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# PERFORMANCE OF 1380-FOOT-PER-SECOND-TIP-SPEED AXIAL-FLOW COMPRESSOR ROTOR WITH BLADE TIP SOLIDITY OF 1.5

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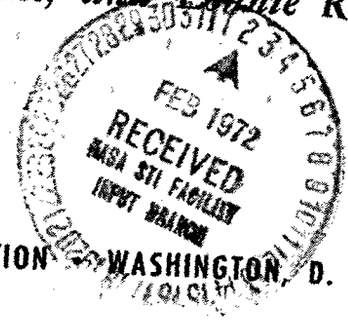


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16. Abstract

This report presents the aerodynamic design parameters along with the overall and blade element performance of an axial-flow compressor rotor designed to study the effects of blade solidity on efficiency and stall margin. At design speed the peak efficiency was 0.892 and occurred at an equivalent weight flow of 65.0 lb/sec. The total pressure ratio was 1.83 and the total temperature ratio was 1.215. Design efficiency, weight flow, pressure ratio, and temperature ratio were 0.824, 65.3, 1.65, and 1.187, respectively. Stall margin for design speed was 10 percent based on the weight flow and pressure ratio values at peak efficiency and just prior to stall.

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## SUMMARY

The overall and blade element performance are presented for an axial-flow compressor rotor designed to study the effects of blade solidity on efficiency and stall margin. The rotor was designed for a tip speed of 1380 feet per second and a blade tip solidity of 1.5. Data were obtained for speeds from 50 to 100 percent of design and over a flow range from maximum flow to stall.

At design speed the peak efficiency was 0.892 and occurred at an equivalent weight flow of 65.0 pounds per second (41.5 lb/(sec)(ft$^2$ of annulus area)). The total pressure ratio was 1.83 and the temperature ratio was 1.215. Design values of efficiency, weight flow, pressure ratio, and temperature ratio were 0.824, 65.3, 1.65, and 1.187, respectively. The stall margin for design speed was 10 percent based on the weight flow and pressure ratio values at peak efficiency and just prior to stall.

Calculations based on radial surveys of the flow parameters indicated that the actual relative total pressure losses are, in general, lower than design across the complete span of the blades. Exception to the low level of losses occurred locally in the end wall regions and behind the blade vibratory damper.

It is concluded that the higher-than-design pressure ratio, temperature ratio, and efficiency of this rotor are primarily a result of the actual losses being generally lower than those assumed in the design. The lower loss level resulted in a higher pressure rise, which reduced the velocity ratio to less than design values. This reduction in velocity ratio further increased the pressure ratio as a result of increasing the energy addition to greater than design.

It is reasoned that the lower loss than that predicted based on the loss correlation used in the design of this rotor may, in part, be the result of the blade solidity. The blade solidity for this rotor is appreciably higher than the average solidity of the rotors used in the loss correlation. The Mach number for this rotor is also much higher than for those used in the correlation. It is concluded that a real need exists to improve on the presently used loss correlation parameters to more accurately account for the Mach number level, the secondary flow losses, and blade solidity.

## INTRODUCTION

The Lewis Research Center of the National Aeronautics and Space Administration is engaged in a research program on axial-flow fans and compressors for advanced air-breathing engines. The program is directed primarily towards providing the technology to permit reducing the size and weight of the fans and compressors while maintaining a high level of performance. In support of this program, experimental studies are being conducted on improved blade shapes for high-Mach-number operation and the effect of blade aspect ratio, blade solidity, blade loading, area margin above choke, weight flow per unit annulus area, contraction ratio (velocity ratio), and blade spacing on efficiency and stall margin. This report presents the aerodynamic design parameters, along with the overall and blade element performance, of an axial-flow compressor rotor designed primarily to study the effect of blade row solidity on efficiency and stall margin. It is one of a series of rotors involving blade solidity. The design and performance of two other rotors having blade tip solidities of 1.1 and 1.3, and which are part of this series, are presented in references 1 and 2, respectively. The rotor presented in this report, designated rotor 5, has a blade tip solidity of 1.5. Overall and blade element performance data for rotor 5 were obtained for six speeds from 50 to 100 percent of design speed. Blade element data were obtained at 11 radial positions (RP). This test was conducted at the Lewis Research Center.

All symbols used in the report are defined in appendix A. Performance parameters are presented in appendix B. All parameters shown in this report are expressed in English units.

## AERODYNAMIC DESIGN

Several design computer programs are being evolved and were used for the design of rotor 5. The design programs were a streamline analysis program, a blade geometry program, and a blade coordinate program. The form of each of these programs at the time of the design of this rotor is reviewed briefly in the following paragraphs.

The streamline analysis program was used in calculating the flow field parameters at several axial stations, including those corresponding to the instrumentation survey planes and planes approximating the blade leading and trailing edges. This program accounts for both streamline curvatures and entropy gradients. Inputs to this program are flow path geometry, weight flow, rotor speed, and the desired radial distribution of total pressure and total temperature at the blade inlet and outlet. Also included as an input to the program is an allowance for boundary-layer blockage. Blockage factors of 0.02 and 0.04 were assumed for this rotor at the rotor inlet and outlet, respectively.

The blade geometry program was used in selecting the blade geometry parameters. Inputs to this program are the flow velocities and angle, along with the total pressures and temperatures at the blade leading- and trailing-edge planes. Incidence angles and parameters which control the blade shape are also inputs to the program. The program calculates the blade shape based on the specified input parameters and deviation angles. The calculations of deviation angles are accomplished within the program. The blade elements are designed on conical surfaces approximating the stream surface passing through the blade. All aerodynamic design data including incidence and deviation angles are based on velocities and flow angles on the stream surface. A blade element total loss is calculated within the program. It is based on a calculated shock loss (as related to the selected blade shape) and on a profile loss. With the calculated radial distribution of total loss and the desired radial distribution of outlet total pressure, a new outlet total temperature distribution is calculated. This temperature is then provided as input to the streamline analysis program as an external iterative procedure in arriving at the temperature distribution which is consistent with the total loss calculation and the desired outlet total pressure. The blade passage area margin as related to flow choking is also calculated within this program based on the flow passage geometry and the flow parameters.

In arriving at the blade coordinates a third computer program was used and is presented in reference 3.

The overall design parameters for this rotor are presented in table I. Tip diameter at the rotor inlet is 19.77 inches and the rotor has an inlet hub-tip radius ratio of 0.51. The rotor was designed to have a blade tip solidity of 1.5 and an aspect ratio of 2.3 (based on mean blade height and cylindrical chord at the exit hub radii). This resulted in 47 blades with tip aerodynamic chord of 1.93 inches. The radially projected chord of each blade element was held constant and thus produced longer aerodynamic chords in the hub region due to high streamline slopes.

The flow path with eight streamlines is presented in figure 1. The rotor location is shown along with the locations of the radial survey instrumentation. A detailed listing of the design blade element flow parameters calculated at planes approximating the rotor leading and trailing edge are presented in table II. The design incidence angles, deviation angles, aerodynamic loadings, loss coefficients, and loss parameters are also presented in table II.

The multiple-circular-arc (MCA) blade shape (see ref. 4 for description) was used for the tip elements, which operated at design inlet relative Mach numbers as high as 1.42. The double-circular-arc (DCA) blade shape, a special case of the MCA blade shape, was used for the elements in the mid-span and hub regions. For the MCA blade elements the maximum thickness and transition point were located at the calculated shock position. At 22 percent span, the shock position had moved forward to 50 percent of chord. The X-factor (ratio of suction-surface camber ahead of assumed shock location

of the MCA blade section to that of a DCA blade section) for the MCA blade elements was varied linearly from 0.637 at the tip to 1.0 at 22 percent span to provide a smooth transition from MCA elements to DCA elements.

The X-factor for the tip element was adjusted to provide an area ratio margin from choke of approximately 0.08. The area ratio margin calculation used in the design of this rotor assumed the minimum area to occur immediately behind the assumed shock location and accounted for both streamline convergence and the loss across the shock. Subsequent calculations of the area ratio for this rotor were made by calculating the area margin throughout the blade passage. These calculations substantiated the assumption that the minimum area for this particular rotor occurs immediately behind the shock for all elements except in the hub region. In the hub region the minimum area occurs further back into the blade passage; however, the reduction in area from that calculated immediately behind the shock is insignificant. The reduction in suction-surface camber ahead of the passage shock for the MCA elements over that which would exist with DCA elements should provide for a reduction in shock loss due to the lower suction-surface Mach number just ahead of the shock. The calculated peak suction Mach numbers are listed in table II. The X-factor, area ratio, and suction-surface camber ahead of the passage shock are listed, along with the blade geometry parameters, in table III.

Incidence angle with reference to the suction surface was set equal to zero for all blade elements. Because of the transonic Mach numbers at which the blade elements must operate, it was assumed that zero incidence angle would result in minimum loss.

Deviation angles were estimated using Carter's rule as follows:

$$\delta^{o} = \frac{\varphi_e m}{\sqrt{\sigma}}$$

where

$$m = x\left(\frac{2a}{c}\right)^{y}$$

$$x = 0.219 + 0.0008916\gamma_b + 0.000027085\gamma_b^2$$

$$y = 2.175 - 0.035528\gamma_b + 0.00019167\gamma_b^2$$

The equation for calculating m is based on the curves presented in reference 5. The equivalent camber $\varphi_e$ was calculated by the method shown in reference 6. Use of an equivalent camber tends to account for the difference in deviation angle between a two-

dimensional cascade and a three-dimensional blade element. The difference results from the change of radius and meridional velocity across the blade row.

The calculation of blade element total loss was based on a calculation of a profile loss and a shock loss. The profile loss calculation used the curves presented in figure 2. These curves are based on the correlation of loss as a function of diffusion factor and percent of blade span presented in reference 7.

The shock loss was calculated based on the method and assumed flow model presented in reference 8 for blade elements (0 to 80 percent of span) for which the inlet relative flow is supersonic. This method basically calculates a loss across a normal shock based on an average of the inlet and suction-surface Mach numbers. The suction-surface Mach number is determined from the inlet Mach number and the acceleration resulting from a Prandtl-Meyer expansion based on the turning of the suction surface ahead of the shock. The flow model is used in estimating the shock location. The method and flow model presented in reference 8 for calculating shock losses were based on supersonic inlet flow and do not include the high subsonic inlet flow condition. To permit calculating a shock loss for blade elements of this rotor which operate at high subsonic inlet flow, the inlet Mach number was assumed to be unity for these elements. The flow model presented in reference 8 was used for estimating the shock location. A Prandtl-Meyer expansion was then assumed to provide an indication of the Mach number ahead of the shock. Using this method a shock loss is calculated for all elements with subsonic inlet flow where the average of the calculated suction-surface Mach number ahead of the shock and the actual inlet relative Mach number is greater than 1.0. This method will likely overestimate the Mach number at the point of shock and thus also overestimate the shock loss. However, it was employed in the design of this rotor to provide a smooth variation in total loss with respect to span through the transonic region.

## APPARATUS AND PROCEDURE

### Test Apparatus

A cutaway view of the compressor assembly with a typical rotor installed is shown in figure 3. The compressor rotor is straddle mounted on a shaft supported by two hydrodynamic journal bearings. A hydrodynamic thrust bearing is used to balance out the thrust load generated by the compressor rotor. Carbon face seals were utilized to prevent bearing oil leakage. The test section with instrumentation installed in the outer casing is shown in figure 4.

The test rotor is depicted in figure 5. The rotor blades were machined from Maraging 200 steel bar stock. Dampers were located at 43 percent of span from the rotor tip to minimize blade vibration. The meanline of the damper formed a section of

a conical surface with the cone angle set equal to the streamline angle. The aerodynamic chord of the damper is approximately 30 percent of the aerodynamic chord of the blade. The thickness of the damper is 15 percent of the aerodynamic chord of the damper. The leading- and trailing-edge radii were set equal to 0.010 inch. The inner and outer surfaces of the damper were formed by circular-arc sections passing through tangency points on the leading- and trailing-edge radii and the maximum thickness radius which was located at midchord.

## Test Facility

A schematic of the test facility is shown in figure 6. Air enters the test facility at an inlet located on the roof of the building or from the laboratory refrigerated air supply through the refrigerated air riser. The air passes through a flow measuring station consisting of a thin-plate orifice, through an inlet throttle valve, and then into a plenum chamber. The air is then accelerated to the compressor test section, through the test section and into a collector, and through a discharge throttle valve; it then exhausts either to the atmosphere or to an altitude exhaust system. The facility is sized for a maximum flow rate of approximately 100 pounds per second (the refrigerated air supply is limited to 60 lb/sec at $-20^{\circ}$ F). A 15 000-horsepower synchronous motor and gearbox are used to obtain speeds up to 17 500 rpm for the research compressor rotors.

## Instrumentation

The axial locations of survey instrumentation are shown in figure 1. The circumferential locations are shown in figure 7 along with the types of probes employed at each location. The types of probes used in obtaining survey data are depicted in figures 8 and 9. In the plenum chamber, two pressure taps were installed to measure plenum pressure and two thermocouples were used in measuring the plenum temperature. One hub and one tip wall-static-pressure tap were located at each of the two survey planes. A hot film probe was located at the inlet survey plane for use in determining stall.

Strain-gage-type transducers were used in measuring pressures. Iron-constantan thermocouples were used in conjunction with a constant-temperature ($610^{\circ}$ R) oven to determine temperature. Flow through the compressor was determined from a thin-plate orifice installed according to ASME standards.

Compressor speed was indicated with the use of a magnetic pickup in conjunction with a gear mounted on the drive motor shaft. All data were measured by an automatic digital potentiometer and recorded on paper tape. The accuracy of measurements is estimated to be

| | |
|---|---|
| Inlet pressure, psi | ±0.05 |
| Outlet pressure, psi | ±0.10 |
| Temperature, $^{o}R$ | ±1.0 |
| Weight flow, percent | ±1.0 |
| Speed, percent | ±0.5 |
| Flow angle, deg | ±2 |

## Test Procedure

Compressor test data were taken over a range of weight flows from maximum flow to stall conditions. For each weight flow, measurements were recorded at 11 radial positions. The data were obtained at 50, 60, 70, 80, 90, and 100 percent of equivalent design speed. The air was brought into the system from the roof inlet. The air to the compressor inlet was not throttled during this series of tests. Thus the pressure at the compressor inlet was equal to atmospheric pressure minus the pressure drop in the inlet line (measured to be approximately 3/4 psi at 65-lb/sec flow rate). Altitude exhaust was used to obtain the desired compressor discharge pressures. All probes were inserted into the flow stream simultaneously in obtaining the data. Initial tests indicated that the insertion of the probes in front of the rotor did not affect the readings from the probes behind the rotor.

The stall points were established by increasing the back pressure on the compressor until a rapid fluctuation was noted in the signal from a hot film gage located at the rotor inlet. Also fluctuations in compressor discharge pressure and blade stress were observed when stall was encountered. The flow at which this condition occurred was indicated on an X-Y plotter which recorded the compressor discharge pressure as a function of weight flow. When the stalled conditions were noted, the discharge throttle was immediately opened. The weight flow was then set to within 1 pound of the weight flow at which stall occurred and the blade element performance was recorded.

## Performance Calculation Procedure

Measured outlet total temperature and total pressures were corrected for Mach number and streamline slope. These corrections were based on calibrations given in reference 9. The stream static pressure was corrected for Mach number and streamline slope based on an average calibration of the probes used. The corrected static pressure in the hub region at the rotor exit differed significantly from the measured inner wall static pressure. This difference is attributed to the combination of high streamline slopes and high Mach numbers in the hub region. Consequently, the outlet static

pressures in the hub region used for data calculations were obtained from fairing between the corrected static pressure at 70 percent of span and the measured inner wall static pressure.

Overall total pressure and total temperature ratios were obtained from a mass average of the survey data at the rotor exit and the pressure and temperature measured in the inlet plenum.

The overall performance and the blade element performance were calculated in accordance with the performance equations as defined in appendix A. The blade element data are based on the calculated flow parameters at planes approximating the blade leading and trailing edges.

The translation of flow parameters from the measuring stations to the blade leading- and trailing-edge planes were made using the following assumptions: The actual radii and slopes of the streamlines were assumed to correspond to those of the design streamlines as tabulated in table II. The total pressure, total temperature, and angular momentum of flow along any given streamline were assumed to be constant between the measuring station and the blade edge. The ratio of the weight flow per unit area (static density times axial velocity) at the measuring station to the weight flow per unit area at the blade edge along any given streamline was assumed to equal the value calculated from the flow parameters in design. The calculation of the flow parameters at the blade edges permits more accurate calculation of incidence angles, deviation angles, and such parameters as diffusion factor.

# RESULTS AND DISCUSSION

## Overall Performance

The overall performance of rotor 5 is plotted in figure 10 and presented in tabular form in tables IV to IX. The plotted data present rotor total pressure ratio, total temperature ratio, and temperature rise efficiency as a function of equivalent weight flow. The data are presented for rotative speeds of 50, 60, 70, 80, 90, and 100 percent of design speed. In addition to the plotted data, the tabular data include the momentum rise efficiency, integrated weight flows at the rotor inlet and outlet, and weight flows per unit frontal area and annulus area.

The peak efficiency for the rotor at design speed was 0.892, as compared to a design value of 0.824. Peak efficiency occurred at an equivalent weight flow of 65.0 pounds per second (41.5 lb/(sec)(ft$^2$ of annulus area)), as compared to the design weight flow of 65.3 pounds per second. Total pressure ratio and total temperature ratio at the weight flow corresponding to peak efficiency were 1.83 and 1.215, respectively, as compared to design values of 1.65 and 1.187. Stall margin at design speed was calculated to be 10 per-

cent based on the equation presented in appendix B and using the weight flow and pressure ratio at which peak efficiency occurred as the reference condition.

At the lower speeds the peak efficiency increased to approximately 0.95. It must be pointed out that data accuracy would be expected to deteriorate somewhat at the lower speeds.

## Blade Element Performance

Tabulations of the blade element data are presented in tables X to XV for the six speeds at which the compressor was tested and for 11 radial locations. Selected parameters are presented as a function of percent span in figure 11 and as a function of incidence angle based on the suction-surface blade angle in figure 12. The radial variations of performance parameters presented in figure 11 are for three weight flows at design speed. One of the weight flow points selected is near maximum flow, one near design flow (which is also near peak efficiency), and one near stall flow. The performance parameters presented in figure 12 as a function of incidence angle are for 60, 80, and 100 percent of design speed and for blade elements at 7, 12, 31, 50, 72, 88, and 93 percent of span as measured from the tip. Design values of the performance parameters are also presented in figures 11 and 12 and are indicated by dashed lines and closed symbols, respectively. In addition to the parameters presented in the plots, the tabulated data present information on flow angles, velocities, incidence angles with reference to the mean blade angle, and peak suction-surface Mach number based on the suction-surface incidence angle and supersonic suction-surface camber. All blade element data presented are based on the flow parameters calculated at planes approximating the blade leading and trailing edges.

Radial variation of performance parameters. - The plots of blade element and performance parameters as a function of percent of span (fig. 11) show that for a weight flow of 65.6 pounds per second (near design flow) the pressure ratio in the tip region of the blade is much higher than design, with that in the hub region being close to design. The rotor was designed for a radially constant total pressure. The temperature ratio shows the same trend as pressure ratio, indicating a higher-than-design energy input in the tip region. The efficiency, in general, is higher than design. Locally in the hub region and in the damper region of the blade (43 percent of span), sharp gradients towards lower efficiencies are noted. The velocity ratio is lower than design over the complete span. Incidence angle and inlet velocity are near design values. The total loss coefficient reflects the same trends as the efficiency. The blade loading as indicated by the diffusion factor is appreciably higher than design over the complete span. Deviation angle, in general, is lower than design in the tip region. In the midspan and hub regions it is

higher than design, with the exception of that at 93 percent of span. At this location the deviation angle dropped sharply to below the design value.

The appreciably higher-than-design pressure ratio in the tip region appears to be a result of both higher energy input and lower losses than assumed in the design. The higher energy input reflected in the temperature ratio is attributed to the lower-than-design velocity ratio (resulting from the higher overall pressure ratio) coupled with the lower-than-design deviation angle. In the hub region the velocity ratio remains lower than design as in the tip but the deviation angle is higher than design, resulting in the temperature ratio being close to design. The slightly higher-than-design pressure ratio in the hub region is attributed to the lower losses. The higher-than-design blade loading is a result of both the lower-than-design velocity ratio and the difference in deviation angle from design.

The damper has a pronounced effect on the aerodynamic performance, as shown in figure 11. The lower pressure ratio and efficiency in the region of the damper are attributed to the losses associated with the damper. No attempt was made in the aerodynamic design of the rotor to account for the damper effects.

It is apparent from the data presented in figure 11 that the effect of the end walls on the performance parameters were not adequately accounted for in the design. This is particularly true of the effect of the end walls on the gradient in losses in these regions.

In noting the radial variation in performance parameters it is apparent that the higher-than-design overall pressure ratio (fig. 10) is primarily a result of much-higher-than-design pressure ratios in the blade tip region. The higher-than-design overall efficiency is attributed to the generally low level of loss across the blade span as compared to design.

Performance parameters as function of incidence angle. - The plots of the blade element and performance parameters as a function of incidence angle (fig. 12) show that, except for 93 percent span, the incidence angles (with reference to the suction surface) associated with minimum loss varied from $-1^{\circ}$ to $+1^{\circ}$ for design speed. Design incidence was zero for all elements. Minimum loss in the tip region tended to occur at slightly positive incidence angles. In the hub region, minimum loss tended to occur at slightly negative incidence angles, with the exception of the 93-percent-of-span location. At this percent of span, minimum loss occurred at a positive incidence angle of about $2^{\circ}$. Since minimum loss occurs at or near design incidence angle and the incidence angle across the span is close to design for design flow (fig. 11), all blade elements were operating at or very near minimum loss at design speed and design flow. Therefore, the performance parameters as a function of percent span presented in figure 11 for the near-design-weight-flow point are essentially those for minimum blade element loss.

The deviation angles associated with minimum loss varied from $+2^{\circ}$ to $-4^{\circ}$ from design values. In the tip region the deviation angles are lower than design by as much as $2^{\circ}$ at 30 percent span. In the midspan-to-hub region the deviation angles associated with

minimum loss are higher than design (except for 93 percent of span) by as much as $2^{\circ}$ at 70 percent span. At 93 percent of span the deviation angle decreased to $4^{\circ}$ less than design.

The higher-than-design deviation angle in the midspan-to-hub region of the blade may be attributed to the lower-than-design velocity ratio. The lower-than-design deviation angle in the tip region is opposite to the trend expected from the velocity ratio. This lower-than-design deviation can, in part, be explained by untwist of the blade tip which was not accounted for in the design.

The minimum total loss coefficient (fig. 12) shows the same trend and essentially the same level as shown in figure 11 for the near-design-weight-flow point. The losses are, in general, lower than design with steep gradients existing in the end wall region of the blades.

The loss parameter presented in figure 12 is based on the measured total loss coefficient, which includes a shock loss for elements operating at high subsonic and supersonic inlet relative velocities. In the tabulated data, a loss parameter is presented based on the measured total loss coefficient minus a calculated shock loss and is referred to as the profile loss. (The shock loss calculation was presented in the design section of this report.) In comparing the profile loss parameter presented in tables X to XV with that assumed in the design (fig. 2), it is concluded that the curves of loss as a function of loading and percent span used in the design did not adequately predict the level of loss or the gradient in loss which exists in the tip and hub regions of the blades. As indicated in the design section of this report the loss parameter as a function of loading used in the design was based on the correlation presented in reference 7. The generally lower calculated profile loss for the tip region may, in part, be a result of the calculated shock loss being too high. However, even when comparing the loss parameter based on total loss, the same general conclusions can be drawn.

## CONCLUDING REMARKS

It is concluded that the higher-than-design pressure ratio, temperature ratio, and efficiency of this rotor are primarily a result of the actual losses being generally lower than those assumed in the design. The lower loss level resulted in a higher pressure rise, which reduced the velocity ratio. This reduction in velocity ratio further increased the pressure ratio as a result of increasing the energy addition above design.

The lower loss than that predicted based on reference 7 may in part be a result of the blade solidity for this rotor being appreciably higher than the average solidity of the rotors used in arriving at that correlation. (The average blade tip solidity of the rotors used in that correlation was 0.83, with some rotors having blade tip solidities as low as 0.6). The correlating parameters both for loss and loading include solidity terms,

which were meant to account for the effect of solidity on loss and aerodynamic blade loading. However, for a more general correlation it may be necessary to include solidity as an independent parameter or modify the manner in which it is included in the loss and/or blade loading parameters through empirical correlation techniques. Also a more accurate method of estimating total-pressure losses associated with secondary flows is required to predict the end wall gradients in loss.

It must be recognized that a larger percentage of the rotors used in the correlation presented in reference 7 used a 65-series blade section as compared to the circular-arc-type section. The inlet relative Mach number for this rotor is also much higher than for those used for the correlation. The loading parameter diffusion factor was derived based on assuming blade velocity distributions typical of subsonic flow conditions (ref. 10). Even though it is recognized that the diffusion factor was not intended for blade sections operating with transonic flows at present, attempts to arrive at a better loading parameter have been fruitless. One such attempt at arriving at a more fundamental loading parameter than diffusion factor for transonic blading was presented in reference 8. Several flow parameters indicative of the magnitude of diffusion on the blade suction surface where passage flow shocks exist were considered. However, no consistent variation of profile loss was obtained with these parameters.

It is concluded that a real need exists to improve on the presently used loss correlation parameters to more accurately account for the Mach number level, secondary flow losses, and blade solidity. This is based on the fact that at least for this rotor the loss correlation as a function of loading based on that presented in reference 7 does not adequately predict the level of loss or the loss gradients which exist in the end wall regions of the blades.

## SUMMARY OF RESULTS

The overall and blade element performance of an axial-flow compressor rotor has been presented. The rotor was designed for a tip speed of 1380 feet per second and a blade tip solidity of 1.5. It was tested over a range of flows from maximum flow to stall and at speeds from 50 to 100 percent of design speed. Radial surveys were taken at 11 radial positions. The investigation yielded the following principal results:

1. At design speed the peak efficiency was 0.892 and occurred at an equivalent weight flow of 65.0 pounds per second (41.5 lb/(sec)($ft^2$ of annulus area)). The total pressure ratio was 1.83 and temperature ratio was 1.215. Design values of efficiency, weight flow, pressure ratio, and temperature ratio were 0.824, 65.3, 1.65, and 1.187, respectively.

2. Stall margin for design speed was 10 percent based on the weight flow and pressure ratio at peak efficiency and that just prior to stall.

3. Except for 93 percent of span, incidence angles (with reference to the suction surface) associated with minimum loss varied from $-1^{\circ}$ to $+1^{\circ}$ for design speed. Minimum loss in the tip region tended to occur at slightly positive incidence angles, while minimum loss in the hub region tended to occur at slightly negative values with the exception of the 93-percent-of-span location. At 93 percent of span, minimum loss occurred at a positive incidence angle of about $2^{\circ}$.

4. Deviation angles associated with minimum loss vary from $+2^{\circ}$ to $-4^{\circ}$ from design values. Deviation angles are lower than design in the tip region by as much as $2^{\circ}$ and higher than design in the midspan-to-hub region by as much as $2^{\circ}$, except for 93 percent of span. For 93 percent of span the deviation is $4^{\circ}$ less than design.

5. The losses are, in general, lower than design with steep gradients existing in the end wall and damper regions of the blades.

Lewis Research Center,
National Aeronautics and Space Administration,
Cleveland, Ohio, June 14, 1971,
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# APPENDIX A

## SYMBOLS

| | |
|---|---|
| A | area, $ft^2$ |
| a | distance from blade leading edge to maximum camber point |
| $C_p$ | specific heat at constant pressure, 0.24 Btu/(lb)($^oR$) |
| c | chord length, in. |
| D | diffusion factor, $1 - \frac{V'_{TE}}{V'_{LE}} + \frac{(rV_\theta)_{TE} - (rV_\theta)_{LE}}{(r_{LE} + r_{TE})\sigma V'_{LE}}$ |
| g | acceleration of gravity, 32.17 $ft/sec^2$ |
| $i_{mc}$ | incidence angle, angle between inlet air direction and line tangent to blade mean camber line at leading edge, $(\beta'_m)_{LE} - (\kappa_{mc})_{LE}$, deg |
| $i_{ss}$ | incidence angle, angle between inlet air direction and line tangent to blade suction surface at leading edge, $(\beta'_m)_{LE} - (\kappa_{ss})_{LE}$, deg |
| J | mechanical equivalent of heat, 778.16 ft-lb/Btu |
| KIC | angle between blade mean camber line at leading edge and axial direction, deg |
| KOC | angle between blade mean camber line at trailing edge and axial direction, deg |
| KTC | angle between blade mean camber line at transition point and axial direction, deg |
| N | rotor speed, rpm |
| P | total pressure, psia |
| PHISS | suction-surface camber ahead of assumed shock location, deg |
| p | static pressure, psia |
| R | gas constant, 53.35 ft-lb/(lb)($^oR$) |
| RI | inlet radii, in. |
| RO | outlet radii, in. |
| r | radius, in. |
| SM | stall margin |
| T | total temperature, $^oR$ |
| TI | inlet blade thickness, in. |

| | |
|---|---|
| TM | maximum blade thickness, in. |
| TO | outlet blade thickness, in. |
| U | rotor speed, ft/sec |
| V | air velocity, ft/sec |
| W | weight flow, lb/sec |
| X-factor | ratio of suction-surface camber ahead of assumed shock location of the MCA blade section to that of a DCA blade section |
| Z | displacement along compressor axis, in. |
| ZIC | axial distance to inlet from reference point, in. |
| ZMC | axial distance to maximum thickness point from inlet, in. |
| ZOC | axial distance to outlet from inlet, in. |
| ZTC | axial distance to transition point from inlet, in. |
| $\beta$ | air angle, angle between air velocity and axial direction, deg |
| $\gamma$ | ratio of specific heats, 1.40 Btu/(lb)($^{o}$R) |
| $\gamma_b$ | blade setting angle, deg |
| $\delta$ | ratio of inlet total pressure to standard pressure of 14.69 psia |
| $\delta^o$ | deviation angle, angle between exit air direction and tangent to blade mean camber line at trailing edge, $(\beta'_m)_{TE} - (\kappa_{mc})_{LE}$, deg |
| $\eta$ | efficiency |
| $\theta$ | ratio of inlet total temperature to standard temperature of 518.7$^{o}$ R |
| $\kappa_{mc}$ | angle between blade mean camber line at leading or trailing edge and axial direction, deg |
| $\kappa_{ss}$ | angle between blade suction-surface camber line at leading edge and axial direction, deg |
| $\sigma$ | solidity, ratio of chord to spacing |
| $\varphi$ | camber angle, deg |
| $\bar{\omega}$ | total loss coefficient, $\dfrac{(P'_{id})_{TE} - P'_{TE}}{P'_{LE} - p_{LE}}$ |
| $\bar{\omega}_p$ | profile loss coefficient, $\bar{\omega} - \bar{\omega}_s$ |
| $\bar{\omega}_s$ | shock loss coefficient |

Subscripts:

| | |
|---|---|
| ad | adiabatic |
| id | ideal |
| LE | blade leading edge |
| m | meridional direction |
| mc | reference to mean camber line |
| r | radial direction |
| ss | reference to suction-surface camber line |
| TE | blade trailing edge |
| z | axial direction |
| $\theta$ | tangential direction |
| 1 | instrument plane upstream of rotor |
| 2 | instrument plane downstream of rotor |

Superscript:

| | |
|---|---|
| ′ | relative to rotor |

# APPENDIX B

## PERFORMANCE PARAMETERS

The performance parameters referred to in the main text are defined as follows:
Incidence angle based on suction-surface blade angle:

$$i_{ss} = (\beta'_m)_{LE} - (\kappa_{ss})_{LE}$$

Incidence angle based on mean blade angle:

$$i_{mc} = (\beta'_m)_{LE} - (\kappa_{mc})_{LE}$$

Deviation:

$$\delta^o = (\beta'_m)_{TE} - (\kappa_{mc})_{TE}$$

Diffusion factor:

$$D = 1 - \frac{V'_{TE}}{V'_{LE}} + \frac{(rV_\theta)_{TE} - (rV_\theta)_{LE}}{(r_{LE} + r_{TE})\sigma V'_{LE}}$$

Total loss coefficient:

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

Profile loss coefficient:

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

Total loss parameter:

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

Profile loss parameter:

$$\frac{(\bar{\omega} - \bar{\omega}_s) \cos (\beta'_m)_{TE}}{2\sigma}$$

Adiabatic efficiency:

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

Stall margin:

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

Momentum rise efficiency:

$$\eta_{mr} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{\frac{\gamma-1}{\gamma}} - 1}{\frac{(UV_\theta)_{TE} - (UV_\theta)_{LE}}{T_{LE} g J C_p}}$$

Equivalent weight flow:

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

Equivalent rotative speed:

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

# REFERENCES


1. Janetzke, David C.; Ball, Calvin L.; and Hager, Roy D.: Performance of 1380-Foot-Per-Second-Tip-Speed Axial-Flow Compressor Rotor With Blade Tip Solidity of 1.3. NASA TM X-2449, 1972.

2. Hager, Roy D.; Janetzke, David C.; and Reid, Lonnie: Performance of a 1380-Foot-Per-Second-Tip-Speed Axial-Flow Compressor Rotor With Blade Tip Solidity of 1.3. NASA TM X-2448, 1972.

3. Crouse, James E.; Janetzke, David C.; and Schwirian, Richard E.: A Computer Program for Composing Compressor Blading From Simulated Circular-Arc Elements on Conical Surfaces. NASA TN D-5437, 1969.

4. Monsarrat, N. T.; and Keenan, K. J.: Experimental Evaluation of Transonic Stators - Preliminary Analysis and Design Report. Rep. PWA-2749, Pratt & Whitney Aircraft. (NASA CR-54620), 1967.

5. Carter, A. D. S.; and Hughes, Hazel P.: A Theoretical Investigation Into The Effect of Profile Shape on The Performance of Aerofoils in Cascade. R & M 2384, Aeronautical Research Council, Gt. Britain, Mar. 1946.

6. Seyler, D. R.; and Smith, Leroy H., Jr.: Single Stage Experimental Evaluation of High Mach Number Compressor Rotor Blading. Part 1 - Design of Rotor Blading. Rep. R66FPD321, pt. 1, General Electric Co. (NASA CR-54581), Apr. 1, 1967.

7. Johnsen, Irving A.; and Bullock, Robert O., eds.: Aerodynamic Design of Axial-Flow Compressors. NASA SP-36, 1965.

8. Schwenk, Francis C.; Lewis, George, W.; and Hartman, Melvin J.: A Preliminary Analysis of the Magnitude of Shock Losses in Transonic Compressors. NACA RM E57A30, 1957.

9. Glawe, George E.; Krause, Lloyd N.; and Dudzinski, Thomas J.: A Small Combination Sensing Probe for Measurement of Temperature, Pressure, and Flow Direction. NASA TN D-4816, 1968.

10. Lieblein, Seymour; Schwenk, Francis C.; and Broderick, Robert L.: Diffusion Factor For Estimating Losses and Limiting Blade Loadings in Axial-Flow-Compressor Blade Elements. RM E53D01, 1953.

TABLE I. - DESIGN OVERALL PARAMETERS FOR ROTOR 5

| | |
|---|---|
| TOTAL PRESSURE RATIO | 1.652 |
| TOTAL TEMPERATURE RATIO | 1.187 |
| EFFICIENCY | 0.824 |
| WT FLOW PER UNIT FRONTAL AREA | 30.624 |
| WT FLOW PER UNIT ANNULUS AREA | 41.153 |
| WT FLOW | 65.284 |
| RPM | 16000.000 |
| TIP SPEED | 1380.206 |

TABLE II. - DESIGN BLADE ELEMENT PARAMETERS FOR ROTOR 5

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | RATIO | IN | RATIO |
| TIP | 9.885 | 9.770 | 0. | 44.4 | 64.6 | 55.3 | 518.7 | 1.241 | 14.69 | 1.652 |
| 1 | 9.651 | 9.504 | -0. | 42.1 | 63.8 | 53.8 | 518.7 | 1.225 | 14.69 | 1.652 |
| 2 | 9.440 | 9.322 | 0. | 40.8 | 63.1 | 52.7 | 518.7 | 1.216 | 14.69 | 1.652 |
| 3 | 8.559 | 8.588 | 0. | 38.0 | 60.0 | 48.5 | 518.7 | 1.189 | 14.69 | 1.652 |
| 4 | 8.102 | 8.222 | 0. | 38.0 | 58.4 | 45.9 | 518.7 | 1.182 | 14.69 | 1.652 |
| 5 | 7.985 | 8.129 | 0. | 38.2 | 58.0 | 45.1 | 518.7 | 1.181 | 14.69 | 1.652 |
| 6 | 7.868 | 8.038 | 0. | 38.3 | 57.6 | 44.3 | 518.7 | 1.181 | 14.69 | 1.652 |
| 7 | 7.740 | 7.937 | 0. | 38.5 | 57.2 | 43.5 | 518.7 | 1.180 | 14.69 | 1.652 |
| 8 | 7.638 | 7.854 | 0. | 38.6 | 56.8 | 42.7 | 518.7 | 1.179 | 14.69 | 1.652 |
| 9 | 6.546 | 7.019 | 0. | 39.8 | 53.5 | 33.8 | 518.7 | 1.171 | 14.69 | 1.652 |
| 10 | 5.639 | 6.387 | 0. | 40.8 | 51.2 | 25.1 | 518.7 | 1.166 | 14.69 | 1.652 |
| 11 | 5.352 | 6.204 | 0. | 41.2 | 50.6 | 22.3 | 518.7 | 1.164 | 14.69 | 1.652 |
| HUB | 5.000 | 5.940 | -0. | 41.6 | 49.9 | 18.1 | 518.7 | 1.161 | 14.69 | 1.652 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| TIP | 656.7 | 787.7 | 1528.5 | 988.2 | 656.7 | 562.4 | 0. | 551.6 | 1380.2 | 1364.1 |
| 1 | 662.6 | 788.8 | 1501.6 | 989.7 | 662.6 | 585.2 | -0. | 528.8 | 1347.5 | 1327.0 |
| 2 | 668.2 | 790.1 | 1477.8 | 987.3 | 668.2 | 598.2 | 0. | 516.1 | 1318.1 | 1301.6 |
| 3 | 690.5 | 796.4 | 1380.2 | 947.0 | 690.5 | 627.8 | 0. | 490.1 | 1195.1 | 1199.1 |
| 4 | 696.2 | 803.8 | 1328.3 | 909.8 | 696.2 | 633.4 | 0. | 494.9 | 1131.3 | 1148.0 |
| 5 | 697.4 | 806.4 | 1315.1 | 898.7 | 697.4 | 634.1 | 0. | 498.2 | 1114.9 | 1135.0 |
| 6 | 696.9 | 809.2 | 1301.0 | 887.6 | 696.9 | 634.8 | 0. | 501.9 | 1098.6 | 1122.3 |
| 7 | 696.5 | 811.9 | 1285.7 | 876.0 | 696.5 | 635.5 | 0. | 505.3 | 1080.7 | 1108.2 |
| 8 | 697.7 | 814.9 | 1274.4 | 867.1 | 697.7 | 637.0 | 0. | 508.3 | 1066.5 | 1096.6 |
| 9 | 677.0 | 849.6 | 1137.4 | 785.5 | 677.0 | 653.0 | 0. | 543.4 | 914.0 | 980.0 |
| 10 | 633.9 | 884.3 | 1010.8 | 738.8 | 633.9 | 669.0 | 0. | 578.4 | 787.4 | 891.8 |
| 11 | 614.0 | 895.3 | 967.2 | 728.4 | 614.0 | 673.8 | 0. | 589.6 | 747.3 | 866.2 |
| HUB | 588.4 | 913.6 | 913.0 | 719.0 | 588.4 | 683.5 | -0. | 606.2 | 698.1 | 829.4 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | STREAMLINE SLOPE | | MERID PEAK SS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO |
| TIP | 0.610 | 0.660 | 1.419 | 0.828 | 0.610 | 0.471 | -4.00 | -4.80 | 0.856 | 1.617 |
| 1 | 0.616 | 0.666 | 1.395 | 0.836 | 0.616 | 0.494 | -3.40 | -3.40 | 0.883 | 1.619 |
| 2 | 0.621 | 0.670 | 1.374 | 0.837 | 0.621 | 0.507 | -2.60 | -2.55 | 0.895 | 1.623 |
| 3 | 0.644 | 0.684 | 1.287 | 0.814 | 0.644 | 0.539 | 0.65 | 1.75 | 0.909 | 1.599 |
| 4 | 0.649 | 0.693 | 1.239 | 0.785 | 0.649 | 0.546 | 3.02 | 4.25 | 0.910 | 1.559 |
| 5 | 0.651 | 0.696 | 1.227 | 0.776 | 0.651 | 0.547 | 3.70 | 4.85 | 0.909 | 1.550 |
| 6 | 0.650 | 0.699 | 1.214 | 0.767 | 0.650 | 0.548 | 4.40 | 5.60 | 0.911 | 1.540 |
| 7 | 0.650 | 0.702 | 1.199 | 0.757 | 0.650 | 0.549 | 5.02 | 6.01 | 0.912 | 1.529 |
| 8 | 0.651 | 0.705 | 1.189 | 0.750 | 0.651 | 0.551 | 5.75 | 7.00 | 0.913 | 1.522 |
| 9 | 0.630 | 0.741 | 1.059 | 0.685 | 0.630 | 0.569 | 14.05 | 14.60 | 0.965 | 1.448 |
| 10 | 0.587 | 0.777 | 0.936 | 0.649 | 0.587 | 0.588 | 23.35 | 21.95 | 1.055 | 1.265 |
| 11 | 0.567 | 0.788 | 0.894 | 0.641 | 0.567 | 0.593 | 26.64 | 24.45 | 1.097 | 1.207 |
| HUB | 0.542 | 0.807 | 0.842 | 0.635 | 0.542 | 0.604 | 30.90 | 28.40 | 1.162 | 1.134 |

| | PERCENT | INCIDENCE | | DEV | D-FACT | EFF | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | SPAN | MEAN | SS | | | | TOT | PROF | TOT | PROF |
| TIP | 0. | 2.0 | 0.0 | 5.8 | 0.473 | 0.639 | 0.318 | 0.209 | 0.060 | 0.040 |
| 1 | 6.95 | 2.3 | 0.0 | 5.1 | 0.455 | 0.684 | 0.270 | 0.164 | 0.052 | 0.032 |
| 2 | 11.70 | 2.6 | 0.0 | 4.6 | 0.443 | 0.715 | 0.242 | 0.138 | 0.047 | 0.027 |
| 3 | 30.86 | 3.8 | 0.0 | 3.6 | 0.418 | 0.817 | 0.156 | 0.072 | 0.030 | 0.014 |
| 4 | 40.42 | 4.4 | 0.0 | 3.5 | 0.420 | 0.846 | 0.135 | 0.067 | 0.026 | 0.013 |
| 5 | 42.85 | 4.5 | -0.0 | 3.9 | 0.422 | 0.850 | 0.133 | 0.068 | 0.026 | 0.013 |
| 6 | 45.22 | 4.6 | -0.0 | 4.0 | 0.424 | 0.853 | 0.132 | 0.071 | 0.026 | 0.014 |
| 7 | 47.86 | 4.8 | 0.0 | 3.7 | 0.425 | 0.858 | 0.129 | 0.072 | 0.025 | 0.014 |
| 8 | 50.03 | 4.9 | -0.0 | 4.2 | 0.426 | 0.862 | 0.127 | 0.073 | 0.024 | 0.014 |
| 9 | 71.83 | 5.9 | 0.0 | 5.0 | 0.421 | 0.902 | 0.103 | 0.077 | 0.019 | 0.014 |
| 10 | 88.33 | 6.6 | 0.0 | 6.2 | 0.386 | 0.931 | 0.085 | 0.083 | 0.015 | 0.014 |
| 11 | 93.11 | 6.7 | 0.0 | 6.1 | 0.366 | 0.941 | 0.079 | 0.078 | 0.013 | 0.013 |
| HUB | 100.00 | 6.8 | 0.0 | 7.8 | 0.333 | 0.955 | 0.065 | 0.065 | 0.010 | 0.010 |

TABLE III. - BLADE GEOMETRY FOR ROTOR 5

| RP | PERCENT SPAN | RADII RI | RADII RO | BLADE ANGLES KIC | BLADE ANGLES KTC | BLADE ANGLES KOC | DELTA INC |
|---|---|---|---|---|---|---|---|
| TIP | 0. | 9.885 | 9.770 | 62.55 | 58.60 | 49.50 | 1.95 |
| 1 | 7. | 9.651 | 9.504 | 61.52 | 57.06 | 48.60 | 2.26 |
| 2 | 12. | 9.440 | 9.322 | 60.48 | 55.71 | 48.06 | 2.61 |
| 3 | 31. | 8.559 | 8.588 | 56.16 | 50.45 | 44.90 | 3.82 |
| 4 | 40. | 8.102 | 8.222 | 54.00 | 48.06 | 42.42 | 4.36 |
| 5 | 43. | 7.985 | 8.129 | 53.44 | 47.37 | 41.24 | 4.49 |
| 6 | 45. | 7.868 | 8.038 | 52.94 | 46.66 | 40.30 | 4.61 |
| 7 | 48. | 7.740 | 7.937 | 52.38 | 45.88 | 39.80 | 4.75 |
| 8 | 50. | 7.638 | 7.854 | 51.86 | 45.25 | 38.55 | 4.86 |
| 9 | 72. | 6.546 | 7.019 | 47.35 | 37.94 | 28.70 | 5.94 |
| 10 | 88. | 5.639 | 6.387 | 44.55 | 31.48 | 18.60 | 6.56 |
| 11 | 93. | 5.352 | 6.204 | 43.92 | 29.46 | 15.90 | 6.68 |
| HUB | 100. | 5.000 | 5.940 | 43.25 | 27.01 | 10.00 | 6.80 |

| RP | BLADE THICKNESSES TI | BLADE THICKNESSES TM | BLADE THICKNESSES TO | AXIAL DIMENSIONS ZMC | AXIAL DIMENSIONS ZTC | AXIAL DIMENSIONS ZOC | CONE ANGLE |
|---|---|---|---|---|---|---|---|
| TIP | 0.020 | 0.059 | 0.020 | 0.554 | 0.554 | 1.008 | -5.700 |
| 1 | 0.020 | 0.064 | 0.020 | 0.558 | 0.558 | 1.061 | -4.700 |
| 2 | 0.020 | 0.068 | 0.020 | 0.560 | 0.560 | 1.097 | -3.750 |
| 3 | 0.020 | 0.085 | 0.020 | 0.576 | 0.576 | 1.233 | 1.000 |
| 4 | 0.020 | 0.094 | 0.020 | 0.608 | 0.608 | 1.290 | 4.150 |
| 5 | 0.020 | 0.096 | 0.020 | 0.615 | 0.615 | 1.306 | 4.950 |
| 6 | 0.020 | 0.098 | 0.020 | 0.622 | 0.622 | 1.321 | 5.850 |
| 7 | 0.020 | 0.101 | 0.020 | 0.630 | 0.630 | 1.338 | 6.500 |
| 8 | 0.020 | 0.103 | 0.020 | 0.636 | 0.636 | 1.352 | 7.400 |
| 9 | 0.020 | 0.124 | 0.020 | 0.697 | 0.697 | 1.489 | 15.500 |
| 10 | 0.020 | 0.141 | 0.020 | 0.742 | 0.742 | 1.595 | 23.600 |
| 11 | 0.020 | 0.147 | 0.020 | 0.755 | 0.755 | 1.627 | 26.600 |
| HUB | 0.020 | 0.153 | 0.020 | 0.772 | 0.772 | 1.673 | 30.300 |

| RP | AERO CHORD | SETTING ANGLE | TOTAL CAMBER | SOLIDITY | X FACTOR | PHISS | AREA RATIO |
|---|---|---|---|---|---|---|---|
| TIP | 1.930 | 57.92 | 13.05 | 1.500 | 0.637 | 5.82 | 1.086 |
| 1 | 1.960 | 56.50 | 12.92 | 1.531 | 0.724 | 6.59 | 1.081 |
| 2 | 1.958 | 55.29 | 12.42 | 1.563 | 0.798 | 7.31 | 1.077 |
| 3 | 1.958 | 50.47 | 11.26 | 1.705 | 1.000 | 9.04 | 1.061 |
| 4 | 1.962 | 48.13 | 11.58 | 1.793 | 1.000 | 9.10 | 1.051 |
| 5 | 1.959 | 47.35 | 12.20 | 1.820 | 1.000 | 9.15 | 1.049 |
| 6 | 1.961 | 46.64 | 12.64 | 1.842 | 1.000 | 9.18 | 1.047 |
| 7 | 1.966 | 45.98 | 12.58 | 1.876 | 1.000 | 9.23 | 1.045 |
| 8 | 1.964 | 45.23 | 13.31 | 1.903 | 1.000 | 9.26 | 1.044 |
| 9 | 2.003 | 37.98 | 18.65 | 2.210 | 1.000 | 9.76 | 1.031 |
| 10 | 2.086 | 31.52 | 25.95 | 2.590 | 1.000 | 10.05 | 1.036 |
| 11 | 2.133 | 29.67 | 28.02 | 2.750 | 1.000 | 10.05 | 1.044 |
| HUB | 2.170 | 26.78 | 33.25 | 2.980 | 1.000 | 9.95 | 1.057 |

