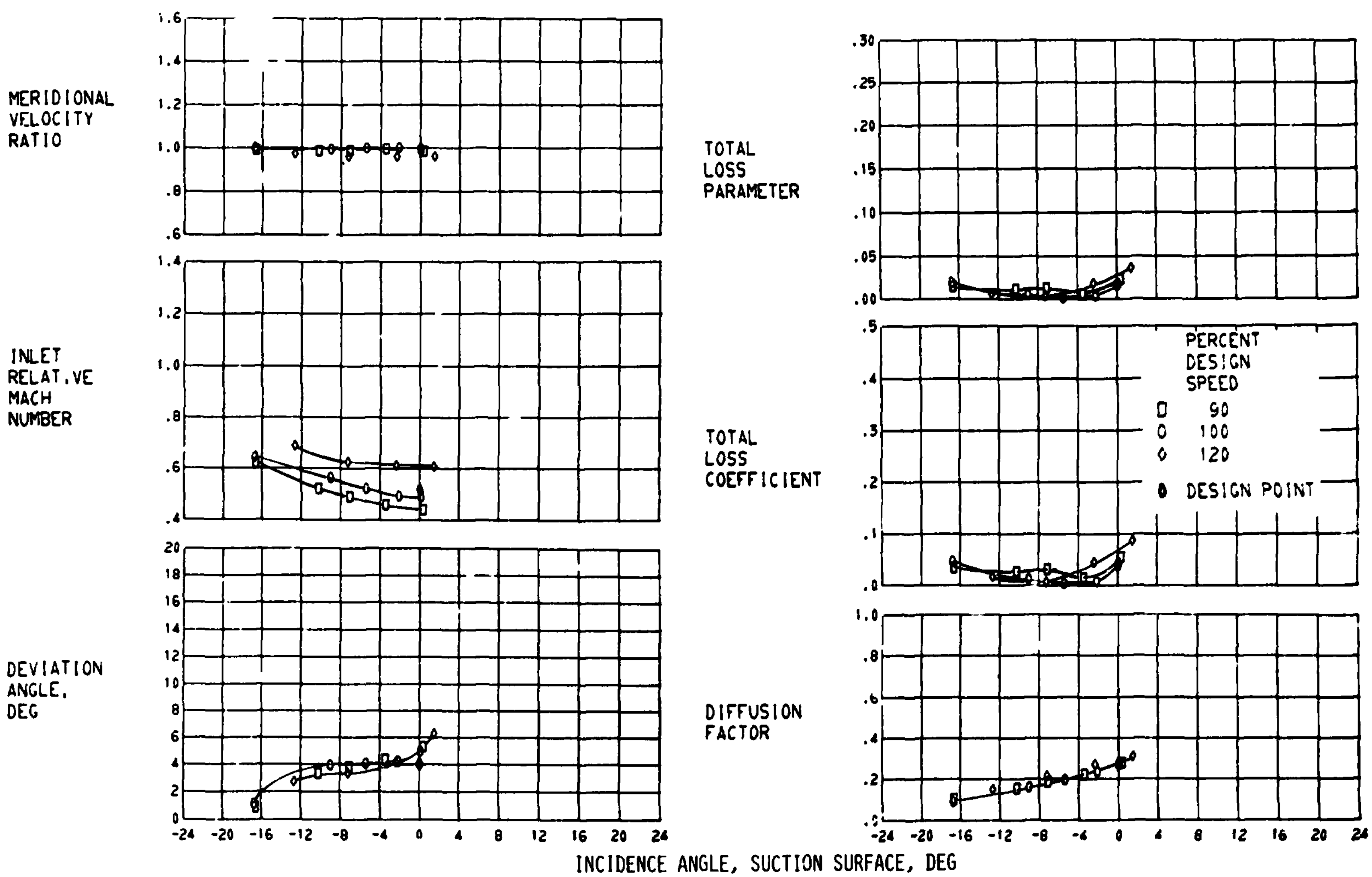
FIGURE 12. - BLADE-ELEMENT PERFORMANCE FOR STATOR 51.