TABLE IV. - OVERALL PERFORMANCE FOR ROTOR 5, 50 PERCENT DESIGN SPEED

| PARAMETER | READING | | | | | | |
|---|---|---|---|---|---|---|---|
| | 939 | 940 | 941 | 942 | 943 | 944 | 945 |
| TOTAL PRESSURE RATIO | 1.013 | 1.038 | 1.071 | 1.106 | 1.130 | 1.152 | 1.166 |
| TOTAL TEMPERATURE RATIO | 1.011 | 1.015 | 1.025 | 1.031 | 1.037 | 1.044 | 1.052 |
| TEMP RISE EFFICIENCY | 0.361 | 0.690 | 0.874 | 0.945 | 0.951 | 0.930 | 0.869 |
| MOMENTUM RISE EFFICIENCY | 0.449 | 0.809 | 0.920 | 0.976 | 0.951 | 0.935 | 0.845 |
| WT FLOW PER UNIT FRONTAL AREA | 22.216 | 21.782 | 20.515 | 18.741 | 17.143 | 15.147 | 12.810 |
| WT FLOW PER UNIT ANNULUS AREA | 30.127 | 29.538 | 27.821 | 25.414 | 23.248 | 20.541 | 17.371 |
| WT FLOW AT ORIFICE | 47.073 | 46.153 | 43.469 | 39.709 | 36.524 | 32.094 | 27.142 |
| WT FLOW AT INLET | 47.210 | 46.176 | 43.664 | 39.880 | 36.529 | 32.145 | 27.096 |
| WT FLOW AT OUTLET | 44.271 | 43.407 | 41.099 | 37.933 | 34.831 | 31.398 | 26.789 |
| RPM | 7958.668 | 7967.881 | 7967.960 | 7966.119 | 7954.209 | 7956.405 | 7966.763 |
| PERCENT OF DESIGN SPEED | 49.742 | 49.799 | 49.800 | 49.788 | 49.714 | 49.728 | 49.792 |

TABLE V. - OVERALL PERFORMANCE FOR ROTOR 5, 60 PERCENT DESIGN SPEED

| PARAMETER | READING | | | | | | |
|---|---|---|---|---|---|---|---|
| | 947 | 948 | 949 | 950 | 951 | 952 | 953 |
| TOTAL PRESSURE RATIO | 1.081 | 1.129 | 1.172 | 1.203 | 1.231 | 1.242 | 1.246 |
| TOTAL TEMPERATURE RATIO | 1.030 | 1.040 | 1.049 | 1.058 | 1.066 | 1.072 | 1.074 |
| TEMP RISE EFFICIENCY | 0.743 | 0.893 | 0.944 | 0.945 | 0.924 | 0.892 | 0.871 |
| MOMENTUM RISE EFFICIENCY | 0.807 | 0.932 | 0.954 | 0.946 | 0.918 | 0.887 | 0.862 |
| WT FLOW PER UNIT FRONTAL AREA | 23.827 | 23.138 | 21.749 | 20.226 | 18.291 | 16.916 | 16.229 |
| WT FLOW PER UNIT ANNULUS AREA | 32.312 | 31.377 | 29.493 | 27.428 | 24.805 | 22.940 | 22.008 |
| WT FLOW AT ORIFICE | 50.487 | 49.026 | 46.082 | 42.856 | 38.757 | 35.843 | 34.386 |
| WT FLOW AT INLET | 50.535 | 49.087 | 46.213 | 42.949 | 38.751 | 35.817 | 34.255 |
| WT FLOW AT OUTLET | 47.536 | 46.515 | 43.980 | 41.051 | 37.460 | 35.113 | 33.678 |
| RPM | 9610.339 | 9608.428 | 9614.760 | 9604.724 | 9618.851 | 9608.011 | 9611.133 |
| PERCENT OF DESIGN SPEED | 60.065 | 60.053 | 60.092 | 60.030 | 60.118 | 60.050 | 60.070 |

TABLE VI. - OVERALL PERFORMANCE FOR ROTOR 5, 70 PERCENT DESIGN SPEED

| PARAMETER | READING | | | | | | |
|---|---|---|---|---|---|---|---|
| | 957 | 958 | 959 | 960 | 961 | 962 | 963 |
| TOTAL PRESSURE RATIO | 1.143 | 1.212 | 1.255 | 1.302 | 1.328 | 1.340 | 1.347 |
| TOTAL TEMPERATURE RATIO | 1.050 | 1.064 | 1.072 | 1.085 | 1.090 | 1.097 | 1.105 |
| TEMP RISE EFFICIENCY | 0.774 | 0.888 | 0.933 | 0.946 | 0.933 | 0.902 | 0.867 |
| MOMENTUM RISE EFFICIENCY | 0.819 | 0.916 | 0.950 | 0.950 | 0.921 | 0.885 | 0.842 |
| WT FLOW PER UNIT FRONTAL AREA | 25.771 | 25.375 | 24.770 | 23.271 | 22.005 | 20.476 | 19.120 |
| WT FLOW PER UNIT ANNULUS AREA | 34.948 | 34.409 | 33.591 | 31.558 | 29.840 | 27.767 | 25.928 |
| WT FLOW AT ORIFICE | 54.605 | 53.762 | 52.485 | 49.309 | 46.625 | 43.386 | 40.512 |
| WT FLOW AT INLET | 54.793 | 53.992 | 52.686 | 49.553 | 46.806 | 43.543 | 40.414 |
| WT FLOW AT OUTLET | 51.323 | 51.091 | 49.943 | 47.170 | 44.985 | 42.085 | 39.385 |
| RPM | 11226.262 | 11219.750 | 11225.899 | 11224.358 | 11210.065 | 11254.312 | 11244.552 |
| PERCENT OF DESIGN SPEED | 70.164 | 70.123 | 70.149 | 70.152 | 70.063 | 70.214 | 70.278 |

TABLE VII. - OVERALL PERFORMANCE FOR ROTOR 5, 80 PERCENT DESIGN SPEED

| PARAMETER | READING | | | | | | |
|---|---|---|---|---|---|---|---|
| | 964 | 965 | 966 | 967 | 968 | 969 | 970 |
| TOTAL PRESSURE RATIO | 1.155 | 1.270 | 1.351 | 1.396 | 1.454 | 1.473 | 1.477 |
| TOTAL TEMPERATURE RATIO | 1.060 | 1.083 | 1.099 | 1.107 | 1.121 | 1.129 | 1.136 |
| TEMP RISE EFFICIENCY | 0.699 | 0.847 | 0.909 | 0.936 | 0.931 | 0.911 | 0.868 |
| MOMENTUM RISE EFFICIENCY | 0.761 | 0.883 | 0.921 | 0.939 | 0.928 | 0.898 | 0.852 |
| WT FLOW PER UNIT FRONTAL AREA | 27.994 | 27.883 | 27.515 | 27.097 | 25.325 | 23.833 | 22.109 |
| WT FLOW PER UNIT ANNULUS AREA | 37.962 | 37.812 | 37.312 | 36.746 | 34.343 | 32.320 | 29.982 |
| WT FLOW AT ORIFICE | 59.315 | 59.081 | 58.299 | 57.415 | 53.660 | 50.498 | 46.846 |
| WT FLOW AT INLET | 59.576 | 59.222 | 58.459 | 57.585 | 53.797 | 50.622 | 46.850 |
| WT FLOW AT OUTLET | 56.089 | 56.014 | 55.647 | 55.243 | 51.924 | 49.033 | 46.072 |
| RPM | 12818.786 | 12836.805 | 12821.826 | 12819.814 | 12807.844 | 12789.956 | 12828.696 |
| PERCENT OF DESIGN SPEED | 80.117 | 80.230 | 80.136 | 80.124 | 80.047 | 79.937 | 80.179 |

TABLE VIII. - OVERALL PERFORMANCE FOR ROTOR 5, 90 PERCENT DESIGN SPEED

| PARAMETER | READING | | | | | | |
|---|---|---|---|---|---|---|---|
| | 971 | 973 | 974 | 975 | 976 | 977 | 978 |
| TOTAL PRESSURE RATIO | 1.265 | 1.487 | 1.564 | 1.602 | 1.631 | 1.649 | 1.657 |
| TOTAL TEMPERATURE RATIO | 1.093 | 1.135 | 1.148 | 1.156 | 1.163 | 1.169 | 1.175 |
| TEMP RISE EFFICIENCY | 0.751 | 0.891 | 0.922 | 0.926 | 0.919 | 0.909 | 0.884 |
| MOMENTUM RISE EFFICIENCY | 0.813 | 0.885 | 0.913 | 0.914 | 0.907 | 0.897 | 0.866 |
| WT FLOW PER UNIT FRONTAL AREA | 29.867 | 29.678 | 29.343 | 28.719 | 27.829 | 27.001 | 25.490 |
| WT FLOW PER UNIT ANNULUS AREA | 40.503 | 40.247 | 39.792 | 38.945 | 37.739 | 36.616 | 34.567 |
| WT FLOW AT ORIFICE | 63.285 | 62.884 | 62.174 | 60.851 | 58.966 | 57.211 | 54.010 |
| WT FLOW AT INLET | 63.357 | 62.930 | 62.156 | 60.948 | 58.965 | 57.107 | 53.891 |
| WT FLOW AT OUTLET | 59.708 | 60.112 | 59.951 | 58.802 | 57.062 | 55.656 | 52.987 |
| RPM | 14377.100 | 14396.016 | 14394.358 | 14381.975 | 14366.744 | 14359.984 | 14364.394 |
| PERCENT OF DESIGN SPEED | 89.857 | 89.975 | 89.965 | 89.887 | 89.792 | 89.750 | 89.777 |

TABLE IX. - OVERALL PERFORMANCE FOR ROTOR 5, 100 PERCENT DESIGN SPEED

| PARAMETER | READING | | | | | | |
|---|---|---|---|---|---|---|---|
| | 981 | 982 | 984 | 985 | 987 | 990 | 992 |
| TOTAL PRESSURE RATIO | 1.368 | 1.572 | 1.838 | 1.849 | 1.855 | 1.745 | 1.822 |
| TOTAL TEMPERATURE RATIO | 1.123 | 1.165 | 1.213 | 1.219 | 1.225 | 1.196 | 1.210 |
| TEMP RISE EFFICIENCY | 0.758 | 0.854 | 0.890 | 0.875 | 0.858 | 0.881 | 0.891 |
| MOMENTUM RISE EFFICIENCY | 0.776 | 0.821 | 0.863 | 0.856 | 0.835 | 0.861 | 0.872 |
| WT FLOW PER UNIT FRONTAL AREA | 31.353 | 31.320 | 29.983 | 29.520 | 28.318 | 31.470 | 30.967 |
| WT FLOW PER UNIT ANNULUS AREA | 42.517 | 42.472 | 40.660 | 40.032 | 38.401 | 42.676 | 41.994 |
| WT FLOW AT ORIFICE | 66.432 | 66.362 | 63.529 | 62.549 | 60.001 | 66.681 | 65.614 |
| WT FLOW AT INLET | 66.426 | 66.411 | 63.429 | 62.193 | 59.691 | 66.378 | 65.232 |
| WT FLOW AT OUTLET | 62.789 | 62.464 | 61.115 | 60.020 | 57.914 | 65.311 | 62.462 |
| RPM | 15939.107 | 15910.080 | 15919.479 | 15950.561 | 15949.806 | 16008.819 | 16021.201 |
| PERCENT OF DESIGN SPEED | 99.619 | 99.438 | 99.497 | 99.691 | 99.686 | 100.053 | 100.133 |

TABLE X. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5,

50 PERCENT DESIGN SPEED

(a) Reading 939

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | -1.4 | 58.0 | 54.8 | 518.7 | 518.9 | 14.69 | 14.32 |
| 2 | 9.440 | 9.322 | 0. | -1.1 | 57.3 | 53.7 | 518.7 | 518.8 | 14.69 | 14.38 |
| 3 | 8.559 | 8.588 | 0. | 3.0 | 55.3 | 48.7 | 518.7 | 521.5 | 14.69 | 14.54 |
| 4 | 8.102 | 8.222 | 0. | 3.2 | 51.5 | 47.8 | 518.7 | 522.6 | 14.69 | 14.41 |
| 5 | 7.985 | 8.129 | 0. | 5.4 | 51.0 | 47.0 | 518.7 | 522.7 | 14.69 | 14.31 |
| 6 | 7.868 | 8.038 | 0. | 5.5 | 50.5 | 47.0 | 518.7 | 523.5 | 14.69 | 14.38 |
| 7 | 7.740 | 7.937 | 0. | 4.8 | 50.0 | 45.1 | 518.7 | 523.2 | 14.69 | 14.59 |
| 8 | 7.638 | 7.854 | 0. | 4.1 | 49.6 | 43.9 | 518.7 | 523.5 | 14.69 | 14.82 |
| 9 | 6.546 | 7.019 | 0. | 9.0 | 45.7 | 34.6 | 518.7 | 527.2 | 14.69 | 15.36 |
| 10 | 5.639 | 6.387 | 0. | 13.9 | 42.7 | 25.7 | 518.7 | 531.4 | 14.69 | 15.76 |
| 11 | 5.352 | 6.204 | 0. | 15.5 | 42.4 | 22.7 | 518.7 | 532.6 | 14.69 | 15.96 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 419.1 | 473.4 | 790.3 | 821.3 | 419.1 | 473.3 | 0. | -11.4 | 670.0 | 659.8 |
| 2 | 421.2 | 482.5 | 780.6 | 815.8 | 421.2 | 482.5 | 0. | -8.9 | 657.2 | 649.0 |
| 3 | 441.9 | 501.4 | 740.1 | 758.0 | 441.9 | 500.7 | 0. | 26.6 | 593.7 | 595.7 |
| 4 | 448.3 | 494.2 | 719.8 | 734.2 | 448.3 | 493.4 | 0. | 27.8 | 563.1 | 571.5 |
| 5 | 448.5 | 484.5 | 712.6 | 707.9 | 448.5 | 482.4 | 0. | 45.5 | 553.7 | 565.7 |
| 6 | 449.5 | 491.7 | 706.4 | 720.3 | 449.5 | 490.8 | 0. | 29.6 | 545.0 | 556.8 |
| 7 | 451.0 | 510.2 | 702.2 | 719.7 | 451.0 | 508.4 | 0. | 42.6 | 538.3 | 552.0 |
| 8 | 451.3 | 529.2 | 696.3 | 732.3 | 451.3 | 527.8 | 0. | 37.8 | 530.3 | 545.3 |
| 9 | 444.1 | 583.3 | 636.2 | 699.5 | 444.1 | 576.0 | 0. | 91.7 | 455.6 | 488.5 |
| 10 | 424.3 | 626.7 | 577.5 | 675.3 | 424.3 | 608.3 | 0. | 150.5 | 391.8 | 443.8 |
| 11 | 407.1 | 643.8 | 551.1 | 672.3 | 407.1 | 620.5 | 0. | 171.7 | 371.5 | 430.6 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS EFF |
|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO |
| 1 | 0.381 | 0.432 | 0.718 | 0.749 | 0.381 | 0.432 | 1.129 | 0.763-17.718 |
| 2 | 0.383 | 0.441 | 0.709 | 0.745 | 0.383 | 0.440 | 1.145 | 0.787-21.896 |
| 3 | 0.402 | 0.457 | 0.674 | 0.691 | 0.402 | 0.457 | 1.133 | 0.775 -0.560 |
| 4 | 0.408 | 0.450 | 0.655 | 0.668 | 0.408 | 0.449 | 1.101 | 0.747 -0.737 |
| 5 | 0.408 | 0.441 | 0.649 | 0.644 | 0.408 | 0.439 | 1.075 | 0.739 -0.970 |
| 6 | 0.409 | 0.447 | 0.643 | 0.655 | 0.409 | 0.446 | 1.092 | 0.729 -0.667 |
| 7 | 0.411 | 0.465 | 0.640 | 0.656 | 0.411 | 0.463 | 1.127 | 0.726 -0.224 |
| 8 | 0.411 | 0.483 | 0.634 | 0.668 | 0.411 | 0.482 | 1.170 | 0.720 0.264 |
| 9 | 0.404 | 0.533 | 0.579 | 0.639 | 0.404 | 0.526 | 1.297 | 0.656 0.773 |
| 10 | 0.386 | 0.573 | 0.525 | 0.617 | 0.386 | 0.556 | 1.434 | 0.584 0.827 |
| 11 | 0.370 | 0.589 | 0.500 | 0.615 | 0.370 | 0.567 | 1.524 | 0.563 0.892 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | -3.6 | -5.8 | 6.2 | -0.035 | 0.091 | 0.091 | 0.017 | 0.017 |
| 2 | 9.11 | 11.70 | -3.2 | -5.8 | 5.6 | -0.042 | 0.077 | 0.077 | 0.015 | 0.015 |
| 3 | 27.14 | 30.86 | -2.8 | -6.7 | 3.8 | -0.014 | 0.110 | 0.110 | 0.021 | 0.021 |
| 4 | 36.50 | 40.42 | -2.6 | -6.9 | 5.4 | -0.009 | 0.180 | 0.180 | 0.034 | 0.034 |
| 5 | 38.89 | 42.85 | -2.5 | -7.0 | 5.8 | 0.024 | 0.213 | 0.213 | 0.040 | 0.040 |
| 6 | 41.29 | 45.22 | -2.5 | -7.1 | 6.7 | -0.008 | 0.216 | 0.216 | 0.040 | 0.040 |
| 7 | 43.91 | 47.86 | -2.4 | -7.2 | 5.2 | -0.008 | 0.153 | 0.153 | 0.029 | 0.029 |
| 8 | 46.00 | 50.03 | -2.4 | -7.2 | 5.3 | -0.037 | 0.099 | 0.099 | 0.019 | 0.019 |
| 9 | 68.35 | 71.83 | -1.8 | -7.8 | 5.7 | -0.066 | 0.064 | 0.064 | 0.012 | 0.012 |
| 10 | 86.92 | 88.33 | -1.9 | -8.5 | 6.9 | -0.116 | 0.086 | 0.086 | 0.015 | 0.015 |
| 11 | 92.79 | 93.11 | -1.5 | -8.2 | 6.4 | -0.159 | 0.064 | 0.064 | 0.011 | 0.011 |

TABLE X. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 50 PERCENT DESIGN SPEED

(b) Reading 940

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 2.5 | 58.5 | 54.7 | 518.7 | 522.6 | 14.69 | 14.78 |
| 2 | 9.440 | 9.322 | 0. | 3.7 | 57.8 | 53.6 | 518.7 | 522.5 | 14.69 | 14.81 |
| 3 | 8.559 | 8.588 | 0. | 5.8 | 53.9 | 49.0 | 518.7 | 524.7 | 14.69 | 15.00 |
| 4 | 8.102 | 8.222 | 0. | 8.3 | 52.1 | 46.3 | 518.7 | 525.6 | 14.69 | 14.98 |
| 5 | 7.985 | 8.129 | 0. | 8.3 | 51.7 | 46.2 | 518.7 | 526.0 | 14.69 | 14.94 |
| 6 | 7.868 | 8.038 | 0. | 8.7 | 51.3 | 45.4 | 518.7 | 526.5 | 14.69 | 14.98 |
| 7 | 7.740 | 7.937 | 0. | 8.6 | 50.8 | 44.2 | 518.7 | 525.5 | 14.69 | 15.13 |
| 8 | 7.638 | 7.854 | 0. | 7.3 | 50.5 | 43.8 | 518.7 | 525.6 | 14.69 | 15.22 |
| 9 | 6.546 | 7.019 | 0. | 11.6 | 46.6 | 34.9 | 518.7 | 529.3 | 14.69 | 15.57 |
| 10 | 5.639 | 6.387 | 0. | 15.9 | 44.0 | 26.1 | 518.7 | 532.3 | 14.69 | 15.91 |
| 11 | 5.352 | 6.204 | 0. | 17.3 | 43.4 | 23.0 | 518.7 | 534.0 | 14.69 | 16.06 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 410.7 | 454.6 | 786.4 | 785.3 | 410.7 | 454.2 | 0. | 19.8 | 670.6 | 660.4 |
| 2 | 413.9 | 457.6 | 777.1 | 769.8 | 413.9 | 456.6 | 0. | 29.7 | 657.7 | 649.5 |
| 3 | 433.3 | 479.3 | 735.5 | 726.3 | 433.3 | 476.9 | 0. | 48.5 | 594.3 | 596.3 |
| 4 | 436.9 | 483.0 | 711.1 | 691.1 | 436.9 | 477.9 | 0. | 70.1 | 561.1 | 569.4 |
| 5 | 439.1 | 479.8 | 707.8 | 686.3 | 439.1 | 474.8 | 0. | 69.7 | 555.2 | 565.2 |
| 6 | 438.3 | 484.7 | 700.7 | 682.0 | 438.3 | 479.2 | 0. | 73.2 | 546.7 | 558.5 |
| 7 | 438.8 | 498.1 | 694.9 | 686.5 | 438.8 | 492.6 | 0. | 74.3 | 538.8 | 552.5 |
| 8 | 438.7 | 506.3 | 689.1 | 696.2 | 438.7 | 502.2 | 0. | 64.4 | 531.5 | 546.5 |
| 9 | 430.7 | 551.9 | 626.6 | 658.8 | 430.7 | 540.6 | 0. | 111.4 | 455.1 | 488.0 |
| 10 | 406.5 | 596.7 | 565.5 | 639.1 | 406.5 | 573.8 | 0. | 163.8 | 393.2 | 445.3 |
| 11 | 394.1 | 614.5 | 542.1 | 637.4 | 394.1 | 586.7 | 0. | 182.6 | 372.3 | 431.5 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.373 | 0.413 | 0.714 | 0.713 | 0.373 | 0.412 | 1.106 | 0.782 | 0.228 |
| 2 | 0.376 | 0.415 | 0.706 | 0.699 | 0.376 | 0.415 | 1.103 | 0.799 | 0.311 |
| 3 | 0.394 | 0.435 | 0.669 | 0.659 | 0.394 | 0.433 | 1.100 | 0.786 | 0.504 |
| 4 | 0.398 | 0.438 | 0.647 | 0.627 | 0.398 | 0.433 | 1.094 | 0.755 | 0.412 |
| 5 | 0.400 | 0.435 | 0.644 | 0.622 | 0.400 | 0.430 | 1.081 | 0.753 | 0.336 |
| 6 | 0.399 | 0.439 | 0.638 | 0.618 | 0.399 | 0.434 | 1.093 | 0.746 | 0.363 |
| 7 | 0.399 | 0.452 | 0.632 | 0.623 | 0.399 | 0.447 | 1.123 | 0.741 | 0.637 |
| 8 | 0.399 | 0.460 | 0.627 | 0.633 | 0.399 | 0.456 | 1.145 | 0.736 | 0.769 |
| 9 | 0.392 | 0.502 | 0.570 | 0.599 | 0.392 | 0.491 | 1.255 | 0.667 | 0.814 |
| 10 | 0.369 | 0.543 | 0.513 | 0.582 | 0.369 | 0.522 | 1.412 | 0.603 | 0.880 |
| 11 | 0.358 | 0.559 | 0.492 | 0.580 | 0.358 | 0.534 | 1.489 | 0.575 | 0.872 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | -3.1 | -5.3 | 6.0 | 0.010 | 0.070 | 0.070 | 0.013 | 0.013 |
| 2 | 9.11 | 11.70 | -2.7 | -5.3 | 5.5 | 0.021 | 0.062 | 0.062 | 0.012 | 0.012 |
| 3 | 27.14 | 30.86 | -2.3 | -6.1 | 4.0 | 0.032 | 0.076 | 0.076 | 0.015 | 0.015 |
| 4 | 36.50 | 40.42 | -2.0 | -6.3 | 3.8 | 0.056 | 0.110 | 0.110 | 0.021 | 0.021 |
| 5 | 38.89 | 42.85 | -1.8 | -6.3 | 5.0 | 0.058 | 0.131 | 0.131 | 0.025 | 0.025 |
| 6 | 41.29 | 45.22 | -1.7 | -6.3 | 5.0 | 0.055 | 0.137 | 0.137 | 0.026 | 0.026 |
| 7 | 43.91 | 47.86 | -1.6 | -6.4 | 4.3 | 0.041 | 0.070 | 0.070 | 0.013 | 0.013 |
| 8 | 46.00 | 50.03 | -1.5 | -6.4 | 5.2 | 0.015 | 0.045 | 0.045 | 0.009 | 0.009 |
| 9 | 68.35 | 71.83 | -1.0 | -6.9 | 6.0 | -0.010 | 0.067 | 0.067 | 0.012 | 0.012 |
| 10 | 86.92 | 88.33 | -0.6 | -7.1 | 7.2 | -0.071 | 0.066 | 0.066 | 0.012 | 0.012 |
| 11 | 92.79 | 93.11 | -0.5 | -7.2 | 6.7 | -0.110 | 0.086 | 0.086 | 0.014 | 0.014 |

TABLE X. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 50 PERCENT DESIGN SPEED

(c) Reading 941

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 10.2 | 60.1 | 54.4 | 518.7 | 528.0 | 14.69 | 15.43 |
| 2 | 9.440 | 9.322 | 0. | 10.2 | 59.3 | 53.5 | 518.7 | 527.8 | 14.69 | 15.45 |
| 3 | 8.559 | 8.588 | 0. | 12.8 | 55.7 | 48.9 | 518.7 | 528.4 | 14.69 | 15.56 |
| 4 | 8.102 | 8.222 | 0. | 16.4 | 54.0 | 45.8 | 518.7 | 530.7 | 14.69 | 15.57 |
| 5 | 7.985 | 8.129 | 0. | 16.0 | 53.6 | 45.2 | 518.7 | 531.0 | 14.69 | 15.57 |
| 6 | 7.868 | 8.038 | 0. | 15.6 | 53.2 | 44.7 | 518.7 | 530.2 | 14.69 | 15.62 |
| 7 | 7.740 | 7.937 | 0. | 14.7 | 52.7 | 43.6 | 518.7 | 529.9 | 14.69 | 15.71 |
| 8 | 7.638 | 7.854 | 0. | 15.0 | 52.4 | 42.7 | 518.7 | 529.7 | 14.69 | 15.76 |
| 9 | 6.546 | 7.019 | 0. | 17.3 | 48.6 | 34.9 | 518.7 | 531.9 | 14.69 | 15.93 |
| 10 | 5.639 | 6.387 | 0. | 20.0 | 45.8 | 26.5 | 518.7 | 534.2 | 14.69 | 16.14 |
| 11 | 5.352 | 6.204 | 0. | 22.6 | 44.9 | 22.0 | 518.7 | 535.7 | 14.69 | 16.27 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 386.6 | 426.9 | 774.9 | 721.1 | 386.6 | 420.2 | 0. | 75.3 | 671.6 | 661.4 |
| 2 | 390.5 | 430.9 | 763.8 | 712.3 | 390.5 | 424.1 | 0. | 76.0 | 656.5 | 648.3 |
| 3 | 405.9 | 445.2 | 719.5 | 660.0 | 405.9 | 434.1 | 0. | 98.9 | 594.1 | 596.1 |
| 4 | 409.4 | 451.9 | 697.0 | 621.5 | 409.4 | 433.6 | 0. | 127.3 | 564.1 | 572.5 |
| 5 | 409.7 | 454.3 | 689.8 | 619.8 | 409.7 | 436.7 | 0. | 125.1 | 554.9 | 564.9 |
| 6 | 410.5 | 459.0 | 685.6 | 621.9 | 410.5 | 442.1 | 0. | 123.6 | 549.2 | 561.0 |
| 7 | 409.3 | 467.7 | 675.1 | 625.2 | 409.3 | 452.4 | 0. | 119.0 | 536.8 | 550.5 |
| 8 | 409.4 | 473.8 | 670.4 | 623.1 | 409.4 | 457.6 | 0. | 123.0 | 530.8 | 545.8 |
| 9 | 400.8 | 506.4 | 606.2 | 589.6 | 400.8 | 483.5 | 0. | 150.3 | 454.8 | 487.6 |
| 10 | 381.3 | 548.6 | 546.8 | 576.0 | 381.3 | 515.7 | 0. | 187.2 | 391.9 | 443.8 |
| 11 | 374.0 | 570.7 | 527.8 | 568.2 | 374.0 | 526.9 | 0. | 219.2 | 372.4 | 431.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.351 | 0.385 | 0.705 | 0.650 | 0.351 | 0.379 | 1.087 | 0.822 | 0.781 |
| 2 | 0.354 | 0.388 | 0.693 | 0.642 | 0.354 | 0.382 | 1.086 | 0.828 | 0.829 |
| 3 | 0.369 | 0.401 | 0.653 | 0.595 | 0.369 | 0.391 | 1.069 | 0.813 | 0.878 |
| 4 | 0.372 | 0.407 | 0.633 | 0.559 | 0.372 | 0.390 | 1.059 | 0.789 | 0.722 |
| 5 | 0.372 | 0.409 | 0.626 | 0.558 | 0.372 | 0.393 | 1.066 | 0.780 | 0.704 |
| 6 | 0.373 | 0.414 | 0.623 | 0.560 | 0.373 | 0.398 | 1.077 | 0.777 | 0.795 |
| 7 | 0.372 | 0.422 | 0.613 | 0.564 | 0.372 | 0.408 | 1.105 | 0.763 | 0.890 |
| 8 | 0.372 | 0.428 | 0.609 | 0.562 | 0.372 | 0.413 | 1.118 | 0.760 | 0.952 |
| 9 | 0.364 | 0.457 | 0.550 | 0.532 | 0.364 | 0.437 | 1.206 | 0.689 | 0.916 |
| 10 | 0.346 | 0.496 | 0.496 | 0.521 | 0.346 | 0.466 | 1.352 | 0.616 | 0.910 |
| 11 | 0.339 | 0.516 | 0.478 | 0.514 | 0.339 | 0.477 | 1.409 | 0.589 | 0.905 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | -1.5 | -3.7 | 5.7 | 0.101 | 0.048 | 0.048 | 0.009 | 0.009 |
| 2 | 9.11 | 11.70 | -1.3 | -3.9 | 5.3 | 0.099 | 0.037 | 0.037 | 0.007 | 0.007 |
| 3 | 27.14 | 30.86 | -0.5 | -4.3 | 4.0 | 0.123 | 0.031 | 0.031 | 0.006 | 0.006 |
| 4 | 36.50 | 40.42 | -0.0 | -4.4 | 3.3 | 0.160 | 0.093 | 0.093 | 0.018 | 0.018 |
| 5 | 38.89 | 42.85 | 0.1 | -4.4 | 3.9 | 0.152 | 0.103 | 0.103 | 0.020 | 0.020 |
| 6 | 41.29 | 45.22 | 0.2 | -4.4 | 4.4 | 0.142 | 0.068 | 0.068 | 0.013 | 0.013 |
| 7 | 43.91 | 47.86 | 0.2 | -4.5 | 3.8 | 0.121 | 0.036 | 0.036 | 0.007 | 0.007 |
| 8 | 46.00 | 50.03 | 0.4 | -4.5 | 4.2 | 0.119 | 0.016 | 0.016 | 0.003 | 0.003 |
| 9 | 68.35 | 71.83 | 1.1 | -4.9 | 6.1 | 0.085 | 0.040 | 0.040 | 0.007 | 0.007 |
| 10 | 86.92 | 88.53 | 1.2 | -5.4 | 7.6 | 0.017 | 0.060 | 0.060 | 0.010 | 0.010 |
| 11 | 92.79 | 93.11 | 1.0 | -5.7 | 5.7 | 0.004 | 0.074 | 0.074 | 0.013 | 0.013 |

TABLE X. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 50 PERCENT DESIGN SPEED

(d) Reading 942

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 19.4 | 62.3 | 53.8 | 518.7 | 534.2 | 14.69 | 16.16 |
| 2 | 9.440 | 9.322 | 0. | 18.8 | 61.7 | 53.2 | 518.7 | 533.8 | 14.69 | 16.16 |
| 3 | 8.559 | 8.588 | 0. | 20.7 | 58.2 | 49.0 | 518.7 | 533.6 | 14.69 | 16.17 |
| 4 | 8.102 | 8.222 | 0. | 22.7 | 56.6 | 46.3 | 518.7 | 535.6 | 14.69 | 16.16 |
| 5 | 7.985 | 8.129 | 0. | 24.7 | 56.3 | 45.2 | 518.7 | 535.8 | 14.69 | 16.16 |
| 6 | 7.868 | 8.038 | 0. | 24.3 | 55.9 | 44.3 | 518.7 | 535.0 | 14.69 | 16.20 |
| 7 | 7.740 | 7.937 | 0. | 22.9 | 55.6 | 43.8 | 518.7 | 534.5 | 14.69 | 16.24 |
| 8 | 7.638 | 7.854 | 0. | 23.1 | 55.1 | 42.8 | 518.7 | 534.3 | 14.69 | 16.26 |
| 9 | 6.546 | 7.019 | 0. | 24.4 | 51.7 | 35.1 | 518.7 | 534.9 | 14.69 | 16.31 |
| 10 | 5.639 | 6.387 | 0. | 26.6 | 49.0 | 26.1 | 518.7 | 535.9 | 14.69 | 16.41 |
| 11 | 5.352 | 6.204 | 0. | 28.8 | 48.3 | 21.6 | 518.7 | 537.6 | 14.69 | 16.51 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 351.7 | 408.1 | 757.8 | 651.1 | 351.7 | 384.9 | 0. | 135.8 | 671.2 | 661.0 |
| 2 | 353.8 | 408.6 | 746.5 | 646.3 | 353.8 | 386.9 | 0. | 131.4 | 657.3 | 649.1 |
| 3 | 368.8 | 417.1 | 700.0 | 594.9 | 368.8 | 390.1 | 0. | 147.8 | 594.9 | 596.9 |
| 4 | 370.4 | 422.2 | 673.6 | 564.1 | 370.4 | 389.5 | 0. | 163.0 | 562.6 | 571.0 |
| 5 | 370.5 | 424.2 | 668.0 | 547.3 | 370.5 | 385.5 | 0. | 177.3 | 555.8 | 565.8 |
| 6 | 370.4 | 429.2 | 660.1 | 546.8 | 370.4 | 391.3 | 0. | 176.3 | 546.4 | 558.2 |
| 7 | 369.1 | 434.2 | 653.0 | 553.8 | 369.1 | 399.9 | 0. | 169.2 | 538.7 | 552.4 |
| 8 | 369.6 | 438.7 | 646.2 | 549.7 | 369.6 | 403.6 | 0. | 171.9 | 530.1 | 545.1 |
| 9 | 359.8 | 463.1 | 580.3 | 515.5 | 359.8 | 421.6 | 0. | 191.5 | 455.3 | 488.2 |
| 10 | 340.7 | 500.2 | 518.8 | 498.0 | 340.7 | 447.2 | 0. | 224.1 | 391.3 | 443.2 |
| 11 | 332.3 | 521.1 | 499.1 | 491.0 | 332.3 | 456.6 | 0. | 251.0 | 372.4 | 431.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.318 | 0.365 | 0.686 | 0.582 | 0.318 | 0.344 | 1.094 | 0.865 | 0.924 |
| 2 | 0.320 | 0.366 | 0.676 | 0.578 | 0.320 | 0.346 | 1.094 | 0.871 | 0.944 |
| 3 | 0.334 | 0.374 | 0.634 | 0.533 | 0.334 | 0.349 | 1.058 | 0.849 | 0.963 |
| 4 | 0.336 | 0.377 | 0.610 | 0.504 | 0.336 | 0.348 | 1.051 | 0.819 | 0.845 |
| 5 | 0.336 | 0.379 | 0.605 | 0.489 | 0.336 | 0.345 | 1.041 | 0.815 | 0.834 |
| 6 | 0.336 | 0.384 | 0.598 | 0.489 | 0.336 | 0.350 | 1.056 | 0.804 | 0.900 |
| 7 | 0.334 | 0.389 | 0.591 | 0.496 | 0.334 | 0.358 | 1.083 | 0.799 | 0.954 |
| 8 | 0.335 | 0.393 | 0.585 | 0.493 | 0.335 | 0.362 | 1.092 | 0.790 | 0.977 |
| 9 | 0.326 | 0.416 | 0.525 | 0.463 | 0.326 | 0.378 | 1.172 | 0.717 | 0.970 |
| 10 | 0.308 | 0.450 | 0.469 | 0.448 | 0.308 | 0.402 | 1.313 | 0.638 | 0.969 |
| 11 | 0.300 | 0.468 | 0.451 | 0.441 | 0.300 | 0.411 | 1.374 | 0.611 | 0.928 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 0.8 | -1.5 | 5.1 | 0.199 | 0.028 | 0.028 | 0.005 | 0.005 |
| 2 | 9.11 | 11.70 | 1.2 | -1.4 | 5.1 | 0.190 | 0.021 | 0.021 | 0.004 | 0.004 |
| 3 | 27.14 | 30.86 | 2.0 | -1.8 | 4.1 | 0.212 | 0.015 | 0.015 | 0.003 | 0.003 |
| 4 | 36.50 | 40.42 | 2.6 | -1.8 | 3.9 | 0.231 | 0.077 | 0.077 | 0.015 | 0.015 |
| 5 | 38.89 | 42.85 | 2.8 | -1.7 | 4.0 | 0.254 | 0.084 | 0.084 | 0.016 | 0.016 |
| 6 | 41.29 | 45.22 | 2.9 | -1.8 | 4.0 | 0.245 | 0.050 | 0.050 | 0.010 | 0.010 |
| 7 | 43.91 | 47.86 | 3.1 | -1.6 | 3.9 | 0.222 | 0.023 | 0.023 | 0.004 | 0.004 |
| 8 | 46.00 | 50.03 | 3.2 | -1.7 | 4.2 | 0.220 | 0.011 | 0.011 | 0.002 | 0.002 |
| 9 | 68.35 | 71.83 | 4.1 | -1.8 | 6.3 | 0.189 | 0.019 | 0.019 | 0.004 | 0.004 |
| 10 | 86.92 | 88.33 | 4.3 | -2.2 | 7.2 | 0.129 | 0.025 | 0.025 | 0.004 | 0.004 |
| 11 | 92.79 | 93.11 | 4.3 | -2.3 | 5.3 | 0.114 | 0.069 | 0.069 | 0.012 | 0.012 |

TABLE X. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 50 PERCENT DESIGN SPEED

(e) Reading 943

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 27.8 | 64.3 | 53.3 | 518.7 | 538.9 | 14.69 | 16.65 |
| 2 | 9.440 | 9.322 | 0. | 27.1 | 63.7 | 52.7 | 518.7 | 538.6 | 14.69 | 16.64 |
| 3 | 8.559 | 8.588 | 0. | 29.6 | 60.5 | 48.7 | 518.7 | 537.7 | 14.69 | 16.59 |
| 4 | 8.102 | 8.222 | 0. | 32.5 | 59.1 | 45.6 | 518.7 | 539.5 | 14.69 | 16.57 |
| 5 | 7.985 | 8.129 | 0. | 32.2 | 58.8 | 45.2 | 518.7 | 539.2 | 14.69 | 16.54 |
| 6 | 7.868 | 8.038 | 0. | 31.8 | 58.5 | 44.2 | 518.7 | 538.1 | 14.69 | 16.56 |
| 7 | 7.740 | 7.937 | 0. | 30.1 | 58.0 | 43.5 | 518.7 | 537.7 | 14.69 | 16.58 |
| 8 | 7.638 | 7.854 | 0. | 29.8 | 57.6 | 43.0 | 518.7 | 537.5 | 14.69 | 16.58 |
| 9 | 6.546 | 7.019 | 0. | 30.9 | 54.5 | 35.0 | 518.7 | 537.1 | 14.69 | 16.57 |
| 10 | 5.639 | 6.387 | 0. | 32.7 | 52.3 | 25.5 | 518.7 | 537.9 | 14.69 | 16.62 |
| 11 | 5.352 | 6.204 | 0. | 34.2 | 51.0 | 20.9 | 518.7 | 539.3 | 14.69 | 16.70 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 322.9 | 399.6 | 745.0 | 591.9 | 322.9 | 353.5 | 0. | 186.5 | 671.4 | 661.2 |
| 2 | 324.8 | 399.1 | 731.8 | 585.7 | 324.8 | 355.2 | 0. | 181.9 | 655.8 | 647.6 |
| 3 | 336.2 | 402.9 | 683.7 | 530.4 | 336.2 | 350.3 | 0. | 199.1 | 595.3 | 597.3 |
| 4 | 337.1 | 408.2 | 655.9 | 492.1 | 337.1 | 344.2 | 0. | 219.4 | 562.7 | 571.0 |
| 5 | 336.3 | 407.5 | 648.4 | 489.1 | 336.3 | 344.7 | 0. | 217.4 | 554.3 | 564.3 |
| 6 | 334.6 | 411.8 | 640.5 | 488.7 | 334.6 | 350.1 | 0. | 217.0 | 546.1 | 557.9 |
| 7 | 334.6 | 415.6 | 632.1 | 495.7 | 334.6 | 359.4 | 0. | 208.6 | 536.2 | 549.9 |
| 8 | 335.7 | 416.4 | 626.8 | 494.4 | 335.7 | 361.4 | 0. | 206.9 | 529.4 | 544.3 |
| 9 | 324.0 | 436.4 | 557.5 | 457.0 | 324.0 | 374.3 | 0. | 224.4 | 453.7 | 486.5 |
| 10 | 302.4 | 471.2 | 494.6 | 439.3 | 302.4 | 396.6 | 0. | 254.5 | 391.4 | 443.4 |
| 11 | 300.4 | 490.3 | 477.5 | 434.4 | 300.4 | 405.8 | 0. | 275.2 | 371.2 | 430.3 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.292 | 0.356 | 0.673 | 0.527 | 0.292 | 0.315 | 1.095 | 0.897 | 0.932 |
| 2 | 0.293 | 0.355 | 0.661 | 0.521 | 0.293 | 0.316 | 1.094 | 0.899 | 0.941 |
| 3 | 0.304 | 0.359 | 0.618 | 0.473 | 0.304 | 0.312 | 1.042 | 0.878 | 0.967 |
| 4 | 0.305 | 0.363 | 0.593 | 0.438 | 0.305 | 0.306 | 1.021 | 0.847 | 0.869 |
| 5 | 0.304 | 0.363 | 0.586 | 0.435 | 0.304 | 0.307 | 1.025 | 0.840 | 0.871 |
| 6 | 0.302 | 0.367 | 0.579 | 0.436 | 0.302 | 0.312 | 1.046 | 0.852 | 0.926 |
| 7 | 0.302 | 0.371 | 0.571 | 0.442 | 0.302 | 0.321 | 1.074 | 0.821 | 0.957 |
| 8 | 0.304 | 0.371 | 0.567 | 0.441 | 0.304 | 0.322 | 1.076 | 0.815 | 0.971 |
| 9 | 0.293 | 0.390 | 0.504 | 0.408 | 0.293 | 0.335 | 1.155 | 0.736 | 0.984 |
| 10 | 0.273 | 0.422 | 0.446 | 0.393 | 0.273 | 0.355 | 1.312 | 0.659 | 0.972 |
| 11 | 0.271 | 0.439 | 0.431 | 0.389 | 0.271 | 0.363 | 1.351 | 0.626 | 0.939 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.8 | 0.5 | 4.7 | 0.287 | 0.034 | 0.034 | 0.007 | 0.007 |
| 2 | 9.11 | 11.70 | 3.1 | 0.5 | 4.6 | 0.279 | 0.030 | 0.030 | 0.006 | 0.006 |
| 3 | 27.14 | 30.86 | 4.4 | 0.6 | 5.8 | 0.310 | 0.018 | 0.018 | 0.003 | 0.003 |
| 4 | 36.50 | 40.42 | 5.0 | 0.7 | 5.2 | 0.344 | 0.083 | 0.083 | 0.016 | 0.016 |
| 5 | 38.89 | 42.85 | 5.3 | 0.8 | 5.9 | 0.339 | 0.083 | 0.083 | 0.016 | 0.016 |
| 6 | 41.29 | 45.22 | 5.5 | 0.9 | 5.9 | 0.330 | 0.046 | 0.046 | 0.009 | 0.009 |
| 7 | 43.91 | 47.86 | 5.6 | 0.8 | 5.7 | 0.305 | 0.027 | 0.027 | 0.005 | 0.005 |
| 8 | 46.00 | 50.03 | 5.7 | 0.8 | 4.5 | 0.299 | 0.018 | 0.018 | 0.003 | 0.003 |
| 9 | 68.35 | 71.83 | 6.9 | 1.0 | 6.2 | 0.275 | 0.012 | 0.012 | 0.002 | 0.002 |
| 10 | 86.92 | 88.33 | 7.7 | 1.2 | 6.6 | 0.217 | 0.028 | 0.028 | 0.005 | 0.005 |
| 11 | 92.79 | 93.11 | 7.1 | 0.4 | 4.7 | 0.203 | 0.069 | 0.069 | 0.012 | 0.012 |

TABLE X. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 50 PERCENT DESIGN SPEED

(f) Reading 944

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 35.2 | 67.3 | 53.4 | 518.7 | 544.3 | 14.69 | 17.08 |
| 2 | 9.440 | 9.322 | 0. | 34.8 | 66.8 | 52.8 | 518.7 | 543.6 | 14.69 | 17.06 |
| 3 | 8.559 | 8.588 | 0. | 37.5 | 63.8 | 48.5 | 518.7 | 542.2 | 14.69 | 16.98 |
| 4 | 8.102 | 8.222 | 0. | 39.0 | 62.5 | 46.0 | 518.7 | 543.1 | 14.69 | 16.91 |
| 5 | 7.985 | 8.129 | 0. | 40.0 | 62.1 | 45.7 | 518.7 | 542.7 | 14.69 | 16.86 |
| 6 | 7.868 | 8.038 | 0. | 40.5 | 61.8 | 44.9 | 518.7 | 542.1 | 14.69 | 16.86 |
| 7 | 7.740 | 7.937 | 0. | 38.9 | 61.5 | 44.0 | 518.7 | 541.4 | 14.69 | 16.87 |
| 8 | 7.638 | 7.854 | 0. | 38.2 | 61.1 | 43.4 | 518.7 | 541.0 | 14.69 | 16.87 |
| 9 | 6.546 | 7.019 | 0. | 38.4 | 58.3 | 35.2 | 518.7 | 539.5 | 14.69 | 16.80 |
| 10 | 5.639 | 6.387 | 0. | 38.5 | 55.4 | 25.6 | 518.7 | 538.9 | 14.69 | 16.85 |
| 11 | 5.352 | 6.204 | 0. | 40.0 | 54.9 | 20.8 | 518.7 | 540.7 | 14.69 | 16.87 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 280.9 | 393.7 | 727.4 | 540.3 | 280.9 | 321.8 | 0. | 226.7 | 670.9 | 660.7 |
| 2 | 281.0 | 391.8 | 714.1 | 532.7 | 281.0 | 321.7 | 0. | 223.7 | 656.5 | 648.3 |
| 3 | 292.4 | 396.4 | 663.0 | 475.1 | 292.4 | 314.7 | 0. | 241.1 | 595.0 | 597.0 |
| 4 | 292.7 | 397.6 | 633.6 | 444.9 | 292.7 | 309.0 | 0. | 250.3 | 562.0 | 570.3 |
| 5 | 292.7 | 394.3 | 626.1 | 432.7 | 292.7 | 302.0 | 0. | 253.6 | 553.5 | 563.5 |
| 6 | 291.7 | 395.9 | 618.2 | 424.7 | 291.7 | 301.0 | 0. | 257.2 | 545.0 | 556.8 |
| 7 | 292.0 | 399.4 | 611.8 | 432.4 | 292.0 | 310.9 | 0. | 250.7 | 537.6 | 551.3 |
| 8 | 291.9 | 399.8 | 604.9 | 433.0 | 291.9 | 314.4 | 0. | 247.1 | 529.8 | 544.8 |
| 9 | 281.5 | 415.3 | 535.1 | 398.3 | 281.5 | 325.4 | 0. | 258.2 | 455.1 | 488.0 |
| 10 | 270.3 | 444.8 | 475.9 | 386.0 | 270.3 | 348.1 | 0. | 276.8 | 391.7 | 443.7 |
| 11 | 260.7 | 461.4 | 453.9 | 378.0 | 260.7 | 353.4 | 0. | 296.6 | 371.5 | 430.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.253 | 0.348 | 0.656 | 0.478 | 0.253 | 0.285 | 1.146 | 0.942 | 0.892 |
| 2 | 0.253 | 0.347 | 0.644 | 0.472 | 0.253 | 0.285 | 1.145 | 0.946 | 0.904 |
| 3 | 0.264 | 0.352 | 0.598 | 0.421 | 0.264 | 0.279 | 1.076 | 0.917 | 0.931 |
| 4 | 0.264 | 0.352 | 0.572 | 0.394 | 0.264 | 0.274 | 1.056 | 0.882 | 0.871 |
| 5 | 0.264 | 0.350 | 0.565 | 0.384 | 0.264 | 0.268 | 1.032 | 0.874 | 0.866 |
| 6 | 0.263 | 0.351 | 0.558 | 0.377 | 0.263 | 0.267 | 1.032 | 0.865 | 0.891 |
| 7 | 0.263 | 0.355 | 0.552 | 0.384 | 0.263 | 0.276 | 1.065 | 0.858 | 0.920 |
| 8 | 0.263 | 0.355 | 0.546 | 0.385 | 0.263 | 0.279 | 1.077 | 0.850 | 0.935 |
| 9 | 0.254 | 0.370 | 0.482 | 0.355 | 0.254 | 0.290 | 1.156 | 0.767 | 0.970 |
| 10 | 0.244 | 0.397 | 0.429 | 0.345 | 0.244 | 0.311 | 1.288 | 0.678 | 1.012 |
| 11 | 0.235 | 0.412 | 0.409 | 0.337 | 0.235 | 0.315 | 1.356 | 0.648 | 0.948 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 5.7 | 3.5 | 4.8 | 0.358 | 0.070 | 0.070 | 0.014 | 0.014 |
| 2 | 9.11 | 11.70 | 6.3 | 3.7 | 4.8 | 0.354 | 0.062 | 0.062 | 0.012 | 0.012 |
| 3 | 27.14 | 30.86 | 7.7 | 3.8 | 3.6 | 0.390 | 0.049 | 0.049 | 0.009 | 0.009 |
| 4 | 36.50 | 40.42 | 8.5 | 4.1 | 3.6 | 0.409 | 0.102 | 0.102 | 0.020 | 0.020 |
| 5 | 38.89 | 42.85 | 8.6 | 4.2 | 4.5 | 0.421 | 0.106 | 0.106 | 0.020 | 0.020 |
| 6 | 41.29 | 45.22 | 8.8 | 4.2 | 4.6 | 0.427 | 0.087 | 0.087 | 0.017 | 0.017 |
| 7 | 43.91 | 47.86 | 9.1 | 4.3 | 4.2 | 0.404 | 0.063 | 0.063 | 0.012 | 0.012 |
| 8 | 46.00 | 50.03 | 9.2 | 4.3 | 4.9 | 0.393 | 0.052 | 0.052 | 0.010 | 0.010 |
| 9 | 68.35 | 71.83 | 10.7 | 4.8 | 6.4 | 0.369 | 0.028 | 0.028 | 0.005 | 0.005 |
| 10 | 86.92 | 88.33 | 10.8 | 4.2 | 6.7 | 0.308 | -0.013 | -0.013 | -0.002 | -0.002 |
| 11 | 92.79 | 95.11 | 11.0 | 4.4 | 4.8 | 0.295 | 0.069 | 0.069 | 0.012 | 0.012 |

TABLE X. - Concluded. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 50 PERCENT DESIGN SPEED

(g) Reading 945

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 55.9 | 71.3 | 55.2 | 518.7 | 554.0 | 14.69 | 17.32 |
| 2 | 9.440 | 9.322 | 0. | 51.5 | 70.7 | 53.5 | 518.7 | 551.1 | 14.69 | 17.29 |
| 3 | 8.559 | 8.588 | 0. | 44.7 | 67.9 | 48.1 | 518.7 | 546.4 | 14.69 | 17.27 |
| 4 | 8.102 | 8.222 | 0. | 47.7 | 66.7 | 46.0 | 518.7 | 545.4 | 14.69 | 17.17 |
| 5 | 7.985 | 8.129 | 0. | 48.8 | 66.5 | 45.7 | 518.7 | 545.5 | 14.69 | 17.13 |
| 6 | 7.868 | 8.038 | 0. | 48.8 | 66.0 | 44.7 | 518.7 | 545.5 | 14.69 | 17.12 |
| 7 | 7.740 | 7.937 | 0. | 48.7 | 65.7 | 43.9 | 518.7 | 545.3 | 14.69 | 17.10 |
| 8 | 7.638 | 7.854 | 0. | 47.6 | 65.5 | 43.3 | 518.7 | 544.5 | 14.69 | 17.09 |
| 9 | 6.546 | 7.019 | 0. | 45.3 | 62.1 | 34.3 | 518.7 | 541.9 | 14.69 | 17.00 |
| 10 | 5.639 | 6.387 | 0. | 44.2 | 59.4 | 25.0 | 518.7 | 540.2 | 14.69 | 16.97 |
| 11 | 5.352 | 6.204 | 0. | 45.1 | 58.7 | 19.9 | 518.7 | 541.7 | 14.69 | 16.99 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 226.5 | 404.0 | 708.3 | 397.4 | 226.5 | 226.6 | 0. | 334.4 | 671.0 | 660.8 |
| 2 | 229.6 | 398.3 | 694.2 | 417.3 | 229.6 | 248.2 | 0. | 311.6 | 655.2 | 647.0 |
| 3 | 241.0 | 398.9 | 641.4 | 424.3 | 241.0 | 285.5 | 0. | 280.6 | 594.4 | 596.4 |
| 4 | 242.1 | 396.6 | 611.7 | 384.6 | 242.1 | 267.0 | 0. | 293.3 | 561.7 | 570.1 |
| 5 | 242.4 | 397.0 | 606.8 | 373.9 | 242.4 | 261.3 | 0. | 298.9 | 556.3 | 566.3 |
| 6 | 243.6 | 397.3 | 598.0 | 368.0 | 243.6 | 261.5 | 0. | 299.1 | 546.2 | 558.0 |
| 7 | 243.0 | 397.2 | 589.4 | 363.6 | 243.0 | 262.0 | 0. | 298.6 | 537.0 | 550.6 |
| 8 | 242.8 | 398.2 | 584.7 | 369.0 | 242.8 | 268.6 | 0. | 294.0 | 531.9 | 547.0 |
| 9 | 240.8 | 409.7 | 514.9 | 348.9 | 240.8 | 288.2 | 0. | 291.2 | 455.1 | 488.0 |
| 10 | 232.9 | 432.8 | 457.7 | 342.5 | 232.9 | 310.4 | 0. | 301.5 | 394.0 | 446.3 |
| 11 | 226.0 | 447.6 | 435.5 | 335.8 | 226.0 | 315.8 | 0. | 317.2 | 372.2 | 431.5 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.204 | 0.355 | 0.637 | 0.349 | 0.204 | 0.199 | 1.000 | 1.004 | 0.708 |
| 2 | 0.207 | 0.350 | 0.625 | 0.367 | 0.207 | 0.218 | 1.081 | 1.000 | 0.764 |
| 3 | 0.217 | 0.352 | 0.577 | 0.375 | 0.217 | 0.250 | 1.176 | 0.965 | 0.882 |
| 4 | 0.218 | 0.351 | 0.551 | 0.340 | 0.218 | 0.236 | 1.103 | 0.928 | 0.882 |
| 5 | 0.218 | 0.351 | 0.546 | 0.331 | 0.218 | 0.231 | 1.078 | 0.925 | 0.868 |
| 6 | 0.219 | 0.351 | 0.538 | 0.325 | 0.219 | 0.231 | 1.073 | 0.910 | 0.864 |
| 7 | 0.219 | 0.351 | 0.531 | 0.322 | 0.219 | 0.232 | 1.078 | 0.900 | 0.862 |
| 8 | 0.219 | 0.353 | 0.526 | 0.327 | 0.219 | 0.238 | 1.106 | 0.897 | 0.886 |
| 9 | 0.217 | 0.364 | 0.463 | 0.310 | 0.217 | 0.256 | 1.197 | 0.798 | 0.950 |
| 10 | 0.210 | 0.386 | 0.412 | 0.305 | 0.210 | 0.277 | 1.333 | 0.707 | 1.013 |
| 11 | 0.203 | 0.399 | 0.392 | 0.299 | 0.203 | 0.281 | 1.397 | 0.671 | 0.957 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 9.8 | 7.5 | 6.6 | 0.592 | 0.264 | 0.264 | 0.049 | 0.049 |
| 2 | 9.11 | 11.70 | 10.2 | 7.6 | 5.4 | 0.542 | 0.205 | 0.205 | 0.039 | 0.039 |
| 3 | 27.14 | 30.86 | 11.8 | 7.9 | 3.2 | 0.467 | 0.103 | 0.103 | 0.020 | 0.020 |
| 4 | 36.50 | 40.42 | 12.7 | 8.3 | 3.6 | 0.506 | 0.108 | 0.108 | 0.021 | 0.021 |
| 5 | 38.89 | 42.85 | 13.0 | 8.5 | 4.4 | 0.520 | 0.125 | 0.125 | 0.024 | 0.024 |
| 6 | 41.29 | 45.22 | 13.0 | 8.4 | 4.4 | 0.522 | 0.130 | 0.130 | 0.025 | 0.025 |
| 7 | 43.91 | 47.86 | 13.2 | 8.5 | 4.1 | 0.520 | 0.135 | 0.135 | 0.026 | 0.026 |
| 8 | 46.00 | 50.03 | 13.5 | 8.7 | 4.7 | 0.503 | 0.110 | 0.110 | 0.021 | 0.021 |
| 9 | 68.35 | 71.83 | 14.6 | 8.7 | 5.5 | 0.455 | 0.055 | 0.055 | 0.010 | 0.010 |
| 10 | 86.92 | 88.33 | 14.8 | 8.3 | 6.1 | 0.387 | -0.017 | -0.017 | -0.003 | -0.003 |
| 11 | 92.79 | 93.11 | 14.8 | 8.1 | 5.7 | 0.371 | 0.065 | 0.065 | 0.011 | 0.011 |

TABLE XI. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5,

60 PERCENT DESIGN SPEED

(a) Reading 947

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 9.1 | 60.6 | 54.4 | 518.7 | 531.4 | 14.69 | 15.50 |
| 2 | 9.440 | 9.322 | 0. | 8.2 | 59.8 | 53.6 | 518.7 | 530.5 | 14.69 | 15.56 |
| 3 | 8.559 | 8.588 | 0. | 12.7 | 56.1 | 49.0 | 518.7 | 533.0 | 14.69 | 15.64 |
| 4 | 8.102 | 8.222 | 0. | 12.6 | 54.3 | 48.2 | 518.7 | 532.9 | 14.69 | 15.39 |
| 5 | 7.985 | 8.129 | 0. | 14.0 | 53.9 | 48.4 | 518.7 | 533.1 | 14.69 | 15.22 |
| 6 | 7.868 | 8.038 | 0. | 13.7 | 53.5 | 47.6 | 518.7 | 533.3 | 14.69 | 15.30 |
| 7 | 7.740 | 7.937 | 0. | 13.0 | 53.0 | 46.2 | 518.7 | 532.3 | 14.69 | 15.50 |
| 8 | 7.638 | 7.854 | 0. | 12.0 | 52.6 | 45.1 | 518.7 | 532.8 | 14.69 | 15.72 |
| 9 | 6.546 | 7.019 | 0. | 15.7 | 48.8 | 35.7 | 518.7 | 536.1 | 14.69 | 16.24 |
| 10 | 5.639 | 6.387 | 0. | 19.5 | 46.1 | 27.1 | 518.7 | 540.2 | 14.69 | 16.66 |
| 11 | 5.352 | 6.204 | 0. | 22.6 | 45.8 | 22.4 | 518.7 | 542.6 | 14.69 | 16.89 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 456.9 | 518.2 | 929.3 | 878.8 | 456.9 | 511.6 | 0. | 82.4 | 809.3 | 797.0 |
| 2 | 461.0 | 524.6 | 915.1 | 875.9 | 461.0 | 519.2 | 0. | 75.2 | 790.5 | 780.6 |
| 3 | 483.5 | 537.0 | 866.4 | 799.1 | 483.5 | 523.9 | 0. | 118.0 | 719.0 | 721.4 |
| 4 | 488.4 | 525.1 | 835.9 | 769.6 | 488.4 | 512.5 | 0. | 114.4 | 678.4 | 688.5 |
| 5 | 489.4 | 512.8 | 831.0 | 748.9 | 489.4 | 497.6 | 0. | 124.1 | 671.7 | 683.8 |
| 6 | 489.6 | 520.3 | 823.7 | 749.8 | 489.6 | 505.5 | 0. | 123.0 | 662.4 | 676.8 |
| 7 | 488.7 | 536.1 | 812.0 | 754.6 | 488.7 | 522.4 | 0. | 120.4 | 648.5 | 665.0 |
| 8 | 489.4 | 552.4 | 805.7 | 765.9 | 489.4 | 540.2 | 0. | 115.3 | 640.0 | 658.1 |
| 9 | 478.4 | 610.0 | 726.5 | 722.9 | 478.4 | 587.4 | 0. | 164.8 | 546.7 | 586.2 |
| 10 | 454.6 | 656.4 | 656.0 | 695.0 | 454.6 | 618.8 | 0. | 219.0 | 472.9 | 535.6 |
| 11 | 437.1 | 681.0 | 626.7 | 680.1 | 437.1 | 628.8 | 0. | 261.4 | 449.2 | 520.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.416 | 0.469 | 0.847 | 0.795 | 0.416 | 0.463 | 1.120 | 1.008 | 0.628 |
| 2 | 0.420 | 0.475 | 0.854 | 0.793 | 0.420 | 0.470 | 1.126 | 1.014 | 0.722 |
| 3 | 0.441 | 0.486 | 0.791 | 0.725 | 0.441 | 0.474 | 1.084 | 0.998 | 0.653 |
| 4 | 0.446 | 0.474 | 0.764 | 0.695 | 0.446 | 0.463 | 1.049 | 0.958 | 0.485 |
| 5 | 0.447 | 0.463 | 0.759 | 0.676 | 0.447 | 0.449 | 1.017 | 0.956 | 0.360 |
| 6 | 0.447 | 0.470 | 0.753 | 0.677 | 0.447 | 0.456 | 1.033 | 0.948 | 0.414 |
| 7 | 0.446 | 0.485 | 0.742 | 0.683 | 0.446 | 0.473 | 1.069 | 0.933 | 0.585 |
| 8 | 0.447 | 0.500 | 0.736 | 0.694 | 0.447 | 0.489 | 1.104 | 0.926 | 0.715 |
| 9 | 0.437 | 0.554 | 0.663 | 0.656 | 0.437 | 0.533 | 1.228 | 0.835 | 0.868 |
| 10 | 0.414 | 0.596 | 0.598 | 0.631 | 0.414 | 0.562 | 1.361 | 0.751 | 0.881 |
| 11 | 0.398 | 0.619 | 0.570 | 0.618 | 0.398 | 0.571 | 1.439 | 0.722 | 0.880 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | -1.0 | -3.3 | 5.7 | 0.085 | 0.082 | 0.082 | 0.016 | 0.016 |
| 2 | 9.11 | 11.70 | -0.8 | -3.4 | 5.6 | 0.069 | 0.058 | 0.058 | 0.011 | 0.011 |
| 3 | 27.14 | 30.86 | -0.1 | -3.9 | 4.1 | 0.118 | 0.095 | 0.095 | 0.018 | 0.018 |
| 4 | 36.50 | 40.42 | 0.2 | -4.2 | 5.8 | 0.118 | 0.148 | 0.148 | 0.028 | 0.028 |
| 5 | 38.89 | 42.85 | 0.4 | -4.1 | 7.1 | 0.140 | 0.188 | 0.188 | 0.034 | 0.034 |
| 6 | 41.29 | 45.22 | 0.5 | -4.1 | 7.3 | 0.131 | 0.178 | 0.178 | 0.033 | 0.033 |
| 7 | 43.91 | 47.86 | 0.5 | -4.2 | 6.3 | 0.111 | 0.121 | 0.121 | 0.022 | 0.022 |
| 8 | 46.00 | 50.03 | 0.6 | -4.2 | 6.5 | 0.088 | 0.087 | 0.087 | 0.016 | 0.016 |
| 9 | 68.35 | 71.85 | 1.3 | -4.7 | 6.8 | 0.058 | 0.060 | 0.060 | 0.011 | 0.011 |
| 10 | 86.92 | 88.35 | 1.5 | -5.0 | 8.2 | 0.009 | 0.080 | 0.080 | 0.014 | 0.014 |
| 11 | 92.79 | 93.11 | 1.9 | -4.8 | 6.1 | -0.004 | 0.096 | 0.096 | 0.016 | 0.016 |

TABLE XI. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 60 PERCENT DESIGN SPEED

(b) Reading 948

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 15.6 | 61.1 | 54.1 | 518.7 | 537.5 | 14.69 | 16.40 |
| 2 | 9.440 | 9.322 | 0. | 16.2 | 60.5 | 52.9 | 518.7 | 537.5 | 14.69 | 16.43 |
| 3 | 8.559 | 8.588 | 0. | 18.4 | 56.9 | 48.2 | 518.7 | 539.6 | 14.69 | 16.51 |
| 4 | 8.102 | 8.222 | 0. | 19.8 | 55.3 | 46.3 | 518.7 | 539.5 | 14.69 | 16.41 |
| 5 | 7.985 | 8.129 | 0. | 19.5 | 54.8 | 46.4 | 518.7 | 539.2 | 14.69 | 16.33 |
| 6 | 7.868 | 8.038 | 0. | 19.0 | 54.4 | 46.0 | 518.7 | 538.3 | 14.69 | 16.34 |
| 7 | 7.740 | 7.937 | 0. | 18.9 | 53.9 | 45.0 | 518.7 | 537.9 | 14.69 | 16.42 |
| 8 | 7.638 | 7.854 | 0. | 17.9 | 53.6 | 44.4 | 518.7 | 537.3 | 14.69 | 16.50 |
| 9 | 6.546 | 7.019 | 0. | 20.7 | 50.2 | 35.9 | 518.7 | 539.6 | 14.69 | 16.73 |
| 10 | 5.639 | 6.387 | 0. | 23.8 | 47.3 | 26.6 | 518.7 | 542.1 | 14.69 | 17.01 |
| 11 | 5.352 | 6.204 | 0. | 26.3 | 47.2 | 22.1 | 518.7 | 544.1 | 14.69 | 17.15 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 446.3 | 498.7 | 925.0 | 819.2 | 446.3 | 480.4 | 0. | 134.2 | 810.1 | 797.8 |
| 2 | 448.0 | 504.4 | 909.3 | 803.3 | 448.0 | 484.5 | 0. | 140.6 | 791.3 | 781.4 |
| 3 | 468.2 | 521.8 | 856.3 | 743.2 | 468.2 | 495.0 | 0. | 165.1 | 717.0 | 719.5 |
| 4 | 471.4 | 522.1 | 827.8 | 711.1 | 471.4 | 491.4 | 0. | 176.5 | 680.5 | 690.5 |
| 5 | 472.7 | 515.8 | 820.1 | 704.2 | 472.7 | 486.1 | 0. | 172.7 | 670.2 | 682.3 |
| 6 | 472.5 | 515.8 | 811.1 | 702.0 | 472.5 | 487.6 | 0. | 168.5 | 659.2 | 675.5 |
| 7 | 472.8 | 523.6 | 803.1 | 700.9 | 472.8 | 495.3 | 0. | 169.8 | 649.2 | 665.7 |
| 8 | 472.6 | 531.6 | 795.6 | 707.4 | 472.6 | 505.8 | 0. | 163.5 | 640.0 | 658.1 |
| 9 | 458.9 | 572.3 | 716.3 | 660.9 | 458.9 | 535.4 | 0. | 202.2 | 550,0 | 589.7 |
| 10 | 435.5 | 619.1 | 641.9 | 633.9 | 435.5 | 566.6 | 0. | 249.9 | 471.6 | 534.1 |
| 11 | 415.6 | 643.3 | 611.4 | 622.3 | 415.6 | 576.4 | 0. | 285.5 | 448.4 | 519.8 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.406 | 0.448 | 0.842 | 0.735 | 0.406 | 0.431 | 1.076 | 1.023 | 0.879 |
| 2 | 0.408 | 0.455 | 0.828 | 0.721 | 0.408 | 0.435 | 1.081 | 1.030 | 0.893 |
| 3 | 0.427 | 0.468 | 0.781 | 0.667 | 0.427 | 0.444 | 1.057 | 1.008 | 0.838 |
| 4 | 0.430 | 0.469 | 0.755 | 0.638 | 0.430 | 0.441 | 1.043 | 0.976 | 0.797 |
| 5 | 0.431 | 0.463 | 0.748 | 0.632 | 0.431 | 0.436 | 1.028 | 0.967 | 0.776 |
| 6 | 0.431 | 0.463 | 0.740 | 0.630 | 0.431 | 0.438 | 1.032 | 0.955 | 0.813 |
| 7 | 0.431 | 0.471 | 0.733 | 0.630 | 0.431 | 0.445 | 1.048 | 0.947 | 0.869 |
| 8 | 0.431 | 0.478 | 0.726 | 0.637 | 0.431 | 0.455 | 1.070 | 0.939 | 0.941 |
| 9 | 0.418 | 0.516 | 0.653 | 0.596 | 0.418 | 0.483 | 1.167 | 0.855 | 0.957 |
| 10 | 0.396 | 0.559 | 0.584 | 0.573 | 0.396 | 0.512 | 1.301 | 0.759 | 0.947 |
| 11 | 0.378 | 0.581 | 0.555 | 0.562 | 0.378 | 0.521 | 1.387 | 0.732 | 0.925 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | -0.4 | -2.7 | 5.4 | 0.161 | 0.039 | 0.039 | 0.008 | 0.008 |
| 2 | 9.11 | 11.70 | -0.0 | -2.6 | 4.8 | 0.166 | 0.036 | 0.036 | 0.007 | 0.007 |
| 3 | 27.14 | 30.86 | 0.7 | -3.1 | 5.3 | 0.189 | 0.066 | 0.066 | 0.013 | 0.013 |
| 4 | 36.50 | 40.42 | 1.2 | -3.1 | 5.9 | 0.201 | 0.087 | 0.087 | 0.017 | 0.017 |
| 5 | 38.89 | 42.85 | 1.3 | -3.2 | 5.1 | 0.200 | 0.096 | 0.096 | 0.018 | 0.018 |
| 6 | 41.29 | 45.22 | 1.3 | -3.3 | 5.7 | 0.191 | 0.078 | 0.078 | 0.015 | 0.015 |
| 7 | 43.91 | 47.86 | 1.5 | -3.3 | 5.2 | 0.184 | 0.055 | 0.055 | 0.010 | 0.010 |
| 8 | 46.00 | 50.03 | 1.6 | -3.3 | 5.8 | 0.166 | 0.024 | 0.024 | 0.005 | 0.005 |
| 9 | 68.35 | 71.83 | 2.6 | -3.3 | 7.1 | 0.143 | 0.035 | 0.035 | 0.006 | 0.006 |
| 10 | 86.92 | 88.33 | 2.7 | -3.9 | 7.7 | 0.092 | 0.040 | 0.040 | 0.007 | 0.007 |
| 11 | 92.79 | 93.11 | 3.3 | -3.4 | 8.9 | 0.073 | 0.069 | 0.069 | 0.012 | 0.012 |

TABLE XI. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 60 PERCENT DESIGN SPEED

(c) Reading 949

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 22.8 | 62.7 | 53.6 | 518.7 | 544.5 | 14.69 | 17.21 |
| 2 | 9.440 | 9.322 | 0. | 22.8 | 62.0 | 52.8 | 518.7 | 544.0 | 14.69 | 17.18 |
| 3 | 8.559 | 8.588 | 0. | 24.6 | 58.6 | 48.7 | 518.7 | 543.6 | 14.69 | 17.17 |
| 4 | 8.102 | 8.222 | 0. | 27.7 | 57.2 | 45.9 | 518.7 | 545.5 | 14.69 | 17.12 |
| 5 | 7.985 | 8.129 | 0. | 27.8 | 56.7 | 45.5 | 518.7 | 545.1 | 14.69 | 17.07 |
| 6 | 7.868 | 8.038 | 0. | 28.2 | 56.4 | 44.6 | 518.7 | 544.2 | 14.69 | 17.12 |
| 7 | 7.740 | 7.937 | 0. | 27.2 | 56.1 | 43.9 | 518.7 | 543.5 | 14.69 | 17.16 |
| 8 | 7.638 | 7.854 | 0. | 26.0 | 55.7 | 43.6 | 518.7 | 543.1 | 14.69 | 17.18 |
| 9 | 6.546 | 7.019 | 0. | 27.7 | 52.3 | 35.1 | 518.7 | 543.5 | 14.69 | 17.24 |
| 10 | 5.639 | 6.387 | 0. | 29.6 | 49.7 | 25.9 | 518.7 | 545.3 | 14.69 | 17.39 |
| 11 | 5.352 | 6.204 | 0. | 31.7 | 48.8 | 21.4 | 518.7 | 547.3 | 14.69 | 17.50 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 417.3 | 486.2 | 911.0 | 756.0 | 417.3 | 448.2 | 0. | 188.6 | 809.8 | 797.4 |
| 2 | 420.5 | 486.9 | 895.5 | 743.0 | 420.5 | 448.9 | 0. | 188.7 | 790.6 | 780.7 |
| 3 | 437.4 | 495.8 | 840.0 | 683.1 | 437.4 | 450.8 | 0. | 206.4 | 717.1 | 719.5 |
| 4 | 438.5 | 500.2 | 809.2 | 636.7 | 438.5 | 442.8 | 0. | 232.7 | 680.1 | 690.2 |
| 5 | 439.2 | 498.4 | 800.7 | 629.7 | 439.2 | 441.1 | 0. | 232.2 | 669.5 | 681.6 |
| 6 | 439.4 | 503.1 | 795.4 | 622.2 | 439.4 | 443.2 | 0. | 238.1 | 660.6 | 674.8 |
| 7 | 437.9 | 508.6 | 784.9 | 627.7 | 437.9 | 452.3 | 0. | 232.7 | 651.4 | 668.0 |
| 8 | 437.7 | 509.8 | 776.4 | 632.3 | 437.7 | 458.2 | 0. | 223.6 | 641.3 | 659.4 |
| 9 | 423.8 | 541.5 | 693.8 | 586.1 | 423.8 | 479.4 | 0. | 251.8 | 549.3 | 589.0 |
| 10 | 401.3 | 584.5 | 620.1 | 564.9 | 401.3 | 508.2 | 0. | 288.6 | 472.7 | 535.4 |
| 11 | 392.8 | 607.1 | 596.7 | 554.9 | 392.8 | 516.8 | 0. | 318.6 | 449.2 | 520.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.379 | 0.433 | 0.828 | 0.673 | 0.379 | 0.399 | 1.074 | 1.056 | 0.930 |
| 2 | 0.382 | 0.434 | 0.814 | 0.662 | 0.382 | 0.400 | 1.067 | 1.058 | 0.936 |
| 3 | 0.398 | 0.442 | 0.764 | 0.609 | 0.398 | 0.402 | 1.031 | 1.035 | 0.947 |
| 4 | 0.399 | 0.446 | 0.736 | 0.567 | 0.399 | 0.394 | 1.010 | 1.003 | 0.866 |
| 5 | 0.400 | 0.444 | 0.729 | 0.561 | 0.400 | 0.393 | 1.004 | 0.992 | 0.862 |
| 6 | 0.400 | 0.449 | 0.722 | 0.555 | 0.400 | 0.395 | 1.009 | 0.984 | 0.906 |
| 7 | 0.399 | 0.454 | 0.714 | 0.561 | 0.399 | 0.404 | 1.033 | 0.978 | 0.949 |
| 8 | 0.398 | 0.456 | 0.706 | 0.565 | 0.398 | 0.409 | 1.047 | 0.968 | 0.972 |
| 9 | 0.385 | 0.485 | 0.631 | 0.525 | 0.385 | 0.429 | 1.131 | 0.875 | 0.979 |
| 10 | 0.364 | 0.524 | 0.563 | 0.507 | 0.364 | 0.456 | 1.266 | 0.779 | 0.960 |
| 11 | 0.356 | 0.545 | 0.541 | 0.498 | 0.356 | 0.464 | 1.316 | 0.745 | 0.927 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.2 | -1.1 | 5.0 | 0.237 | 0.032 | 0.032 | 0.006 | 0.006 |
| 2 | 9.11 | 11.70 | 1.5 | -1.1 | 4.7 | 0.237 | 0.029 | 0.029 | 0.006 | 0.006 |
| 3 | 27.14 | 30.86 | 2.4 | -1.4 | 3.8 | 0.259 | 0.026 | 0.026 | 0.005 | 0.005 |
| 4 | 36.50 | 40.42 | 3.1 | -1.2 | 3.5 | 0.294 | 0.076 | 0.076 | 0.015 | 0.015 |
| 5 | 38.89 | 42.85 | 3.2 | -1.3 | 4.3 | 0.294 | 0.078 | 0.078 | 0.015 | 0.015 |
| 6 | 41.29 | 45.22 | 3.4 | -1.3 | 4.2 | 0.298 | 0.053 | 0.053 | 0.010 | 0.010 |
| 7 | 43.91 | 47.86 | 3.6 | -1.1 | 4.1 | 0.280 | 0.028 | 0.028 | 0.005 | 0.005 |
| 8 | 46.00 | 50.03 | 3.7 | -1.1 | 5.0 | 0.262 | 0.016 | 0.016 | 0.003 | 0.003 |
| 9 | 68.35 | 71.83 | 4.8 | -1.1 | 6.3 | 0.240 | 0.014 | 0.014 | 0.003 | 0.003 |
| 10 | 86.92 | 88.33 | 5.1 | -1.5 | 7.0 | 0.184 | 0.036 | 0.036 | 0.006 | 0.006 |
| 11 | 92.79 | 93.11 | 4.9 | -1.8 | 5.1 | 0.174 | 0.076 | 0.076 | 0.013 | 0.013 |

TABLE XI. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 60 PERCENT DESIGN SPEED

(d) Reading 950

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 29.5 | 64.4 | 53.3 | 518.7 | 550.1 | 14.69 | 17.83 |
| 2 | 9.440 | 9.322 | 0. | 28.7 | 63.8 | 52.8 | 518.7 | 549.9 | 14.69 | 17.81 |
| 3 | 8.559 | 8.588 | 0. | 31.6 | 60.7 | 48.7 | 518.7 | 548.5 | 14.69 | 17.70 |
| 4 | 8.102 | 8.222 | 0. | 35.2 | 59.2 | 45.9 | 518.7 | 550.2 | 14.69 | 17.64 |
| 5 | 7.985 | 8.129 | 0. | 35.4 | 58.9 | 45.4 | 518.7 | 549.8 | 14.69 | 17.57 |
| 6 | 7.868 | 8.038 | 0. | 34.0 | 58.6 | 44.8 | 518.7 | 548.9 | 14.69 | 17.60 |
| 7 | 7.740 | 7.937 | 0. | 32.8 | 58.1 | 43.9 | 518.7 | 548.0 | 14.69 | 17.63 |
| 8 | 7.638 | 7.854 | 0. | 33.6 | 57.9 | 42.8 | 518.7 | 548.1 | 14.69 | 17.65 |
| 9 | 6.546 | 7.019 | 0. | 33.6 | 54.9 | 35.2 | 518.7 | 546.4 | 14.69 | 17.58 |
| 10 | 5.639 | 6.387 | 0. | 35.2 | 52.4 | 25.5 | 518.7 | 547.2 | 14.69 | 17.63 |
| 11 | 5.352 | 6.204 | 0. | 36.4 | 51.2 | 20.9 | 518.7 | 549.8 | 14.69 | 17.73 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 387.3 | 479.7 | 896.2 | 697.9 | 387.3 | 417.3 | 0. | 236.5 | 808.2 | 795.9 |
| 2 | 389.0 | 477.9 | 881.7 | 693.3 | 389.0 | 419.4 | 0. | 229.3 | 791.3 | 781.4 |
| 3 | 403.4 | 482.6 | 823.6 | 622.9 | 403.4 | 411.2 | 0. | 252.7 | 718.1 | 720.5 |
| 4 | 405.3 | 486.8 | 792.4 | 571.4 | 405.3 | 397.8 | 0. | 280.7 | 680.9 | 690.9 |
| 5 | 404.6 | 485.0 | 782.4 | 563.0 | 404.6 | 395.4 | 0. | 281.0 | 669.7 | 681.7 |
| 6 | 403.5 | 488.0 | 773.6 | 569.5 | 403.5 | 404.4 | 0. | 273.5 | 660.1 | 674.3 |
| 7 | 403.2 | 491.3 | 762.8 | 573.4 | 403.2 | 413.0 | 0. | 266.2 | 647.5 | 664.0 |
| 8 | 401.4 | 496.6 | 754.7 | 563.4 | 401.4 | 413.7 | 0. | 274.7 | 639.0 | 657.1 |
| 9 | 386.1 | 515.9 | 670.9 | 525.6 | 386.1 | 429.6 | 0. | 285.6 | 548.7 | 588.3 |
| 10 | 363.7 | 554.7 | 596.6 | 502.5 | 363.7 | 453.5 | 0. | 319.4 | 473.0 | 535.7 |
| 11 | 359.9 | 577.0 | 574.7 | 497.2 | 359.9 | 464.6 | 0. | 342.2 | 448.0 | 519.3 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.351 | 0.425 | 0.813 | 0.618 | 0.351 | 0.370 | 1.078 | 1.086 | 0.938 |
| 2 | 0.353 | 0.423 | 0.800 | 0.614 | 0.353 | 0.371 | 1.078 | 1.092 | 0.939 |
| 3 | 0.366 | 0.428 | 0.748 | 0.552 | 0.366 | 0.365 | 1.019 | 1.066 | 0.951 |
| 4 | 0.368 | 0.431 | 0.719 | 0.506 | 0.368 | 0.352 | 0.981 | 1.031 | 0.881 |
| 5 | 0.367 | 0.430 | 0.710 | 0.499 | 0.367 | 0.350 | 0.977 | 1.020 | 0.873 |
| 6 | 0.366 | 0.433 | 0.702 | 0.505 | 0.366 | 0.359 | 1.002 | 1.011 | 0.907 |
| 7 | 0.366 | 0.436 | 0.692 | 0.509 | 0.366 | 0.367 | 1.024 | 0.997 | 0.945 |
| 8 | 0.364 | 0.441 | 0.685 | 0.500 | 0.364 | 0.367 | 1.030 | 0.990 | 0.949 |
| 9 | 0.350 | 0.460 | 0.608 | 0.468 | 0.350 | 0.383 | 1.113 | 0.897 | 0.983 |
| 10 | 0.329 | 0.496 | 0.540 | 0.449 | 0.329 | 0.405 | 1.247 | 0.800 | 0.973 |
| 11 | 0.326 | 0.515 | 0.520 | 0.444 | 0.326 | 0.415 | 1.291 | 0.759 | 0.921 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.8 | 0.6 | 4.6 | 0.307 | 0.035 | 0.035 | 0.007 | 0.007 |
| 2 | 9.11 | 11.70 | 3.3 | 0.7 | 4.7 | 0.296 | 0.035 | 0.035 | 0.007 | 0.007 |
| 3 | 27.14 | 30.86 | 4.5 | 0.7 | 3.8 | 0.334 | 0.030 | 0.030 | 0.006 | 0.006 |
| 4 | 36.50 | 40.42 | 5.2 | 0.8 | 3.5 | 0.378 | 0.082 | 0.082 | 0.016 | 0.016 |
| 5 | 38.89 | 42.85 | 5.4 | 0.9 | 4.1 | 0.380 | 0.088 | 0.088 | 0.017 | 0.017 |
| 6 | 41.29 | 45.22 | 5.6 | 0.9 | 4.4 | 0.361 | 0.064 | 0.064 | 0.012 | 0.012 |
| 7 | 43.91 | 47.86 | 5.6 | 0.9 | 4.1 | 0.342 | 0.038 | 0.038 | 0.007 | 0.007 |
| 8 | 46.00 | 50.03 | 5.9 | 1.1 | 4.2 | 0.350 | 0.036 | 0.036 | 0.007 | 0.007 |
| 9 | 68.35 | 71.83 | 7.3 | 1.4 | 6.3 | 0.316 | 0.014 | 0.014 | 0.003 | 0.003 |
| 10 | 86.92 | 88.33 | 7.8 | 1.3 | 6.6 | 0.268 | 0.028 | 0.028 | 0.005 | 0.005 |
| 11 | 92.79 | 93.11 | 7.3 | 0.6 | 4.6 | 0.251 | 0.096 | 0.096 | 0.016 | 0.016 |

TABLE XI. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 60 PERCENT DESIGN SPEED

(e) Reading 951

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 36.8 | 66.9 | 53.9 | 518.7 | 556.5 | 14.69 | 18.30 |
| 2 | 9.440 | 9.322 | 0. | 35.9 | 66.3 | 53.0 | 518.7 | 555.7 | 14.69 | 18.29 |
| 3 | 8.559 | 8.588 | 0. | 39.2 | 63.4 | 48.7 | 518.7 | 554.2 | 14.69 | 18.19 |
| 4 | 8.102 | 8.222 | 0. | 41.8 | 62.2 | 46.1 | 518.7 | 554.7 | 14.69 | 18.10 |
| 5 | 7.985 | 8.129 | 0. | 42.7 | 61.8 | 45.4 | 518.7 | 554.6 | 14.69 | 18.01 |
| 6 | 7.868 | 8.038 | 0. | 42.3 | 60.8 | 45.0 | 518.7 | 553.7 | 14.69 | 17.99 |
| 7 | 7.740 | 7.937 | 0. | 40.9 | 61.2 | 44.2 | 518.7 | 552.8 | 14.69 | 18.00 |
| 8 | 7.638 | 7.854 | 0. | 41.1 | 60.9 | 43.4 | 518.7 | 552.2 | 14.69 | 18.00 |
| 9 | 6.546 | 7.019 | 0. | 39.8 | 57.8 | 35.0 | 518.7 | 550.1 | 14.69 | 17.91 |
| 10 | 5.639 | 6.387 | 0. | 40.0 | 55.6 | 25.4 | 518.7 | 549.3 | 14.69 | 17.91 |
| 11 | 5.352 | 6.204 | 0. | 41.3 | 55.2 | 20.7 | 518.7 | 550.8 | 14.69 | 17.98 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 345.7 | 469.7 | 880.6 | 639.0 | 345.7 | 376.2 | 0. | 281.1 | 809.9 | 797.6 |
| 2 | 346.9 | 469.1 | 862.8 | 632.1 | 346.9 | 380.1 | 0. | 275.0 | 789.9 | 780.1 |
| 3 | 359.3 | 476.5 | 803.4 | 559.1 | 359.3 | 369.3 | 0. | 301.2 | 718.6 | 721.0 |
| 4 | 358.7 | 479.8 | 770.1 | 515.8 | 358.7 | 357.6 | 0. | 319.9 | 681.5 | 691.6 |
| 5 | 359.6 | 479.3 | 761.0 | 501.6 | 359.6 | 351.9 | 0. | 325.3 | 670.7 | 682.8 |
| 6 | 370.3 | 478.4 | 758.1 | 499.9 | 370.3 | 353.6 | 0. | 322.3 | 661.5 | 675.7 |
| 7 | 357.8 | 479.6 | 741.9 | 505.6 | 357.8 | 362.6 | 0. | 314.0 | 649.9 | 666.4 |
| 8 | 357.3 | 481.3 | 734.4 | 499.2 | 357.3 | 362.6 | 0. | 316.6 | 641.6 | 659.7 |
| 9 | 345.3 | 498.7 | 647.8 | 468.1 | 345.3 | 383.4 | 0. | 319.0 | 548.1 | 587.7 |
| 10 | 324.0 | 532.2 | 573.0 | 451.2 | 324.0 | 407.7 | 0. | 342.0 | 472.6 | 535.3 |
| 11 | 313.2 | 552.7 | 548.4 | 443.8 | 313.2 | 415.1 | 0. | 364.9 | 450.2 | 521.9 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.313 | 0.413 | 0.797 | 0.562 | 0.313 | 0.331 | 1.088 | 1.134 | 0.892 |
| 2 | 0.314 | 0.413 | 0.780 | 0.556 | 0.314 | 0.335 | 1.096 | 1.133 | 0.904 |
| 3 | 0.325 | 0.420 | 0.727 | 0.493 | 0.325 | 0.326 | 1.028 | 1.105 | 0.920 |
| 4 | 0.325 | 0.423 | 0.697 | 0.455 | 0.325 | 0.315 | 0.997 | 1.070 | 0.883 |
| 5 | 0.326 | 0.423 | 0.689 | 0.442 | 0.326 | 0.310 | 0.979 | 1.058 | 0.865 |
| 6 | 0.335 | 0.422 | 0.687 | 0.441 | 0.335 | 0.312 | 0.955 | 1.040 | 0.882 |
| 7 | 0.324 | 0.424 | 0.672 | 0.447 | 0.324 | 0.320 | 1.013 | 1.037 | 0.907 |
| 8 | 0.323 | 0.425 | 0.665 | 0.441 | 0.323 | 0.320 | 1.015 | 1.030 | 0.922 |
| 9 | 0.312 | 0.442 | 0.586 | 0.415 | 0.312 | 0.340 | 1.110 | 0.922 | 0.961 |
| 10 | 0.293 | 0.474 | 0.518 | 0.401 | 0.293 | 0.363 | 1.258 | 0.821 | 0.987 |
| 11 | 0.283 | 0.492 | 0.495 | 0.395 | 0.283 | 0.369 | 1.325 | 0.789 | 0.959 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 5.3 | 3.1 | 5.3 | 0.378 | 0.073 | 0.073 | 0.014 | 0.014 |
| 2 | 9.11 | 11.70 | 5.8 | 3.2 | 4.9 | 0.369 | 0.066 | 0.066 | 0.013 | 0.013 |
| 3 | 27.14 | 30.86 | 7.3 | 3.4 | 3.8 | 0.414 | 0.060 | 0.060 | 0.012 | 0.012 |
| 4 | 36.50 | 40.42 | 8.2 | 3.8 | 3.7 | 0.447 | 0.095 | 0.095 | 0.018 | 0.018 |
| 5 | 38.89 | 42.85 | 8.3 | 3.8 | 4.2 | 0.459 | 0.112 | 0.112 | 0.022 | 0.022 |
| 6 | 41.29 | 45.22 | 7.8 | 3.1 | 4.7 | 0.457 | 0.097 | 0.097 | 0.019 | 0.019 |
| 7 | 43.91 | 47.86 | 8.7 | 4.0 | 4.4 | 0.433 | 0.077 | 0.077 | 0.015 | 0.015 |
| 8 | 46.00 | 50.03 | 8.9 | 4.1 | 4.9 | 0.435 | 0.065 | 0.065 | 0.012 | 0.012 |
| 9 | 68.35 | 71.83 | 10.3 | 4.3 | 6.2 | 0.393 | 0.039 | 0.039 | 0.007 | 0.007 |
| 10 | 86.92 | 88.33 | 11.0 | 4.4 | 6.6 | 0.335 | 0.016 | 0.016 | 0.003 | 0.003 |
| 11 | 92.79 | 93.11 | 11.3 | 4.6 | 4.5 | 0.321 | 0.056 | 0.056 | 0.010 | 0.010 |

TABLE XI. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 60 PERCENT DESIGN SPEED

(f) Reading 952

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 44.6 | 68.8 | 54.7 | 518.7 | 563.0 | 14.69 | 18.45 |
| 2 | 9.440 | 9.322 | 0. | 41.4 | 68.2 | 53.5 | 518.7 | 560.0 | 14.69 | 18.47 |
| 3 | 8.559 | 8.588 | 0. | 42.7 | 65.5 | 48.5 | 518.7 | 557.4 | 14.69 | 18.42 |
| 4 | 8.102 | 8.222 | 0. | 46.0 | 64.3 | 46.0 | 518.7 | 557.0 | 14.69 | 18.30 |
| 5 | 7.985 | 8.129 | 0. | 46.7 | 63.9 | 45.4 | 518.7 | 557.3 | 14.69 | 18.25 |
| 6 | 7.868 | 8.038 | 0. | 46.1 | 63.7 | 44.9 | 518.7 | 557.0 | 14.69 | 18.20 |
| 7 | 7.740 | 7.937 | 0. | 45.8 | 63.3 | 44.0 | 518.7 | 556.0 | 14.69 | 18.18 |
| 8 | 7.638 | 7.854 | 0. | 44.6 | 62.9 | 43.1 | 518.7 | 555.1 | 14.69 | 18.17 |
| 9 | 6.546 | 7.019 | 0. | 43.9 | 59.9 | 34.5 | 518.7 | 551.3 | 14.69 | 18.04 |
| 10 | 5.639 | 6.387 | 0. | 42.6 | 56.9 | 25.1 | 518.7 | 550.1 | 14.69 | 18.01 |
| 11 | 5.352 | 6.204 | 0. | 43.9 | 57.1 | 20.1 | 518.7 | 551.8 | 14.69 | 18.07 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 313.6 | 467.0 | 868.2 | 575.3 | 313.6 | 332.6 | 0. | 327.8 | 809.6 | 797.3 |
| 2 | 316.7 | 467.3 | 853.3 | 588.9 | 316.7 | 350.5 | 0. | 309.1 | 792.3 | 782.4 |
| 3 | 327.1 | 477.7 | 788.8 | 529.8 | 327.1 | 351.3 | 0. | 323.7 | 717.8 | 720.2 |
| 4 | 327.4 | 479.3 | 753.9 | 478.8 | 327.4 | 332.8 | 0. | 345.0 | 679.1 | 689.1 |
| 5 | 328.2 | 479.1 | 746.1 | 468.3 | 328.2 | 328.7 | 0. | 348.5 | 670.0 | 682.1 |
| 6 | 326.4 | 477.4 | 735.5 | 467.3 | 326.4 | 331.3 | 0. | 345.8 | 659.1 | 673.3 |
| 7 | 326.5 | 478.5 | 725.7 | 463.7 | 326.5 | 333.8 | 0. | 342.8 | 648.1 | 664.6 |
| 8 | 327.6 | 480.6 | 718.3 | 468.8 | 327.6 | 342.4 | 0. | 337.2 | 639.3 | 657.4 |
| 9 | 318.5 | 496.1 | 635.9 | 433.8 | 318.5 | 357.3 | 0. | 344.3 | 550.4 | 590.2 |
| 10 | 307.7 | 523.4 | 563.4 | 425.4 | 307.7 | 385.2 | 0. | 354.2 | 472.0 | 534.6 |
| 11 | 290.2 | 543.7 | 554.6 | 417.2 | 290.2 | 391.7 | 0. | 377.0 | 449.0 | 520.5 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.283 | 0.408 | 0.784 | 0.503 | 0.283 | 0.291 | 1.060 | 1.168 | 0.786 |
| 2 | 0.286 | 0.410 | 0.771 | 0.516 | 0.286 | 0.307 | 1.107 | 1.169 | 0.848 |
| 3 | 0.296 | 0.420 | 0.713 | 0.466 | 0.296 | 0.309 | 1.074 | 1.133 | 0.894 |
| 4 | 0.296 | 0.422 | 0.681 | 0.421 | 0.296 | 0.293 | 1.017 | 1.092 | 0.875 |
| 5 | 0.297 | 0.421 | 0.674 | 0.412 | 0.297 | 0.289 | 1.001 | 1.084 | 0.853 |
| 6 | 0.295 | 0.420 | 0.665 | 0.411 | 0.295 | 0.291 | 1.015 | 1.072 | 0.853 |
| 7 | 0.295 | 0.421 | 0.656 | 0.408 | 0.295 | 0.294 | 1.022 | 1.059 | 0.872 |
| 8 | 0.296 | 0.424 | 0.649 | 0.413 | 0.296 | 0.302 | 1.045 | 1.049 | 0.892 |
| 9 | 0.288 | 0.439 | 0.574 | 0.384 | 0.288 | 0.316 | 1.122 | 0.946 | 0.962 |
| 10 | 0.278 | 0.465 | 0.509 | 0.378 | 0.278 | 0.342 | 1.252 | 0.850 | 0.989 |
| 11 | 0.262 | 0.483 | 0.482 | 0.371 | 0.262 | 0.348 | 1.350 | 0.800 | 0.956 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 7.3 | 5.0 | 6.0 | 0.460 | 0.172 | 0.172 | 0.032 | 0.032 |
| 2 | 9.11 | 11.70 | 7.7 | 5.1 | 5.4 | 0.425 | 0.118 | 0.118 | 0.022 | 0.022 |
| 3 | 27.14 | 30.86 | 9.3 | 5.5 | 3.6 | 0.449 | 0.089 | 0.089 | 0.017 | 0.017 |
| 4 | 36.50 | 40.42 | 10.2 | 5.9 | 3.5 | 0.493 | 0.112 | 0.112 | 0.022 | 0.022 |
| 5 | 38.89 | 42.85 | 10.4 | 5.9 | 4.2 | 0.502 | 0.135 | 0.135 | 0.026 | 0.026 |
| 6 | 41.29 | 45.22 | 10.7 | 6.0 | 4.5 | 0.493 | 0.138 | 0.138 | 0.026 | 0.026 |
| 7 | 43.91 | 47.86 | 10.8 | 6.1 | 4.1 | 0.489 | 0.119 | 0.119 | 0.023 | 0.023 |
| 8 | 46.00 | 50.03 | 10.9 | 6.1 | 4.5 | 0.472 | 0.101 | 0.101 | 0.019 | 0.019 |
| 9 | 68.35 | 71.83 | 12.4 | 6.5 | 5.7 | 0.445 | 0.040 | 0.040 | 0.008 | 0.008 |
| 10 | 86.92 | 88.33 | 12.3 | 5.7 | 6.2 | 0.374 | 0.014 | 0.014 | 0.002 | 0.002 |
| 11 | 92.79 | 95.11 | 13.2 | 6.5 | 5.9 | 0.357 | 0.065 | 0.065 | 0.011 | 0.011 |