INCIDENCE ANGLE, SUCTION SURFACE, DEG

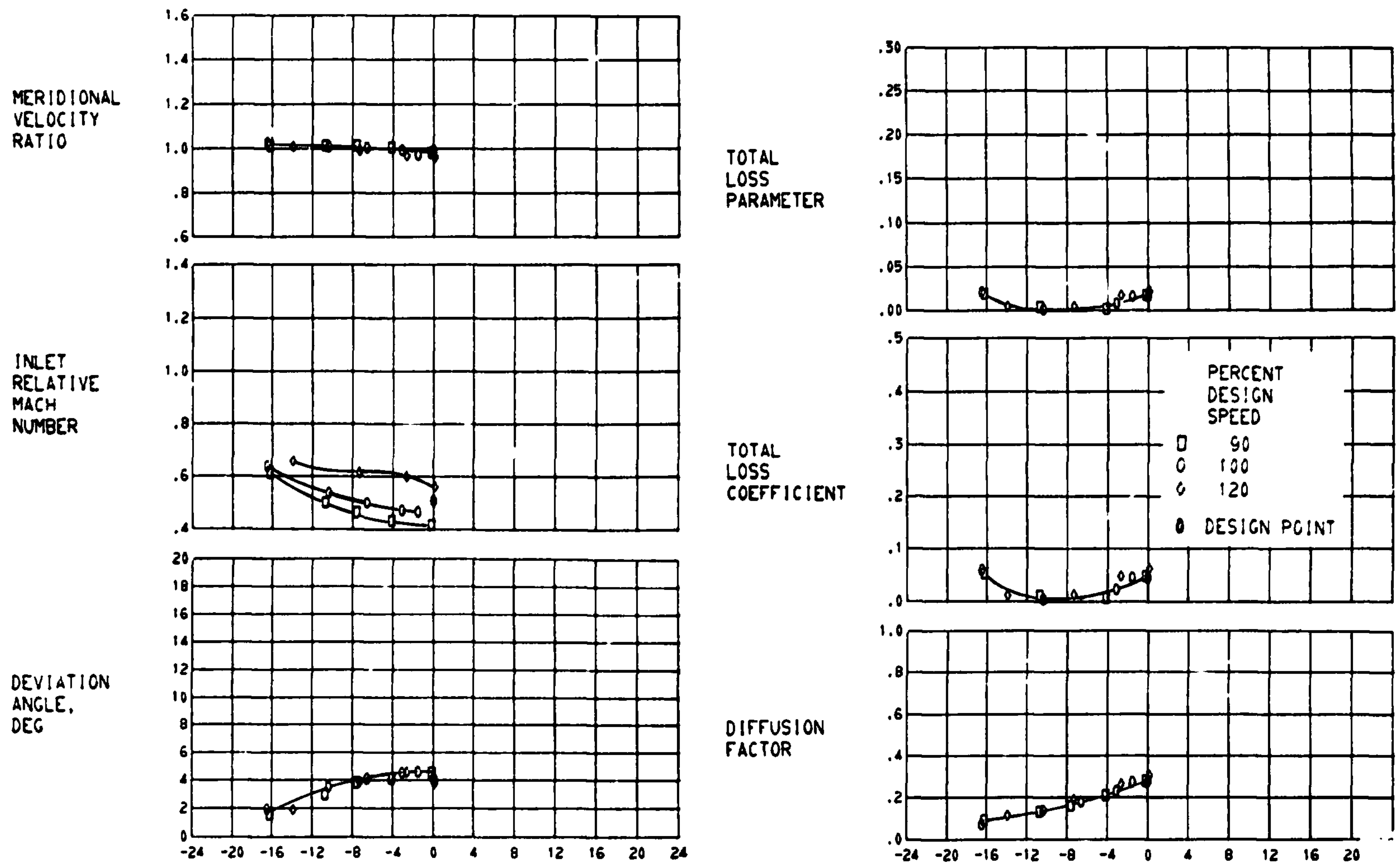
(B) 10.0 PERCENT SPAN.

FIGURE 12. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR STATOR 51.