TABLE XI. - Concluded. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 60 PERCENT DESIGN SPEED

(g) Reading 953

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 52.1 | 69.9 | 55.6 | 518.7 | 567.4 | 14.69 | 18.50 |
| 2 | 9.440 | 9.322 | 0. | 46.1 | 69.4 | 53.8 | 518.7 | 563.1 | 14.69 | 18.52 |
| 3 | 8.559 | 8.588 | 0. | 44.4 | 66.6 | 48.2 | 518.7 | 559.1 | 14.69 | 18.50 |
| 4 | 8.102 | 8.222 | 0. | 46.7 | 65.4 | 46.4 | 518.7 | 558.1 | 14.69 | 18.33 |
| 5 | 7.985 | 8.129 | 0. | 48.0 | 65.1 | 45.8 | 518.7 | 557.8 | 14.69 | 18.29 |
| 6 | 7.868 | 8.038 | 0. | 47.7 | 64.7 | 45.0 | 518.7 | 557.7 | 14.69 | 18.27 |
| 7 | 7.740 | 7.937 | 0. | 47.7 | 64.3 | 43.9 | 518.7 | 557.1 | 14.69 | 18.24 |
| 8 | 7.638 | 7.854 | 0. | 46.7 | 64.0 | 43.2 | 518.7 | 556.2 | 14.69 | 18.23 |
| 9 | 6.546 | 7.019 | 0. | 45.5 | 60.9 | 34.2 | 518.7 | 552.1 | 14.69 | 18.10 |
| 10 | 5.639 | 6.387 | 0. | 42.7 | 58.3 | 25.6 | 518.7 | 550.3 | 14.69 | 18.05 |
| 11 | 5.352 | 6.204 | 0. | 44.8 | 57.4 | 20.1 | 518.7 | 551.6 | 14.69 | 18.10 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 296.4 | 472.2 | 861.5 | 513.9 | 296.4 | 290.2 | 0. | 372.5 | 808.9 | 796.6 |
| 2 | 297.9 | 469.5 | 846.6 | 550.8 | 297.9 | 325.6 | 0. | 338.3 | 792.4 | 782.5 |
| 3 | 310.2 | 479.6 | 781.2 | 514.2 | 310.2 | 342.5 | 0. | 335.8 | 716.9 | 719.4 |
| 4 | 311.7 | 476.7 | 747.9 | 474.0 | 311.7 | 327.1 | 0. | 346.9 | 679.9 | 690.0 |
| 5 | 311.2 | 477.5 | 739.7 | 458.1 | 311.2 | 319.5 | 0. | 354.9 | 671.1 | 685.2 |
| 6 | 311.4 | 477.0 | 729.3 | 454.2 | 311.4 | 321.2 | 0. | 352.6 | 659.5 | 673.7 |
| 7 | 311.6 | 479.5 | 719.6 | 448.1 | 311.6 | 322.8 | 0. | 354.3 | 648.7 | 665.2 |
| 8 | 311.8 | 479.7 | 711.7 | 451.4 | 311.8 | 329.1 | 0. | 349.0 | 639.8 | 657.9 |
| 9 | 306.1 | 495.6 | 629.1 | 420.1 | 306.1 | 347.6 | 0. | 353.3 | 549.6 | 589.3 |
| 10 | 292.2 | 519.5 | 555.8 | 423.2 | 292.2 | 381.6 | 0. | 352.6 | 472.8 | 535.5 |
| 11 | 287.6 | 539.8 | 533.3 | 408.2 | 287.6 | 383.3 | 0. | 380.1 | 449.1 | 520.6 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | | VEL R | MACH NO | |
| 1 | 0.267 | 0.411 | 0.777 | 0.448 | 0.267 | 0.253 | | 0.979 | 1.186 | 0.725 |
| 2 | 0.269 | 0.410 | 0.764 | 0.482 | 0.269 | 0.285 | | 1.093 | 1.190 | 0.798 |
| 3 | 0.280 | 0.421 | 0.705 | 0.452 | 0.280 | 0.301 | | 1.104 | 1.147 | 0.874 |
| 4 | 0.281 | 0.419 | 0.675 | 0.417 | 0.281 | 0.287 | | 1.049 | 1.108 | 0.859 |
| 5 | 0.281 | 0.420 | 0.668 | 0.403 | 0.281 | 0.281 | | 1.027 | 1.101 | 0.858 |
| 6 | 0.281 | 0.419 | 0.659 | 0.399 | 0.281 | 0.282 | | 1.032 | 1.086 | 0.853 |
| 7 | 0.281 | 0.422 | 0.650 | 0.394 | 0.281 | 0.284 | | 1.036 | 1.073 | 0.860 |
| 8 | 0.282 | 0.422 | 0.643 | 0.397 | 0.282 | 0.290 | | 1.056 | 1.063 | 0.879 |
| 9 | 0.276 | 0.439 | 0.568 | 0.372 | 0.276 | 0.308 | | 1.135 | 0.953 | 0.952 |
| 10 | 0.264 | 0.461 | 0.501 | 0.376 | 0.264 | 0.339 | | 1.306 | 0.842 | 0.994 |
| 11 | 0.259 | 0.480 | 0.481 | 0.363 | 0.259 | 0.341 | | 1.333 | 0.801 | 0.966 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 8.3 | 6.1 | 7.0 | 0.544 | 0.241 | 0.241 | 0.044 | 0.044 |
| 2 | 9.11 | 11.70 | 8.9 | 6.3 | 5.7 | 0.476 | 0.169 | 0.169 | 0.032 | 0.032 |
| 3 | 27.14 | 30.86 | 10.4 | 6.6 | 3.3 | 0.468 | 0.111 | 0.111 | 0.022 | 0.022 |
| 4 | 36.50 | 40.42 | 11.3 | 7.0 | 4.0 | 0.497 | 0.131 | 0.131 | 0.025 | 0.025 |
| 5 | 38.89 | 42.85 | 11.6 | 7.2 | 4.5 | 0.514 | 0.134 | 0.134 | 0.026 | 0.026 |
| 6 | 41.29 | 45.22 | 11.7 | 7.1 | 4.7 | 0.510 | 0.142 | 0.142 | 0.027 | 0.027 |
| 7 | 43.91 | 47.86 | 11.9 | 7.2 | 4.1 | 0.510 | 0.136 | 0.136 | 0.026 | 0.026 |
| 8 | 46.00 | 50.03 | 12.1 | 7.2 | 4.6 | 0.496 | 0.118 | 0.118 | 0.023 | 0.023 |
| 9 | 68.35 | 71.83 | 13.4 | 7.4 | 5.4 | 0.464 | 0.052 | 0.052 | 0.010 | 0.010 |
| 10 | 86.92 | 88.33 | 13.7 | 7.1 | 6.7 | 0.369 | 0.008 | 0.008 | 0.001 | 0.001 |
| 11 | 92.79 | 93.11 | 13.5 | 6.8 | 3.9 | 0.374 | 0.050 | 0.050 | 0.009 | 0.009 |

TABLE XII. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5,

70 PERCENT DESIGN SPEED

(a) Reading 957

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 14.3 | 61.7 | 55.2 | 518.7 | 541.5 | 14.69 | 16.39 |
| 2 | 9.440 | 9.322 | 0. | 14.3 | 61.1 | 54.1 | 518.7 | 542.0 | 14.69 | 16.50 |
| 3 | 8.559 | 8.588 | 0. | 17.8 | 57.4 | 49.5 | 518.7 | 543.7 | 14.69 | 16.54 |
| 4 | 8.102 | 8.222 | 0. | 17.2 | 55.8 | 50.1 | 518.7 | 542.0 | 14.69 | 16.01 |
| 5 | 7.985 | 8.129 | 0. | 17.6 | 55.2 | 50.3 | 518.7 | 541.8 | 14.69 | 15.82 |
| 6 | 7.868 | 8.038 | 0. | 18.1 | 54.9 | 48.9 | 518.7 | 542.3 | 14.69 | 15.95 |
| 7 | 7.740 | 7.937 | 0. | 17.5 | 54.5 | 47.7 | 518.7 | 542.5 | 14.69 | 16.21 |
| 8 | 7.638 | 7.854 | 0. | 17.3 | 54.1 | 45.9 | 518.7 | 543.2 | 14.69 | 16.52 |
| 9 | 6.546 | 7.019 | 0. | 19.1 | 50.5 | 37.2 | 518.7 | 546.0 | 14.69 | 17.21 |
| 10 | 5.639 | 6.387 | 0. | 23.7 | 47.9 | 27.4 | 518.7 | 550.9 | 14.69 | 17.77 |
| 11 | 5.352 | 6.204 | 0. | 26.5 | 47.0 | 22.6 | 518.7 | 553.9 | 14.69 | 18.12 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 507.7 | 566.4 | 1072.2 | 962.1 | 507.7 | 548.8 | 0. | 139.8 | 944.4 | 930.0 |
| 2 | 510.4 | 576.3 | 1055.9 | 951.4 | 510.4 | 558.4 | 0. | 142.5 | 924.3 | 912.8 |
| 3 | 535.5 | 591.8 | 995.2 | 868.4 | 535.5 | 563.5 | 0. | 180.9 | 838.9 | 841.7 |
| 4 | 541.1 | 560.5 | 961.6 | 835.2 | 541.1 | 535.5 | 0. | 165.7 | 794.9 | 806.6 |
| 5 | 542.9 | 548.5 | 952.5 | 819.0 | 542.9 | 522.7 | 0. | 166.3 | 782.6 | 796.7 |
| 6 | 542.1 | 561.3 | 941.7 | 812.1 | 542.1 | 533.5 | 0. | 174.4 | 770.0 | 786.6 |
| 7 | 542.5 | 576.8 | 933.6 | 817.7 | 542.5 | 550.0 | 0. | 174.0 | 759.8 | 779.1 |
| 8 | 543.0 | 599.8 | 925.0 | 823.4 | 543.0 | 572.7 | 0. | 178.4 | 748.8 | 770.0 |
| 9 | 528.8 | 659.3 | 831.3 | 781.8 | 528.8 | 623.1 | 0. | 215.6 | 641.4 | 687.7 |
| 10 | 497.7 | 713.2 | 742.9 | 735.2 | 497.7 | 653.0 | 0. | 286.8 | 551.6 | 624.7 |
| 11 | 487.8 | 741.6 | 715.8 | 718.8 | 487.8 | 663.6 | 0. | 331.0 | 523.9 | 607.3 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.465 | 0.509 | 0.981 | 0.865 | 0.465 | 0.494 | 1.081 | 1.214 | 0.720 |
| 2 | 0.467 | 0.518 | 0.966 | 0.856 | 0.467 | 0.502 | 1.094 | 1.224 | 0.748 |
| 3 | 0.491 | 0.532 | 0.913 | 0.781 | 0.491 | 0.507 | 1.052 | 1.197 | 0.716 |
| 4 | 0.497 | 0.503 | 0.882 | 0.750 | 0.497 | 0.481 | 0.990 | 1.156 | 0.551 |
| 5 | 0.498 | 0.492 | 0.874 | 0.735 | 0.498 | 0.469 | 0.963 | 1.145 | 0.478 |
| 6 | 0.497 | 0.504 | 0.864 | 0.729 | 0.497 | 0.479 | 0.984 | 1.130 | 0.523 |
| 7 | 0.498 | 0.519 | 0.857 | 0.735 | 0.498 | 0.495 | 1.014 | 1.124 | 0.620 |
| 8 | 0.498 | 0.540 | 0.849 | 0.741 | 0.498 | 0.516 | 1.055 | 1.114 | 0.721 |
| 9 | 0.485 | 0.596 | 0.762 | 0.706 | 0.485 | 0.563 | 1.178 | 1.007 | 0.878 |
| 10 | 0.455 | 0.645 | 0.679 | 0.665 | 0.455 | 0.591 | 1.312 | 0.899 | 0.898 |
| 11 | 0.446 | 0.671 | 0.654 | 0.651 | 0.446 | 0.601 | 1.360 | 0.858 | 0.909 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 0.2 | -2.1 | 6.6 | 0.145 | 0.087 | 0.085 | 0.016 | 0.016 |
| 2 | 9.11 | 11.70 | 0.6 | -2.0 | 6.0 | 0.142 | 0.082 | 0.080 | 0.015 | 0.015 |
| 3 | 27.14 | 30.86 | 1.3 | -2.6 | 4.7 | 0.181 | 0.108 | 0.107 | 0.021 | 0.020 |
| 4 | 36.50 | 40.42 | 1.7 | -2.7 | 7.7 | 0.180 | 0.168 | 0.168 | 0.030 | 0.030 |
| 5 | 38.89 | 42.85 | 1.8 | -2.7 | 9.1 | 0.189 | 0.196 | 0.196 | 0.034 | 0.034 |
| 6 | 41.29 | 45.22 | 1.8 | -2.8 | 8.6 | 0.188 | 0.186 | 0.186 | 0.033 | 0.033 |
| 7 | 43.91 | 47.86 | 2.0 | -2.7 | 7.9 | 0.174 | 0.152 | 0.152 | 0.027 | 0.027 |
| 8 | 46.00 | 50.03 | 2.1 | -2.8 | 7.3 | 0.161 | 0.117 | 0.117 | 0.021 | 0.021 |
| 9 | 68.35 | 71.83 | 2.9 | -3.0 | 8.3 | 0.120 | 0.069 | 0.069 | 0.012 | 0.012 |
| 10 | 86.92 | 88.33 | 3.3 | -3.2 | 8.5 | 0.090 | 0.081 | 0.081 | 0.014 | 0.014 |
| 11 | 92.79 | 93.11 | 3.1 | -3.6 | 6.3 | 0.086 | 0.085 | 0.085 | 0.014 | 0.014 |

TABLE XII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 70 PERCENT DESIGN SPEED

(b) Reading 958

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 21.4 | 62.0 | 54.1 | 518.7 | 552.2 | 14.69 | 17.74 |
| 2 | 9.440 | 9.322 | 0. | 20.7 | 61.3 | 52.9 | 518.7 | 551.8 | 14.69 | 17.88 |
| 3 | 8.559 | 8.588 | 0. | 24.9 | 57.9 | 47.9 | 518.7 | 554.0 | 14.69 | 17.84 |
| 4 | 8.102 | 8.222 | 0. | 25.0 | 56.2 | 47.1 | 518.7 | 551.3 | 14.69 | 17.50 |
| 5 | 7.985 | 8.129 | 0. | 25.1 | 55.7 | 47.6 | 518.7 | 550.2 | 14.69 | 17.29 |
| 6 | 7.868 | 8.038 | 0. | 24.8 | 55.3 | 47.3 | 518.7 | 549.7 | 14.69 | 17.26 |
| 7 | 7.740 | 7.937 | 0. | 23.3 | 55.0 | 46.5 | 518.7 | 548.2 | 14.69 | 17.39 |
| 8 | 7.638 | 7.854 | 0. | 23.5 | 54.6 | 45.2 | 518.7 | 548.0 | 14.69 | 17.53 |
| 9 | 6.546 | 7.019 | 0. | 24.6 | 51.2 | 36.7 | 518.7 | 550.2 | 14.69 | 17.86 |
| 10 | 5.639 | 6.387 | 0. | 28.3 | 48.5 | 26.6 | 518.7 | 554.0 | 14.69 | 18.19 |
| 11 | 5.352 | 6.204 | 0. | 30.0 | 47.8 | 22.4 | 518.7 | 556.0 | 14.69 | 18.43 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 502.1 | 563.8 | 1071.0 | 895.4 | 502.1 | 524.9 | 0. | 206.2 | 946.0 | 931.6 |
| 2 | 504.9 | 574.1 | 1052.8 | 889.3 | 504.9 | 536.9 | 0. | 203.3 | 923.8 | 912.3 |
| 3 | 526.4 | 590.5 | 989.8 | 798.9 | 526.4 | 535.7 | 0. | 248.4 | 838.3 | 841.1 |
| 4 | 530.9 | 575.8 | 954.6 | 767.2 | 530.9 | 522.0 | 0. | 242.9 | 793.4 | 805.1 |
| 5 | 533.5 | 562.8 | 947.0 | 755.7 | 533.5 | 509.7 | 0. | 238.6 | 782.4 | 796.5 |
| 6 | 532.7 | 560.5 | 936.6 | 750.2 | 532.7 | 508.7 | 0. | 235.6 | 770.3 | 787.0 |
| 7 | 529.8 | 568.7 | 923.9 | 759.2 | 529.8 | 522.3 | 0. | 225.2 | 756.9 | 776.2 |
| 8 | 531.8 | 581.1 | 917.0 | 756.0 | 531.8 | 532.9 | 0. | 231.9 | 747.1 | 768.2 |
| 9 | 515.3 | 627.5 | 822.4 | 711.7 | 515.3 | 570.3 | 0. | 261.7 | 641.0 | 687.3 |
| 10 | 487.4 | 682.3 | 736.1 | 672.4 | 487.4 | 601.0 | 0. | 323.3 | 551.6 | 624.8 |
| 11 | 475.4 | 709.8 | 708.0 | 665.3 | 475.4 | 615.0 | 0. | 354.4 | 524.7 | 608.2 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.459 | 0.502 | 0.979 | 0.797 | 0.459 | 0.467 | 1.045 | 1.223 | 0.858 |
| 2 | 0.462 | 0.512 | 0.963 | 0.792 | 0.462 | 0.478 | 1.064 | 1.229 | 0.904 |
| 3 | 0.482 | 0.526 | 0.907 | 0.711 | 0.482 | 0.477 | 1.018 | 1.203 | 0.836 |
| 4 | 0.487 | 0.513 | 0.875 | 0.684 | 0.487 | 0.465 | 0.983 | 1.161 | 0.815 |
| 5 | 0.489 | 0.502 | 0.868 | 0.674 | 0.489 | 0.454 | 0.955 | 1.152 | 0.782 |
| 6 | 0.488 | 0.500 | 0.859 | 0.669 | 0.488 | 0.454 | 0.955 | 1.138 | 0.789 |
| 7 | 0.486 | 0.508 | 0.847 | 0.678 | 0.486 | 0.467 | 0.986 | 1.128 | 0.865 |
| 8 | 0.488 | 0.520 | 0.841 | 0.677 | 0.488 | 0.477 | 1.002 | 1.118 | 0.915 |
| 9 | 0.472 | 0.563 | 0.753 | 0.638 | 0.472 | 0.512 | 1.107 | 1.014 | 0.946 |
| 10 | 0.445 | 0.613 | 0.672 | 0.604 | 0.445 | 0.540 | 1.233 | 0.904 | 0.923 |
| 11 | 0.434 | 0.639 | 0.646 | 0.599 | 0.434 | 0.553 | 1.294 | 0.866 | 0.931 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 0.5 | -1.8 | 5.4 | 0.226 | 0.064 | 0.062 | 0.012 | 0.012 |
| 2 | 9.11 | 11.70 | 0.8 | -1.8 | 4.8 | 0.217 | 0.044 | 0.042 | 0.009 | 0.008 |
| 3 | 27.14 | 30.86 | 1.7 | -2.1 | 3.0 | 0.267 | 0.088 | 0.087 | 0.017 | 0.017 |
| 4 | 36.50 | 40.42 | 2.2 | -2.2 | 4.7 | 0.268 | 0.097 | 0.097 | 0.018 | 0.018 |
| 5 | 38.89 | 42.85 | 2.2 | -2.3 | 6.3 | 0.272 | 0.112 | 0.112 | 0.021 | 0.021 |
| 6 | 41.29 | 45.22 | 2.3 | -2.3 | 7.0 | 0.268 | 0.109 | 0.109 | 0.020 | 0.020 |
| 7 | 43.91 | 47.86 | 2.6 | -2.2 | 6.7 | 0.244 | 0.068 | 0.068 | 0.013 | 0.013 |
| 8 | 46.00 | 50.03 | 2.6 | -2.3 | 6.6 | 0.243 | 0.043 | 0.043 | 0.008 | 0.008 |
| 9 | 68.35 | 71.85 | 3.6 | -2.3 | 7.9 | 0.209 | 0.036 | 0.036 | 0.006 | 0.006 |
| 10 | 86.92 | 88.33 | 3.9 | -2.6 | 7.7 | 0.177 | 0.069 | 0.069 | 0.012 | 0.012 |
| 11 | 92.79 | 93.11 | 3.9 | -2.8 | 6.2 | 0.158 | 0.069 | 0.069 | 0.012 | 0.012 |

TABLE XII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 70 PERCENT DESIGN SPEED

(c) Reading 959

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 26.4 | 62.7 | 53.4 | 518.7 | 557.7 | 14.69 | 18.61 |
| 2 | 9.440 | 9.322 | 0. | 25.6 | 62.0 | 52.6 | 518.7 | 557.0 | 14.69 | 18.62 |
| 3 | 8.559 | 8.588 | 0. | 29.3 | 58.5 | 47.6 | 518.7 | 558.0 | 14.69 | 18.55 |
| 4 | 8.102 | 8.222 | 0. | 30.0 | 56.9 | 45.8 | 518.7 | 557.0 | 14.69 | 18.33 |
| 5 | 7.985 | 8.129 | 0. | 30.4 | 56.5 | 46.2 | 518.7 | 556.2 | 14.69 | 18.17 |
| 6 | 7.868 | 8.038 | 0. | 29.9 | 56.2 | 45.8 | 518.7 | 554.7 | 14.69 | 18.10 |
| 7 | 7.740 | 7.937 | 0. | 29.2 | 55.8 | 45.2 | 518.7 | 554.0 | 14.69 | 18.14 |
| 8 | 7.638 | 7.854 | 0. | 28.6 | 55.5 | 44.2 | 518.7 | 553.1 | 14.69 | 18.22 |
| 9 | 6.546 | 7.019 | 0. | 30.2 | 52.2 | 35.4 | 518.7 | 553.8 | 14.69 | 18.31 |
| 10 | 5.639 | 6.387 | 0. | 31.5 | 49.4 | 26.4 | 518.7 | 555.4 | 14.69 | 18.49 |
| 11 | 5.352 | 6.204 | 0. | 34.1 | 49.3 | 21.1 | 518.7 | 557.9 | 14.69 | 18.68 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 488.2 | 563.5 | 1064.0 | 847.1 | 488.2 | 504.7 | 0. | 250.7 | 945.4 | 931.0 |
| 2 | 492.8 | 567.1 | 1048.5 | 841.5 | 492.8 | 511.2 | 0. | 245.4 | 925.4 | 913.9 |
| 3 | 513.2 | 582.7 | 982.6 | 753.1 | 513.2 | 508.2 | 0. | 285.1 | 838.0 | 840.8 |
| 4 | 517.1 | 578.0 | 946.4 | 718.6 | 517.1 | 500.6 | 0. | 288.9 | 792.7 | 804.5 |
| 5 | 517.4 | 567.1 | 938.4 | 706.9 | 517.4 | 489.3 | 0. | 286.9 | 782.9 | 797.0 |
| 6 | 516.0 | 566.5 | 928.2 | 704.6 | 516.0 | 491.0 | 0. | 282.8 | 771.5 | 788.2 |
| 7 | 513.9 | 568.8 | 915.5 | 704.3 | 513.9 | 496.6 | 0. | 277.5 | 757.6 | 776.9 |
| 8 | 515.0 | 576.8 | 908.3 | 706.4 | 515.0 | 506.2 | 0. | 276.5 | 748.2 | 769.3 |
| 9 | 496.3 | 614.6 | 810.5 | 652.1 | 496.3 | 531.2 | 0. | 309.0 | 640.8 | 687.2 |
| 10 | 473.4 | 660.7 | 727.1 | 628.6 | 473.4 | 563.0 | 0. | 345.7 | 551.9 | 625.1 |
| 11 | 450.3 | 690.8 | 691.1 | 613.4 | 450.3 | 572.3 | 0. | 387.0 | 524.3 | 607.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.446 | 0.499 | 0.972 | 0.750 | 0.446 | 0.447 | 1.034 | 1.238 | 0.930 |
| 2 | 0.450 | 0.502 | 0.958 | 0.746 | 0.450 | 0.453 | 1.037 | 1.245 | 0.946 |
| 3 | 0.470 | 0.516 | 0.899 | 0.668 | 0.470 | 0.450 | 0.990 | 1.214 | 0.909 |
| 4 | 0.473 | 0.513 | 0.867 | 0.637 | 0.473 | 0.444 | 0.968 | 1.170 | 0.883 |
| 5 | 0.474 | 0.503 | 0.859 | 0.627 | 0.474 | 0.434 | 0.946 | 1.165 | 0.865 |
| 6 | 0.472 | 0.503 | 0.850 | 0.626 | 0.472 | 0.436 | 0.951 | 1.154 | 0.884 |
| 7 | 0.470 | 0.506 | 0.838 | 0.626 | 0.470 | 0.441 | 0.966 | 1.141 | 0.913 |
| 8 | 0.472 | 0.513 | 0.832 | 0.629 | 0.472 | 0.451 | 0.983 | 1.133 | 0.955 |
| 9 | 0.454 | 0.549 | 0.741 | 0.582 | 0.454 | 0.474 | 1.070 | 1.025 | 0.958 |
| 10 | 0.432 | 0.592 | 0.663 | 0.563 | 0.432 | 0.504 | 1.189 | 0.912 | 0.959 |
| 11 | 0.410 | 0.619 | 0.629 | 0.550 | 0.410 | 0.513 | 1.271 | 0.877 | 0.939 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.1 | -1.1 | 4.8 | 0.280 | 0.037 | 0.034 | 0.007 | 0.007 |
| 2 | 9.11 | 11.70 | 1.4 | -1.2 | 4.5 | 0.272 | 0.029 | 0.026 | 0.006 | 0.005 |
| 3 | 27.14 | 30.86 | 2.3 | -1.5 | 2.7 | 0.319 | 0.055 | 0.054 | 0.011 | 0.011 |
| 4 | 36.50 | 40.42 | 2.8 | -1.5 | 3.4 | 0.326 | 0.073 | 0.073 | 0.014 | 0.014 |
| 5 | 38.89 | 42.85 | 3.1 | -1.4 | 4.9 | 0.332 | 0.083 | 0.083 | 0.016 | 0.016 |
| 6 | 41.29 | 45.22 | 3.2 | -1.4 | 5.5 | 0.324 | 0.070 | 0.070 | 0.013 | 0.013 |
| 7 | 43.91 | 47.86 | 3.4 | -1.4 | 5.3 | 0.312 | 0.053 | 0.053 | 0.010 | 0.010 |
| 8 | 46.00 | 50.03 | 3.5 | -1.4 | 5.6 | 0.303 | 0.027 | 0.027 | 0.005 | 0.005 |
| 9 | 68.35 | 71.83 | 4.7 | -1.2 | 6.6 | 0.285 | 0.031 | 0.031 | 0.006 | 0.006 |
| 10 | 86.92 | 88.33 | 4.8 | -1.8 | 7.5 | 0.233 | 0.039 | 0.039 | 0.007 | 0.007 |
| 11 | 92.79 | 93.11 | 5.4 | -1.3 | 4.9 | 0.222 | 0.067 | 0.067 | 0.011 | 0.011 |

TABLE XII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 70 PERCENT DESIGN SPEED

(d) Reading 960

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 32.1 | 64.0 | 52.9 | 518.7 | 565.4 | 14.69 | 19.49 |
| 2 | 9.440 | 9.322 | 0. | 32.3 | 63.5 | 52.2 | 518.7 | 564.1 | 14.69 | 19.44 |
| 3 | 8.559 | 8.588 | 0. | 34.0 | 60.4 | 48.1 | 518.7 | 563.0 | 14.69 | 19.28 |
| 4 | 8.102 | 8.222 | 0. | 37.6 | 58.9 | 45.7 | 518.7 | 563.3 | 14.69 | 19.05 |
| 5 | 7.985 | 8.129 | 0. | 38.0 | 58.5 | 45.8 | 518.7 | 562.9 | 14.69 | 18.89 |
| 6 | 7.868 | 8.038 | 0. | 37.2 | 58.1 | 45.3 | 518.7 | 561.2 | 14.69 | 18.87 |
| 7 | 7.740 | 7.937 | 0. | 36.1 | 57.8 | 44.4 | 518.7 | 560.5 | 14.69 | 18.92 |
| 8 | 7.638 | 7.854 | 0. | 35.9 | 57.5 | 43.5 | 518.7 | 560.3 | 14.69 | 18.96 |
| 9 | 6.546 | 7.019 | 0. | 36.8 | 54.6 | 35.0 | 518.7 | 558.1 | 14.69 | 18.88 |
| 10 | 5.639 | 6.387 | 0. | 37.8 | 52.1 | 28.1 | 518.7 | 559.0 | 14.69 | 18.94 |
| 11 | 5.352 | 6.204 | 0. | 38.7 | 51.3 | 20.7 | 518.7 | 561.2 | 14.69 | 19.11 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 459.6 | 562.1 | 1049.8 | 790.4 | 459.6 | 476.2 | 0. | 298.6 | 943.8 | 929.5 |
| 2 | 461.3 | 561.9 | 1033.4 | 775.3 | 461.3 | 475.0 | 0. | 300.4 | 924.7 | 913.1 |
| 3 | 477.2 | 567.1 | 965.0 | 704.0 | 477.2 | 470.0 | 0. | 317.5 | 838.8 | 841.6 |
| 4 | 478.7 | 566.6 | 927.7 | 643.0 | 478.7 | 448.9 | 0. | 345.9 | 794.6 | 806.4 |
| 5 | 478.7 | 557.4 | 916.3 | 630.0 | 478.7 | 439.0 | 0. | 343.6 | 781.3 | 795.4 |
| 6 | 478.9 | 557.4 | 906.4 | 631.3 | 478.9 | 443.8 | 0. | 337.3 | 769.6 | 786.2 |
| 7 | 477.0 | 562.2 | 894.9 | 636.2 | 477.0 | 454.4 | 0. | 331.1 | 757.1 | 776.4 |
| 8 | 475.4 | 567.1 | 885.7 | 633.6 | 475.4 | 459.6 | 0. | 332.2 | 747.2 | 768.4 |
| 9 | 456.1 | 593.7 | 787.6 | 580.4 | 456.1 | 475.4 | 0. | 355.6 | 642.1 | 688.5 |
| 10 | 430.6 | 636.2 | 700.7 | 555.2 | 430.6 | 502.6 | 0. | 390.1 | 552.7 | 626.0 |
| 11 | 421.7 | 662.0 | 673.9 | 552.8 | 421.7 | 517.0 | 0. | 413.5 | 525.6 | 609.3 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | | VEL R | MACH NO | |
| 1 | 0.419 | 0.494 | 0.957 | 0.695 | 0.419 | 0.418 | | 1.036 | 1.266 | 0.934 |
| 2 | 0.420 | 0.494 | 0.942 | 0.682 | 0.420 | 0.418 | | 1.030 | 1.276 | 0.951 |
| 3 | 0.436 | 0.500 | 0.881 | 0.620 | 0.436 | 0.414 | | 0.985 | 1.246 | 0.945 |
| 4 | 0.437 | 0.499 | 0.847 | 0.566 | 0.437 | 0.395 | | 0.938 | 1.204 | 0.896 |
| 5 | 0.437 | 0.491 | 0.836 | 0.555 | 0.437 | 0.387 | | 0.917 | 1.190 | 0.875 |
| 6 | 0.437 | 0.492 | 0.827 | 0.557 | 0.437 | 0.391 | | 0.927 | 1.178 | 0.904 |
| 7 | 0.435 | 0.496 | 0.817 | 0.562 | 0.435 | 0.401 | | 0.953 | 1.167 | 0.929 |
| 8 | 0.434 | 0.501 | 0.808 | 0.560 | 0.434 | 0.406 | | 0.967 | 1.159 | 0.941 |
| 9 | 0.416 | 0.527 | 0.718 | 0.515 | 0.416 | 0.422 | | 1.042 | 1.052 | 0.978 |
| 10 | 0.392 | 0.566 | 0.637 | 0.494 | 0.392 | 0.447 | | 1.167 | 0.935 | 0.967 |
| 11 | 0.383 | 0.590 | 0.612 | 0.492 | 0.383 | 0.460 | | 1.226 | 0.894 | 0.951 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.5 | 0.2 | 4.3 | 0.339 | 0.042 | 0.039 | 0.008 | 0.008 |
| 2 | 9.11 | 11.70 | 3.0 | 0.4 | 4.1 | 0.342 | 0.031 | 0.028 | 0.006 | 0.005 |
| 3 | 27.14 | 30.86 | 4.2 | 0.4 | 3.2 | 0.367 | 0.038 | 0.037 | 0.007 | 0.007 |
| 4 | 36.50 | 40.42 | 4.9 | 0.5 | 3.3 | 0.412 | 0.077 | 0.077 | 0.015 | 0.015 |
| 5 | 38.89 | 42.85 | 5.0 | 0.5 | 4.6 | 0.416 | 0.095 | 0.095 | 0.018 | 0.018 |
| 6 | 41.29 | 45.22 | 5.1 | 0.5 | 5.0 | 0.406 | 0.070 | 0.070 | 0.013 | 0.013 |
| 7 | 43.91 | 47.86 | 5.3 | 0.6 | 4.6 | 0.389 | 0.053 | 0.053 | 0.010 | 0.010 |
| 8 | 46.00 | 50.05 | 5.6 | 0.7 | 4.9 | 0.385 | 0.045 | 0.045 | 0.009 | 0.009 |
| 9 | 68.35 | 71.85 | 7.1 | 1.1 | 6.2 | 0.369 | 0.019 | 0.019 | 0.004 | 0.004 |
| 10 | 86.92 | 88.35 | 7.5 | 0.9 | 6.3 | 0.322 | 0.036 | 0.036 | 0.006 | 0.006 |
| 11 | 92.79 | 93.11 | 7.3 | 0.7 | 4.5 | 0.299 | 0.060 | 0.060 | 0.010 | 0.010 |

TABLE XII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 70 PERCENT DESIGN SPEED

(e) Reading 961

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 36.7 | 65.5 | 52.8 | 518.7 | 570.7 | 14.69 | 19.94 |
| 2 | 9.440 | 9.322 | 0. | 35.8 | 64.9 | 52.3 | 518.7 | 569.3 | 14.69 | 19.89 |
| 3 | 8.559 | 8.588 | 0. | 38.7 | 61.9 | 48.3 | 518.7 | 567.2 | 14.69 | 19.63 |
| 4 | 8.102 | 8.222 | 0. | 42.0 | 60.6 | 45.6 | 518.7 | 567.3 | 14.69 | 19.43 |
| 5 | 7.985 | 8.129 | 0. | 42.4 | 60.2 | 45.5 | 518.7 | 566.9 | 14.69 | 19.29 |
| 6 | 7.868 | 8.038 | 0. | 41.5 | 60.0 | 45.2 | 518.7 | 566.0 | 14.69 | 19.26 |
| 7 | 7.740 | 7.937 | 0. | 40.6 | 59.6 | 44.1 | 518.7 | 564.9 | 14.69 | 19.27 |
| 8 | 7.638 | 7.854 | 0. | 39.9 | 59.4 | 43.3 | 518.7 | 563.6 | 14.69 | 19.29 |
| 9 | 6.546 | 7.019 | 0. | 40.3 | 56.4 | 34.7 | 518.7 | 560.6 | 14.69 | 19.16 |
| 10 | 5.639 | 6.387 | 0. | 40.0 | 53.9 | 25.3 | 518.7 | 560.1 | 14.69 | 19.15 |
| 11 | 5.352 | 6.204 | 0. | 41.8 | 53.2 | 20.2 | 518.7 | 562.2 | 14.69 | 19.23 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 430.4 | 561.4 | 1036.9 | 744.4 | 430.4 | 449.9 | 0. | 335.8 | 943.3 | 929.0 |
| 2 | 433.1 | 558.8 | 1021.8 | 741.4 | 433.1 | 453.2 | 0. | 327.1 | 925.4 | 913.8 |
| 3 | 446.8 | 559.7 | 949.8 | 657.4 | 446.8 | 437.0 | 0. | 349.8 | 838.2 | 841.0 |
| 4 | 446.6 | 563.3 | 909.9 | 598.6 | 446.6 | 418.8 | 0. | 376.8 | 792.8 | 804.5 |
| 5 | 447.1 | 557.0 | 899.3 | 586.9 | 447.1 | 411.3 | 0. | 375.7 | 780.3 | 794.4 |
| 6 | 445.2 | 555.2 | 889.6 | 590.5 | 445.2 | 416.0 | 0. | 367.8 | 770.2 | 786.8 |
| 7 | 444.1 | 559.7 | 877.4 | 592.1 | 444.1 | 425.2 | 0. | 364.0 | 756.8 | 776.0 |
| 8 | 441.4 | 561.2 | 866.0 | 591.8 | 441.4 | 430.5 | 0. | 360.1 | 745.1 | 766.2 |
| 9 | 426.4 | 584.9 | 769.7 | 542.2 | 426.4 | 445.9 | 0. | 378.6 | 640.7 | 687.0 |
| 10 | 401.6 | 621.4 | 682.1 | 526.6 | 401.6 | 476.1 | 0. | 399.4 | 551.3 | 624.4 |
| 11 | 391.6 | 646.1 | 654.4 | 512.9 | 391.6 | 481.4 | 0. | 430.8 | 524.2 | 607.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.391 | 0.491 | 0.943 | 0.651 | 0.391 | 0.393 | 1.045 | 1.296 | 0.910 |
| 2 | 0.394 | 0.489 | 0.929 | 0.649 | 0.394 | 0.397 | 1.046 | 1.305 | 0.927 |
| 3 | 0.407 | 0.491 | 0.865 | 0.577 | 0.407 | 0.383 | 0.978 | 1.270 | 0.923 |
| 4 | 0.407 | 0.494 | 0.829 | 0.525 | 0.407 | 0.367 | 0.938 | 1.226 | 0.887 |
| 5 | 0.407 | 0.489 | 0.819 | 0.515 | 0.407 | 0.361 | 0.920 | 1.213 | 0.870 |
| 6 | 0.405 | 0.487 | 0.810 | 0.518 | 0.405 | 0.365 | 0.934 | 1.205 | 0.882 |
| 7 | 0.404 | 0.492 | 0.799 | 0.520 | 0.404 | 0.374 | 0.957 | 1.191 | 0.905 |
| 8 | 0.402 | 0.494 | 0.788 | 0.521 | 0.402 | 0.379 | 0.975 | 1.180 | 0.932 |
| 9 | 0.388 | 0.517 | 0.700 | 0.480 | 0.388 | 0.394 | 1.046 | 1.067 | 0.974 |
| 10 | 0.364 | 0.552 | 0.619 | 0.468 | 0.364 | 0.423 | 1.186 | 0.948 | 0.986 |
| 11 | 0.355 | 0.574 | 0.594 | 0.456 | 0.355 | 0.428 | 1.229 | 0.906 | 0.953 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 3.9 | 1.7 | 4.2 | 0.387 | 0.065 | 0.061 | 0.013 | 0.012 |
| 2 | 9.11 | 11.70 | 4.4 | 1.8 | 4.2 | 0.376 | 0.052 | 0.049 | 0.010 | 0.009 |
| 3 | 27.14 | 30.86 | 5.8 | 1.9 | 3.4 | 0.416 | 0.059 | 0.058 | 0.012 | 0.011 |
| 4 | 36.50 | 40.42 | 6.6 | 2.2 | 3.2 | 0.458 | 0.093 | 0.093 | 0.018 | 0.018 |
| 5 | 38.89 | 42.85 | 6.7 | 2.2 | 4.3 | 0.463 | 0.108 | 0.108 | 0.021 | 0.021 |
| 6 | 41.29 | 45.22 | 7.0 | 2.3 | 4.9 | 0.450 | 0.099 | 0.099 | 0.019 | 0.019 |
| 7 | 43.91 | 47.86 | 7.2 | 2.4 | 4.3 | 0.437 | 0.079 | 0.079 | 0.015 | 0.015 |
| 8 | 46.00 | 50.03 | 7.4 | 2.6 | 4.8 | 0.427 | 0.057 | 0.057 | 0.011 | 0.011 |
| 9 | 68.35 | 71.83 | 8.8 | 2.9 | 5.9 | 0.411 | 0.026 | 0.026 | 0.005 | 0.005 |
| 10 | 86.92 | 88.33 | 9.3 | 2.8 | 6.4 | 0.348 | 0.017 | 0.017 | 0.003 | 0.003 |
| 11 | 92.79 | 93.11 | 9.3 | 2.6 | 3.9 | 0.345 | 0.062 | 0.062 | 0.011 | 0.011 |

TABLE XII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 70 PERCENT DESIGN SPEED

(f) Reading 962

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 42.0 | 67.4 | 53.9 | 518.7 | 575.8 | 14.69 | 20.11 |
| 2 | 9.440 | 9.322 | 0. | 41.6 | 66.8 | 53.2 | 518.7 | 573.5 | 14.69 | 20.01 |
| 3 | 8.559 | 8.588 | 0. | 42.7 | 64.1 | 48.4 | 518.7 | 571.8 | 14.69 | 19.92 |
| 4 | 8.102 | 8.222 | 0. | 45.5 | 62.8 | 46.1 | 518.7 | 570.6 | 14.69 | 19.69 |
| 5 | 7.985 | 8.129 | 0. | 46.9 | 62.5 | 45.9 | 518.7 | 570.6 | 14.69 | 19.58 |
| 6 | 7.868 | 8.038 | 0. | 46.4 | 62.3 | 45.1 | 518.7 | 570.3 | 14.69 | 19.55 |
| 7 | 7.740 | 7.937 | 0. | 45.7 | 61.9 | 44.0 | 518.7 | 568.9 | 14.69 | 19.56 |
| 8 | 7.638 | 7.854 | 0. | 44.8 | 61.5 | 43.3 | 518.7 | 567.9 | 14.69 | 19.54 |
| 9 | 6.546 | 7.019 | 0. | 43.5 | 58.4 | 34.5 | 518.7 | 563.5 | 14.69 | 19.38 |
| 10 | 5.639 | 6.387 | 0. | 43.6 | 56.1 | 24.6 | 518.7 | 561.1 | 14.69 | 19.32 |
| 11 | 5.352 | 6.204 | 0. | 44.1 | 54.9 | 20.2 | 518.7 | 563.7 | 14.69 | 19.39 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 394.0 | 551.2 | 1023.3 | 694.3 | 394.0 | 409.3 | 0. | 369.2 | 944.4 | 930.0 |
| 2 | 396.0 | 548.3 | 1004.6 | 684.0 | 396.0 | 410.0 | 0. | 364.1 | 923.2 | 911.7 |
| 3 | 408.6 | 560.0 | 934.3 | 619.3 | 408.6 | 411.4 | 0. | 380.1 | 840.2 | 843.1 |
| 4 | 407.0 | 558.5 | 891.2 | 563.8 | 407.0 | 391.3 | 0. | 398.6 | 792.8 | 804.5 |
| 5 | 408.1 | 555.5 | 882.9 | 545.5 | 408.1 | 379.8 | 0. | 405.4 | 782.9 | 797.0 |
| 6 | 406.0 | 557.2 | 872.3 | 544.5 | 406.0 | 384.5 | 0. | 403.3 | 772.1 | 788.8 |
| 7 | 405.5 | 560.0 | 861.1 | 544.1 | 405.5 | 391.1 | 0. | 400.8 | 759.7 | 779.0 |
| 8 | 406.2 | 560.6 | 852.3 | 546.8 | 406.2 | 397.7 | 0. | 395.1 | 749.3 | 770.4 |
| 9 | 394.2 | 579.6 | 753.0 | 509.6 | 394.2 | 420.1 | 0. | 399.3 | 641.5 | 687.9 |
| 10 | 371.9 | 613.7 | 666.7 | 489.1 | 371.9 | 444.6 | 0. | 423.0 | 553.4 | 626.8 |
| 11 | 369.4 | 634.8 | 642.3 | 485.3 | 369.4 | 455.6 | 0. | 441.9 | 525.5 | 609.2 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.357 | 0.479 | 0.928 | 0.604 | 0.357 | 0.356 | 1.039 | 1.336 | 0.851 |
| 2 | 0.359 | 0.478 | 0.911 | 0.596 | 0.359 | 0.357 | 1.035 | 1.339 | 0.874 |
| 3 | 0.371 | 0.489 | 0.848 | 0.541 | 0.371 | 0.359 | 1.007 | 1.307 | 0.888 |
| 4 | 0.370 | 0.488 | 0.809 | 0.493 | 0.370 | 0.342 | 0.961 | 1.258 | 0.871 |
| 5 | 0.371 | 0.486 | 0.802 | 0.477 | 0.371 | 0.332 | 0.931 | 1.250 | 0.853 |
| 6 | 0.369 | 0.487 | 0.792 | 0.476 | 0.369 | 0.336 | 0.947 | 1.240 | 0.854 |
| 7 | 0.368 | 0.490 | 0.782 | 0.476 | 0.368 | 0.342 | 0.964 | 1.227 | 0.879 |
| 8 | 0.369 | 0.491 | 0.774 | 0.479 | 0.369 | 0.349 | 0.979 | 1.216 | 0.896 |
| 9 | 0.358 | 0.511 | 0.683 | 0.449 | 0.358 | 0.370 | 1.066 | 1.090 | 0.954 |
| 10 | 0.337 | 0.544 | 0.604 | 0.434 | 0.337 | 0.394 | 1.196 | 0.969 | 0.995 |
| 11 | 0.335 | 0.562 | 0.582 | 0.430 | 0.335 | 0.404 | 1.233 | 0.921 | 0.949 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 5.8 | 3.5 | 5.2 | 0.438 | 0.117 | 0.111 | 0.023 | 0.021 |
| 2 | 9.11 | 11.70 | 6.3 | 3.7 | 5.1 | 0.434 | 0.099 | 0.094 | 0.019 | 0.018 |
| 3 | 27.14 | 30.86 | 7.9 | 4.1 | 3.5 | 0.457 | 0.096 | 0.094 | 0.019 | 0.018 |
| 4 | 36.50 | 40.42 | 8.8 | 4.4 | 3.6 | 0.493 | 0.116 | 0.116 | 0.023 | 0.023 |
| 5 | 38.89 | 42.85 | 9.0 | 4.5 | 4.6 | 0.509 | 0.134 | 0.134 | 0.026 | 0.026 |
| 6 | 41.29 | 45.22 | 9.3 | 4.7 | 4.8 | 0.503 | 0.136 | 0.136 | 0.026 | 0.026 |
| 7 | 43.91 | 47.86 | 9.5 | 4.7 | 4.2 | 0.494 | 0.113 | 0.113 | 0.022 | 0.022 |
| 8 | 46.00 | 50.03 | 9.6 | 4.7 | 4.8 | 0.482 | 0.097 | 0.097 | 0.019 | 0.019 |
| 9 | 68.35 | 71.83 | 10.9 | 5.0 | 5.7 | 0.447 | 0.049 | 0.049 | 0.009 | 0.009 |
| 10 | 86.92 | 88.35 | 11.5 | 4.9 | 5.8 | 0.397 | 0.006 | 0.006 | 0.001 | 0.001 |
| 11 | 92.79 | 93.11 | 11.0 | 4.3 | 5.9 | 0.379 | 0.072 | 0.072 | 0.012 | 0.012 |

TABLE XII. - Concluded. BLADE ELEMENT PERFORMANCE FOR

*ROTOR 5, 70 PERCENT DESIGN SPEED*

(g) Reading 963

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 51.7 | 69.4 | 55.3 | 518.7 | 584.5 | 14.69 | 20.10 |
| 2 | 9.440 | 9.322 | 0. | 48.1 | 68.9 | 53.8 | 518.7 | 580.3 | 14.69 | 20.10 |
| 3 | 8.559 | 8.588 | 0. | 46.4 | 66.2 | 48.3 | 518.7 | 575.0 | 14.69 | 20.07 |
| 4 | 8.102 | 8.222 | 0. | 48.7 | 64.8 | 45.9 | 518.7 | 572.9 | 14.69 | 19.88 |
| 5 | 7.985 | 8.129 | 0. | 49.3 | 64.4 | 45.8 | 518.7 | 573.2 | 14.69 | 19.75 |
| 6 | 7.868 | 8.038 | 0. | 49.3 | 64.2 | 45.0 | 518.7 | 572.9 | 14.69 | 19.72 |
| 7 | 7.740 | 7.937 | 0. | 48.6 | 63.8 | 44.2 | 518.7 | 571.6 | 14.69 | 19.71 |
| 8 | 7.638 | 7.854 | 0. | 48.3 | 63.4 | 43.0 | 518.7 | 570.8 | 14.69 | 19.70 |
| 9 | 6.546 | 7.019 | 0. | 46.1 | 60.2 | 34.1 | 518.7 | 564.4 | 14.69 | 19.51 |
| 10 | 5.639 | 6.387 | 0. | 44.5 | 57.5 | 24.6 | 518.7 | 562.1 | 14.69 | 19.43 |
| 11 | 5.352 | 6.204 | 0. | 45.4 | 57.0 | 19.9 | 518.7 | 563.8 | 14.69 | 19.49 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 354.9 | 554.5 | 1010.6 | 603.9 | 354.9 | 343.6 | 0. | 435.3 | 946.2 | 931.8 |
| 2 | 358.1 | 552.3 | 992.7 | 624.2 | 358.1 | 369.1 | 0. | 410.9 | 925.8 | 914.3 |
| 3 | 371.0 | 563.1 | 918.5 | 583.5 | 371.0 | 388.5 | 0. | 407.7 | 840.2 | 843.1 |
| 4 | 373.2 | 563.4 | 877.9 | 533.9 | 373.2 | 371.9 | 0. | 423.3 | 794.6 | 806.4 |
| 5 | 375.0 | 558.3 | 868.2 | 521.3 | 375.0 | 363.7 | 0. | 423.7 | 783.0 | 797.1 |
| 6 | 374.3 | 559.4 | 858.6 | 516.2 | 374.3 | 364.8 | 0. | 424.2 | 772.7 | 789.4 |
| 7 | 373.5 | 559.8 | 847.2 | 516.1 | 373.5 | 370.1 | 0. | 420.0 | 760.5 | 779.8 |
| 8 | 374.7 | 563.7 | 837.5 | 512.2 | 374.7 | 374.8 | 0. | 421.0 | 748.9 | 770.1 |
| 9 | 367.9 | 579.7 | 740.9 | 485.4 | 367.9 | 402.1 | 0. | 417.6 | 643.1 | 689.6 |
| 10 | 351.6 | 609.8 | 655.2 | 478.5 | 351.6 | 435.2 | 0. | 427.1 | 552.8 | 626.2 |
| 11 | 340.9 | 630.7 | 626.3 | 471.1 | 340.9 | 443.0 | 0. | 448.9 | 525.4 | 609.1 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.321 | 0.479 | 0.915 | 0.521 | 0.321 | 0.297 | 0.968 | 1.382 | 0.738 |
| 2 | 0.324 | 0.478 | 0.899 | 0.541 | 0.324 | 0.320 | 1.031 | 1.383 | 0.789 |
| 3 | 0.336 | 0.490 | 0.832 | 0.508 | 0.336 | 0.338 | 1.047 | 1.342 | 0.858 |
| 4 | 0.338 | 0.492 | 0.795 | 0.466 | 0.338 | 0.325 | 0.996 | 1.291 | 0.864 |
| 5 | 0.340 | 0.487 | 0.787 | 0.455 | 0.340 | 0.317 | 0.970 | 1.278 | 0.839 |
| 6 | 0.339 | 0.488 | 0.778 | 0.450 | 0.339 | 0.318 | 0.975 | 1.268 | 0.840 |
| 7 | 0.338 | 0.489 | 0.768 | 0.451 | 0.338 | 0.323 | 0.991 | 1.254 | 0.859 |
| 8 | 0.340 | 0.493 | 0.759 | 0.448 | 0.340 | 0.328 | 1.000 | 1.240 | 0.869 |
| 9 | 0.333 | 0.511 | 0.671 | 0.428 | 0.333 | 0.354 | 1.093 | 1.112 | 0.958 |
| 10 | 0.318 | 0.540 | 0.593 | 0.424 | 0.318 | 0.385 | 1.238 | 0.980 | 0.993 |
| 11 | 0.308 | 0.559 | 0.566 | 0.417 | 0.308 | 0.392 | 1.299 | 0.937 | 0.966 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 7.9 | 5.6 | 6.7 | 0.542 | 0.235 | 0.227 | 0.044 | 0.042 |
| 2 | 9.11 | 11.70 | 8.4 | 5.7 | 5.7 | 0.503 | 0.185 | 0.178 | 0.035 | 0.034 |
| 3 | 27.14 | 30.86 | 10.0 | 6.2 | 3.4 | 0.495 | 0.132 | 0.130 | 0.026 | 0.025 |
| 4 | 36.50 | 40.42 | 10.8 | 6.5 | 3.4 | 0.527 | 0.131 | 0.131 | 0.025 | 0.025 |
| 5 | 38.89 | 42.85 | 10.9 | 6.4 | 4.5 | 0.535 | 0.158 | 0.158 | 0.030 | 0.030 |
| 6 | 41.29 | 45.22 | 11.2 | 6.5 | 4.7 | 0.534 | 0.160 | 0.160 | 0.031 | 0.031 |
| 7 | 43.91 | 47.86 | 11.4 | 6.6 | 4.4 | 0.525 | 0.141 | 0.141 | 0.027 | 0.027 |
| 8 | 46.00 | 50.03 | 11.5 | 6.6 | 4.4 | 0.522 | 0.132 | 0.132 | 0.025 | 0.025 |
| 9 | 68.35 | 71.83 | 12.7 | 6.8 | 5.3 | 0.477 | 0.047 | 0.047 | 0.009 | 0.009 |
| 10 | 86.92 | 88.33 | 12.9 | 6.4 | 5.7 | 0.403 | 0.010 | 0.010 | 0.002 | 0.002 |
| 11 | 92.79 | 93.11 | 13.1 | 6.4 | 5.7 | 0.388 | 0.051 | 0.051 | 0.009 | 0.009 |

TABLE XIII. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5,

80 PERCENT DESIGN SPEED

(a) Reading 964

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 17.6 | 62.2 | 50.8 | 518.7 | 553.8 | 14.69 | 17.72 |
| 2 | 9.440 | 9.322 | 0. | 8.5 | 61.5 | 55.9 | 518.7 | 539.7 | 14.69 | 16.14 |
| 3 | 8.559 | 8.588 | 0. | 12.5 | 57.8 | 51.9 | 518.7 | 544.2 | 14.69 | 16.12 |
| 4 | 8.102 | 8.222 | 0. | 13.9 | 56.1 | 50.5 | 518.7 | 545.9 | 14.69 | 15.87 |
| 5 | 7.985 | 8.129 | 0. | 15.5 | 55.7 | 50.1 | 518.7 | 546.7 | 14.69 | 15.64 |
| 6 | 7.868 | 8.038 | 0. | 15.2 | 55.3 | 49.4 | 518.7 | 547.5 | 14.69 | 15.75 |
| 7 | 7.740 | 7.937 | 0. | 15.2 | 54.9 | 48.2 | 518.7 | 548.0 | 14.69 | 16.02 |
| 8 | 7.638 | 7.854 | 0. | 15.1 | 54.5 | 47.3 | 518.7 | 547.4 | 14.69 | 16.21 |
| 9 | 6.546 | 7.019 | 0. | 19.0 | 51.2 | 38.4 | 518.7 | 553.5 | 14.69 | 17.63 |
| 10 | 5.639 | 6.387 | 0. | 25.0 | 48.7 | 28.7 | 518.7 | 561.2 | 14.69 | 18.67 |
| 11 | 5.352 | 6.204 | 0. | 29.3 | 47.9 | 22.7 | 518.7 | 564.7 | 14.69 | 19.25 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 569.2 | 723.8 | 1221.0 | 1090.8 | 569.2 | 689.9 | 0. | 218.8 | 1080.2 | 1063.7 |
| 2 | 573.7 | 648.0 | 1200.5 | 1142.1 | 573.7 | 640.8 | 0. | 96.0 | 1054.5 | 1041.4 |
| 3 | 602.3 | 658.0 | 1131.7 | 1040.6 | 602.3 | 642.3 | 0. | 142.6 | 958.1 | 961.4 |
| 4 | 608.9 | 649.3 | 1092.2 | 990.6 | 608.9 | 630.3 | 0. | 155.9 | 906.7 | 920.2 |
| 5 | 609.7 | 641.3 | 1081.5 | 962.7 | 609.7 | 618.0 | 0. | 171.1 | 893.2 | 909.3 |
| 6 | 609.6 | 647.0 | 1070.4 | 960.3 | 609.6 | 624.4 | 0. | 169.4 | 879.9 | 898.9 |
| 7 | 608.5 | 661.2 | 1058.3 | 958.2 | 608.5 | 638.2 | 0. | 173.1 | 865.8 | 887.9 |
| 8 | 609.1 | 673.6 | 1049.7 | 958.5 | 609.1 | 650.5 | 0. | 175.1 | 854.9 | 879.1 |
| 9 | 590.2 | 750.4 | 940.9 | 881.8 | 590.2 | 690.7 | 0. | 237.5 | 732.8 | 785.8 |
| 10 | 553.0 | 777.7 | 838.5 | 803.1 | 553.0 | 704.8 | 0. | 328.8 | 630.3 | 713.9 |
| 11 | 541.2 | 811.2 | 806.8 | 766.8 | 541.2 | 707.3 | 0. | 397.5 | 598.4 | 693.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.524 | 0.654 | 1.123 | 0.985 | 0.524 | 0.623 | 1.212 | 1.322 | 0.812 |
| 2 | 0.528 | 0.588 | 1.105 | 1.037 | 0.528 | 0.582 | 1.117 | 1.332 | 0.672 |
| 3 | 0.556 | 0.595 | 1.045 | 0.942 | 0.556 | 0.581 | 1.066 | 1.341 | 0.546 |
| 4 | 0.562 | 0.586 | 1.009 | 0.894 | 0.562 | 0.569 | 1.035 | 1.325 | 0.422 |
| 5 | 0.563 | 0.578 | 0.999 | 0.868 | 0.563 | 0.557 | 1.014 | 1.324 | 0.332 |
| 6 | 0.563 | 0.583 | 0.989 | 0.865 | 0.563 | 0.563 | 1.024 | 1.310 | 0.360 |
| 7 | 0.562 | 0.596 | 0.978 | 0.864 | 0.562 | 0.576 | 1.049 | 1.297 | 0.443 |
| 8 | 0.563 | 0.609 | 0.970 | 0.866 | 0.563 | 0.588 | 1.068 | 1.288 | 0.514 |
| 9 | 0.544 | 0.660 | 0.868 | 0.797 | 0.544 | 0.625 | 1.170 | 1.167 | 0.795 |
| 10 | 0.508 | 0.702 | 0.770 | 0.725 | 0.508 | 0.636 | 1.274 | 1.041 | 0.864 |
| 11 | 0.497 | 0.735 | 0.740 | 0.693 | 0.497 | 0.639 | 1.307 | 0.993 | 0.900 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 0.6 | -1.6 | 2.1 | 0.165 | 0.074 | 0.056 | 0.015 | 0.012 |
| 2 | 9.11 | 11.70 | 0.9 | -1.7 | 7.8 | 0.074 | 0.081 | 0.064 | 0.015 | 0.011 |
| 3 | 27.14 | 30.86 | 1.7 | -2.1 | 7.0 | 0.118 | 0.146 | 0.133 | 0.026 | 0.024 |
| 4 | 36.50 | 40.42 | 2.1 | -2.3 | 8.1 | 0.133 | 0.206 | 0.197 | 0.037 | 0.035 |
| 5 | 38.89 | 42.85 | 2.2 | -2.3 | 8.8 | 0.154 | 0.247 | 0.238 | 0.043 | 0.042 |
| 6 | 41.29 | 45.22 | 2.3 | -2.3 | 9.1 | 0.146 | 0.247 | 0.240 | 0.044 | 0.042 |
| 7 | 43.91 | 47.86 | 2.4 | -2.3 | 8.4 | 0.139 | 0.224 | 0.218 | 0.040 | 0.039 |
| 8 | 46.00 | 50.03 | 2.6 | -2.3 | 8.7 | 0.131 | 0.195 | 0.190 | 0.035 | 0.034 |
| 9 | 68.55 | 71.83 | 3.6 | -2.3 | 9.6 | 0.122 | 0.119 | 0.119 | 0.021 | 0.021 |
| 10 | 86.92 | 88.33 | 4.1 | -2.5 | 9.8 | 0.125 | 0.116 | 0.116 | 0.020 | 0.020 |
| 11 | 92.79 | 93.11 | 4.0 | -2.7 | 6.5 | 0.146 | 0.098 | 0.098 | 0.016 | 0.016 |

TABLE XIII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 80 PERCENT DESIGN SPEED

(b) Reading 965

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 21.9 | 62.4 | 54.7 | 518.7 | 564.8 | 14.69 | 18.74 |
| 2 | 9.440 | 9.322 | 0. | 22.5 | 61.7 | 53.8 | 518.7 | 562.5 | 14.69 | 18.73 |
| 3 | 8.559 | 8.588 | 0. | 25.1 | 58.1 | 49.1 | 518.7 | 564.1 | 14.69 | 18.70 |
| 4 | 8.102 | 8.222 | 0. | 25.4 | 56.4 | 49.2 | 518.7 | 558.6 | 14.69 | 18.01 |
| 5 | 7.985 | 8.129 | 0. | 25.1 | 56.0 | 50.3 | 518.7 | 558.8 | 14.69 | 17.61 |
| 6 | 7.868 | 8.038 | 0. | 25.4 | 55.6 | 49.4 | 518.7 | 559.0 | 14.69 | 17.68 |
| 7 | 7.740 | 7.937 | 0. | 24.2 | 55.2 | 48.4 | 518.7 | 558.6 | 14.69 | 17.89 |
| 8 | 7.638 | 7.854 | 0. | 23.9 | 54.8 | 46.9 | 518.7 | 558.5 | 14.69 | 18.11 |
| 9 | 6.546 | 7.019 | 0. | 25.1 | 51.4 | 37.9 | 518.7 | 560.0 | 14.69 | 18.76 |
| 10 | 5.639 | 6.387 | 0. | 29.0 | 48.9 | 27.6 | 518.7 | 564.5 | 14.69 | 19.38 |
| 11 | 5.352 | 6.204 | 0. | 32.6 | 48.4 | 21.6 | 518.7 | 566.7 | 14.69 | 19.76 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 566.0 | 631.8 | 1220.7 | 1015.6 | 566.0 | 586.2 | 0. | 235.7 | 1081.5 | 1065.0 |
| 2 | 570.7 | 635.2 | 1201.9 | 995.1 | 570.7 | 587.5 | 0. | 241.4 | 1057.8 | 1044.5 |
| 3 | 596.7 | 655.1 | 1128.9 | 905.7 | 596.7 | 593.4 | 0. | 277.4 | 958.4 | 961.6 |
| 4 | 603.8 | 624.4 | 1090.4 | 863.9 | 603.8 | 564.3 | 0. | 267.4 | 908.0 | 921.5 |
| 5 | 604.6 | 601.1 | 1080.5 | 853.0 | 604.6 | 544.3 | 0. | 254.9 | 895.5 | 911.7 |
| 6 | 603.8 | 607.0 | 1068.1 | 842.5 | 603.8 | 548.3 | 0. | 260.4 | 881.1 | 900.1 |
| 7 | 603.2 | 619.7 | 1056.4 | 850.9 | 603.2 | 565.5 | 0. | 253.5 | 867.3 | 889.4 |
| 8 | 602.6 | 635.8 | 1046.6 | 850.9 | 602.6 | 581.0 | 0. | 258.3 | 855.7 | 879.9 |
| 9 | 585.6 | 696.0 | 938.8 | 798.7 | 585.6 | 630.1 | 0. | 295.9 | 735.8 | 786.8 |
| 10 | 550.3 | 758.1 | 837.4 | 748.2 | 550.3 | 662.9 | 0. | 367.9 | 631.2 | 714.9 |
| 11 | 531.5 | 795.8 | 800.4 | 720.8 | 531.5 | 670.4 | 0. | 428.8 | 598.5 | 693.8 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.521 | 0.559 | 1.123 | 0.899 | 0.521 | 0.519 | 1.036 | 1.328 | 0.809 |
| 2 | 0.525 | 0.564 | 1.106 | 0.883 | 0.525 | 0.521 | 1.029 | 1.340 | 0.850 |
| 3 | 0.550 | 0.581 | 1.042 | 0.804 | 0.550 | 0.527 | 0.995 | 1.349 | 0.814 |
| 4 | 0.557 | 0.555 | 1.007 | 0.768 | 0.557 | 0.502 | 0.935 | 1.334 | 0.779 |
| 5 | 0.558 | 0.533 | 0.998 | 0.757 | 0.558 | 0.483 | 0.900 | 1.332 | 0.686 |
| 6 | 0.557 | 0.539 | 0.986 | 0.748 | 0.557 | 0.487 | 0.908 | 1.317 | 0.698 |
| 7 | 0.557 | 0.551 | 0.975 | 0.756 | 0.557 | 0.503 | 0.937 | 1.304 | 0.751 |
| 8 | 0.556 | 0.566 | 0.966 | 0.758 | 0.556 | 0.517 | 0.964 | 1.295 | 0.802 |
| 9 | 0.540 | 0.623 | 0.865 | 0.715 | 0.540 | 0.564 | 1.076 | 1.172 | 0.908 |
| 10 | 0.505 | 0.680 | 0.769 | 0.672 | 0.505 | 0.595 | 1.205 | 1.044 | 0.933 |
| 11 | 0.487 | 0.716 | 0.734 | 0.649 | 0.487 | 0.603 | 1.261 | 0.998 | 0.954 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 0.8 | -1.5 | 6.1 | 0.231 | 0.097 | 0.079 | 0.018 | 0.015 |
| 2 | 9.11 | 11.70 | 1.1 | -1.5 | 5.7 | 0.236 | 0.074 | 0.056 | 0.014 | 0.011 |
| 3 | 27.14 | 30.86 | 1.9 | -1.9 | 4.2 | 0.270 | 0.104 | 0.090 | 0.020 | 0.017 |
| 4 | 36.50 | 40.42 | 2.3 | -2.0 | 6.8 | 0.277 | 0.115 | 0.105 | 0.021 | 0.019 |
| 5 | 38.89 | 42.85 | 2.5 | -2.0 | 9.1 | 0.276 | 0.165 | 0.156 | 0.029 | 0.027 |
| 6 | 41.29 | 45.22 | 2.6 | -2.0 | 9.1 | 0.278 | 0.163 | 0.156 | 0.029 | 0.027 |
| 7 | 43.91 | 47.86 | 2.7 | -2.0 | 8.5 | 0.259 | 0.136 | 0.130 | 0.024 | 0.023 |
| 8 | 46.00 | 50.03 | 2.9 | -2.0 | 8.3 | 0.253 | 0.110 | 0.105 | 0.020 | 0.019 |
| 9 | 68.35 | 71.83 | 3.9 | -2.1 | 9.1 | 0.225 | 0.063 | 0.063 | 0.011 | 0.011 |
| 10 | 86.92 | 88.35 | 4.3 | -2.3 | 8.7 | 0.197 | 0.062 | 0.062 | 0.011 | 0.011 |
| 11 | 92.79 | 93.11 | 4.5 | -2.2 | 5.3 | 0.204 | 0.048 | 0.048 | 0.008 | 0.008 |

TABLE XIII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 80 PERCENT DESIGN SPEED

(c) Reading 966

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 29.3 | 62.5 | 53.2 | 518.7 | 575.8 | 14.69 | 20.34 |
| 2 | 9.440 | 9.322 | 0. | 28.9 | 61.9 | 52.5 | 518.7 | 573.7 | 14.69 | 20.30 |
| 3 | 8.559 | 8.588 | 0. | 31.5 | 58.4 | 47.5 | 518.7 | 574.8 | 14.69 | 20.19 |
| 4 | 8.102 | 8.222 | 0. | 31.9 | 56.7 | 47.3 | 518.7 | 569.3 | 14.69 | 19.47 |
| 5 | 7.985 | 8.129 | 0. | 32.2 | 56.4 | 48.2 | 518.7 | 568.4 | 14.69 | 19.12 |
| 6 | 7.868 | 8.038 | 0. | 31.8 | 56.0 | 47.6 | 518.7 | 566.3 | 14.69 | 19.16 |
| 7 | 7.740 | 7.937 | 0. | 30.9 | 55.6 | 46.6 | 518.7 | 564.9 | 14.69 | 19.29 |
| 8 | 7.638 | 7.854 | 0. | 30.0 | 55.3 | 45.8 | 518 7 | 564.8 | 14.69 | 19.43 |
| 9 | 6.546 | 7.019 | 0. | 30.8 | 52.1 | 37.2 | 518.7 | 564.8 | 14.69 | 19.57 |
| 10 | 5.639 | 6.387 | 0. | 33.3 | 49.8 | 27.3 | 518.7 | 567.4 | 14.69 | 19.80 |
| 11 | 5.352 | 6.204 | 0. | 35.6 | 49.4 | 21.7 | 518.7 | 571.7 | 14.69 | 20.07 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 561.2 | 642.4 | 1217.2 | 935.6 | 561.2 | 560.3 | 0. | 314.3 | 1080.1 | 1063.6 |
| 2 | 563.8 | 642.2 | 1196.3 | 922.2 | 563.8 | 562.0 | 0. | 310.8 | 1055.2 | 1042.0 |
| 3 | 589.6 | 661.7 | 1125.8 | 835.2 | 589.6 | 563.9 | 0. | 346.2 | 959.1 | 962.3 |
| 4 | 594.2 | 634.2 | 1082.6 | 794.0 | 594.2 | 538.5 | 0. | 334.9 | 904.9 | 918.3 |
| 5 | 594.0 | 614.8 | 1072.4 | 780.6 | 594.0 | 520.5 | 0. | 327.3 | 892.9 | 909.0 |
| 6 | 594.0 | 616.7 | 1061.5 | 777.4 | 594.0 | 524.2 | 0. | 324.8 | 879.8 | 898.8 |
| 7 | 592.5 | 625.6 | 1049.6 | 780.9 | 592.5 | 536.8 | 0. | 321.4 | 866.4 | 888.5 |
| 8 | 592.9 | 632.2 | 1040.9 | 785.8 | 592.9 | 547.6 | 0. | 316.0 | 855.5 | 879.7 |
| 9 | 571.0 | 675.2 | 928.9 | 728.3 | 571.0 | 580.2 | 0. | 345.5 | 752.7 | 785.6 |
| 10 | 534.0 | 729.5 | 827.2 | 686.5 | 534.0 | 610.0 | 0. | 400.5 | 631.7 | 715.5 |
| 11 | 513.6 | 765.3 | 788.7 | 669.4 | 513.6 | 621.9 | 0. | 446.0 | 598.5 | 693.8 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.516 | 0.563 | 1.119 | 0.820 | 0.516 | 0.491 | 0.998 | 1.331 | 0.884 |
| 2 | 0.518 | 0.564 | 1.100 | 0.810 | 0.518 | 0.494 | 0.997 | 1.344 | 0.913 |
| 3 | 0.544 | 0.582 | 1.038 | 0.734 | 0.544 | 0.496 | 0.957 | 1.359 | 0.877 |
| 4 | 0.548 | 0.559 | 0.998 | 0.700 | 0.548 | 0.475 | 0.906 | 1.343 | 0.857 |
| 5 | 0.548 | 0.541 | 0.989 | 0.687 | 0.548 | 0.458 | 0.876 | 1.335 | 0.816 |
| 6 | 0.548 | 0.544 | 0.979 | 0.686 | 0.548 | 0.463 | 0.883 | 1.321 | 0.857 |
| 7 | 0.546 | 0.553 | 0.968 | 0.691 | 0.546 | 0.475 | 0.906 | 1.310 | 0.907 |
| 8 | 0.547 | 0.559 | 0.960 | 0.695 | 0.547 | 0.485 | 0.924 | 1.301 | 0.935 |
| 9 | 0.525 | 0.600 | 0.855 | 0.647 | 0.525 | 0.516 | 1.016 | 1.177 | 0.959 |
| 10 | 0.490 | 0.651 | 0.759 | 0.612 | 0.490 | 0.544 | 1.142 | 1.053 | 0.946 |
| 11 | 0.470 | 0.683 | 0.722 | 0.597 | 0.470 | 0.555 | 1.211 | 1.006 | 0.912 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.0 | -1.3 | 4.6 | 0.315 | 0.072 | 0.054 | 0.014 | 0.011 |
| 2 | 9.11 | 11.70 | 1.4 | -1.2 | 4.4 | 0.312 | 0.053 | 0.036 | 0.010 | 0.007 |
| 3 | 27.14 | 30.86 | 2.3 | -1.6 | 2.6 | 0.348 | 0.084 | 0.069 | 0.017 | 0.014 |
| 4 | 36.50 | 40.42 | 2.7 | -1.7 | 4.9 | 0.353 | 0.094 | 0.084 | 0.018 | 0.016 |
| 5 | 38.89 | 42.85 | 2.9 | -1.6 | 6.9 | 0.357 | 0.120 | 0.111 | 0.022 | 0.020 |
| 6 | 41.29 | 45.22 | 3.0 | -1.6 | 7.3 | 0.352 | 0.092 | 0.085 | 0.017 | 0.015 |
| 7 | 43.91 | 47.86 | 3.2 | -1.6 | 6.7 | 0.339 | 0.059 | 0.053 | 0.011 | 0.010 |
| 8 | 46.00 | 50.03 | 3.3 | -1.6 | 7.2 | 0.326 | 0.042 | 0.037 | 0.008 | 0.007 |
| 9 | 68.35 | 71.83 | 4.5 | -1.4 | 8.4 | 0.303 | 0.032 | 0.032 | 0.006 | 0.006 |
| 10 | 86.92 | 88.35 | 5.2 | -1.4 | 8.4 | 0.269 | 0.054 | 0.054 | 0.009 | 0.009 |
| 11 | 92.79 | 93.11 | 5.4 | -1.2 | 5.5 | 0.262 | 0.103 | 0.103 | 0.017 | 0.017 |

TABLE XIII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 80 PERCENT DESIGN SPEED

(d) Reading 967

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 33.1 | 63.0 | 52.9 | 518.7 | 581.6 | 14.69 | 21.13 |
| 2 | 9.440 | 9.322 | 0. | 31.8 | 62.2 | 52.1 | 518.7 | 578.8 | 14.69 | 21.09 |
| 3 | 8.559 | 8.588 | 0. | 34.4 | 58.8 | 46.9 | 518.7 | 579.0 | 14.69 | 20.92 |
| 4 | 8.102 | 8.222 | 0. | 35.2 | 57.3 | 46.0 | 518.7 | 575.0 | 14.69 | 20.41 |
| 5 | 7.985 | 8.129 | 0. | 35.7 | 56.9 | 46.4 | 518.7 | 573.7 | 14.69 | 20.12 |
| 6 | 7.868 | 8.038 | 0. | 34.9 | 56.5 | 46.3 | 518.7 | 571.2 | 14.69 | 19.99 |
| 7 | 7.740 | 7.937 | 0. | 34.5 | 56.2 | 45.5 | 518.7 | 570.1 | 14.69 | 20.03 |
| 8 | 7.638 | 7.854 | 0. | 33.2 | 55.9 | 44.9 | 518.7 | 569.7 | 14.69 | 20.09 |
| 9 | 6.546 | 7.019 | 0. | 33.9 | 52.8 | 36.5 | 518.7 | 567.8 | 14.69 | 20.05 |
| 10 | 5.639 | 6.387 | 0. | 36.5 | 50.6 | 26.3 | 518.7 | 569.2 | 14.69 | 20.13 |
| 11 | 5.352 | 6.204 | 0. | 38.0 | 49.6 | 21.3 | 518.7 | 573.1 | 14.69 | 20.35 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 552.1 | 643.4 | 1214.4 | 893.7 | 552.1 | 538.7 | 0. | 352.1 | 1081.6 | 1065.1 |
| 2 | 557.1 | 644.3 | 1194.0 | 891.5 | 557.1 | 547.7 | 0. | 339.4 | 1056.0 | 1042.8 |
| 3 | 578.4 | 663.0 | 1116.9 | 800.2 | 578.4 | 547.0 | 0. | 374.7 | 955.5 | 958.7 |
| 4 | 581.1 | 646.6 | 1077.1 | 761.0 | 581.1 | 528.4 | 0. | 372.7 | 906.8 | 920.5 |
| 5 | 583.4 | 633.8 | 1067.5 | 746.2 | 583.4 | 514.7 | 0. | 369.9 | 894.0 | 910.1 |
| 6 | 580.6 | 628.1 | 1053.4 | 744.5 | 580.6 | 514.9 | 0. | 360.0 | 878.9 | 897.9 |
| 7 | 580.1 | 631.5 | 1042.3 | 743.4 | 580.1 | 520.7 | 0. | 357.4 | 865.9 | 888.0 |
| 8 | 578.8 | 635.6 | 1032.2 | 751.6 | 578.8 | 532.0 | 0. | 347.9 | 854.6 | 878.8 |
| 9 | 555.6 | 670.1 | 919.2 | 692.0 | 555.6 | 556.3 | 0. | 373.6 | 732.2 | 785.1 |
| 10 | 518.1 | 721.4 | 816.6 | 646.9 | 518.1 | 580.2 | 0. | 428.8 | 631.2 | 714.9 |
| 11 | 509.5 | 752.6 | 786.2 | 656.7 | 509.5 | 593.5 | 0. | 463.1 | 598.8 | 694.1 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.507 | 0.561 | 1.115 | 0.779 | 0.507 | 0.470 | 0.976 | 1.343 | 0.902 |
| 2 | 0.512 | 0.563 | 1.097 | 0.780 | 0.512 | 0.479 | 0.983 | 1.353 | 0.938 |
| 3 | 0.533 | 0.581 | 1.029 | 0.701 | 0.533 | 0.479 | 0.946 | 1.368 | 0.913 |
| 4 | 0.535 | 0.568 | 0.992 | 0.668 | 0.535 | 0.464 | 0.909 | 1.357 | 0.906 |
| 5 | 0.538 | 0.556 | 0.984 | 0.655 | 0.538 | 0.452 | 0.882 | 1.345 | 0.885 |
| 6 | 0.535 | 0.552 | 0.970 | 0.655 | 0.535 | 0.453 | 0.887 | 1.329 | 0.907 |
| 7 | 0.534 | 0.556 | 0.960 | 0.655 | 0.534 | 0.458 | 0.898 | 1.318 | 0.934 |
| 8 | 0.533 | 0.560 | 0.951 | 0.662 | 0.533 | 0.469 | 0.919 | 1.309 | 0.951 |
| 9 | 0.511 | 0.594 | 0.845 | 0.613 | 0.511 | 0.493 | 1.001 | 1.185 | 0.980 |
| 10 | 0.475 | 0.642 | 0.748 | 0.576 | 0.475 | 0.516 | 1.120 | 1.060 | 0.966 |
| 11 | 0.466 | 0.670 | 0.719 | 0.566 | 0.466 | 0.528 | 1.164 | 1.009 | 0.931 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.4 | -0.9 | 4.3 | 0.358 | 0.067 | 0.048 | 0.013 | 0.009 |
| 2 | 9.11 | 11.70 | 1.7 | -0.9 | 4.0 | 0.344 | 0.041 | 0.023 | 0.008 | 0.004 |
| 3 | 27.14 | 30.86 | 2.6 | -1.2 | 2.0 | 0.382 | 0.065 | 0.050 | 0.013 | 0.010 |
| 4 | 36.50 | 40.42 | 3.3 | -1.0 | 3.6 | 0.391 | 0.069 | 0.058 | 0.013 | 0.011 |
| 5 | 38.89 | 42.85 | 3.4 | -1.1 | 5.1 | 0.397 | 0.084 | 0.075 | 0.016 | 0.014 |
| 6 | 41.29 | 45.22 | 3.5 | -1.1 | 5.9 | 0.387 | 0.066 | 0.059 | 0.012 | 0.011 |
| 7 | 43.91 | 47.86 | 3.7 | -1.0 | 5.7 | 0.379 | 0.047 | 0.041 | 0.009 | 0.008 |
| 8 | 46.00 | 50.03 | 3.9 | -0.9 | 6.4 | 0.362 | 0.035 | 0.030 | 0.007 | 0.006 |
| 9 | 68.35 | 71.83 | 5.2 | -0.7 | 7.7 | 0.342 | 0.017 | 0.017 | 0.003 | 0.003 |
| 10 | 86.92 | 88.33 | 6.0 | -0.6 | 7.4 | 0.315 | 0.036 | 0.036 | 0.006 | 0.006 |
| 11 | 92.79 | 93.11 | 5.7 | -1.0 | 5.0 | 0.305 | 0.084 | 0.084 | 0.014 | 0.014 |

TABLE XIII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 80 PERCENT DESIGN SPEED

(e) Reading 968

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 39.2 | 64.6 | 52.5 | 518.7 | 590.4 | 14.69 | 22.21 |
| 2 | 9.440 | 9.322 | 0. | 37.8 | 64.1 | 51.8 | 518.7 | 588.6 | 14.69 | 22.14 |
| 3 | 8.559 | 8.588 | 0. | 39.5 | 60.9 | 47.2 | 518.7 | 585.4 | 14.69 | 21.82 |
| 4 | 8.102 | 8.222 | 0. | 42.1 | 59.6 | 45.7 | 518.7 | 583.5 | 14.69 | 21.34 |
| 5 | 7.985 | 8.129 | 0. | 42.3 | 59.3 | 46.2 | 518.7 | 582.2 | 14.69 | 21.05 |
| 6 | 7.868 | 8.038 | 0. | 42.5 | 59.0 | 46.1 | 518.7 | 580.0 | 14.69 | 20.93 |
| 7 | 7.740 | 7.937 | 0. | 41.6 | 58.6 | 45.2 | 518.7 | 578.9 | 14.69 | 20.89 |
| 8 | 7.638 | 7.854 | 0. | 41.0 | 58.3 | 44.8 | 518.7 | 577.5 | 14.69 | 20.87 |
| 9 | 6.546 | 7.019 | 0. | 40.7 | 55.6 | 35.6 | 518.7 | 574.6 | 14.69 | 20.74 |
| 10 | 5.639 | 6.387 | 0. | 41.9 | 52.8 | 25.0 | 518.7 | 573.4 | 14.69 | 20.72 |
| 11 | 5.352 | 6.204 | 0. | 43.2 | 52.6 | 20.0 | 518.7 | 576.5 | 14.69 | 20.85 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 511.9 | 647.1 | 1195.1 | 824.0 | 511.9 | 501.2 | 0. | 409.4 | 1079.9 | 1063.5 |
| 2 | 513.4 | 645.1 | 1173.7 | 824.0 | 513.4 | 509.9 | 0. | 395.1 | 1055.5 | 1042.3 |
| 3 | 531.1 | 653.0 | 1095.3 | 741.0 | 531.1 | 503.8 | 0. | 415.5 | 955.6 | 958.8 |
| 4 | 530.7 | 642.1 | 1050.2 | 682.4 | 530.7 | 476.2 | 0. | 430.9 | 906.3 | 919.7 |
| 5 | 530.5 | 629.3 | 1038.6 | 672.5 | 530.5 | 465.5 | 0. | 423.6 | 892.9 | 909.0 |
| 6 | 529.2 | 623.6 | 1026.8 | 662.4 | 529.2 | 459.5 | 0. | 421.8 | 879.9 | 898.9 |
| 7 | 527.7 | 625.0 | 1012.1 | 663.2 | 527.7 | 467.3 | 0. | 415.0 | 863.6 | 885.6 |
| 8 | 527.1 | 624.4 | 1003.3 | 664.2 | 527.1 | 471.2 | 0. | 409.6 | 853.6 | 877.8 |
| 9 | 501.8 | 656.3 | 887.2 | 612.1 | 501.8 | 497.6 | 0. | 428.0 | 731.6 | 784.5 |
| 10 | 478.4 | 702.2 | 790.5 | 577.1 | 478.4 | 522.9 | 0. | 468.6 | 629.3 | 712.8 |
| 11 | 458.3 | 730.8 | 754.0 | 567.3 | 458.3 | 533.1 | 0. | 499.9 | 598.7 | 694.0 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.469 | 0.560 | 1.094 | 0.713 | 0.469 | 0.434 | 0.979 | 1.388 | 0.906 |
| 2 | 0.470 | 0.559 | 1.074 | 0.714 | 0.470 | 0.442 | 0.993 | 1.405 | 0.922 |
| 3 | 0.487 | 0.568 | 1.002 | 0.645 | 0.487 | 0.438 | 0.949 | 1.434 | 0.929 |
| 4 | 0.486 | 0.559 | 0.963 | 0.594 | 0.486 | 0.415 | 0.897 | 1.393 | 0.900 |
| 5 | 0.486 | 0.548 | 0.952 | 0.585 | 0.486 | 0.405 | 0.877 | 1.381 | 0.883 |
| 6 | 0.485 | 0.544 | 0.941 | 0.577 | 0.485 | 0.401 | 0.868 | 1.367 | 0.901 |
| 7 | 0.484 | 0.545 | 0.928 | 0.579 | 0.484 | 0.408 | 0.886 | 1.350 | 0.911 |
| 8 | 0.483 | 0.546 | 0.919 | 0.580 | 0.483 | 0.412 | 0.894 | 1.343 | 0.929 |
| 9 | 0.459 | 0.577 | 0.811 | 0.538 | 0.459 | 0.457 | 0.992 | 1.215 | 0.961 |
| 10 | 0.437 | 0.621 | 0.722 | 0.510 | 0.437 | 0.462 | 1.093 | 1.076 | 0.978 |
| 11 | 0.418 | 0.646 | 0.687 | 0.502 | 0.418 | 0.472 | 1.163 | 1.033 | 0.945 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 3.1 | 0.8 | 3.9 | 0.422 | 0.073 | 0.051 | 0.015 | 0.010 |
| 2 | 9.11 | 11.70 | 3.5 | 0.9 | 3.7 | 0.405 | 0.061 | 0.039 | 0.012 | 0.008 |
| 3 | 27.14 | 30.86 | 4.7 | 0.9 | 2.3 | 0.434 | 0.059 | 0.040 | 0.012 | 0.008 |
| 4 | 36.50 | 40.42 | 5.6 | 1.2 | 3.3 | 0.465 | 0.086 | 0.075 | 0.017 | 0.015 |
| 5 | 38.89 | 42.85 | 5.8 | 1.3 | 4.9 | 0.466 | 0.101 | 0.091 | 0.019 | 0.017 |
| 6 | 41.29 | 45.22 | 5.9 | 1.3 | 5.8 | 0.468 | 0.085 | 0.077 | 0.016 | 0.014 |
| 7 | 43.91 | 47.86 | 6.1 | 1.4 | 5.4 | 0.455 | 0.077 | 0.070 | 0.014 | 0.013 |
| 8 | 46.00 | 50.03 | 6.4 | 1.5 | 6.2 | 0.447 | 0.060 | 0.055 | 0.011 | 0.010 |
| 9 | 68.35 | 71.83 | 8.0 | 2.1 | 6.8 | 0.423 | 0.039 | 0.039 | 0.007 | 0.007 |
| 10 | 86.92 | 88.33 | 8.1 | 1.6 | 6.2 | 0.391 | 0.026 | 0.026 | 0.005 | 0.005 |
| 11 | 92.79 | 93.11 | 8.6 | 2.0 | 5.8 | 0.377 | 0.076 | 0.076 | 0.013 | 0.013 |

TABLE XIII. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 80 PERCENT DESIGN SPEED

(f) Reading 969

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 42.5 | 66.2 | 52.7 | 518.7 | 595.5 | 14.69 | 22.52 |
| 2 | 9.440 | 9.322 | 0. | 41.9 | 65.7 | 52.1 | 518.7 | 593.0 | 14.69 | 22.42 |
| 3 | 8.559 | 8.588 | 0. | 43.5 | 62.9 | 47.9 | 518.7 | 588.6 | 14.69 | 22.00 |
| 4 | 8.102 | 8.222 | 0. | 46.5 | 61.6 | 46.2 | 518.7 | 588.0 | 14.69 | 21.53 |
| 5 | 7.985 | 8.129 | 0. | 47.7 | 61.3 | 46.3 | 518.7 | 587.3 | 14.69 | 21.32 |
| 6 | 7.868 | 8.038 | 0. | 48.2 | 61.0 | 45.3 | 518.7 | 586.7 | 14.69 | 21.26 |
| 7 | 7.740 | 7.937 | 0. | 47.2 | 60.6 | 44.6 | 518.7 | 585.1 | 14.69 | 21.25 |
| 8 | 7.638 | 7.854 | 0. | 46.2 | 60.3 | 43.7 | 518.7 | 583.9 | 14.69 | 21.27 |
| 9 | 6.546 | 7.019 | 0. | 44.5 | 57.4 | 34.4 | 518.7 | 577.0 | 14.69 | 21.10 |
| 10 | 5.639 | 6.387 | 0. | 43.8 | 54.9 | 25.1 | 518.7 | 574.2 | 14.69 | 20.93 |
| 11 | 5.352 | 6.204 | 0. | 45.4 | 53.8 | 19.2 | 518.7 | 578.6 | 14.69 | 21.07 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 474.1 | 645.5 | 1176.3 | 784.5 | 474.1 | 475.7 | 0. | 436.4 | 1076.6 | 1060.2 |
| 2 | 476.8 | 641.3 | 1157.4 | 776.7 | 476.8 | 477.2 | 0. | 428.6 | 1054.6 | 1041.4 |
| 3 | 489.1 | 642.7 | 1073.8 | 695.5 | 489.1 | 466.0 | 0. | 442.9 | 956.0 | 959.2 |
| 4 | 488.2 | 635.2 | 1026.2 | 631.0 | 488.2 | 437.1 | 0. | 461.0 | 902.7 | 916.0 |
| 5 | 488.0 | 629.0 | 1016.5 | 612.0 | 488.0 | 423.0 | 0. | 465.6 | 891.7 | 907.8 |
| 6 | 486.9 | 632.5 | 1003.9 | 598.3 | 486.9 | 421.2 | 0. | 471.9 | 877.9 | 896.9 |
| 7 | 486.0 | 631.3 | 991.0 | 602.4 | 486.0 | 429.2 | 0. | 463.0 | 863.7 | 885.6 |
| 8 | 485.8 | 634.0 | 981.6 | 606.8 | 485.8 | 438.7 | 0. | 457.8 | 853.0 | 877.1 |
| 9 | 467.2 | 658.5 | 867.2 | 569.1 | 467.2 | 469.5 | 0. | 461.7 | 730.6 | 783.4 |
| 10 | 442.9 | 692.2 | 770.0 | 551.7 | 442.9 | 499.5 | 0. | 479.2 | 629.9 | 713.4 |
| 11 | 437.4 | 723.2 | 740.1 | 537.4 | 437.4 | 507.5 | 0. | 515.3 | 597.0 | 692.1 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.433 | 0.556 | 1.073 | 0.676 | 0.433 | 0.410 | 1.003 | 1.430 | 0.877 |
| 2 | 0.435 | 0.554 | 1.056 | 0.670 | 0.435 | 0.412 | 1.001 | 1.450 | 0.896 |
| 3 | 0.447 | 0.557 | 0.981 | 0.603 | 0.447 | 0.404 | 0.953 | 1.473 | 0.907 |
| 4 | 0.446 | 0.550 | 0.937 | 0.547 | 0.446 | 0.379 | 0.895 | 1.418 | 0.863 |
| 5 | 0.446 | 0.545 | 0.929 | 0.530 | 0.446 | 0.367 | 0.867 | 1.410 | 0.848 |
| 6 | 0.445 | 0.549 | 0.917 | 0.519 | 0.445 | 0.365 | 0.865 | 1.395 | 0.849 |
| 7 | 0.444 | 0.548 | 0.905 | 0.523 | 0.444 | 0.373 | 0.883 | 1.381 | 0.868 |
| 8 | 0.444 | 0.551 | 0.896 | 0.528 | 0.444 | 0.381 | 0.903 | 1.372 | 0.886 |
| 9 | 0.426 | 0.578 | 0.791 | 0.499 | 0.426 | 0.412 | 1.005 | 1.234 | 0.969 |
| 10 | 0.403 | 0.611 | 0.701 | 0.487 | 0.403 | 0.441 | 1.128 | 1.096 | 0.995 |
| 11 | 0.398 | 0.638 | 0.673 | 0.474 | 0.398 | 0.448 | 1.160 | 1.040 | 0.938 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 4.7 | 2.4 | 4.0 | 0.453 | 0.104 | 0.078 | 0.021 | 0.016 |
| 2 | 9.11 | 11.70 | 5.2 | 2.6 | 4.0 | 0.447 | 0.088 | 0.061 | 0.017 | 0.012 |
| 3 | 27.14 | 30.86 | 6.7 | 2.9 | 3.0 | 0.473 | 0.083 | 0.061 | 0.016 | 0.012 |
| 4 | 36.50 | 40.42 | 7.5 | 3.2 | 3.7 | 0.511 | 0.129 | 0.117 | 0.025 | 0.023 |
| 5 | 38.89 | 42.85 | 7.8 | 3.3 | 5.0 | 0.525 | 0.144 | 0.133 | 0.027 | 0.025 |
| 6 | 41.29 | 45.22 | 8.0 | 3.4 | 4.9 | 0.533 | 0.146 | 0.137 | 0.028 | 0.026 |
| 7 | 43.91 | 47.86 | 8.2 | 3.4 | 4.7 | 0.518 | 0.127 | 0.120 | 0.024 | 0.023 |
| 8 | 46.00 | 50.03 | 8.4 | 3.5 | 5.1 | 0.506 | 0.110 | 0.104 | 0.021 | 0.020 |
| 9 | 68.35 | 71.83 | 9.9 | 3.9 | 5.6 | 0.468 | 0.034 | 0.034 | 0.006 | 0.006 |
| 10 | 86.92 | 88.33 | 10.3 | 3.7 | 6.3 | 0.411 | 0.007 | 0.007 | 0.001 | 0.001 |
| 11 | 92.79 | 93.11 | 9.9 | 3.2 | 5.0 | 0.410 | 0.090 | 0.090 | 0.016 | 0.016 |

TABLE XIII. - Concluded. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 80 PERCENT DESIGN SPEED

(g) Reading 970

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 48.5 | 68.5 | 54.2 | 518.7 | 602.9 | 14.69 | 22.37 |
| 2 | 9.440 | 9.322 | 0. | 46.5 | 67.9 | 53.4 | 518.7 | 597.9 | 14.69 | 22.25 |
| 3 | 8.559 | 8.588 | 0. | 49.0 | 65.3 | 48.2 | 518.7 | 594.9 | 14.69 | 22.06 |
| 4 | 8.102 | 8.222 | 0. | 49.9 | 64.0 | 46.1 | 518.7 | 591.6 | 14.69 | 21.73 |
| 5 | 7.985 | 8.129 | 0. | 50.8 | 63.8 | 45.9 | 518.7 | 591.0 | 14.69 | 21.58 |
| 6 | 7.868 | 8.038 | 0. | 50.6 | 63.4 | 44.8 | 518.7 | 590.3 | 14.69 | 21.52 |
| 7 | 7.740 | 7.937 | 0. | 49.6 | 63.0 | 43.8 | 518.7 | 589.2 | 14.69 | 21.52 |
| 8 | 7.638 | 7.854 | 0. | 49.6 | 62.8 | 42.9 | 518.7 | 587.8 | 14.69 | 21.51 |
| 9 | 6.546 | 7.019 | 0. | 45.4 | 59.3 | 34.4 | 518.7 | 579.3 | 14.69 | 21.26 |
| 10 | 5.639 | 6.387 | 0. | 45.1 | 56.8 | 24.9 | 518.7 | 575.8 | 14.69 | 21.07 |
| 11 | 5.352 | 6.204 | 0. | 46.6 | 56.2 | 19.3 | 518.7 | 578.8 | 14.69 | 21.16 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 426.1 | 638.1 | 1161.8 | 722.8 | 426.1 | 422.7 | 0. | 478.1 | 1080.8 | 1064.4 |
| 2 | 428.6 | 631.8 | 1140.9 | 729.8 | 428.6 | 435.1 | 0. | 458.2 | 1057.3 | 1044.1 |
| 3 | 441.3 | 646.3 | 1055.0 | 635.8 | 441.3 | 424.1 | 0. | 487.8 | 958.3 | 961.6 |
| 4 | 442.4 | 641.7 | 1009.2 | 596.4 | 442.4 | 413.5 | 0. | 490.8 | 907.1 | 920.5 |
| 5 | 440.9 | 638.3 | 997.2 | 579.7 | 440.9 | 403.7 | 0. | 494.5 | 894.4 | 910.6 |
| 6 | 441.3 | 640.5 | 984.4 | 573.2 | 441.3 | 406.7 | 0. | 494.9 | 879.9 | 898.9 |
| 7 | 440.7 | 641.9 | 971.1 | 575.9 | 440.7 | 415.9 | 0. | 488.9 | 865.3 | 887.3 |
| 8 | 439.6 | 644.0 | 960.8 | 569.7 | 439.6 | 417.2 | 0. | 490.6 | 854.4 | 878.5 |
| 9 | 435.2 | 659.5 | 852.9 | 560.9 | 435.2 | 462.7 | 0. | 469.6 | 735.5 | 786.5 |
| 10 | 413.2 | 691.2 | 755.0 | 537.7 | 413.2 | 487.9 | 0. | 489.7 | 631.9 | 715.7 |
| 11 | 400.9 | 718.4 | 720.8 | 523.2 | 400.9 | 495.8 | 0. | 521.7 | 599.1 | 694.4 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.387 | 0.546 | 1.056 | 0.618 | 0.387 | 0.362 | 0.992 | 1.498 | 0.786 |
| 2 | 0.390 | 0.542 | 1.037 | 0.627 | 0.390 | 0.374 | 1.015 | 1.518 | 0.824 |
| 3 | 0.402 | 0.557 | 0.960 | 0.548 | 0.402 | 0.366 | 0.961 | 1.519 | 0.838 |
| 4 | 0.403 | 0.555 | 0.919 | 0.515 | 0.403 | 0.357 | 0.935 | 1.465 | 0.841 |
| 5 | 0.401 | 0.552 | 0.908 | 0.501 | 0.401 | 0.349 | 0.916 | 1.454 | 0.833 |
| 6 | 0.402 | 0.554 | 0.896 | 0.496 | 0.402 | 0.352 | 0.921 | 1.436 | 0.835 |
| 7 | 0.401 | 0.556 | 0.884 | 0.499 | 0.401 | 0.360 | 0.944 | 1.420 | 0.847 |
| 8 | 0.400 | 0.559 | 0.874 | 0.494 | 0.400 | 0.362 | 0.949 | 1.410 | 0.864 |
| 9 | 0.396 | 0.577 | 0.776 | 0.491 | 0.396 | 0.405 | 1.063 | 1.261 | 0.954 |
| 10 | 0.375 | 0.609 | 0.686 | 0.474 | 0.375 | 0.430 | 1.181 | 1.117 | 0.986 |
| 11 | 0.364 | 0.633 | 0.654 | 0.461 | 0.364 | 0.435 | 1.232 | 1.065 | 0.948 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 6.9 | 4.7 | 5.6 | 0.511 | 0.196 | 0.162 | 0.037 | 0.031 |
| 2 | 9.11 | 11.70 | 7.4 | 4.8 | 5.3 | 0.488 | 0.158 | 0.124 | 0.030 | 0.024 |
| 3 | 27.14 | 30.86 | 9.1 | 5.3 | 3.3 | 0.533 | 0.159 | 0.133 | 0.031 | 0.026 |
| 4 | 36.50 | 40.42 | 10.0 | 5.6 | 3.7 | 0.546 | 0.161 | 0.146 | 0.031 | 0.028 |
| 5 | 38.89 | 42.85 | 10.3 | 5.8 | 4.6 | 0.556 | 0.171 | 0.158 | 0.033 | 0.030 |
| 6 | 41.29 | 45.22 | 10.4 | 5.7 | 4.5 | 0.556 | 0.171 | 0.160 | 0.033 | 0.031 |
| 7 | 43.91 | 47.86 | 10.6 | 5.8 | 3.9 | 0.543 | 0.160 | 0.152 | 0.031 | 0.029 |
| 8 | 46.00 | 50.03 | 10.8 | 6.0 | 4.3 | 0.543 | 0.143 | 0.136 | 0.028 | 0.026 |
| 9 | 68.35 | 71.83 | 11.8 | 5.9 | 5.6 | 0.471 | 0.053 | 0.053 | 0.010 | 0.010 |
| 10 | 86.92 | 88.33 | 12.2 | 5.7 | 6.0 | 0.421 | 0.019 | 0.019 | 0.003 | 0.003 |
| 11 | 92.79 | 93.11 | 12.3 | 5.6 | 3.1 | 0.416 | 0.081 | 0.081 | 0.014 | 0.014 |