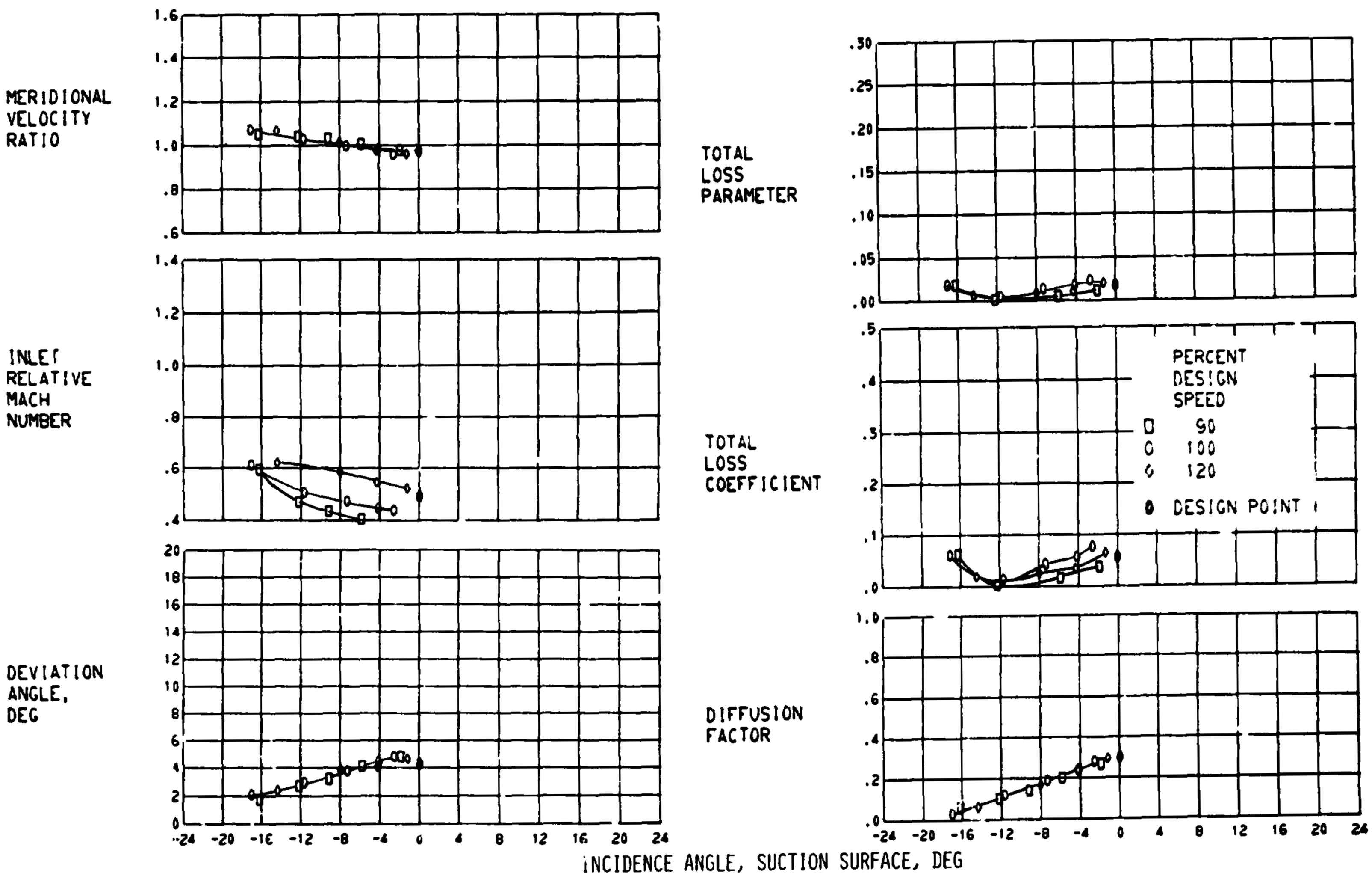
(C) 30.0 PERCENT SPAN.

FIGURE 12. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR STATOR 51.