TABLE XIV. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5,

90 PERCENT DESIGN SPEED

(a) Reading 971

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 18.2 | 62.8 | 55.8 | 518.7 | 567.1 | 14.69 | 18.59 |
| 2 | 9.440 | 9.322 | 0. | 17.2 | 62.2 | 55.2 | 518.7 | 564.9 | 14.69 | 18.47 |
| 3 | 8.559 | 8.588 | 0. | 20.4 | 58.5 | 51.5 | 518.7 | 565.7 | 14.69 | 18.08 |
| 4 | 8.102 | 8.222 | 0. | 20.7 | 56.7 | 51.3 | 518.7 | 560.4 | 14.69 | 17.34 |
| 5 | 7.985 | 8.129 | 0. | 20.3 | 56.2 | 52.0 | 518.7 | 560.7 | 14.69 | 16.96 |
| 6 | 7.868 | 8.038 | 0. | 21.7 | 55.8 | 50.6 | 518.7 | 562.3 | 14.69 | 17.12 |
| 7 | 7.740 | 7.957 | 0. | 21.7 | 55.4 | 49.3 | 518.7 | 562.8 | 14.69 | 17.40 |
| 8 | 7.638 | 7.854 | 0. | 20.4 | 55.1 | 48.7 | 518.7 | 561.7 | 14.69 | 17.65 |
| 9 | 6.546 | 7.019 | 0. | 25.0 | 51.6 | 40.0 | 518.7 | 566.8 | 14.69 | 19.02 |
| 10 | 5.639 | 6.387 | 0. | 29.1 | 49.5 | 29.3 | 518.7 | 576.4 | 14.69 | 20.47 |
| 11 | 5.352 | 6.204 | 0. | 33.5 | 48.9 | 22.9 | 518.7 | 580.7 | 14.69 | 20.95 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 620.7 | 696.5 | 1359.8 | 1177.3 | 620.7 | 661.6 | 0. | 217.7 | 1209.9 | 1191.4 |
| 2 | 624.2 | 700.1 | 1338.4 | 1171.5 | 624.2 | 668.7 | 0. | 207.3 | 1183.9 | 1169.1 |
| 3 | 658.6 | 706.1 | 1259.8 | 1062.1 | 658.6 | 661.6 | 0. | 246.7 | 1073.9 | 1077.5 |
| 4 | 667.9 | 679.2 | 1217.0 | 1015.1 | 667.9 | 635.2 | 0. | 240.6 | 1017.3 | 1032.4 |
| 5 | 670.3 | 658.4 | 1204.5 | 1002.4 | 670.3 | 617.3 | 0. | 229.0 | 1000.7 | 1018.8 |
| 6 | 671.2 | 671.4 | 1193.3 | 983.2 | 671.2 | 623.9 | 0. | 248.0 | 986.6 | 1008.0 |
| 7 | 670.3 | 688.1 | 1180.4 | 979.8 | 670.3 | 639.5 | 0. | 254.0 | 971.7 | 996.4 |
| 8 | 668.9 | 696.9 | 1169.1 | 989.9 | 668.9 | 653.4 | 0. | 242.4 | 958.8 | 986.0 |
| 9 | 651.1 | 756.9 | 1048.3 | 909.5 | 651.1 | 696.6 | 0. | 296.2 | 821.6 | 881.0 |
| 10 | 604.1 | 820.6 | 930.1 | 821.5 | 604.1 | 716.7 | 0. | 399.6 | 707.2 | 801.0 |
| 11 | 587.1 | 860.9 | 892.3 | 779.6 | 587.1 | 718.0 | 0. | 475.2 | 672.0 | 779.0 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.574 | 0.619 | 1.258 | 1.046 | 0.574 | 0.588 | 1.066 | 1.456 | 0.743 |
| 2 | 0.578 | 0.624 | 1.238 | 1.044 | 0.578 | 0.596 | 1.071 | 1.465 | 0.757 |
| 3 | 0.612 | 0.629 | 1.170 | 0.946 | 0.612 | 0.590 | 1.005 | 1.448 | 0.673 |
| 4 | 0.621 | 0.606 | 1.131 | 0.906 | 0.621 | 0.567 | 0.951 | 1.414 | 0.601 |
| 5 | 0.623 | 0.586 | 1.120 | 0.893 | 0.623 | 0.550 | 0.921 | 1.404 | 0.516 |
| 6 | 0.624 | 0.598 | 1.110 | 0.876 | 0.624 | 0.556 | 0.930 | 1.396 | 0.531 |
| 7 | 0.623 | 0.614 | 1.098 | 0.874 | 0.623 | 0.570 | 0.954 | 1.390 | 0.583 |
| 8 | 0.622 | 0.623 | 1.087 | 0.885 | 0.622 | 0.584 | 0.977 | 1.387 | 0.649 |
| 9 | 0.604 | 0.678 | 0.973 | 0.814 | 0.604 | 0.624 | 1.070 | 1.325 | 0.826 |
| 10 | 0.558 | 0.734 | 0.859 | 0.735 | 0.558 | 0.641 | 1.186 | 1.184 | 0.893 |
| 11 | 0.541 | 0.771 | 0.822 | 0.698 | 0.541 | 0.643 | 1.223 | 1.131 | 0.892 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.3 | -1.0 | 7.2 | 0.186 | 0.118 | 0.067 | 0.022 | 0.012 |
| 2 | 9.11 | 11.70 | 1.7 | -0.9 | 7.1 | 0.174 | 0.110 | 0.059 | 0.020 | 0.011 |
| 3 | 27.14 | 30.86 | 2.3 | -1.5 | 6.6 | 0.214 | 0.161 | 0.123 | 0.029 | 0.022 |
| 4 | 36.50 | 40.42 | 2.7 | -1.7 | 8.8 | 0.221 | 0.185 | 0.155 | 0.032 | 0.027 |
| 5 | 38.89 | 42.85 | 2.7 | -1.8 | 10.7 | 0.220 | 0.227 | 0.200 | 0.038 | 0.034 |
| 6 | 41.29 | 45.22 | 2.8 | -1.8 | 10.3 | 0.233 | 0.231 | 0.206 | 0.040 | 0.036 |
| 7 | 43.91 | 47.86 | 2.9 | -1.8 | 9.4 | 0.228 | 0.212 | 0.189 | 0.037 | 0.033 |
| 8 | 46.00 | 50.03 | 3.1 | -1.7 | 10.1 | 0.209 | 0.178 | 0.156 | 0.031 | 0.027 |
| 9 | 68.35 | 71.83 | 4.1 | -1.9 | 11.2 | 0.199 | 0.118 | 0.110 | 0.020 | 0.019 |
| 10 | 86.92 | 88.33 | 4.9 | -1.7 | 10.4 | 0.205 | 0.104 | 0.104 | 0.018 | 0.017 |
| 11 | 92.79 | 93.11 | 4.9 | -1.8 | 6.7 | 0.230 | 0.121 | 0.121 | 0.020 | 0.020 |

TABLE XIV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 90 PERCENT DESIGN SPEED

(b) Reading 973

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 34.3 | 63.0 | 53.7 | 518.7 | 598.8 | 14.69 | 22.71 |
| 2 | 9.440 | 9.322 | 0. | 34.0 | 62.3 | 52.6 | 518.7 | 597.1 | 14.69 | 22.72 |
| 3 | 8.559 | 8.588 | 0. | 36.8 | 58.7 | 47.5 | 518.7 | 596.0 | 14.69 | 22.39 |
| 4 | 8.102 | 8.222 | 0. | 37.1 | 56.9 | 47.9 | 518.7 | 587.3 | 14.69 | 21.36 |
| 5 | 7.985 | 8.129 | 0. | 37.4 | 56.6 | 49.2 | 518.7 | 586.4 | 14.69 | 20.76 |
| 6 | 7.868 | 8.038 | 0. | 36.7 | 56.1 | 48.8 | 518.7 | 584.5 | 14.69 | 20.77 |
| 7 | 7.740 | 7.937 | 0. | 34.5 | 55.7 | 47.5 | 518.7 | 583.6 | 14.69 | 21.01 |
| 8 | 7.638 | 7.854 | 0. | 34.3 | 55.3 | 46.2 | 518.7 | 581.2 | 14.69 | 21.23 |
| 9 | 6.546 | 7.019 | 0. | 34.2 | 52.1 | 37.4 | 518.7 | 580.1 | 14.69 | 21.32 |
| 10 | 5.639 | 6.387 | 0. | 36.9 | 49.8 | 27.1 | 518.7 | 580.9 | 14.69 | 21.50 |
| 11 | 5.352 | 6.204 | 0. | 38.4 | 49.6 | 22.0 | 518.7 | 587.3 | 14.69 | 21.83 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 616.5 | 706.5 | 1360.0 | 986.3 | 616.5 | 583.4 | 0. | 398.5 | 1212.2 | 1193.8 |
| 2 | 621.5 | 712.6 | 1338.2 | 971.6 | 621.5 | 590.6 | 0. | 398.8 | 1185.1 | 1170.3 |
| 3 | 654.6 | 732.0 | 1258.5 | 867.6 | 654.6 | 586.0 | 0. | 438.7 | 1074.9 | 1078.5 |
| 4 | 662.8 | 694.9 | 1214.3 | 826.6 | 662.8 | 554.2 | 0. | 419.2 | 1017.4 | 1032.5 |
| 5 | 662.8 | 668.3 | 1202.9 | 813.5 | 662.8 | 531.1 | 0. | 405.7 | 1003.8 | 1021.9 |
| 6 | 664.3 | 668.2 | 1191.7 | 812.5 | 664.3 | 535.5 | 0. | 399.7 | 989.4 | 1010.8 |
| 7 | 663.4 | 680.4 | 1178.2 | 830.1 | 663.4 | 560.4 | 0. | 386.1 | 973.7 | 998.5 |
| 8 | 663.5 | 693.2 | 1166.9 | 827.3 | 663.5 | 573.0 | 0. | 390.3 | 959.9 | 987.0 |
| 9 | 638.9 | 737.6 | 1040.9 | 768.3 | 638.9 | 610.3 | 0. | 414.4 | 821.7 | 881.1 |
| 10 | 599.1 | 794.2 | 927.5 | 713.6 | 599.1 | 635.3 | 0. | 476.9 | 708.0 | 801.9 |
| 11 | 572.0 | 830.5 | 882.6 | 702.2 | 572.0 | 651.0 | 0. | 515.7 | 672.1 | 779.1 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | | VEL R | MACH NO | |
| 1 | 0.570 | 0.611 | 1.257 | 0.852 | 0.570 | 0.504 | | 0.946 | 1.463 | 0.858 |
| 2 | 0.575 | 0.617 | 1.238 | 0.842 | 0.575 | 0.512 | | 0.950 | 1.469 | 0.877 |
| 3 | 0.608 | 0.636 | 1.168 | 0.754 | 0.608 | 0.509 | | 0.895 | 1.453 | 0.858 |
| 4 | 0.616 | 0.606 | 1.128 | 0.721 | 0.616 | 0.483 | | 0.836 | 1.419 | 0.853 |
| 5 | 0.616 | 0.582 | 1.118 | 0.708 | 0.616 | 0.462 | | 0.801 | 1.415 | 0.796 |
| 6 | 0.617 | 0.583 | 1.107 | 0.709 | 0.617 | 0.467 | | 0.806 | 1.407 | 0.820 |
| 7 | 0.616 | 0.595 | 1.095 | 0.725 | 0.616 | 0.490 | | 0.845 | 1.400 | 0.859 |
| 8 | 0.617 | 0.608 | 1.084 | 0.726 | 0.617 | 0.503 | | 0.864 | 1.394 | 0.920 |
| 9 | 0.592 | 0.651 | 0.965 | 0.678 | 0.592 | 0.538 | | 0.955 | 1.331 | 0.948 |
| 10 | 0.553 | 0.705 | 0.856 | 0.633 | 0.553 | 0.564 | | 1.060 | 1.188 | 0.957 |
| 11 | 0.526 | 0.736 | 0.812 | 0.622 | 0.526 | 0.577 | | 1.138 | 1.139 | 0.905 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.5 | -0.8 | 5.1 | 0.370 | 0.103 | 0.051 | 0.020 | 0.010 |
| 2 | 9.11 | 11.70 | 1.8 | -0.8 | 4.5 | 0.369 | 0.090 | 0.039 | 0.017 | 0.008 |
| 3 | 27.14 | 30.86 | 2.5 | -1.3 | 2.6 | 0.413 | 0.111 | 0.072 | 0.022 | 0.014 |
| 4 | 36.50 | 40.42 | 2.9 | -1.5 | 5.5 | 0.416 | 0.109 | 0.079 | 0.020 | 0.015 |
| 5 | 38.89 | 42.85 | 3.1 | -1.4 | 8.0 | 0.417 | 0.150 | 0.122 | 0.027 | 0.022 |
| 6 | 41.29 | 45.22 | 3.1 | -1.5 | 8.5 | 0.410 | 0.132 | 0.106 | 0.024 | 0.019 |
| 7 | 43.91 | 47.86 | 3.3 | -1.5 | 7.7 | 0.384 | 0.104 | 0.080 | 0.019 | 0.014 |
| 8 | 46.00 | 50.03 | 3.4 | -1.5 | 7.6 | 0.380 | 0.058 | 0.036 | 0.011 | 0.007 |
| 9 | 68.35 | 71.83 | 4.6 | -1.3 | 8.6 | 0.355 | 0.045 | 0.038 | 0.008 | 0.007 |
| 10 | 86.92 | 88.53 | 5.2 | -1.4 | 8.2 | 0.336 | 0.045 | 0.045 | 0.008 | 0.008 |
| 11 | 92.79 | 93.11 | 5.7 | -1.0 | 5.8 | 0.318 | 0.118 | 0.118 | 0.020 | 0.020 |

TABLE XIV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 90 PERCENT DESIGN SPEED

(c) Reading 974

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 39.0 | 63.3 | 52.8 | 518.7 | 609.2 | 14.69 | 24.13 |
| 2 | 9.440 | 9.322 | 0. | 37.7 | 62.6 | 52.0 | 518.7 | 606.2 | 14.69 | 24.09 |
| 3 | 8.559 | 8.588 | 0. | 39.8 | 59.1 | 46.4 | 518.7 | 602.5 | 14.69 | 23.81 |
| 4 | 8.102 | 8.222 | 0. | 41.1 | 57.4 | 46.5 | 518.7 | 596.0 | 14.69 | 22.69 |
| 5 | 7.985 | 8.129 | 0. | 40.5 | 57.0 | 47.3 | 518.7 | 594.2 | 14.69 | 22.30 |
| 6 | 7.868 | 8.038 | 0. | 40.2 | 56.6 | 46.9 | 518.7 | 590.7 | 14.69 | 22.22 |
| 7 | 7.740 | 7.937 | 0. | 39.2 | 56.3 | 45.9 | 518.7 | 590.0 | 14.69 | 22.29 |
| 8 | 7.638 | 7.854 | 0. | 38.2 | 56.0 | 45.2 | 518.7 | 589.2 | 14.69 | 22.39 |
| 9 | 6.546 | 7.019 | 0. | 38.0 | 52.8 | 37.0 | 518.7 | 583.6 | 14.69 | 22.03 |
| 10 | 5.639 | 6.387 | 0. | 40.0 | 50.8 | 26.7 | 518.7 | 584.0 | 14.69 | 21.98 |
| 11 | 5.352 | 6.204 | 0. | 41.9 | 49.9 | 20.8 | 518.7 | 589.8 | 14.69 | 22.26 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 609.3 | 722.5 | 1356.8 | 928.4 | 609.3 | 561.8 | 0. | 454.7 | 1212.3 | 1193.9 |
| 2 | 614.8 | 721.8 | 1336.2 | 926.6 | 614.8 | 570.9 | 0. | 441.7 | 1186.4 | 1171.5 |
| 3 | 644.3 | 745.3 | 1253.1 | 830.9 | 644.3 | 573.0 | 0. | 476.7 | 1074.8 | 1078.4 |
| 4 | 650.8 | 711.1 | 1208.1 | 779.5 | 650.8 | 536.2 | 0. | 467.0 | 1017.7 | 1032.8 |
| 5 | 651.4 | 693.2 | 1196.4 | 777.0 | 651.4 | 526.8 | 0. | 450.5 | 1003.6 | 1021.7 |
| 6 | 651.3 | 690.7 | 1183.3 | 772.1 | 651.3 | 527.7 | 0. | 445.7 | 988.0 | 1009.3 |
| 7 | 648.9 | 696.3 | 1168.4 | 775.3 | 648.9 | 539.9 | 0. | 440.0 | 971.7 | 996.4 |
| 8 | 648.1 | 700.5 | 1158.0 | 781.1 | 648.1 | 550.8 | 0. | 432.9 | 959.6 | 986.8 |
| 9 | 624.8 | 728.7 | 1032.7 | 719.0 | 624.8 | 574.2 | 0. | 449.0 | 822.3 | 881.8 |
| 10 | 577.7 | 780.7 | 914.2 | 669.5 | 577.7 | 598.1 | 0. | 501.7 | 708.5 | 802.5 |
| 11 | 566.3 | 819.7 | 878.9 | 652.9 | 566.3 | 610.3 | 0. | 547.1 | 672.1 | 779.1 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.563 | 0.620 | 1.253 | 0.796 | 0.563 | 0.482 | 0.922 | 1.469 | 0.873 |
| 2 | 0.568 | 0.621 | 1.235 | 0.797 | 0.568 | 0.491 | 0.929 | 1.477 | 0.899 |
| 3 | 0.597 | 0.645 | 1.162 | 0.719 | 0.597 | 0.496 | 0.889 | 1.461 | 0.915 |
| 4 | 0.604 | 0.616 | 1.121 | 0.676 | 0.604 | 0.465 | 0.824 | 1.430 | 0.887 |
| 5 | 0.604 | 0.601 | 1.110 | 0.673 | 0.604 | 0.457 | 0.809 | 1.426 | 0.869 |
| 6 | 0.604 | 0.600 | 1.098 | 0.671 | 0.604 | 0.459 | 0.810 | 1.417 | 0.903 |
| 7 | 0.602 | 0.606 | 1.084 | 0.675 | 0.602 | 0.470 | 0.832 | 1.412 | 0.919 |
| 8 | 0.601 | 0.610 | 1.074 | 0.681 | 0.601 | 0.480 | 0.850 | 1.409 | 0.941 |
| 9 | 0.578 | 0.640 | 0.956 | 0.632 | 0.578 | 0.504 | 0.919 | 1.340 | 0.981 |
| 10 | 0.532 | 0.690 | 0.842 | 0.591 | 0.532 | 0.528 | 1.035 | 1.198 | 0.968 |
| 11 | 0.521 | 0.724 | 0.808 | 0.576 | 0.521 | 0.539 | 1.078 | 1.141 | 0.920 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 1.7 | -0.5 | 4.1 | 0.424 | 0.103 | 0.050 | 0.020 | 0.010 |
| 2 | 9.11 | 11.70 | 2.1 | -0.5 | 3.9 | 0.412 | 0.081 | 0.029 | 0.016 | 0.006 |
| 3 | 27.14 | 30.86 | 2.9 | -0.9 | 1.5 | 0.449 | 0.072 | 0.032 | 0.015 | 0.007 |
| 4 | 36.50 | 40.42 | 3.4 | -1.0 | 4.1 | 0.463 | 0.094 | 0.064 | 0.018 | 0.012 |
| 5 | 38.89 | 42.85 | 3.5 | -1.0 | 6.1 | 0.455 | 0.108 | 0.079 | 0.020 | 0.015 |
| 6 | 41.29 | 45.22 | 3.6 | -1.0 | 6.6 | 0.451 | 0.079 | 0.052 | 0.015 | 0.010 |
| 7 | 43.91 | 47.86 | 3.8 | -0.9 | 6.0 | 0.438 | 0.066 | 0.042 | 0.012 | 0.008 |
| 8 | 46.00 | 50.03 | 4.0 | -0.9 | 6.6 | 0.425 | 0.049 | 0.026 | 0.009 | 0.005 |
| 9 | 68.55 | 71.83 | 5.2 | -0.7 | 8.2 | 0.406 | 0.018 | 0.010 | 0.003 | 0.002 |
| 10 | 86.92 | 88.33 | 6.2 | -0.4 | 7.8 | 0.380 | 0.036 | 0.036 | 0.006 | 0.006 |
| 11 | 92.79 | 93.11 | 5.9 | -0.7 | 4.6 | 0.379 | 0.103 | 0.103 | 0.018 | 0.018 |

TABLE XIV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 90 PERCENT DESIGN SPEED

(d) Reading 975

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 41.2 | 63.8 | 52.5 | 518.7 | 614.0 | 14.69 | 24.82 |
| 2 | 9.440 | 9.322 | 0. | 40.0 | 63.1 | 51.8 | 518.7 | 611.3 | 14.69 | 24.73 |
| 3 | 8.559 | 8.588 | 0. | 42.2 | 59.7 | 46.4 | 518.7 | 605.9 | 14.69 | 24.37 |
| 4 | 8.102 | 8.222 | 0. | 43.4 | 58.2 | 45.6 | 518.7 | 600.8 | 14.69 | 23.53 |
| 5 | 7.985 | 8.129 | 0. | 43.2 | 57.8 | 46.4 | 518.7 | 600.1 | 14.69 | 23.09 |
| 6 | 7.868 | 8.038 | 0. | 42.9 | 57.5 | 46.0 | 518.7 | 597.2 | 14.69 | 22.98 |
| 7 | 7.740 | 7.937 | 0. | 41.8 | 57.1 | 45.3 | 518.7 | 595.3 | 14.69 | 22.99 |
| 8 | 7.638 | 7.854 | 0. | 41.7 | 56.8 | 44.2 | 518.7 | 594.1 | 14.69 | 23.00 |
| 9 | 6.546 | 7.019 | 0. | 41.2 | 53.7 | 36.4 | 518.7 | 587.3 | 14.69 | 22.47 |
| 10 | 5.639 | 6.387 | 0. | 42.4 | 51.6 | 26.2 | 518.7 | 586.4 | 14.69 | 22.30 |
| 11 | 5.352 | 6.204 | 0. | 43.7 | 50.7 | 20.9 | 518.7 | 590.9 | 14.69 | 22.51 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 597.2 | 727.4 | 1350.3 | 898.6 | 597.2 | 547.0 | 0. | 479.7 | 1211.0 | 1192.6 |
| 2 | 602.1 | 724.5 | 1329.3 | 896.8 | 602.1 | 554.9 | 0. | 465.8 | 1185.1 | 1170.3 |
| 3 | 628.1 | 743.6 | 1244.0 | 798.9 | 628.1 | 551.1 | 0. | 499.2 | 1073.8 | 1077.5 |
| 4 | 630.5 | 721.6 | 1196.2 | 750.1 | 630.5 | 524.6 | 0. | 495.5 | 1016.5 | 1031.6 |
| 5 | 631.3 | 704.1 | 1185.8 | 744.4 | 631.3 | 513.1 | 0. | 482.5 | 1003.8 | 1021.9 |
| 6 | 629.7 | 700.7 | 1170.8 | 738.0 | 629.7 | 512.9 | 0. | 477.7 | 987.0 | 1008.4 |
| 7 | 627.8 | 702.5 | 1157.2 | 745.9 | 627.8 | 523.6 | 0. | 468.5 | 972.1 | 996.9 |
| 8 | 626.7 | 708.1 | 1145.4 | 757.7 | 626.7 | 528.5 | 0. | 471.2 | 958.7 | 985.9 |
| 9 | 602.8 | 726.0 | 1019.1 | 678.6 | 602.8 | 546.2 | 0. | 478.5 | 821.6 | 881.0 |
| 10 | 560.4 | 771.7 | 902.0 | 635.5 | 560.4 | 570.3 | 0. | 520.0 | 706.8 | 800.5 |
| 11 | 550.0 | 805.8 | 868.1 | 623.7 | 550.0 | 582.8 | 0. | 556.4 | 671.6 | 778.5 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID VEL R | PEAK SS MACH NO | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | | | |
| 1 | 0.551 | 0.622 | 1.246 | 0.768 | 0.551 | 0.467 | 0.916 | 1.477 | 0.880 |
| 2 | 0.556 | 0.620 | 1.227 | 0.768 | 0.556 | 0.475 | 0.922 | 1.485 | 0.898 |
| 3 | 0.581 | 0.641 | 1.151 | 0.689 | 0.581 | 0.475 | 0.877 | 1.474 | 0.925 |
| 4 | 0.584 | 0.624 | 1.107 | 0.648 | 0.584 | 0.453 | 0.852 | 1.448 | 0.909 |
| 5 | 0.585 | 0.608 | 1.098 | 0.642 | 0.585 | 0.443 | 0.813 | 1.446 | 0.878 |
| 6 | 0.583 | 0.606 | 1.084 | 0.638 | 0.583 | 0.444 | 0.814 | 1.438 | 0.900 |
| 7 | 0.581 | 0.609 | 1.071 | 0.645 | 0.581 | 0.454 | 0.834 | 1.434 | 0.924 |
| 8 | 0.580 | 0.615 | 1.060 | 0.640 | 0.580 | 0.459 | 0.843 | 1.431 | 0.940 |
| 9 | 0.556 | 0.635 | 0.941 | 0.594 | 0.556 | 0.478 | 0.906 | 1.351 | 0.975 |
| 10 | 0.515 | 0.680 | 0.829 | 0.560 | 0.515 | 0.502 | 1.018 | 1.203 | 0.969 |
| 11 | 0.505 | 0.710 | 0.797 | 0.549 | 0.505 | 0.513 | 1.060 | 1.148 | 0.931 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.2 | -0.1 | 3.8 | 0.450 | 0.102 | 0.049 | 0.020 | 0.010 |
| 2 | 9.11 | 11.70 | 2.5 | -0.1 | 3.7 | 0.437 | 0.087 | 0.034 | 0.017 | 0.007 |
| 3 | 27.14 | 30.86 | 3.5 | -0.3 | 1.5 | 0.476 | 0.067 | 0.026 | 0.014 | 0.005 |
| 4 | 36.50 | 40.42 | 4.2 | -0.2 | 3.2 | 0.489 | 0.081 | 0.049 | 0.016 | 0.010 |
| 5 | 38.89 | 42.85 | 4.3 | -0.1 | 5.2 | 0.485 | 0.109 | 0.078 | 0.021 | 0.015 |
| 6 | 41.29 | 45.22 | 4.5 | -0.1 | 5.7 | 0.482 | 0.088 | 0.061 | 0.017 | 0.011 |
| 7 | 43.91 | 47.86 | 4.7 | -0.1 | 5.4 | 0.466 | 0.067 | 0.041 | 0.013 | 0.008 |
| 8 | 46.00 | 50.03 | 4.9 | -0.0 | 5.7 | 0.466 | 0.053 | 0.029 | 0.010 | 0.005 |
| 9 | 68.35 | 71.83 | 6.2 | 0.3 | 7.6 | 0.444 | 0.024 | 0.017 | 0.004 | 0.003 |
| 10 | 86.92 | 88.33 | 7.0 | 0.4 | 7.3 | 0.414 | 0.036 | 0.036 | 0.006 | 0.006 |
| 11 | 92.79 | 93.11 | 6.8 | 0.1 | 4.6 | 0.407 | 0.092 | 0.092 | 0.016 | 0.016 |

TABLE XIV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 90 PERCENT DESIGN SPEED

(e) Reading 976

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 43.3 | 64.6 | 52.4 | 518.7 | 619.2 | 14.69 | 25.39 |
| 2 | 9.440 | 9.322 | 0. | 43.2 | 64.0 | 51.4 | 518.7 | 616.5 | 14.69 | 25.27 |
| 3 | 8.559 | 8.588 | 0. | 44.3 | 60.8 | 46.7 | 518.7 | 610.3 | 14.69 | 24.76 |
| 4 | 8.102 | 8.222 | 0. | 46.0 | 59.4 | 45.3 | 518.7 | 605.8 | 14.69 | 24.01 |
| 5 | 7.985 | 8.129 | 0. | 46.3 | 59.1 | 45.9 | 518.7 | 604.0 | 14.69 | 23.60 |
| 6 | 7.868 | 8.038 | 0. | 45.9 | 58.7 | 45.7 | 518.7 | 601.4 | 14.69 | 23.42 |
| 7 | 7.740 | 7.937 | 0. | 44.8 | 58.4 | 44.8 | 518.7 | 599.7 | 14.69 | 23.42 |
| 8 | 7.638 | 7.854 | 0. | 44.4 | 58.1 | 44.1 | 518.7 | 597.1 | 14.69 | 23.38 |
| 9 | 6.546 | 7.019 | 0. | 44.2 | 55.2 | 36.1 | 518.7 | 590.6 | 14.69 | 22.81 |
| 10 | 5.639 | 6.387 | 0. | 44.0 | 52.8 | 26.3 | 518.7 | 587.4 | 14.69 | 22.59 |
| 11 | 5.352 | 6.204 | 0. | 46.0 | 52.2 | 19.9 | 518.7 | 592.2 | 14.69 | 22.78 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 574.5 | 731.1 | 1339.5 | 871.2 | 574.5 | 532.1 | 0. | 501.7 | 1210.0 | 1191.6 |
| 2 | 577.0 | 730.5 | 1316.0 | 854.1 | 577.0 | 532.4 | 0. | 500.2 | 1182.8 | 1168.0 |
| 3 | 600.0 | 739.5 | 1230.1 | 770.7 | 600.0 | 528.8 | 0. | 516.9 | 1073.9 | 1077.5 |
| 4 | 600.8 | 724.9 | 1180.3 | 716.4 | 600.8 | 503.7 | 0. | 521.6 | 1016.0 | 1031.0 |
| 5 | 600.4 | 709.7 | 1167.5 | 704.4 | 600.4 | 490.2 | 0. | 513.5 | 1001.3 | 1019.4 |
| 6 | 599.1 | 704.7 | 1154.5 | 701.3 | 599.1 | 490.1 | 0. | 506.5 | 986.8 | 1008.2 |
| 7 | 596.5 | 705.9 | 1138.4 | 705.8 | 596.5 | 501.1 | 0. | 497.3 | 969.6 | 994.3 |
| 8 | 596.9 | 707.1 | 1128.2 | 703.5 | 596.9 | 505.2 | 0. | 494.8 | 957.3 | 984.4 |
| 9 | 571.1 | 721.9 | 1000.0 | 639.9 | 571.1 | 517.3 | 0. | 503.5 | 820.9 | 880.3 |
| 10 | 537.3 | 762.6 | 887.9 | 612.3 | 537.3 | 548.9 | 0. | 529.4 | 706.9 | 800.7 |
| 11 | 520.7 | 801.0 | 849.3 | 592.1 | 520.7 | 556.7 | 0. | 576.0 | 670.9 | 777.8 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.529 | 0.622 | 1.233 | 0.741 | 0.529 | 0.453 | 0.926 | 1.495 | 0.873 |
| 2 | 0.531 | 0.623 | 1.212 | 0.729 | 0.531 | 0.454 | 0.923 | 1.504 | 0.889 |
| 3 | 0.554 | 0.635 | 1.135 | 0.662 | 0.554 | 0.454 | 0.881 | 1.501 | 0.910 |
| 4 | 0.554 | 0.624 | 1.089 | 0.616 | 0.554 | 0.433 | 0.838 | 1.478 | 0.897 |
| 5 | 0.554 | 0.611 | 1.078 | 0.606 | 0.554 | 0.422 | 0.816 | 1.474 | 0.881 |
| 6 | 0.553 | 0.607 | 1.065 | 0.605 | 0.553 | 0.422 | 0.818 | 1.470 | 0.894 |
| 7 | 0.550 | 0.610 | 1.050 | 0.609 | 0.550 | 0.433 | 0.840 | 1.467 | 0.912 |
| 8 | 0.551 | 0.612 | 1.041 | 0.609 | 0.551 | 0.437 | 0.846 | 1.464 | 0.939 |
| 9 | 0.526 | 0.630 | 0.920 | 0.558 | 0.526 | 0.451 | 0.906 | 1.366 | 0.965 |
| 10 | 0.493 | 0.670 | 0.814 | 0.538 | 0.493 | 0.482 | 1.022 | 1.214 | 0.986 |
| 11 | 0.477 | 0.704 | 0.778 | 0.520 | 0.477 | 0.489 | 1.069 | 1.160 | 0.942 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 3.0 | 0.8 | 3.7 | 0.471 | 0.114 | 0.059 | 0.023 | 0.012 |
| 2 | 9.11 | 11.70 | 3.5 | 0.9 | 3.3 | 0.472 | 0.100 | 0.046 | 0.020 | 0.009 |
| 3 | 27.14 | 30.86 | 4.6 | 0.8 | 1.8 | 0.497 | 0.084 | 0.041 | 0.017 | 0.008 |
| 4 | 36.50 | 40.42 | 5.4 | 1.0 | 2.9 | 0.517 | 0.098 | 0.064 | 0.019 | 0.013 |
| 5 | 38.89 | 42.85 | 5.6 | 1.1 | 4.6 | 0.519 | 0.113 | 0.081 | 0.022 | 0.015 |
| 6 | 41.29 | 45.22 | 5.7 | 1.1 | 5.3 | 0.513 | 0.100 | 0.070 | 0.019 | 0.013 |
| 7 | 43.91 | 47.86 | 5.9 | 1.2 | 4.9 | 0.498 | 0.084 | 0.056 | 0.016 | 0.011 |
| 8 | 46.00 | 50.03 | 6.1 | 1.2 | 5.5 | 0.493 | 0.058 | 0.031 | 0.011 | 0.006 |
| 9 | 68.35 | 71.83 | 7.6 | 1.7 | 7.3 | 0.478 | 0.037 | 0.030 | 0.007 | 0.005 |
| 10 | 86.92 | 88.33 | 8.1 | 1.6 | 7.4 | 0.433 | 0.017 | 0.017 | 0.003 | 0.003 |
| 11 | 92.79 | 95.11 | 8.3 | 1.6 | 3.7 | 0.435 | 0.082 | 0.082 | 0.014 | 0.014 |

TABLE XIV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 90 PERCENT DESIGN SPEED

(f) Reading 977

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 45.6 | 65.5 | 52.0 | 518.7 | 624.4 | 14.69 | 25.78 |
| 2 | 9.440 | 9.322 | 0. | 44.7 | 64.9 | 51.4 | 518.7 | 619.4 | 14.69 | 25.63 |
| 3 | 8.559 | 8.588 | 0. | 46.0 | 61.9 | 46.6 | 518.7 | 613.5 | 14.69 | 25.05 |
| 4 | 8.102 | 8.222 | 0. | 47.6 | 60.5 | 45.1 | 518.7 | 608.3 | 14.69 | 24.31 |
| 5 | 7.985 | 8.129 | 0. | 48.0 | 60.1 | 46.1 | 518.7 | 607.4 | 14.69 | 23.83 |
| 6 | 7.868 | 8.038 | 0. | 48.4 | 59.8 | 45.7 | 518.7 | 605.0 | 14.69 | 23.62 |
| 7 | 7.740 | 7.937 | 0. | 46.9 | 59.6 | 45.0 | 518.7 | 601.5 | 14.69 | 23.56 |
| 8 | 7.638 | 7.854 | 0. | 46.8 | 59.3 | 44.3 | 518.7 | 600.9 | 14.69 | 23.51 |
| 9 | 6.546 | 7.019 | 0. | 46.3 | 56.3 | 35.4 | 518.7 | 595.1 | 14.69 | 23.07 |
| 10 | 5.639 | 6.387 | 0. | 45.6 | 53.9 | 25.7 | 518.7 | 589.1 | 14.69 | 22.77 |
| 11 | 5.552 | 6.204 | 0. | 47.5 | 53.3 | 19.5 | 518.7 | 595.7 | 14.69 | 22.90 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 551.7 | 739.9 | 1329.8 | 840.7 | 551.7 | 517.5 | 0. | 529.0 | 1209.9 | 1191.5 |
| 2 | 554.0 | 734.3 | 1307.6 | 835.6 | 554.0 | 521.7 | 0. | 516.8 | 1184.4 | 1169.6 |
| 3 | 573.0 | 740.9 | 1216.2 | 748.4 | 573.0 | 514.6 | 0. | 533.0 | 1072.7 | 1076.4 |
| 4 | 574.6 | 727.5 | 1166.7 | 695.5 | 574.6 | 490.6 | 0. | 537.4 | 1015.4 | 1030.4 |
| 5 | 574.6 | 708.0 | 1154.1 | 682.9 | 574.6 | 473.5 | 0. | 526.6 | 1000.9 | 1018.9 |
| 6 | 573.7 | 704.4 | 1139.5 | 669.2 | 573.7 | 467.5 | 0. | 527.0 | 984.6 | 1005.9 |
| 7 | 568.5 | 702.1 | 1123.0 | 679.5 | 568.5 | 480.1 | 0. | 512.5 | 968.5 | 993.1 |
| 8 | 569.8 | 704.9 | 1114.6 | 674.7 | 569.8 | 482.7 | 0. | 513.7 | 957.9 | 985.0 |
| 9 | 546.5 | 724.9 | 985.8 | 614.7 | 546.5 | 501.1 | 0. | 523.7 | 820.4 | 879.7 |
| 10 | 514.7 | 761.0 | 874.1 | 590.7 | 514.7 | 532.2 | 0. | 543.9 | 706.5 | 800.2 |
| 11 | 499.3 | 796.5 | 836.2 | 570.8 | 499.3 | 538.1 | 0. | 587.3 | 670.7 | 777.5 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.507 | 0.627 | 1.221 | 0.715 | 0.507 | 0.439 | 0.938 | 1.515 | 0.855 |
| 2 | 0.509 | 0.625 | 1.201 | 0.711 | 0.509 | 0.444 | 0.942 | 1.527 | 0.887 |
| 3 | 0.527 | 0.634 | 1.119 | 0.641 | 0.527 | 0.441 | 0.898 | 1.526 | 0.901 |
| 4 | 0.529 | 0.625 | 1.074 | 0.597 | 0.529 | 0.421 | 0.854 | 1.506 | 0.895 |
| 5 | 0.529 | 0.607 | 1.062 | 0.586 | 0.529 | 0.406 | 0.824 | 1.503 | 0.866 |
| 6 | 0.528 | 0.605 | 1.049 | 0.575 | 0.528 | 0.402 | 0.815 | 1.497 | 0.873 |
| 7 | 0.525 | 0.605 | 1.033 | 0.586 | 0.525 | 0.414 | 0.845 | 1.499 | 0.904 |
| 8 | 0.524 | 0.608 | 1.026 | 0.582 | 0.524 | 0.416 | 0.847 | 1.499 | 0.907 |
| 9 | 0.502 | 0.631 | 0.905 | 0.535 | 0.502 | 0.436 | 0.917 | 1.379 | 0.959 |
| 10 | 0.471 | 0.668 | 0.800 | 0.518 | 0.471 | 0.467 | 1.034 | 1.225 | 0.982 |
| 11 | 0.456 | 0.699 | 0.765 | 0.501 | 0.456 | 0.472 | 1.078 | 1.170 | 0.935 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 3.9 | 1.7 | 3.4 | 0.497 | 0.136 | 0.079 | 0.027 | 0.016 |
| 2 | 9.11 | 11.70 | 4.4 | 1.8 | 3.3 | 0.487 | 0.105 | 0.048 | 0.021 | 0.010 |
| 3 | 27.14 | 30.86 | 5.7 | 1.9 | 1.7 | 0.513 | 0.097 | 0.052 | 0.020 | 0.010 |
| 4 | 36.50 | 40.42 | 6.5 | 2.1 | 2.7 | 0.533 | 0.105 | 0.068 | 0.021 | 0.013 |
| 5 | 38.89 | 42.85 | 6.7 | 2.2 | 4.9 | 0.535 | 0.133 | 0.099 | 0.025 | 0.019 |
| 6 | 41.29 | 45.22 | 6.8 | 2.2 | 5.4 | 0.540 | 0.126 | 0.094 | 0.024 | 0.018 |
| 7 | 43.91 | 47.86 | 7.1 | 2.4 | 5.2 | 0.518 | 0.094 | 0.063 | 0.018 | 0.012 |
| 8 | 46.00 | 50.05 | 7.3 | 2.4 | 5.7 | 0.517 | 0.092 | 0.062 | 0.017 | 0.012 |
| 9 | 68.35 | 71.83 | 8.8 | 2.8 | 6.6 | 0.501 | 0.045 | 0.039 | 0.008 | 0.007 |
| 10 | 86.92 | 88.33 | 9.3 | 2.7 | 6.8 | 0.452 | 0.024 | 0.024 | 0.004 | 0.004 |
| 11 | 92.79 | 93.11 | 9.4 | 2.7 | 5.2 | 0.455 | 0.097 | 0.097 | 0.017 | 0.017 |

TABLE XIV. - Concluded. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 90 PERCENT DESIGN SPEED

(g) Reading 978

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 49.0 | 67.1 | 52.4 | 518.7 | 629.8 | 14.69 | 25.82 |
| 2 | 9.440 | 9.322 | 0. | 47.0 | 66.5 | 51.6 | 518.7 | 623.7 | 14.69 | 25.67 |
| 3 | 8.559 | 8.588 | 0. | 48.3 | 63.7 | 46.7 | 518.7 | 615.4 | 14.69 | 25.16 |
| 4 | 8.102 | 8.222 | 0. | 51.9 | 62.4 | 45.3 | 518.7 | 612.1 | 14.69 | 24.43 |
| 5 | 7.985 | 8.129 | 0. | 52.8 | 62.1 | 46.0 | 518.7 | 611.2 | 14.69 | 23.97 |
| 6 | 7.868 | 8.038 | 0. | 52.3 | 61.8 | 45.9 | 518.7 | 609.7 | 14.69 | 23.74 |
| 7 | 7.740 | 7.937 | 0. | 52.2 | 61.5 | 45.1 | 518.7 | 608.3 | 14.69 | 23.65 |
| 8 | 7.638 | 7.854 | 0. | 51.7 | 61.3 | 44.2 | 518.7 | 607.0 | 14.69 | 23.61 |
| 9 | 6.546 | 7.019 | 0. | 47.7 | 58.4 | 34.8 | 518.7 | 595.4 | 14.69 | 23.30 |
| 10 | 5.639 | 6.387 | 0. | 46.5 | 55.6 | 25.4 | 518.7 | 590.4 | 14.69 | 22.97 |
| 11 | 5.352 | 6.204 | 0. | 48.3 | 55.3 | 19.6 | 518.7 | 595.5 | 14.69 | 23.00 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 511.4 | 741.2 | 1312.2 | 795.9 | 511.4 | 486.0 | 0. | 559.7 | 1208.4 | 1190.0 |
| 2 | 514.1 | 732.9 | 1288.8 | 804.7 | 514.1 | 499.7 | 0. | 536.3 | 1181.8 | 1167.1 |
| 3 | 530.2 | 740.9 | 1196.2 | 718.0 | 530.2 | 492.7 | 0. | 553.5 | 1072.2 | 1075.9 |
| 4 | 530.3 | 730.5 | 1145.4 | 641.2 | 530.3 | 451.1 | 0. | 574.7 | 1015.3 | 1030.3 |
| 5 | 530.1 | 715.8 | 1132.7 | 623.4 | 530.1 | 432.7 | 0. | 570.3 | 1001.0 | 1019.0 |
| 6 | 528.4 | 708.0 | 1118.3 | 622.1 | 528.4 | 433.0 | 0. | 560.2 | 985.6 | 1006.9 |
| 7 | 526.3 | 708.2 | 1103.9 | 615.0 | 526.3 | 434.2 | 0. | 559.4 | 970.3 | 995.0 |
| 8 | 525.1 | 709.9 | 1092.3 | 614.2 | 525.1 | 440.4 | 0. | 556.8 | 957.8 | 984.8 |
| 9 | 504.9 | 730.1 | 964.3 | 598.4 | 504.9 | 491.6 | 0. | 539.8 | 821.6 | 880.9 |
| 10 | 484.6 | 761.6 | 857.7 | 580.7 | 484.6 | 524.4 | 0. | 552.2 | 707.7 | 801.6 |
| 11 | 465.0 | 792.0 | 817.0 | 559.7 | 465.0 | 527.3 | 0. | 591.0 | 671.7 | 778.6 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.468 | 0.626 | 1.201 | 0.672 | 0.468 | 0.410 | 0.950 | 1.551 | 0.816 |
| 2 | 0.471 | 0.621 | 1.180 | 0.682 | 0.471 | 0.424 | 0.972 | 1.563 | 0.854 |
| 3 | 0.486 | 0.633 | 1.097 | 0.614 | 0.486 | 0.421 | 0.929 | 1.571 | 0.892 |
| 4 | 0.486 | 0.625 | 1.050 | 0.549 | 0.486 | 0.386 | 0.851 | 1.557 | 0.868 |
| 5 | 0.486 | 0.612 | 1.038 | 0.533 | 0.486 | 0.370 | 0.816 | 1.558 | 0.841 |
| 6 | 0.484 | 0.606 | 1.025 | 0.533 | 0.484 | 0.371 | 0.819 | 1.555 | 0.837 |
| 7 | 0.482 | 0.607 | 1.012 | 0.527 | 0.482 | 0.372 | 0.825 | 1.558 | 0.843 |
| 8 | 0.481 | 0.609 | 1.001 | 0.527 | 0.481 | 0.378 | 0.839 | 1.562 | 0.853 |
| 9 | 0.462 | 0.635 | 0.882 | 0.520 | 0.462 | 0.427 | 0.974 | 1.407 | 0.952 |
| 10 | 0.443 | 0.667 | 0.783 | 0.509 | 0.443 | 0.460 | 1.082 | 1.243 | 0.985 |
| 11 | 0.424 | 0.693 | 0.745 | 0.490 | 0.424 | 0.462 | 1.134 | 1.189 | 0.923 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 5.5 | 3.2 | 3.7 | 0.532 | 0.182 | 0.121 | 0.036 | 0.024 |
| 2 | 9.11 | 11.70 | 6.0 | 3.4 | 3.5 | 0.508 | 0.142 | 0.082 | 0.028 | 0.016 |
| 3 | 27.14 | 30.86 | 7.5 | 3.7 | 1.8 | 0.536 | 0.111 | 0.060 | 0.022 | 0.012 |
| 4 | 36.50 | 40.42 | 8.4 | 4.0 | 2.9 | 0.581 | 0.139 | 0.097 | 0.027 | 0.019 |
| 5 | 38.89 | 42.85 | 8.6 | 4.1 | 4.8 | 0.589 | 0.168 | 0.127 | 0.032 | 0.024 |
| 6 | 41.29 | 45.22 | 8.8 | 4.2 | 5.6 | 0.581 | 0.173 | 0.134 | 0.033 | 0.025 |
| 7 | 43.91 | 47.86 | 9.1 | 4.3 | 5.3 | 0.580 | 0.168 | 0.130 | 0.032 | 0.025 |
| 8 | 46.00 | 50.03 | 9.3 | 4.5 | 5.6 | 0.573 | 0.159 | 0.121 | 0.030 | 0.023 |
| 9 | 68.35 | 71.83 | 10.9 | 4.9 | 5.9 | 0.511 | 0.057 | 0.049 | 0.011 | 0.009 |
| 10 | 86.92 | 88.33 | 11.0 | 4.4 | 6.6 | 0.455 | 0.020 | 0.020 | 0.004 | 0.004 |
| 11 | 92.79 | 93.11 | 11.4 | 4.7 | 5.4 | 0.456 | 0.120 | 0.120 | 0.021 | 0.021 |