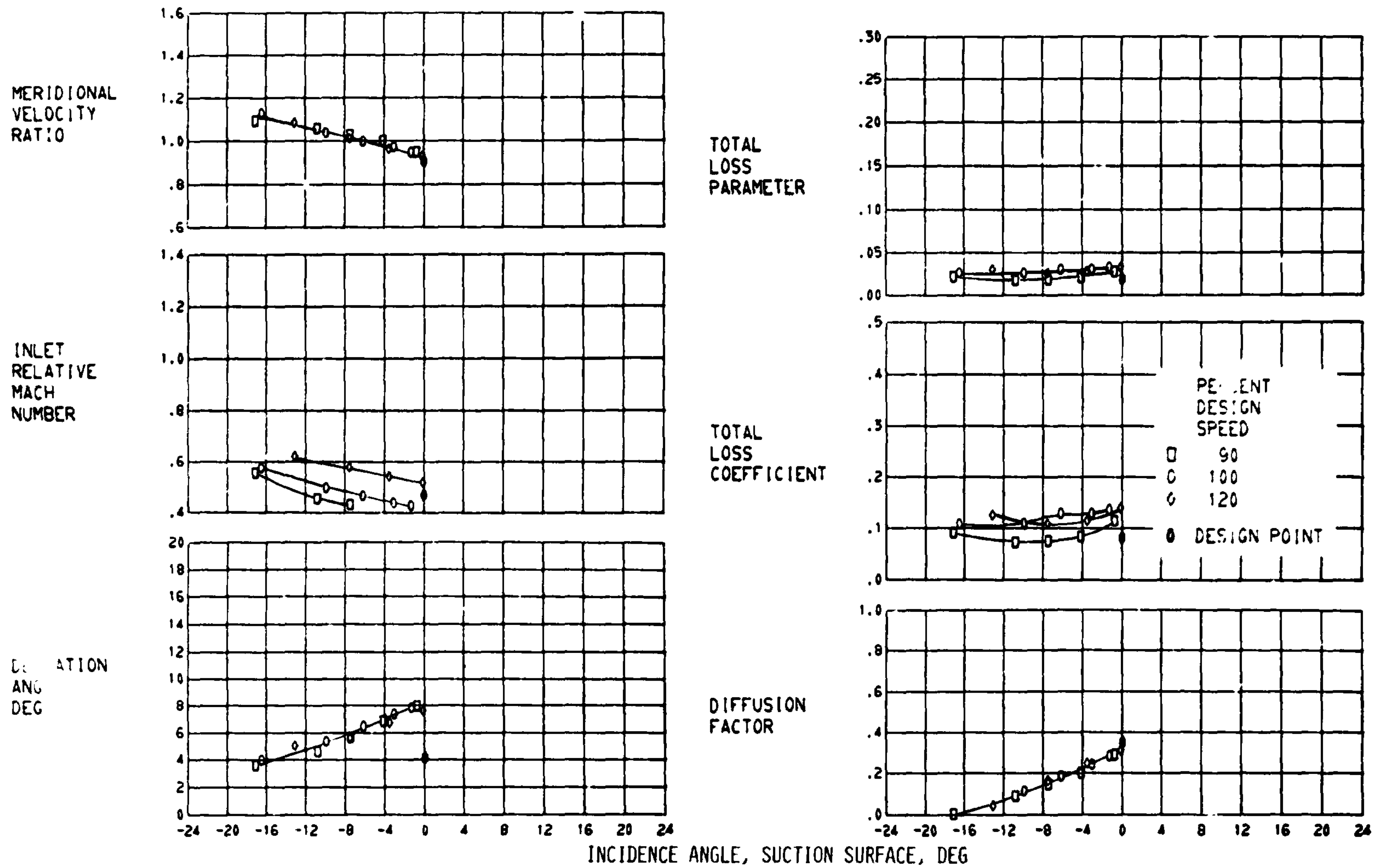
(D) 50.0 PERCENT SPAN.

FIGURE 12. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR STATOR 51.