TABLE XV. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5,

100 PERCENT DESIGN SPEED

(a) Reading 981

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 23.7 | 63.7 | 56.7 | 518.7 | 587.0 | 14.69 | 20.06 |
| 2 | 9.440 | 9.322 | 0. | 22.7 | 63.0 | 55.9 | 518.7 | 584.9 | 14.69 | 20.20 |
| 3 | 8.559 | 8.588 | 0. | 25.5 | 59.1 | 52.1 | 518.7 | 582.9 | 14.69 | 19.84 |
| 4 | 8.102 | 8.222 | 0. | 24.7 | 57.3 | 52.8 | 518.7 | 574.2 | 14.69 | 18.68 |
| 5 | 7.985 | 8.129 | 0. | 25.2 | 56.8 | 53.8 | 518.7 | 575.6 | 14.69 | 17.99 |
| 6 | 7.868 | 8.038 | 0. | 25.3 | 56.4 | 52.5 | 518.7 | 577.1 | 14.69 | 18.22 |
| 7 | 7.740 | 7.937 | 0. | 25.7 | 55.9 | 50.1 | 518.7 | 576.4 | 14.69 | 18.91 |
| 8 | 7.638 | 7.854 | 0. | 25.4 | 55.6 | 49.0 | 518.7 | 576.9 | 14.69 | 19.18 |
| 9 | 6.546 | 7.019 | 0. | 27.2 | 52.3 | 41.4 | 518.7 | 579.5 | 14.69 | 20.35 |
| 10 | 5.639 | 6.387 | 0. | 33.5 | 50.2 | 29.6 | 518.7 | 589.9 | 14.69 | 21.75 |
| 11 | 5.352 | 6.204 | 0. | 36.7 | 49.6 | 23.7 | 518.7 | 597.3 | 14.69 | 22.67 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 665.3 | 736.2 | 1499.2 | 1228.8 | 665.3 | 674.2 | 0. | 295.8 | 1343.5 | 1323.1 |
| 2 | 670.6 | 742.8 | 1475.8 | 1221.5 | 670.6 | 685.1 | 0. | 286.9 | 1314.6 | 1298.2 |
| 3 | 713.8 | 752.8 | 1389.5 | 1105.2 | 713.8 | 679.3 | 0. | 324.4 | 1192.1 | 1196.1 |
| 4 | 723.9 | 709.5 | 1340.0 | 1065.0 | 723.9 | 644.6 | 0. | 296.5 | 1127.6 | 1144.3 |
| 5 | 727.0 | 679.9 | 1327.2 | 1042.5 | 727.0 | 615.5 | 0. | 289.0 | 1110.3 | 1130.4 |
| 6 | 727.5 | 696.4 | 1313.1 | 1032.9 | 727.5 | 629.5 | 0. | 297.9 | 1093.1 | 1116.8 |
| 7 | 728.3 | 730.8 | 1299.1 | 1026.1 | 728.3 | 658.8 | 0. | 316.5 | 1075.8 | 1103.2 |
| 8 | 727.6 | 745.6 | 1287.6 | 1024.3 | 727.6 | 671.7 | 0. | 319.0 | 1062.3 | 1092.3 |
| 9 | 705.0 | 787.7 | 1151.7 | 933.6 | 705.0 | 700.8 | 0. | 359.6 | 910.7 | 976.5 |
| 10 | 652.9 | 864.5 | 1019.5 | 829.5 | 652.9 | 721.1 | 0. | 476.9 | 783.1 | 887.0 |
| 11 | 632.4 | 908.6 | 976.7 | 795.3 | 632.4 | 728.3 | 0. | 543.4 | 744.3 | 862.7 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.618 | 0.645 | 1.393 | 1.077 | 0.618 | 0.591 | 1.013 | 1.611 | 0.706 |
| 2 | 0.624 | 0.653 | 1.372 | 1.073 | 0.624 | 0.602 | 1.022 | 1.617 | 0.747 |
| 3 | 0.667 | 0.664 | 1.299 | 0.974 | 0.667 | 0.599 | 0.952 | 1.581 | 0.724 |
| 4 | 0.678 | 0.627 | 1.254 | 0.942 | 0.678 | 0.570 | 0.890 | 1.535 | 0.662 |
| 5 | 0.681 | 0.599 | 1.243 | 0.918 | 0.681 | 0.542 | 0.847 | 1.524 | 0.542 |
| 6 | 0.681 | 0.613 | 1.230 | 0.910 | 0.681 | 0.554 | 0.865 | 1.511 | 0.563 |
| 7 | 0.682 | 0.646 | 1.217 | 0.908 | 0.682 | 0.583 | 0.905 | 1.500 | 0.671 |
| 8 | 0.681 | 0.658 | 1.206 | 0.907 | 0.681 | 0.595 | 0.923 | 1.495 | 0.704 |
| 9 | 0.658 | 0.700 | 1.075 | 0.829 | 0.658 | 0.622 | 0.994 | 1.415 | 0.834 |
| 10 | 0.606 | 0.768 | 0.946 | 0.737 | 0.606 | 0.640 | 1.105 | 1.327 | 0.864 |
| 11 | 0.586 | 0.806 | 0.904 | 0.706 | 0.586 | 0.646 | 1.152 | 1.270 | 0.870 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.1 | -0.2 | 8.1 | 0.244 | 0.164 | 0.060 | 0.029 | 0.011 |
| 2 | 9.11 | 11.70 | 2.5 | -0.1 | 7.8 | 0.234 | 0.141 | 0.039 | 0.025 | 0.007 |
| 3 | 27.14 | 30.86 | 2.9 | -0.9 | 7.2 | 0.273 | 0.161 | 0.079 | 0.029 | 0.014 |
| 4 | 36.50 | 40.42 | 3.3 | -1.1 | 10.3 | 0.267 | 0.181 | 0.116 | 0.031 | 0.020 |
| 5 | 38.89 | 42.85 | 3.3 | -1.2 | 12.6 | 0.275 | 0.250 | 0.189 | 0.041 | 0.031 |
| 6 | 41.29 | 45.22 | 3.4 | -1.3 | 12.1 | 0.276 | 0.249 | 0.191 | 0.041 | 0.032 |
| 7 | 43.91 | 47.86 | 3.5 | -1.3 | 10.2 | 0.276 | 0.191 | 0.137 | 0.033 | 0.023 |
| 8 | 46.00 | 50.03 | 3.6 | -1.2 | 10.4 | 0.270 | 0.176 | 0.124 | 0.030 | 0.021 |
| 9 | 68.35 | 71.83 | 4.7 | -1.2 | 12.8 | 0.262 | 0.123 | 0.099 | 0.021 | 0.017 |
| 10 | 86.92 | 88.33 | 5.6 | -1.0 | 10.7 | 0.282 | 0.140 | 0.134 | 0.023 | 0.022 |
| 11 | 92.79 | 93.11 | 5.7 | -0.9 | 7.4 | 0.294 | 0.157 | 0.155 | 0.026 | 0.026 |

TABLE XV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 100 PERCENT DESIGN SPEED

(b) Reading 982

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 38.9 | 63.7 | 56.9 | 518.7 | 617.0 | 14.69 | 23.28 |
| 2 | 9.440 | 9.322 | 0. | 36.2 | 62.9 | 55.2 | 518.7 | 615.5 | 14.69 | 23.57 |
| 3 | 8.559 | 8.588 | 0. | 38.5 | 59.1 | 48.8 | 518.7 | 611.4 | 14.69 | 23.95 |
| 4 | 8.102 | 8.222 | 0. | 39.0 | 57.3 | 49.8 | 518.7 | 601.7 | 14.69 | 22.52 |
| 5 | 7.985 | 8.129 | 0. | 38.6 | 56.8 | 51.8 | 518.7 | 600.3 | 14.69 | 21.69 |
| 6 | 7.868 | 8.038 | 0. | 38.7 | 56.4 | 50.8 | 518.7 | 600.3 | 14.69 | 21.74 |
| 7 | 7.740 | 7.937 | 0. | 38.2 | 55.9 | 48.5 | 518.7 | 601.1 | 14.69 | 22.18 |
| 8 | 7.638 | 7.854 | 0. | 37.2 | 55.6 | 47.2 | 518.7 | 599.7 | 14.69 | 22.41 |
| 9 | 6.546 | 7.019 | 0. | 36.3 | 52.2 | 38.3 | 518.7 | 593.5 | 14.69 | 22.74 |
| 10 | 5.639 | 6.387 | 0. | 38.7 | 49.9 | 27.7 | 518.7 | 595.9 | 14.69 | 23.16 |
| 11 | 5.352 | 6.204 | 0. | 40.5 | 49.5 | 22.2 | 518.7 | 602.2 | 14.69 | 23.58 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 661.8 | 725.2 | 1494.8 | 1032.2 | 661.8 | 564.4 | 0. | 455.7 | 1340.3 | 1319.8 |
| 2 | 670.4 | 739.3 | 1472.6 | 1044.9 | 670.4 | 596.5 | 0. | 436.8 | 1311.1 | 1294.7 |
| 3 | 712.0 | 786.5 | 1385.1 | 934.0 | 712.0 | 615.5 | 0. | 489.6 | 1188.0 | 1192.1 |
| 4 | 723.4 | 737.7 | 1337.7 | 888.0 | 723.4 | 573.6 | 0. | 464.0 | 1125.3 | 1141.9 |
| 5 | 726.3 | 698.7 | 1325.6 | 882.0 | 726.3 | 545.9 | 0. | 436.1 | 1108.9 | 1128.9 |
| 6 | 726.6 | 705.9 | 1312.4 | 872.0 | 726.6 | 551.3 | 0. | 440.9 | 1092.9 | 1116.5 |
| 7 | 726.8 | 731.8 | 1298.0 | 867.5 | 726.8 | 574.8 | 0. | 453.2 | 1075.4 | 1102.8 |
| 8 | 726.3 | 744.4 | 1285.2 | 872.5 | 726.3 | 592.9 | 0. | 450.2 | 1060.3 | 1090.3 |
| 9 | 704.0 | 791.9 | 1148.8 | 814.0 | 704.0 | 638.5 | 0. | 468.6 | 907.8 | 973.4 |
| 10 | 659.2 | 856.2 | 1023.4 | 755.2 | 659.2 | 668.4 | 0. | 535.2 | 782.8 | 886.7 |
| 11 | 634.5 | 896.3 | 976.8 | 736.3 | 634.5 | 681.5 | 0. | 582.1 | 742.6 | 860.8 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.615 | 0.618 | 1.389 | 0.880 | 0.615 | 0.481 | 0.853 | 1.609 | 0.741 |
| 2 | 0.623 | 0.632 | 1.369 | 0.893 | 0.623 | 0.510 | 0.890 | 1.612 | 0.775 |
| 3 | 0.665 | 0.678 | 1.294 | 0.805 | 0.665 | 0.531 | 0.864 | 1.576 | 0.857 |
| 4 | 0.677 | 0.638 | 1.252 | 0.768 | 0.677 | 0.496 | 0.793 | 1.532 | 0.811 |
| 5 | 0.680 | 0.603 | 1.241 | 0.761 | 0.680 | 0.471 | 0.752 | 1.522 | 0.748 |
| 6 | 0.680 | 0.609 | 1.229 | 0.753 | 0.680 | 0.476 | 0.759 | 1.511 | 0.753 |
| 7 | 0.680 | 0.633 | 1.215 | 0.750 | 0.680 | 0.497 | 0.791 | 1.501 | 0.786 |
| 8 | 0.680 | 0.645 | 1.203 | 0.757 | 0.680 | 0.514 | 0.816 | 1.492 | 0.821 |
| 9 | 0.657 | 0.694 | 1.073 | 0.714 | 0.657 | 0.560 | 0.907 | 1.412 | 0.922 |
| 10 | 0.612 | 0.755 | 0.951 | 0.666 | 0.612 | 0.590 | 1.014 | 1.324 | 0.933 |
| 11 | 0.588 | 0.790 | 0.905 | 0.649 | 0.588 | 0.601 | 1.074 | 1.265 | 0.899 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.1 | -0.1 | 8.2 | 0.408 | 0.197 | 0.094 | 0.035 | 0.017 |
| 2 | 9.11 | 11.70 | 2.4 | -0.2 | 7.1 | 0.385 | 0.173 | 0.073 | 0.032 | 0.013 |
| 3 | 27.14 | 30.86 | 2.9 | -0.9 | 5.9 | 0.430 | 0.132 | 0.052 | 0.026 | 0.010 |
| 4 | 36.50 | 40.42 | 3.2 | -1.1 | 7.4 | 0.434 | 0.146 | 0.081 | 0.026 | 0.015 |
| 5 | 38.89 | 42.85 | 3.3 | -1.2 | 10.5 | 0.426 | 0.192 | 0.131 | 0.033 | 0.022 |
| 6 | 41.29 | 45.22 | 3.4 | -1.2 | 10.5 | 0.428 | 0.192 | 0.134 | 0.033 | 0.023 |
| 7 | 43.91 | 47.86 | 3.5 | -1.2 | 8.6 | 0.426 | 0.171 | 0.117 | 0.030 | 0.021 |
| 8 | 46.00 | 50.03 | 3.6 | -1.2 | 8.6 | 0.414 | 0.143 | 0.093 | 0.026 | 0.017 |
| 9 | 68.35 | 71.83 | 4.7 | -1.3 | 9.5 | 0.387 | 0.070 | 0.047 | 0.012 | 0.008 |
| 10 | 86.92 | 88.33 | 5.3 | -1.3 | 8.8 | 0.369 | 0.075 | 0.069 | 0.013 | 0.012 |
| 11 | 92.79 | 93.11 | 5.6 | -1.1 | 6.0 | 0.363 | 0.129 | 0.128 | 0.022 | 0.021 |

TABLE XV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 100 PERCENT DESIGN SPEED

(c) Reading 984

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 49.6 | 64.7 | 52.2 | 518.7 | 654.9 | 14.69 | 28.85 |
| 2 | 9.440 | 9.322 | 0. | 47.9 | 64.0 | 51.1 | 518.7 | 649.0 | 14.69 | 28.77 |
| 3 | 8.559 | 8.588 | 0. | 48.8 | 60.6 | 45.9 | 518.7 | 638.0 | 14.69 | 28.29 |
| 4 | 8.102 | 8.222 | 0. | 50.6 | 59.2 | 45.6 | 518.7 | 631.8 | 14.69 | 27.01 |
| 5 | 7.985 | 8.129 | 0. | 50.5 | 58.7 | 46.6 | 518.7 | 630.4 | 14.69 | 26.41 |
| 6 | 7.868 | 8.038 | 0. | 51.1 | 58.5 | 45.8 | 518.7 | 628.9 | 14.69 | 26.32 |
| 7 | 7.740 | 7.937 | 0. | 49.6 | 58.2 | 44.4 | 518.7 | 626.4 | 14.69 | 26.37 |
| 8 | 7.638 | 7.854 | 0. | 49.1 | 57.9 | 43.3 | 518.7 | 624.0 | 14.69 | 26.39 |
| 9 | 6.546 | 7.019 | 0. | 47.1 | 54.9 | 36.2 | 518.7 | 609.0 | 14.69 | 25.40 |
| 10 | 5.639 | 6.387 | 0. | 47.2 | 52.6 | 25.9 | 518.7 | 605.8 | 14.69 | 24.90 |
| 11 | 5.352 | 6.204 | 0. | 48.7 | 52.3 | 19.5 | 518.7 | 611.7 | 14.69 | 25.08 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 631.5 | 825.7 | 1479.9 | 871.9 | 631.5 | 534.8 | 0. | 629.4 | 1338.4 | 1318.0 |
| 2 | 638.1 | 823.3 | 1457.5 | 878.5 | 638.1 | 552.1 | 0. | 610.7 | 1310.4 | 1294.1 |
| 3 | 669.0 | 833.5 | 1364.0 | 787.7 | 669.0 | 548.6 | 0. | 627.5 | 1188.7 | 1192.7 |
| 4 | 670.8 | 802.9 | 1310.0 | 728.9 | 670.8 | 509.6 | 0. | 620.7 | 1125.2 | 1141.9 |
| 5 | 675.1 | 782.0 | 1297.4 | 725.0 | 675.1 | 497.0 | 0. | 604.0 | 1109.1 | 1129.1 |
| 6 | 670.3 | 784.8 | 1282.6 | 706.4 | 670.3 | 492.7 | 0. | 611.0 | 1093.6 | 1117.2 |
| 7 | 666.5 | 790.3 | 1265.5 | 716.9 | 666.5 | 512.4 | 0. | 601.8 | 1075.7 | 1103.1 |
| 8 | 665.1 | 795.4 | 1252.5 | 715.3 | 665.1 | 521.0 | 0. | 601.1 | 1061.2 | 1091.2 |
| 9 | 641.3 | 793.9 | 1113.9 | 669.5 | 641.3 | 540.5 | 0. | 581.5 | 910.8 | 976.6 |
| 10 | 600.0 | 834.7 | 987.2 | 630.3 | 600.0 | 567.0 | 0. | 612.5 | 783.9 | 887.8 |
| 11 | 574.9 | 874.5 | 939.9 | 612.3 | 574.9 | 577.0 | 0. | 657.1 | 743.6 | 862.0 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.585 | 0.689 | 1.370 | 0.727 | 0.585 | 0.446 | 0.847 | 1.626 | 0.809 |
| 2 | 0.591 | 0.690 | 1.351 | 0.736 | 0.591 | 0.463 | 0.865 | 1.632 | 0.843 |
| 3 | 0.622 | 0.706 | 1.268 | 0.667 | 0.622 | 0.465 | 0.820 | 1.605 | 0.895 |
| 4 | 0.624 | 0.681 | 1.218 | 0.618 | 0.624 | 0.432 | 0.760 | 1.568 | 0.871 |
| 5 | 0.626 | 0.663 | 1.207 | 0.613 | 0.626 | 0.421 | 0.738 | 1.559 | 0.847 |
| 6 | 0.623 | 0.666 | 1.193 | 0.600 | 0.623 | 0.418 | 0.735 | 1.552 | 0.853 |
| 7 | 0.620 | 0.673 | 1.176 | 0.610 | 0.620 | 0.436 | 0.769 | 1.545 | 0.875 |
| 8 | 0.618 | 0.679 | 1.164 | 0.610 | 0.618 | 0.445 | 0.783 | 1.538 | 0.897 |
| 9 | 0.594 | 0.687 | 1.032 | 0.579 | 0.594 | 0.467 | 0.843 | 1.483 | 0.973 |
| 10 | 0.554 | 0.728 | 0.911 | 0.549 | 0.554 | 0.494 | 0.945 | 1.353 | 0.968 |
| 11 | 0.529 | 0.762 | 0.865 | 0.534 | 0.529 | 0.503 | 1.004 | 1.293 | 0.921 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 3.2 | 0.9 | 3.5 | 0.549 | 0.192 | 0.088 | 0.038 | 0.018 |
| 2 | 9.11 | 11.70 | 3.5 | 0.9 | 3.0 | 0.530 | 0.157 | 0.055 | 0.032 | 0.011 |
| 3 | 27.14 | 30.86 | 4.5 | 0.6 | 1.0 | 0.558 | 0.108 | 0.025 | 0.022 | 0.005 |
| 4 | 36.50 | 40.42 | 5.2 | 0.8 | 3.2 | 0.577 | 0.134 | 0.067 | 0.026 | 0.013 |
| 5 | 38.89 | 42.85 | 5.3 | 0.8 | 5.3 | 0.572 | 0.158 | 0.094 | 0.030 | 0.018 |
| 6 | 41.29 | 45.22 | 5.5 | 0.9 | 5.5 | 0.580 | 0.153 | 0.093 | 0.029 | 0.018 |
| 7 | 43.91 | 47.86 | 5.8 | 1.0 | 4.5 | 0.562 | 0.131 | 0.074 | 0.025 | 0.014 |
| 8 | 46.00 | 50.03 | 5.9 | 1.1 | 4.7 | 0.557 | 0.108 | 0.054 | 0.021 | 0.010 |
| 9 | 68.35 | 71.83 | 7.3 | 1.4 | 7.4 | 0.521 | 0.050 | 0.002 | 0.006 | 0.000 |
| 10 | 86.92 | 88.33 | 8.0 | 1.4 | 7.0 | 0.489 | 0.042 | 0.037 | 0.007 | 0.006 |
| 11 | 92.79 | 93.11 | 8.4 | 1.7 | 3.3 | 0.485 | 0.118 | 0.117 | 0.020 | 0.020 |

TABLE XV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 100 PERCENT DESIGN SPEED

(d) Reading 985

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 50.8 | 65.4 | 52.5 | 518.7 | 661.0 | 14.69 | 29.06 |
| 2 | 9.440 | 9.322 | 0. | 48.9 | 64.8 | 51.3 | 518.7 | 653.5 | 14.69 | 28.98 |
| 3 | 8.559 | 8.588 | 0. | 49.5 | 61.5 | 46.6 | 518.7 | 640.5 | 14.69 | 28.24 |
| 4 | 8.102 | 8.222 | 0. | 51.6 | 60.1 | 46.0 | 518.7 | 635.3 | 14.69 | 27.13 |
| 5 | 7.985 | 8.129 | 0. | 52.4 | 59.7 | 46.4 | 518.7 | 635.5 | 14.69 | 26.72 |
| 6 | 7.868 | 8.038 | 0. | 52.5 | 59.4 | 45.2 | 518.7 | 632.1 | 14.69 | 26.65 |
| 7 | 7.740 | 7.937 | 0. | 51.2 | 59.1 | 44.0 | 518.7 | 630.0 | 14.69 | 26.69 |
| 8 | 7.638 | 7.854 | 0. | 50.4 | 58.8 | 42.8 | 518.7 | 627.5 | 14.69 | 26.67 |
| 9 | 6.546 | 7.019 | 0. | 48.4 | 55.7 | 35.8 | 518.7 | 610.7 | 14.69 | 25.59 |
| 10 | 5.639 | 6.387 | 0. | 48.0 | 53.1 | 25.6 | 518.7 | 606.7 | 14.69 | 25.04 |
| 11 | 5.352 | 6.204 | 0. | 49.7 | 53.0 | 18.8 | 518.7 | 612.0 | 14.69 | 25.24 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 613.8 | 831.2 | 1477.3 | 858.3 | 613.8 | 525.2 | 0. | 644.4 | 1343.7 | 1325.2 |
| 2 | 617.3 | 824.8 | 1451.9 | 866.8 | 617.3 | 542.2 | 0. | 621.5 | 1314.2 | 1297.7 |
| 3 | 646.9 | 826.6 | 1355.8 | 780.7 | 646.9 | 536.8 | 0. | 628.6 | 1191.5 | 1195.5 |
| 4 | 648.1 | 801.6 | 1300.9 | 717.2 | 648.1 | 497.9 | 0. | 628.5 | 1127.9 | 1144.6 |
| 5 | 649.1 | 789.7 | 1286.9 | 698.0 | 649.1 | 481.6 | 0. | 626.0 | 1111.2 | 1131.2 |
| 6 | 646.9 | 795.8 | 1271.6 | 686.4 | 646.9 | 484.1 | 0. | 631.8 | 1094.8 | 1118.4 |
| 7 | 643.9 | 798.8 | 1255.5 | 695.0 | 643.9 | 500.3 | 0. | 622.8 | 1077.8 | 1105.3 |
| 8 | 644.4 | 803.0 | 1243.1 | 698.4 | 644.4 | 512.3 | 0. | 618.4 | 1063.0 | 1093.1 |
| 9 | 623.3 | 797.0 | 1104.7 | 652.9 | 623.3 | 529.4 | 0. | 595.8 | 912.1 | 978.0 |
| 10 | 589.1 | 835.7 | 981.5 | 619.9 | 589.1 | 558.9 | 0. | 621.2 | 785.0 | 889.2 |
| 11 | 560.1 | 877.3 | 931.2 | 599.8 | 560.1 | 567.7 | 0. | 668.9 | 743.9 | 862.3 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.567 | 0.690 | 1.365 | 0.713 | 0.567 | 0.436 | 0.856 | 1.645 | 0.784 |
| 2 | 0.571 | 0.689 | 1.342 | 0.724 | 0.571 | 0.453 | 0.878 | 1.650 | 0.825 |
| 3 | 0.600 | 0.698 | 1.257 | 0.659 | 0.600 | 0.453 | 0.830 | 1.624 | 0.874 |
| 4 | 0.601 | 0.678 | 1.207 | 0.607 | 0.601 | 0.421 | 0.768 | 1.590 | 0.852 |
| 5 | 0.602 | 0.667 | 1.194 | 0.589 | 0.602 | 0.407 | 0.742 | 1.581 | 0.828 |
| 6 | 0.600 | 0.674 | 1.179 | 0.582 | 0.600 | 0.410 | 0.748 | 1.573 | 0.848 |
| 7 | 0.597 | 0.678 | 1.164 | 0.590 | 0.597 | 0.425 | 0.777 | 1.566 | 0.866 |
| 8 | 0.597 | 0.684 | 1.153 | 0.595 | 0.597 | 0.436 | 0.795 | 1.559 | 0.885 |
| 9 | 0.577 | 0.688 | 1.022 | 0.564 | 0.577 | 0.457 | 0.849 | 1.506 | 0.968 |
| 10 | 0.543 | 0.728 | 0.905 | 0.540 | 0.543 | 0.487 | 0.949 | 1.360 | 0.970 |
| 11 | 0.515 | 0.765 | 0.856 | 0.523 | 0.515 | 0.495 | 1.014 | 1.300 | 0.930 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 3.9 | 1.6 | 3.6 | 0.560 | 0.225 | 0.116 | 0.045 | 0.023 |
| 2 | 9.11 | 11.70 | 4.3 | 1.7 | 3.2 | 0.539 | 0.179 | 0.075 | 0.036 | 0.015 |
| 3 | 27.14 | 30.86 | 5.3 | 1.5 | 1.7 | 0.560 | 0.133 | 0.047 | 0.027 | 0.010 |
| 4 | 36.50 | 40.42 | 6.1 | 1.7 | 3.6 | 0.584 | 0.159 | 0.089 | 0.031 | 0.017 |
| 5 | 38.89 | 42.85 | 6.2 | 1.7 | 5.1 | 0.592 | 0.186 | 0.120 | 0.035 | 0.023 |
| 6 | 41.29 | 45.22 | 6.4 | 1.8 | 4.8 | 0.596 | 0.164 | 0.102 | 0.031 | 0.019 |
| 7 | 43.91 | 47.86 | 6.7 | 1.9 | 4.1 | 0.580 | 0.145 | 0.086 | 0.028 | 0.017 |
| 8 | 46.00 | 50.03 | 6.8 | 1.9 | 4.2 | 0.571 | 0.125 | 0.069 | 0.024 | 0.013 |
| 9 | 68.35 | 71.83 | 8.1 | 2.2 | 7.0 | 0.535 | 0.037 | 0.006 | 0.007 | 0.001 |
| 10 | 86.92 | 88.33 | 8.5 | 2.0 | 6.7 | 0.498 | 0.041 | 0.035 | 0.007 | 0.006 |
| 11 | 92.79 | 95.11 | 9.1 | 2.4 | 2.6 | 0.496 | 0.107 | 0.106 | 0.018 | 0.018 |

TABLE XV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 100 PERCENT DESIGN SPEED

(e) Reading 987

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 53.9 | 66.8 | 52.4 | 518.7 | 670.1 | 14.69 | 29.16 |
| 2 | 9.440 | 9.322 | 0. | 51.5 | 66.3 | 51.2 | 518.7 | 659.1 | 14.69 | 29.07 |
| 3 | 8.559 | 8.588 | 0. | 51.4 | 63.0 | 47.2 | 518.7 | 642.3 | 14.69 | 28.21 |
| 4 | 8.102 | 8.222 | 0. | 53.4 | 61.5 | 45.9 | 518.7 | 638.4 | 14.69 | 27.26 |
| 5 | 7.985 | 8.129 | 0. | 54.0 | 61.2 | 45.5 | 518.7 | 638.4 | 14.69 | 27.00 |
| 6 | 7.868 | 8.038 | 0. | 53.3 | 60.9 | 44.3 | 518.7 | 636.6 | 14.69 | 27.00 |
| 7 | 7.740 | 7.937 | 0. | 52.5 | 60.6 | 43.1 | 518.7 | 633.6 | 14.69 | 26.99 |
| 8 | 7.638 | 7.854 | 0. | 51.7 | 60.2 | 42.3 | 518.7 | 630.0 | 14.69 | 26.93 |
| 9 | 6.546 | 7.019 | 0. | 50.1 | 57.1 | 35.8 | 518.7 | 612.8 | 14.69 | 25.65 |
| 10 | 5.639 | 6.387 | 0. | 48.9 | 54.8 | 25.1 | 518.7 | 608.1 | 14.69 | 25.24 |
| 11 | 5.352 | 6.204 | 0. | 50.5 | 54.0 | 18.4 | 518.7 | 612.3 | 14.69 | 25.43 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 574.5 | 840.6 | 1459.8 | 811.0 | 574.5 | 495.2 | 0. | 679.3 | 1342.0 | 1321.6 |
| 2 | 577.5 | 832.6 | 1435.2 | 828.1 | 577.5 | 518.5 | 0. | 651.8 | 1313.8 | 1297.4 |
| 3 | 606.3 | 821.5 | 1337.2 | 754.2 | 606.3 | 512.4 | 0. | 642.4 | 1191.8 | 1195.9 |
| 4 | 611.4 | 807.1 | 1282.9 | 691.8 | 611.4 | 481.5 | 0. | 647.9 | 1127.9 | 1144.6 |
| 5 | 611.6 | 803.6 | 1268.0 | 674.5 | 611.6 | 472.9 | 0. | 649.8 | 1110.7 | 1130.7 |
| 6 | 610.0 | 807.8 | 1253.6 | 674.5 | 610.0 | 482.8 | 0. | 647.8 | 1095.1 | 1118.8 |
| 7 | 607.8 | 811.1 | 1237.3 | 676.0 | 607.8 | 493.9 | 0. | 645.5 | 1077.7 | 1105.1 |
| 8 | 607.6 | 809.8 | 1224.4 | 679.7 | 607.6 | 502.4 | 0. | 635.2 | 1063.0 | 1093.0 |
| 9 | 588.9 | 794.4 | 1084.9 | 628.8 | 588.9 | 510.0 | 0. | 609.1 | 911.1 | 976.9 |
| 10 | 553.9 | 838.2 | 960.9 | 608.2 | 553.9 | 550.9 | 0. | 631.8 | 785.2 | 889.4 |
| 11 | 542.4 | 879.2 | 921.8 | 589.8 | 542.4 | 559.7 | 0. | 678.0 | 745.3 | 863.9 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.529 | 0.694 | 1.344 | 0.669 | 0.529 | 0.409 | 0.862 | 1.672 | 0.741 |
| 2 | 0.532 | 0.693 | 1.321 | 0.689 | 0.532 | 0.431 | 0.898 | 1.680 | 0.795 |
| 3 | 0.560 | 0.692 | 1.235 | 0.636 | 0.560 | 0.432 | 0.845 | 1.657 | 0.860 |
| 4 | 0.565 | 0.681 | 1.185 | 0.584 | 0.565 | 0.406 | 0.788 | 1.620 | 0.837 |
| 5 | 0.565 | 0.678 | 1.172 | 0.569 | 0.565 | 0.399 | 0.773 | 1.612 | 0.823 |
| 6 | 0.563 | 0.683 | 1.158 | 0.570 | 0.563 | 0.408 | 0.791 | 1.605 | 0.835 |
| 7 | 0.561 | 0.688 | 1.143 | 0.573 | 0.561 | 0.419 | 0.813 | 1.599 | 0.857 |
| 8 | 0.561 | 0.689 | 1.131 | 0.578 | 0.561 | 0.427 | 0.827 | 1.593 | 0.881 |
| 9 | 0.543 | 0.685 | 1.000 | 0.542 | 0.543 | 0.440 | 0.866 | 1.551 | 0.950 |
| 10 | 0.509 | 0.729 | 0.883 | 0.529 | 0.509 | 0.479 | 0.995 | 1.377 | 0.970 |
| 11 | 0.498 | 0.766 | 0.846 | 0.514 | 0.498 | 0.488 | 1.032 | 1.312 | 0.940 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 5.3 | 3.0 | 3.7 | 0.595 | 0.281 | 0.171 | 0.056 | 0.034 |
| 2 | 9.11 | 11.70 | 5.8 | 3.1 | 3.1 | 0.567 | 0.218 | 0.110 | 0.044 | 0.022 |
| 3 | 27.14 | 30.86 | 6.9 | 3.1 | 2.3 | 0.577 | 0.151 | 0.062 | 0.030 | 0.012 |
| 4 | 36.50 | 40.42 | 7.5 | 3.2 | 3.5 | 0.603 | 0.181 | 0.108 | 0.035 | 0.021 |
| 5 | 38.89 | 42.85 | 7.7 | 3.2 | 4.2 | 0.610 | 0.199 | 0.130 | 0.038 | 0.025 |
| 6 | 41.29 | 45.22 | 7.9 | 3.3 | 4.0 | 0.604 | 0.187 | 0.120 | 0.036 | 0.023 |
| 7 | 43.91 | 47.86 | 8.1 | 3.4 | 3.2 | 0.594 | 0.163 | 0.100 | 0.032 | 0.019 |
| 8 | 46.00 | 50.03 | 8.3 | 3.4 | 3.8 | 0.583 | 0.135 | 0.075 | 0.026 | 0.015 |
| 9 | 68.35 | 71.83 | 9.6 | 3.7 | 7.0 | 0.552 | 0.060 | 0.025 | 0.011 | 0.005 |
| 10 | 86.92 | 88.33 | 10.2 | 3.6 | 6.2 | 0.502 | 0.042 | 0.037 | 0.007 | 0.006 |
| 11 | 92.79 | 93.11 | 10.0 | 3.3 | 2.2 | 0.504 | 0.093 | 0.091 | 0.016 | 0.016 |

TABLE XV. - Continued. BLADE ELEMENT PERFORMANCE FOR

ROTOR 5, 100 PERCENT DESIGN SPEED

(f) Reading 990

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 46.9 | 63.8 | 54.4 | 518.7 | 644.8 | 14.69 | 26.80 |
| 2 | 9.440 | 9.322 | 0. | 44.7 | 63.0 | 53.2 | 518.7 | 637.1 | 14.69 | 26.82 |
| 3 | 8.559 | 8.588 | 0. | 43.4 | 59.2 | 47.1 | 518.7 | 630.2 | 14.69 | 26.91 |
| 4 | 8.102 | 8.222 | 0. | 46.1 | 57.4 | 47.0 | 518.7 | 620.2 | 14.69 | 25.46 |
| 5 | 7.985 | 8.129 | 0. | 45.2 | 56.9 | 48.3 | 518.7 | 619.2 | 14.69 | 24.74 |
| 6 | 7.868 | 8.038 | 0. | 45.7 | 56.5 | 47.5 | 518.7 | 617.1 | 14.69 | 24.68 |
| 7 | 7.740 | 7.937 | 0. | 43.7 | 56.1 | 46.4 | 518.7 | 614.6 | 14.69 | 24.85 |
| 8 | 7.638 | 7.854 | 0. | 42.9 | 55.7 | 45.0 | 518.7 | 613.4 | 14.69 | 25.07 |
| 9 | 6.546 | 7.019 | 0. | 41.7 | 52.5 | 36.5 | 518.7 | 603.3 | 14.69 | 24.71 |
| 10 | 5.639 | 6.387 | 0. | 43.3 | 50.2 | 26.8 | 518.7 | 600.7 | 14.69 | 24.25 |
| 11 | 5.352 | 6.204 | 0. | 45.9 | 50.1 | 20.0 | 518.7 | 608.9 | 14.69 | 24.47 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 664.7 | 788.5 | 1504.5 | 925.5 | 664.7 | 538.3 | 0. | 576.4 | 1349.8 | 1329.2 |
| 2 | 672.1 | 787.6 | 1480.9 | 934.8 | 672.1 | 559.5 | 0. | 554.2 | 1319.6 | 1303.1 |
| 3 | 713.1 | 817.6 | 1392.7 | 872.1 | 713.1 | 594.0 | 0. | 561.8 | 1196.3 | 1200.3 |
| 4 | 724.2 | 784.5 | 1343.3 | 797.7 | 724.2 | 544.3 | 0. | 565.0 | 1131.3 | 1148.1 |
| 5 | 726.4 | 756.6 | 1330.9 | 801.9 | 726.4 | 533.5 | 0. | 536.5 | 1115.1 | 1135.2 |
| 6 | 728.0 | 759.5 | 1318.0 | 784.4 | 728.0 | 530.0 | 0. | 544.2 | 1098.7 | 1122.5 |
| 7 | 725.5 | 762.9 | 1300.9 | 800.5 | 725.5 | 551.7 | 0. | 527.2 | 1079.8 | 1107.3 |
| 8 | 727.2 | 776.1 | 1291.3 | 804.9 | 727.2 | 568.9 | 0. | 528.0 | 1067.1 | 1097.3 |
| 9 | 702.1 | 806.7 | 1153.7 | 749.3 | 702.1 | 602.6 | 0. | 536.3 | 915.4 | 981.6 |
| 10 | 655.1 | 846.9 | 1024.3 | 689.8 | 655.1 | 616.0 | 0. | 581.2 | 787.3 | 891.8 |
| 11 | 624.7 | 891.8 | 974.2 | 660.4 | 624.7 | 620.5 | 0. | 640.5 | 747.6 | 866.6 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.618 | 0.661 | 1.398 | 0.775 | 0.618 | 0.451 | 0.810 | 1.620 | 0.771 |
| 2 | 0.625 | 0.664 | 1.377 | 0.788 | 0.625 | 0.472 | 0.833 | 1.623 | 0.822 |
| 3 | 0.667 | 0.696 | 1.302 | 0.742 | 0.667 | 0.506 | 0.833 | 1.587 | 0.878 |
| 4 | 0.678 | 0.671 | 1.257 | 0.682 | 0.678 | 0.466 | 0.752 | 1.541 | 0.869 |
| 5 | 0.680 | 0.646 | 1.246 | 0.684 | 0.680 | 0.455 | 0.734 | 1.531 | 0.828 |
| 6 | 0.682 | 0.650 | 1.254 | 0.671 | 0.682 | 0.453 | 0.728 | 1.519 | 0.842 |
| 7 | 0.679 | 0.654 | 1.218 | 0.686 | 0.679 | 0.473 | 0.760 | 1.508 | 0.876 |
| 8 | 0.681 | 0.667 | 1.209 | 0.692 | 0.681 | 0.489 | 0.782 | 1.502 | 0.905 |
| 9 | 0.655 | 0.702 | 1.077 | 0.652 | 0.655 | 0.525 | 0.858 | 1.425 | 0.982 |
| 10 | 0.608 | 0.743 | 0.951 | 0.605 | 0.608 | 0.540 | 0.940 | 1.336 | 0.973 |
| 11 | 0.578 | 0.781 | 0.901 | 0.578 | 0.578 | 0.543 | 0.993 | 1.280 | 0.903 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.2 | -0.1 | 5.8 | 0.509 | 0.211 | 0.104 | 0.040 | 0.020 |
| 2 | 9.11 | 11.70 | 2.5 | -0.1 | 5.1 | 0.488 | 0.161 | 0.057 | 0.031 | 0.011 |
| 3 | 27.14 | 30.86 | 3.0 | -0.8 | 2.2 | 0.492 | 0.116 | 0.032 | 0.023 | 0.006 |
| 4 | 36.50 | 40.42 | 3.3 | -1.0 | 4.6 | 0.524 | 0.120 | 0.053 | 0.023 | 0.010 |
| 5 | 38.89 | 42.85 | 3.4 | -1.1 | 7.1 | 0.509 | 0.157 | 0.094 | 0.029 | 0.017 |
| 6 | 41.29 | 45.22 | 3.5 | -1.1 | 7.2 | 0.518 | 0.144 | 0.084 | 0.026 | 0.015 |
| 7 | 43.91 | 47.86 | 3.7 | -1.1 | 6.6 | 0.494 | 0.114 | 0.058 | 0.021 | 0.011 |
| 8 | 46.00 | 50.03 | 3.8 | -1.1 | 6.4 | 0.486 | 0.090 | 0.036 | 0.017 | 0.007 |
| 9 | 68.35 | 71.83 | 5.0 | -1.0 | 7.6 | 0.459 | 0.018 | -0.007 | 0.003 | -0.001 |
| 10 | 86.92 | 88.33 | 5.6 | -0.9 | 7.9 | 0.443 | 0.032 | 0.025 | 0.005 | 0.004 |
| 11 | 92.79 | 93.11 | 6.2 | -0.5 | 3.8 | 0.450 | 0.134 | 0.132 | 0.023 | 0.022 |

TABLE XV. - Concluded. BLADE ELEMENT PERFORMANCE FOR ROTOR 5, 100 PERCENT DESIGN SPEED

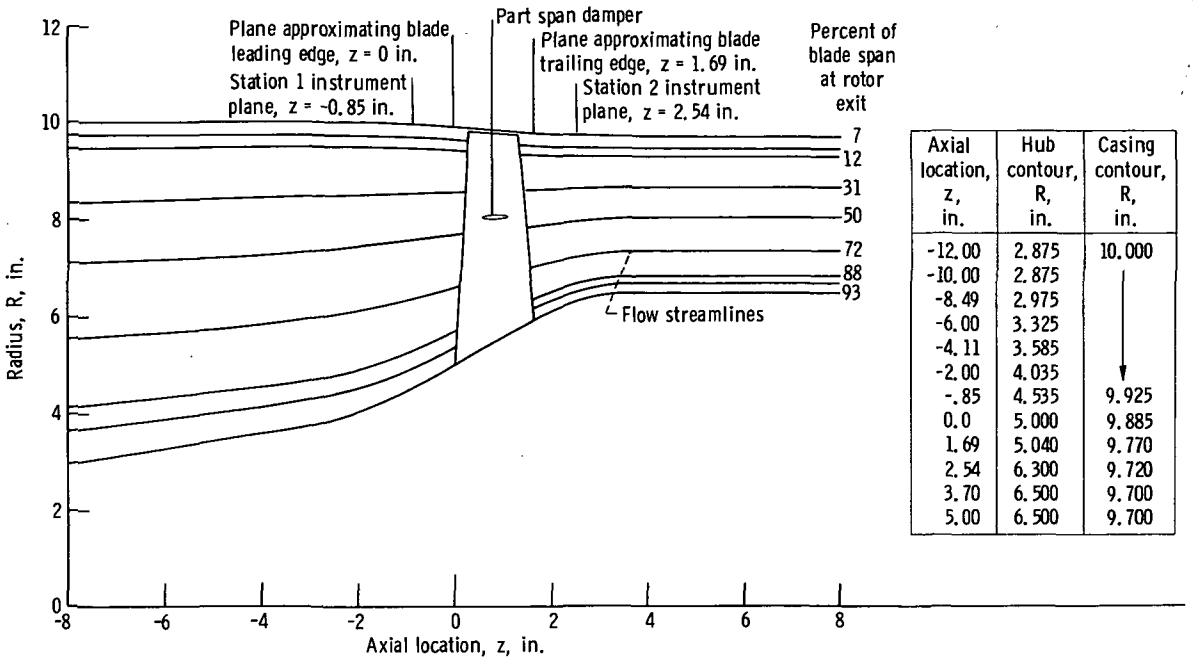
(g) Reading 992

| | RADII | | ABS BETAM | | REL BETAM | | TOTAL TEMP | | TOTAL PRESS | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 9.651 | 9.504 | 0. | 49.0 | 64.1 | 53.3 | 518.7 | 653.3 | 14.69 | 28.42 |
| 2 | 9.440 | 9.322 | 0. | 46.5 | 63.5 | 52.1 | 518.7 | 645.6 | 14.69 | 28.38 |
| 3 | 8.559 | 8.588 | 0. | 47.0 | 59.8 | 46.6 | 518.7 | 636.4 | 14.69 | 28.02 |
| 4 | 8.102 | 8.222 | 0. | 48.7 | 58.2 | 46.2 | 518.7 | 628.7 | 14.69 | 26.78 |
| 5 | 7.985 | 8.129 | 0. | 48.7 | 57.8 | 47.2 | 518.7 | 628.0 | 14.69 | 26.13 |
| 6 | 7.868 | 8.038 | 0. | 48.4 | 57.4 | 46.4 | 518.7 | 625.3 | 14.69 | 26.04 |
| 7 | 7.740 | 7.937 | 0. | 47.9 | 57.1 | 44.8 | 518.7 | 623.7 | 14.69 | 26.14 |
| 8 | 7.638 | 7.854 | 0. | 46.8 | 56.7 | 43.8 | 518.7 | 621.4 | 14.69 | 26.20 |
| 9 | 6.546 | 7.019 | 0. | 45.4 | 53.6 | 36.0 | 518.7 | 608.9 | 14.69 | 25.35 |
| 10 | 5.639 | 6.387 | 0. | 46.2 | 51.3 | 26.1 | 518.7 | 605.0 | 14.69 | 24.80 |
| 11 | 5.352 | 6.204 | 0. | 48.1 | 51.0 | 19.2 | 518.7 | 612.1 | 14.69 | 25.09 |

| | ABS VEL | | REL VEL | | MERID VEL | | TANG VEL | | WHEEL SPEED | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | IN | OUT | IN | OUT |
| 1 | 655.0 | 813.2 | 1501.0 | 892.9 | 655.0 | 533.4 | 0. | 614.0 | 1350.6 | 1330.0 |
| 2 | 658.3 | 810.1 | 1474.4 | 906.8 | 658.3 | 557.6 | 0. | 587.7 | 1319.3 | 1302.8 |
| 3 | 697.1 | 826.4 | 1384.0 | 819.3 | 697.1 | 563.2 | 0. | 604.7 | 1195.6 | 1199.7 |
| 4 | 703.0 | 798.3 | 1333.5 | 761.3 | 703.0 | 526.5 | 0. | 600.0 | 1153.1 | 1149.9 |
| 5 | 704.7 | 777.7 | 1321.5 | 754.7 | 704.7 | 513.2 | 0. | 584.6 | 1117.9 | 1138.1 |
| 6 | 705.0 | 778.7 | 1307.4 | 749.6 | 705.0 | 517.3 | 0. | 582.3 | 1101.0 | 1124.8 |
| 7 | 700.9 | 788.8 | 1289.4 | 744.8 | 700.9 | 528.9 | 0. | 585.3 | 1082.2 | 1109.7 |
| 8 | 701.4 | 792.8 | 1278.0 | 751.6 | 701.4 | 542.4 | 0. | 578.3 | 1068.4 | 1098.6 |
| 9 | 675.2 | 802.0 | 1136.8 | 695.8 | 675.2 | 562.7 | 0. | 571.4 | 914.5 | 980.6 |
| 10 | 630.8 | 841.2 | 1009.3 | 648.0 | 630.8 | 581.9 | 0. | 607.5 | 788.0 | 892.5 |
| 11 | 604.9 | 886.4 | 961.2 | 626.6 | 604.9 | 591.8 | 0. | 659.9 | 747.1 | 866.0 |

| | ABS MACH NO | | REL MACH NO | | MERID MACH NO | | MERID | PEAK SS | EFF |
|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | IN | OUT | IN | OUT | VEL R | MACH NO | |
| 1 | 0.608 | 0.678 | 1.393 | 0.745 | 0.608 | 0.445 | 0.814 | 1.628 | 0.799 |
| 2 | 0.611 | 0.680 | 1.369 | 0.761 | 0.611 | 0.468 | 0.847 | 1.631 | 0.845 |
| 3 | 0.650 | 0.700 | 1.291 | 0.694 | 0.650 | 0.477 | 0.808 | 1.596 | 0.893 |
| 4 | 0.656 | 0.679 | 1.245 | 0.647 | 0.656 | 0.448 | 0.749 | 1.557 | 0.882 |
| 5 | 0.658 | 0.660 | 1.234 | 0.641 | 0.658 | 0.436 | 0.728 | 1.549 | 0.848 |
| 6 | 0.658 | 0.663 | 1.221 | 0.638 | 0.658 | 0.440 | 0.734 | 1.538 | 0.865 |
| 7 | 0.654 | 0.673 | 1.203 | 0.635 | 0.654 | 0.451 | 0.755 | 1.527 | 0.884 |
| 8 | 0.655 | 0.678 | 1.193 | 0.643 | 0.655 | 0.464 | 0.773 | 1.522 | 0.907 |
| 9 | 0.628 | 0.694 | 1.058 | 0.602 | 0.628 | 0.487 | 0.833 | 1.450 | 0.969 |
| 10 | 0.584 | 0.734 | 0.934 | 0.566 | 0.584 | 0.508 | 0.923 | 1.348 | 0.970 |
| 11 | 0.558 | 0.773 | 0.888 | 0.547 | 0.558 | 0.516 | 0.978 | 1.287 | 0.917 |

| | PERCENT SPAN | | INCIDENCE | | DEV | D-FACT | LOSS COEFF | | LOSS PARAM | |
|---|---|---|---|---|---|---|---|---|---|---|
| RP | IN | OUT | MEAN | SS | | | TOT | PROF | TOT | PROF |
| 1 | 4.79 | 6.95 | 2.5 | 0.3 | 4.7 | 0.538 | 0.196 | 0.089 | 0.038 | 0.017 |
| 2 | 9.11 | 11.70 | 3.0 | 0.4 | 4.0 | 0.512 | 0.150 | 0.045 | 0.029 | 0.009 |
| 3 | 27.14 | 30.86 | 3.6 | -0.2 | 1.7 | 0.536 | 0.107 | 0.023 | 0.022 | 0.005 |
| 4 | 36.50 | 40.42 | 4.2 | -0.2 | 3.8 | 0.555 | 0.117 | 0.048 | 0.023 | 0.009 |
| 5 | 38.89 | 42.85 | 4.3 | -0.2 | 5.9 | 0.551 | 0.151 | 0.085 | 0.028 | 0.016 |
| 6 | 41.29 | 45.22 | 4.4 | -0.2 | 6.0 | 0.549 | 0.134 | 0.073 | 0.025 | 0.014 |
| 7 | 43.91 | 47.86 | 4.6 | -0.2 | 4.9 | 0.545 | 0.117 | 0.060 | 0.022 | 0.011 |
| 8 | 46.00 | 50.03 | 4.8 | -0.1 | 5.2 | 0.532 | 0.093 | 0.039 | 0.018 | 0.007 |
| 9 | 68.35 | 71.83 | 6.0 | 0.1 | 7.2 | 0.506 | 0.033 | 0.006 | 0.006 | 0.001 |
| 10 | 86.92 | 88.33 | 6.7 | 0.2 | 7.2 | 0.481 | 0.038 | 0.031 | 0.007 | 0.005 |
| 11 | 92.79 | 93.11 | 7.1 | 0.4 | 5.0 | 0.482 | 0.120 | 0.118 | 0.021 | 0.020 |




| Axial location, z, in. | Hub contour, R, in. | Casing contour, R, in. |
|---|---|---|
| -12.00 | 2.875 | 10.000 |
| -10.00 | 2.875 | |
| -8.49 | 2.975 | |
| -6.00 | 3.325 | |
| -4.11 | 3.585 | |
| -2.00 | 4.035 | |
| -.85 | 4.535 | 9.925 |
| 0.0 | 5.000 | 9.885 |
| 1.69 | 5.040 | 9.770 |
| 2.54 | 6.300 | 9.720 |
| 3.70 | 6.500 | 9.700 |
| 5.00 | 6.500 | 9.700 |

Figure 1. - Compressor flow path for rotor 5.