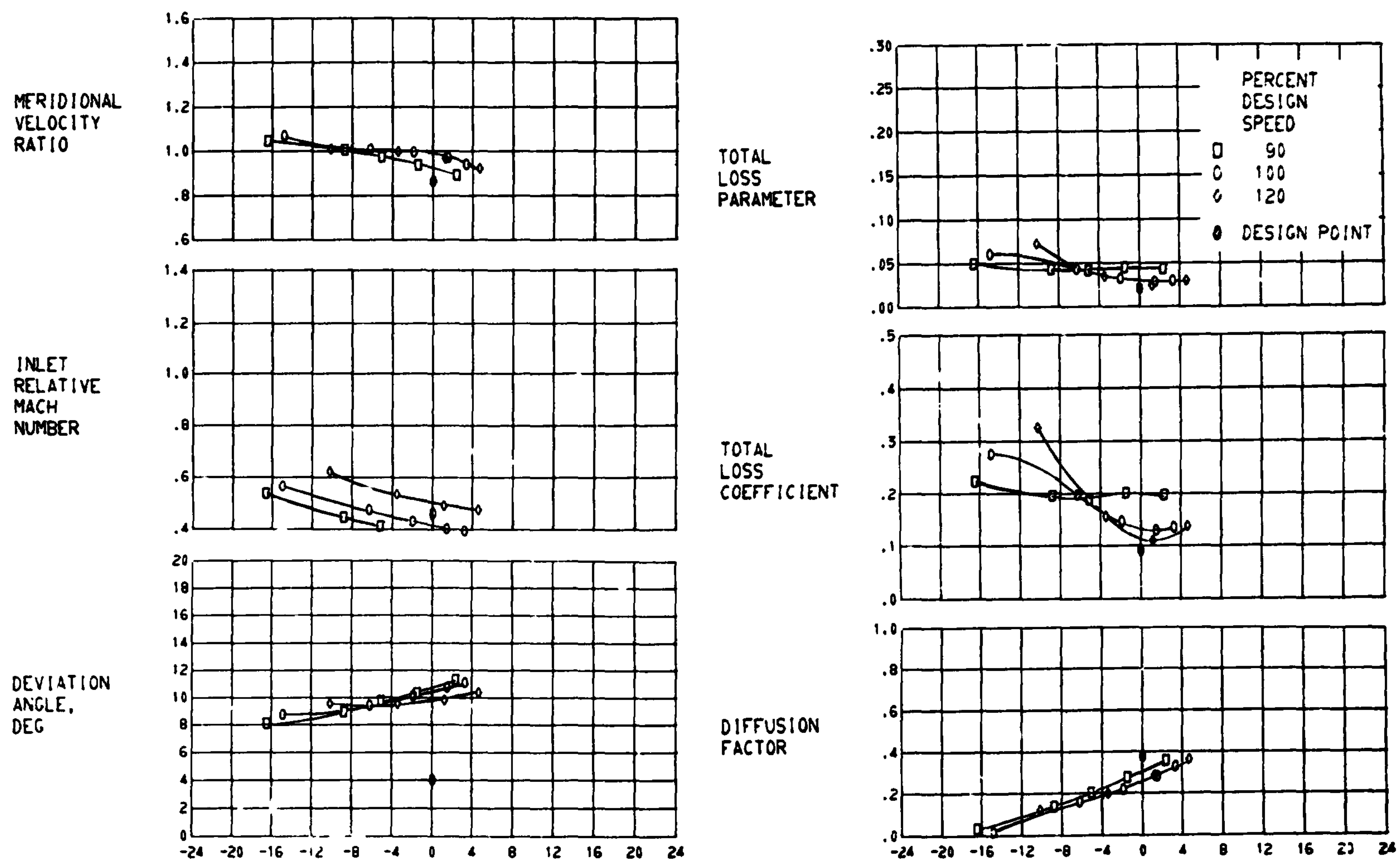
(E) 70.0 PERCENT SPAN.

FIGURE 12. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR STATOR 51.



(F) 90.0 PERCENT SPAN.

FIGURE 12. - CONTINUED. BLADE-ELEMENT PERFORMANCE FOR STATOR 51.



INCIDENCE ANGLE, SUCTION SURFACE, DEG

(G) 95.0 PERCENT SPAN.

FIGURE 12. - CONCLUDED. BLADE-ELEMENT PERFORMANCE FOR STATOR 51.