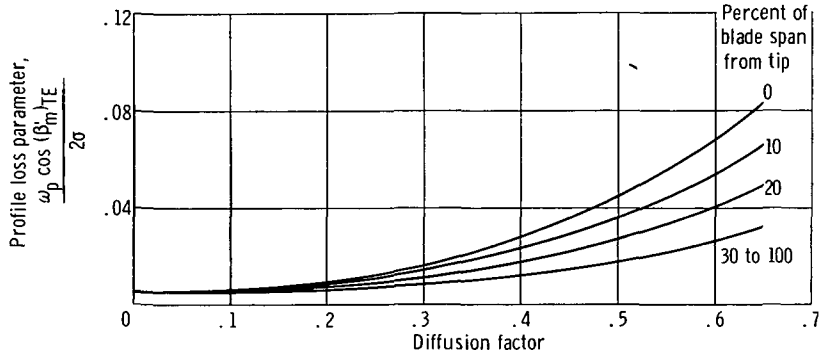



Figure 2. - Profile loss parameter as function of loading and percent span used in design of rotor 5.

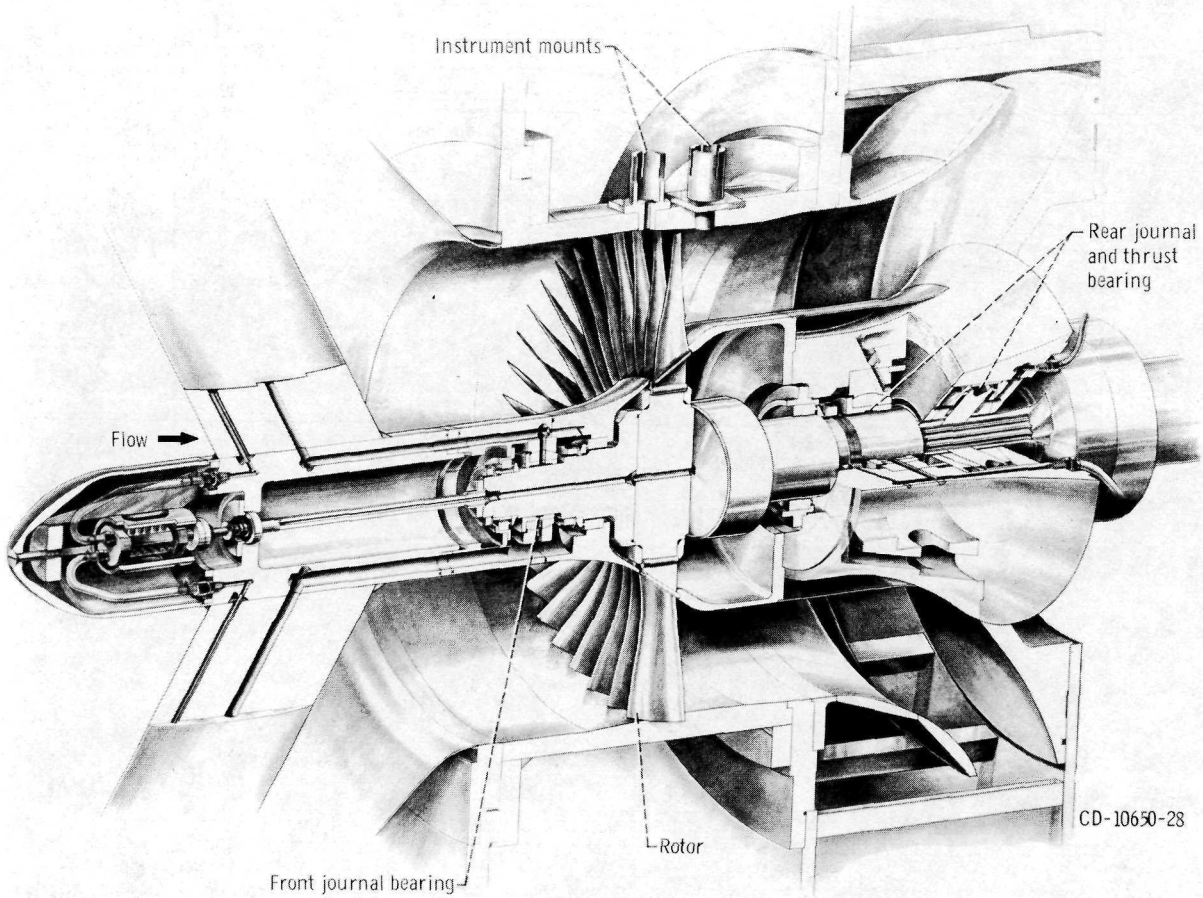



Figure 3. - Compressor assembly.

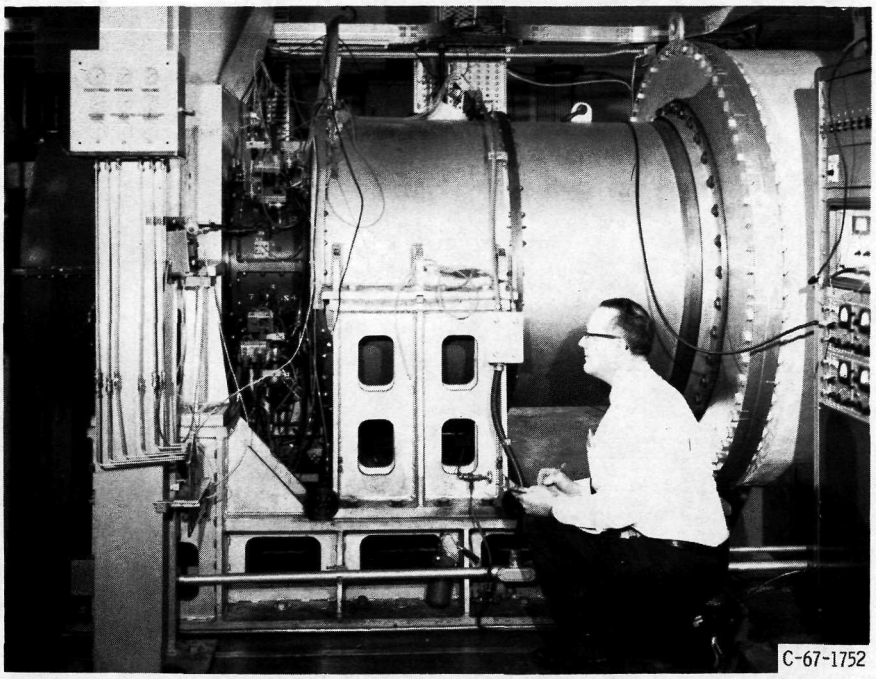



Figure 4. - Compressor test section.

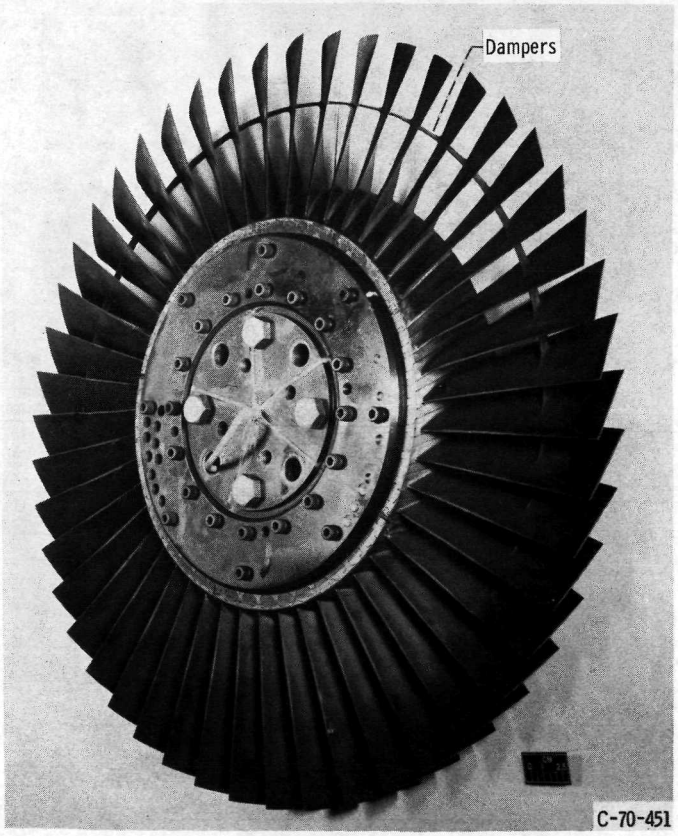



Figure 5. - Test rotor 5.

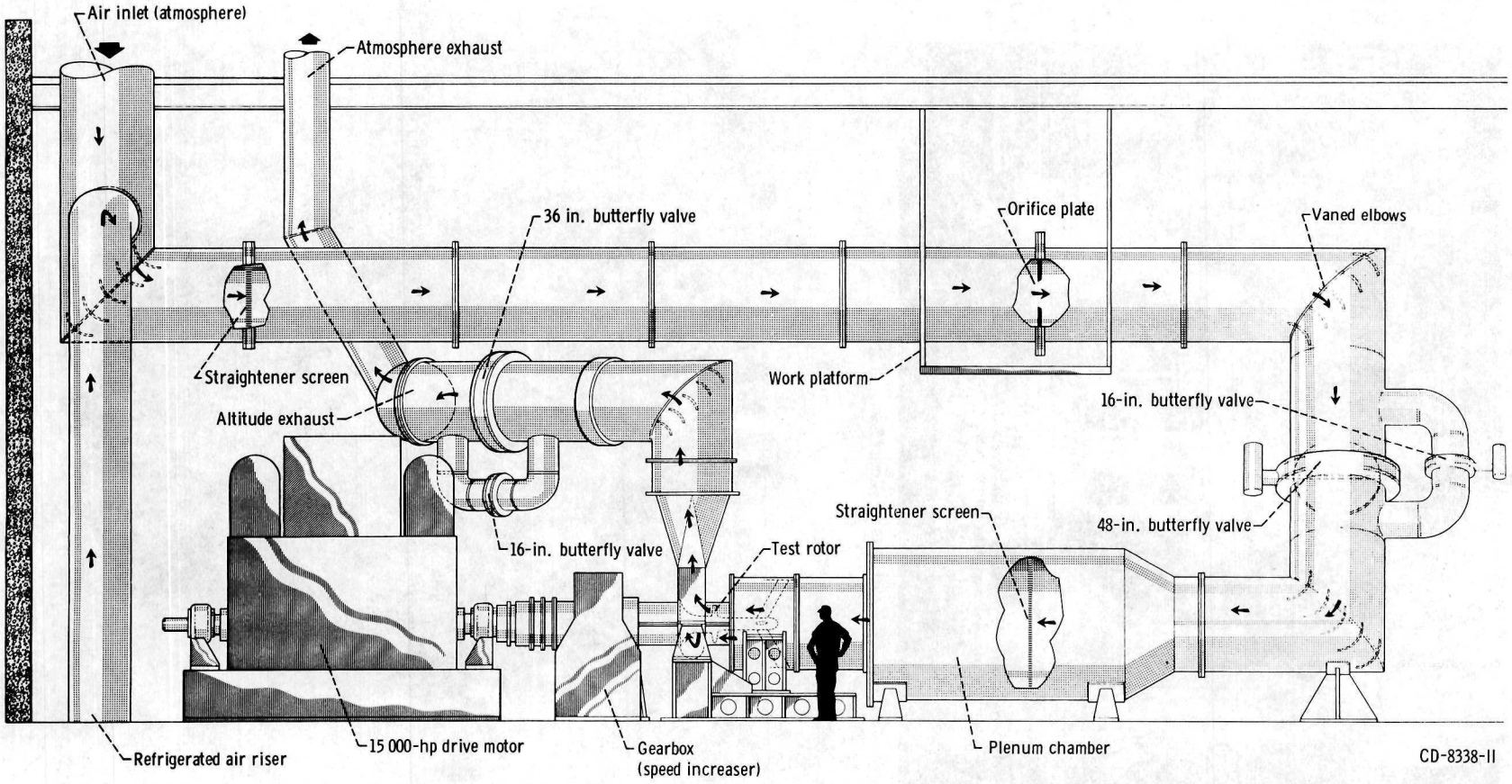



Figure 6. - Compressor test facility.

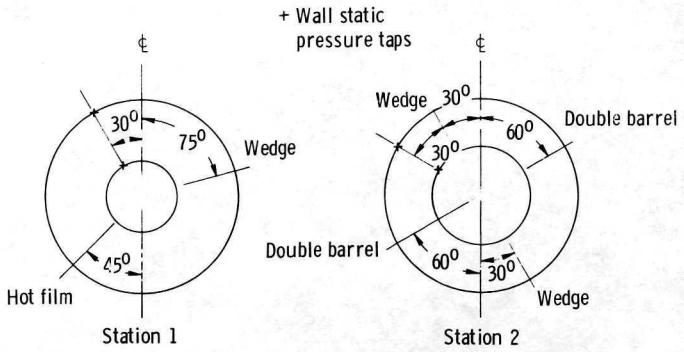



Figure 7. - Circumferential location of survey instrumentation and type of probes employed at each location.

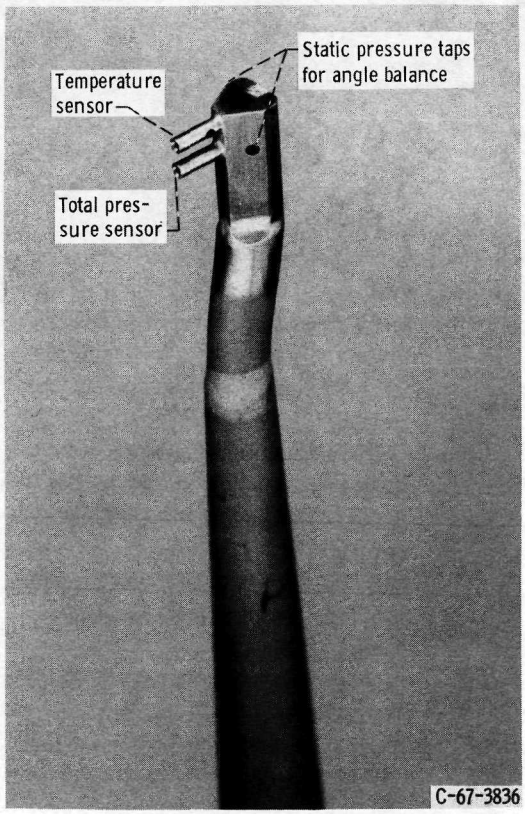



Figure 8. - Combination total pressure, total temperature, and flow angle probe (double barrel).

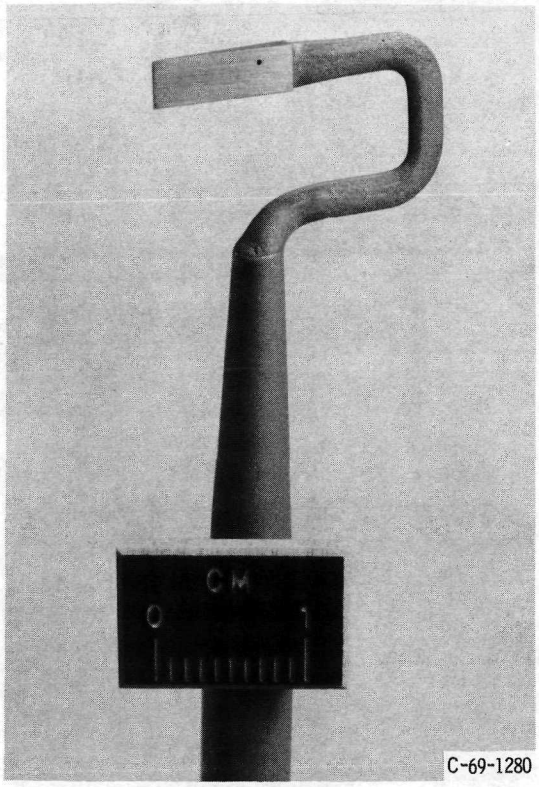



Figure 9. - Static pressure probe (C type; $7\frac{1}{2}^{\circ}$ wedge).

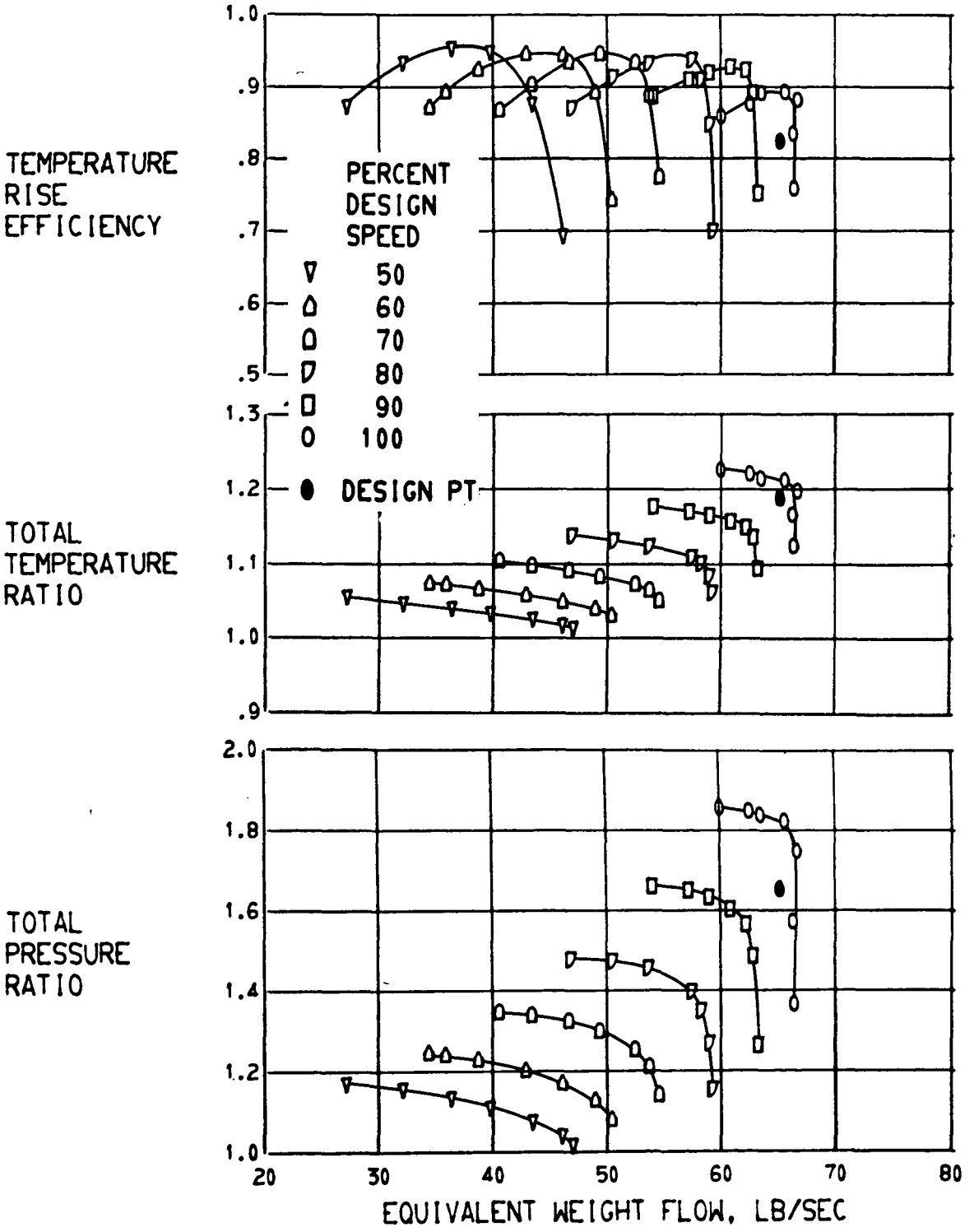



FIGURE 10. - OVERALL PERFORMANCE FOR ROTOR 5.

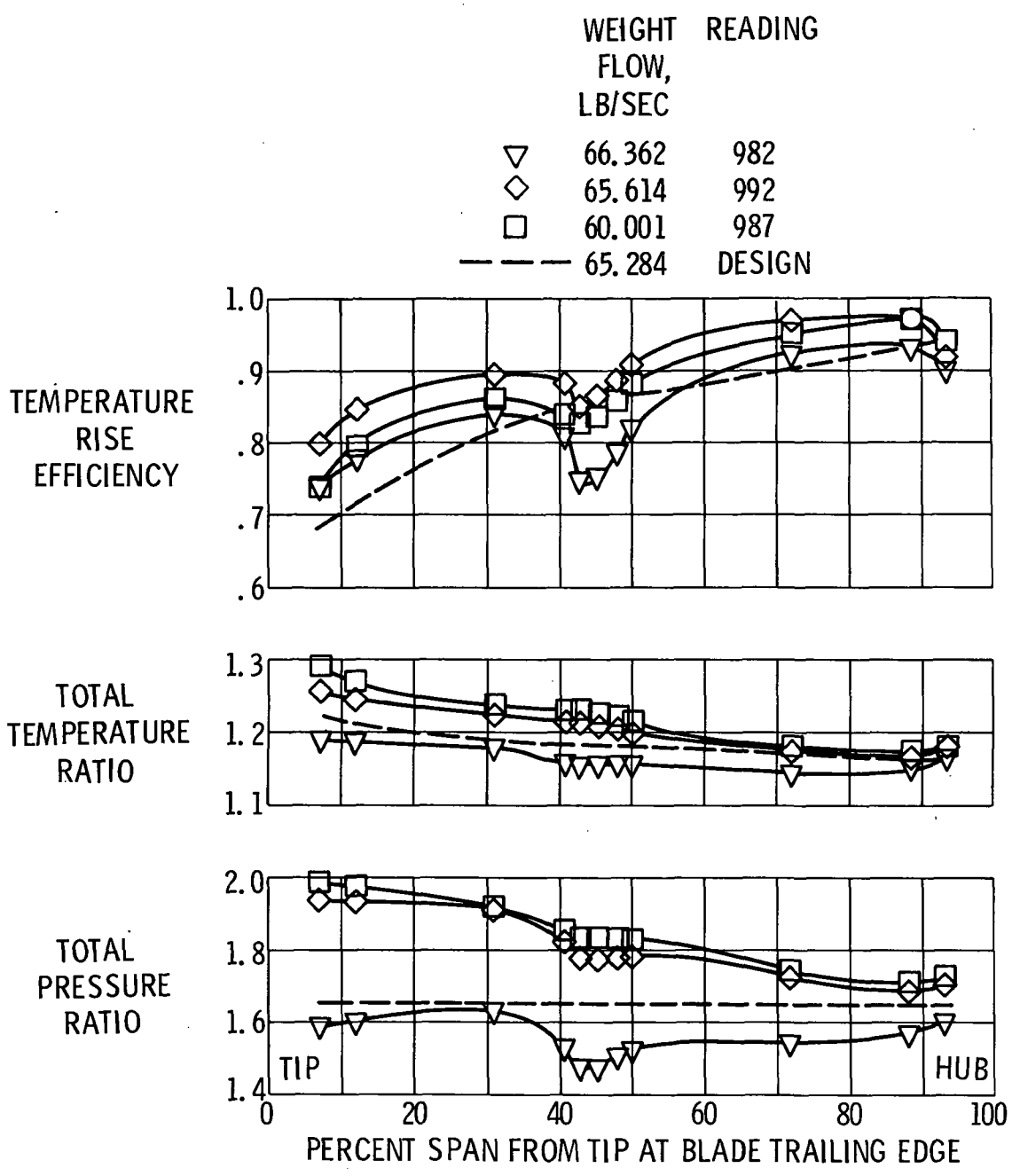



FIGURE 11. - RADIAL VARIATION OF PERFORMANCE PARAMETERS.

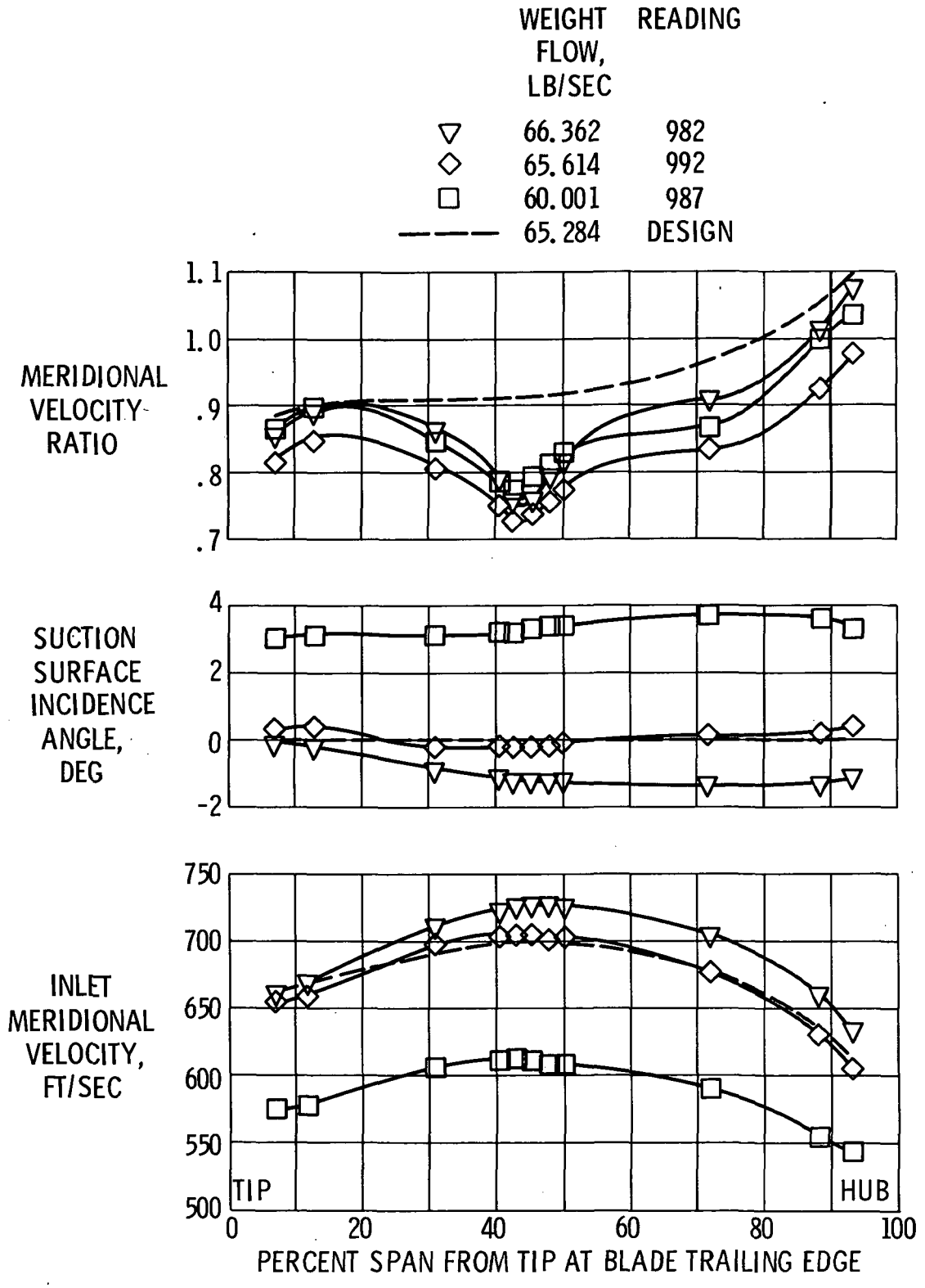



FIGURE 11. - CONTINUED. RADIAL VARIATION OF PERFORMANCE PARAMETERS.

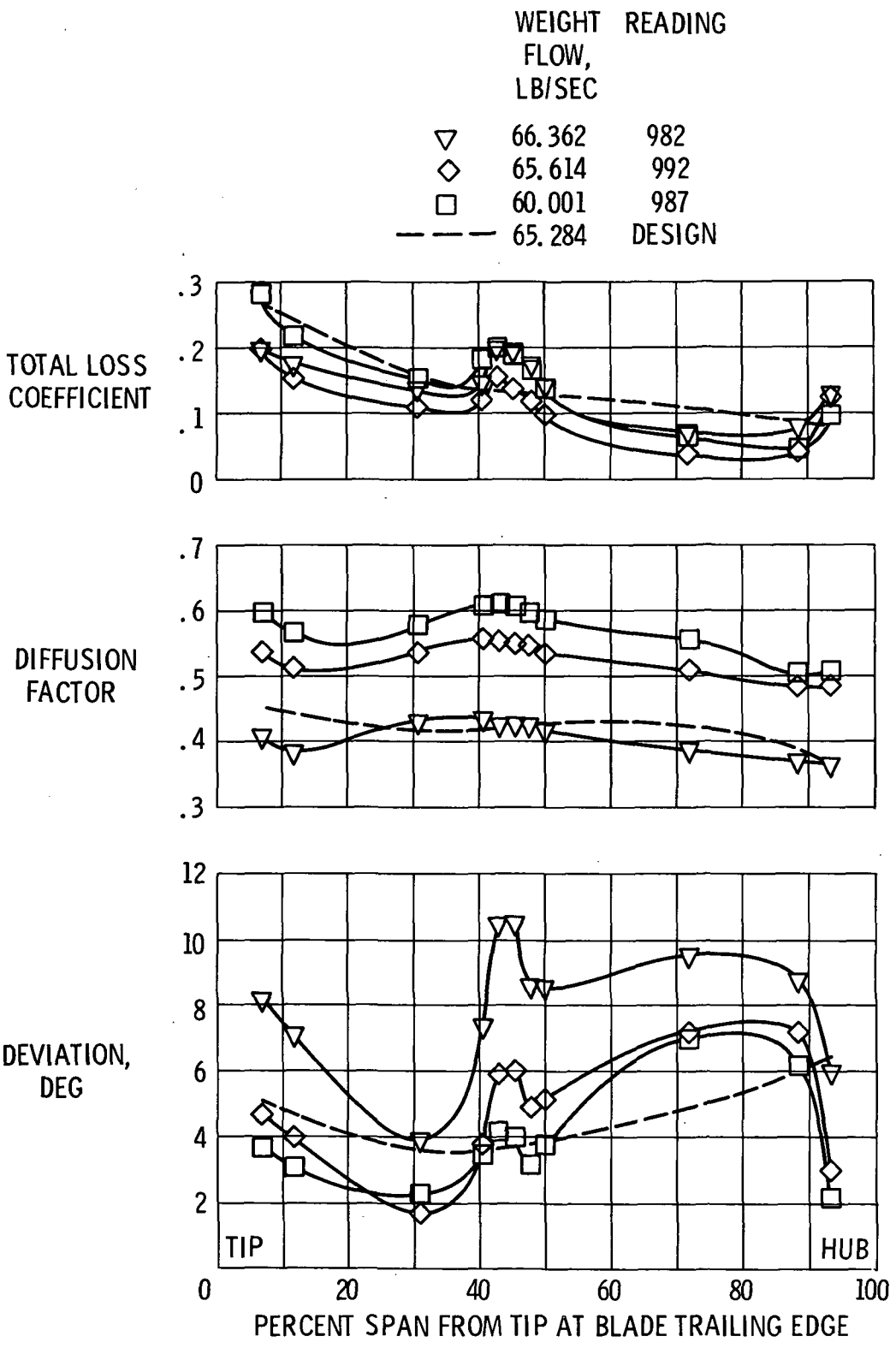
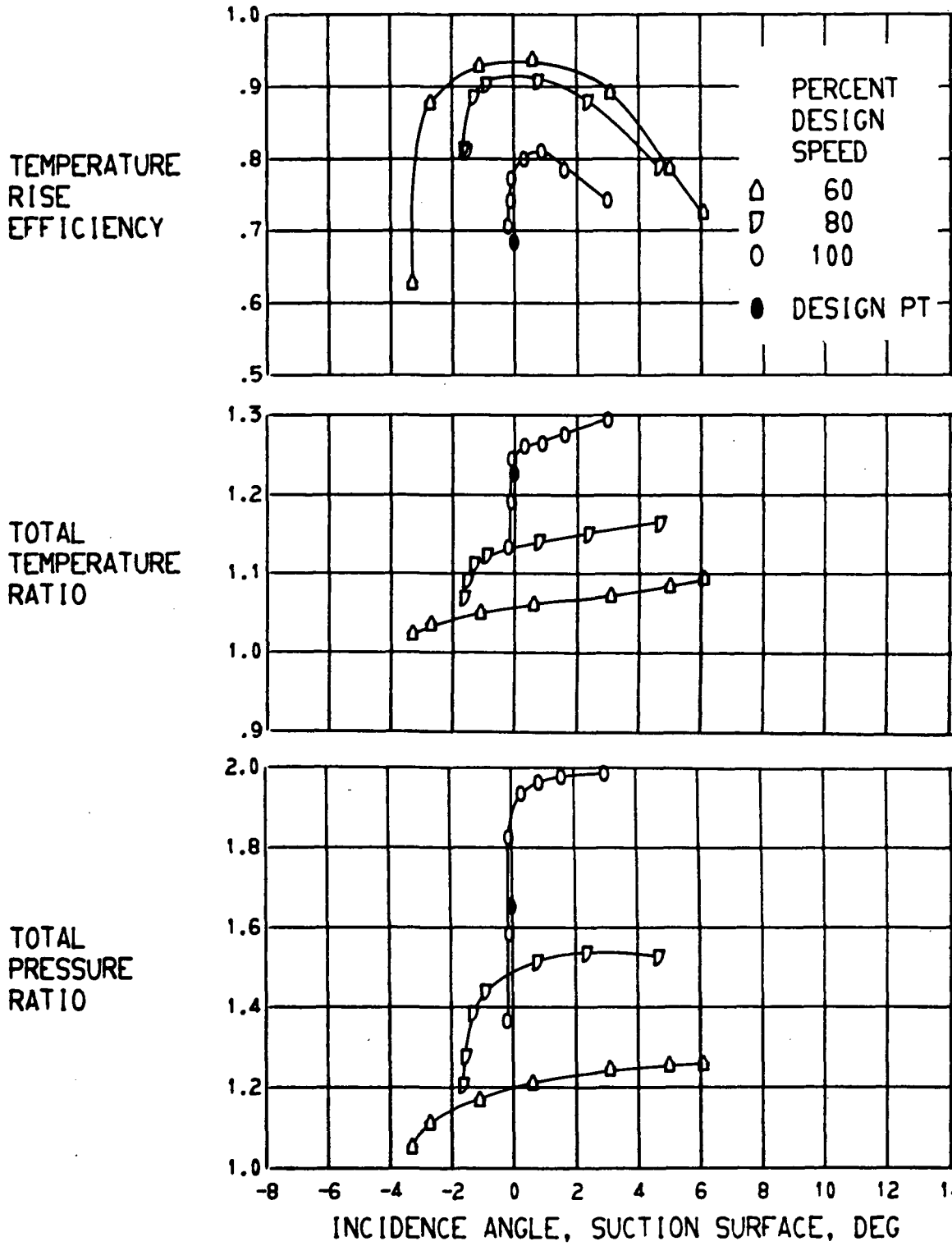
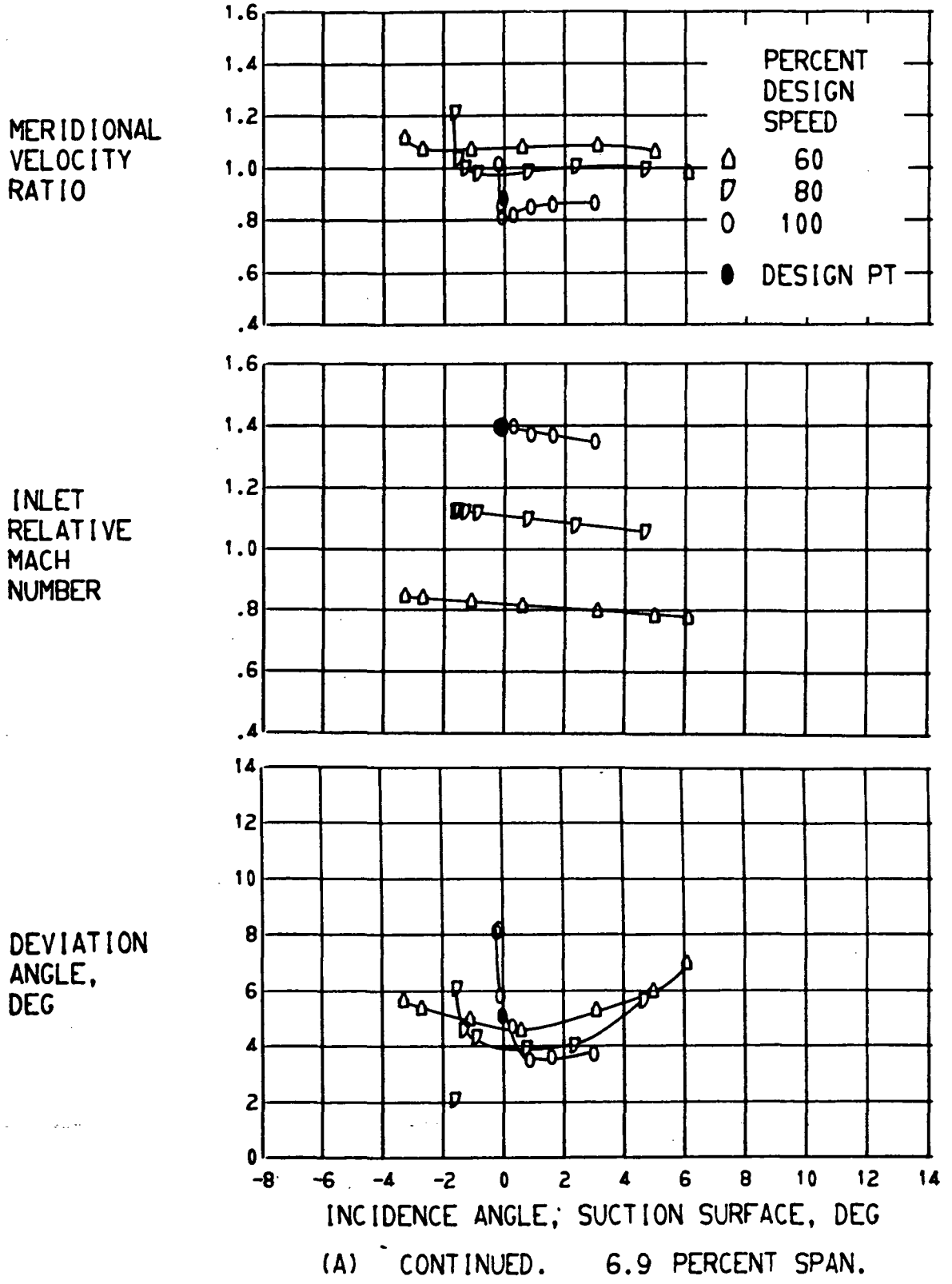



FIGURE 11. - CONCLUDED. RADIAL VARIATION OF PERFORMANCE PARAMETERS.



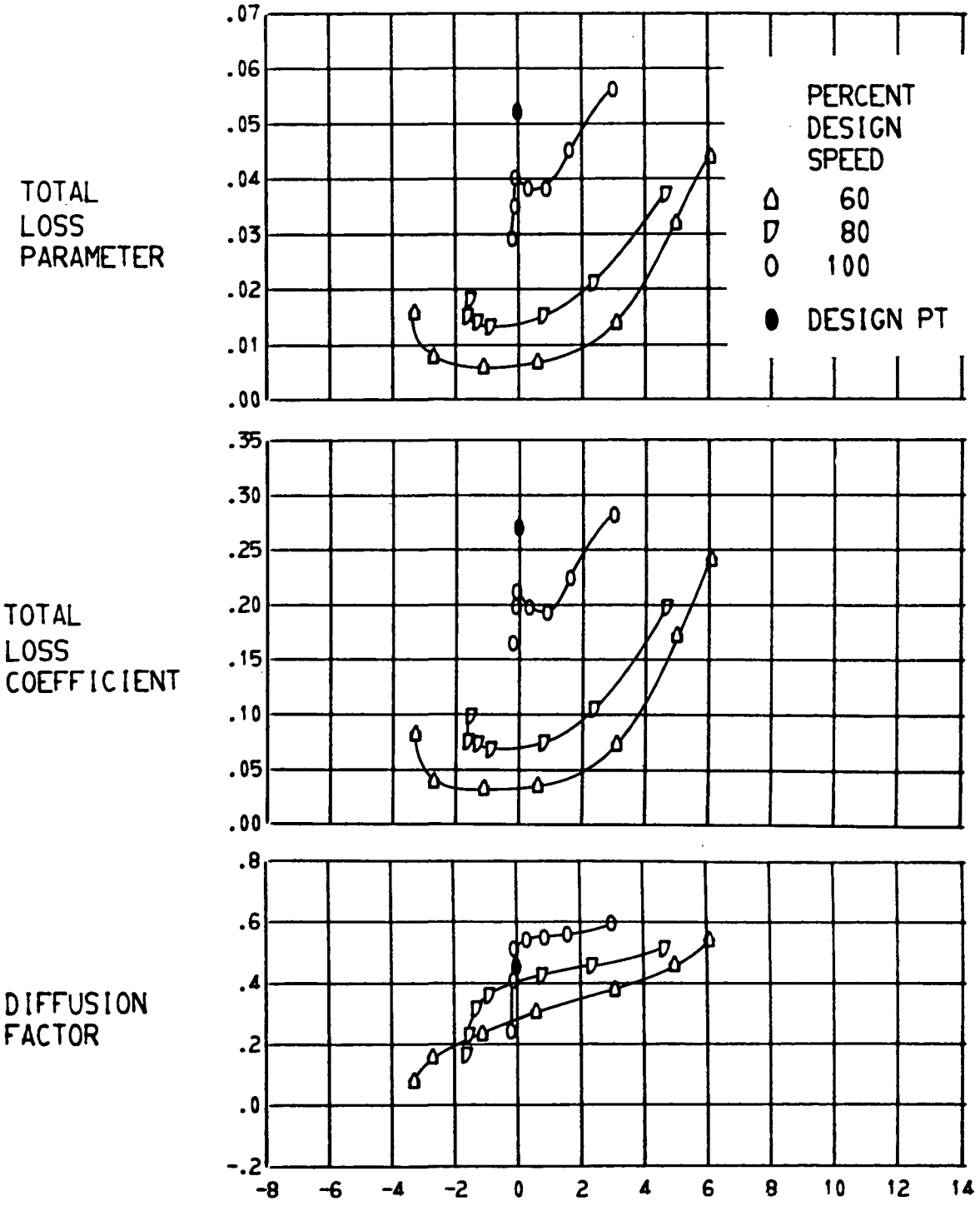

(A) 6.9 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



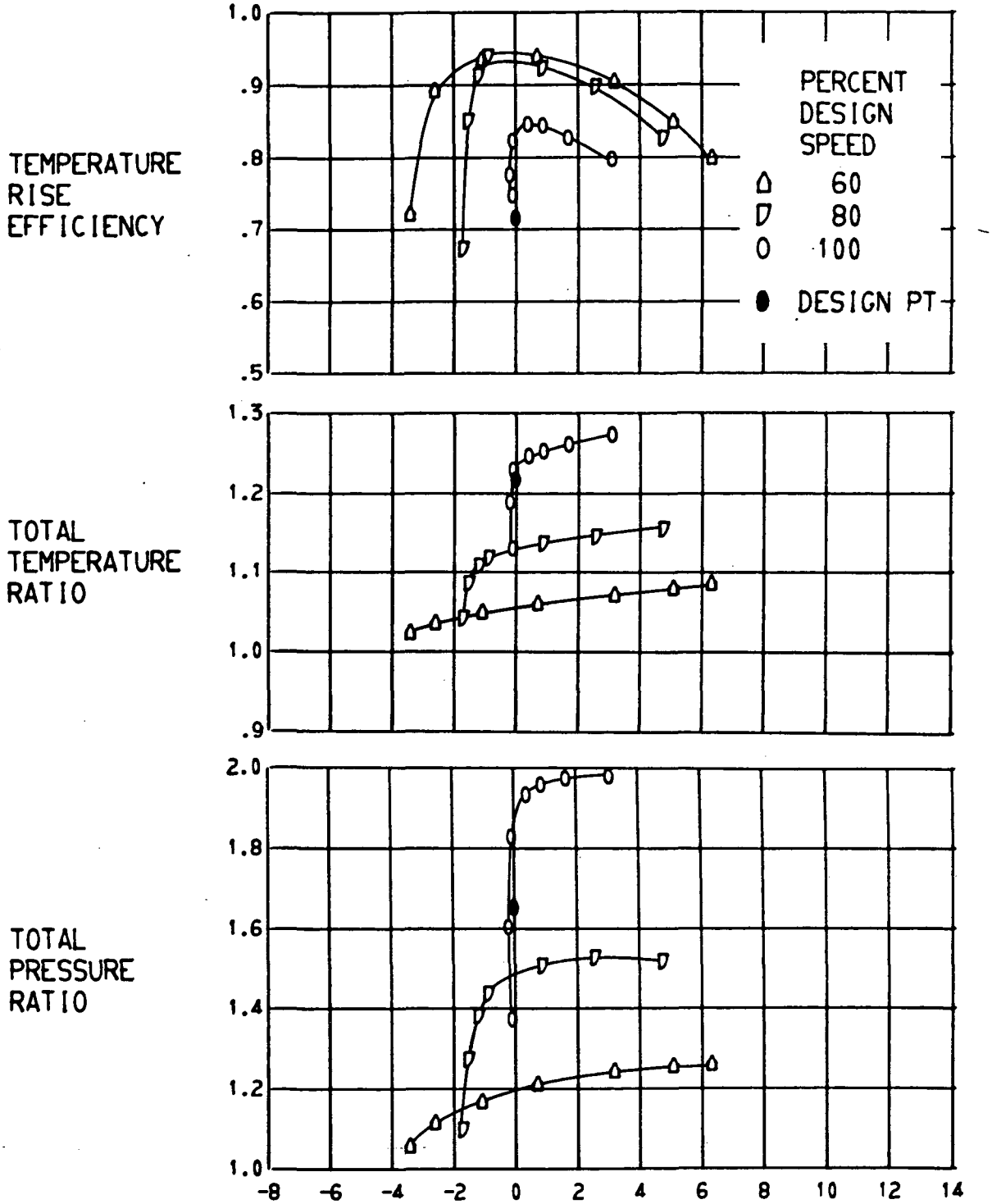

(A) CONTINUED. 6.9 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



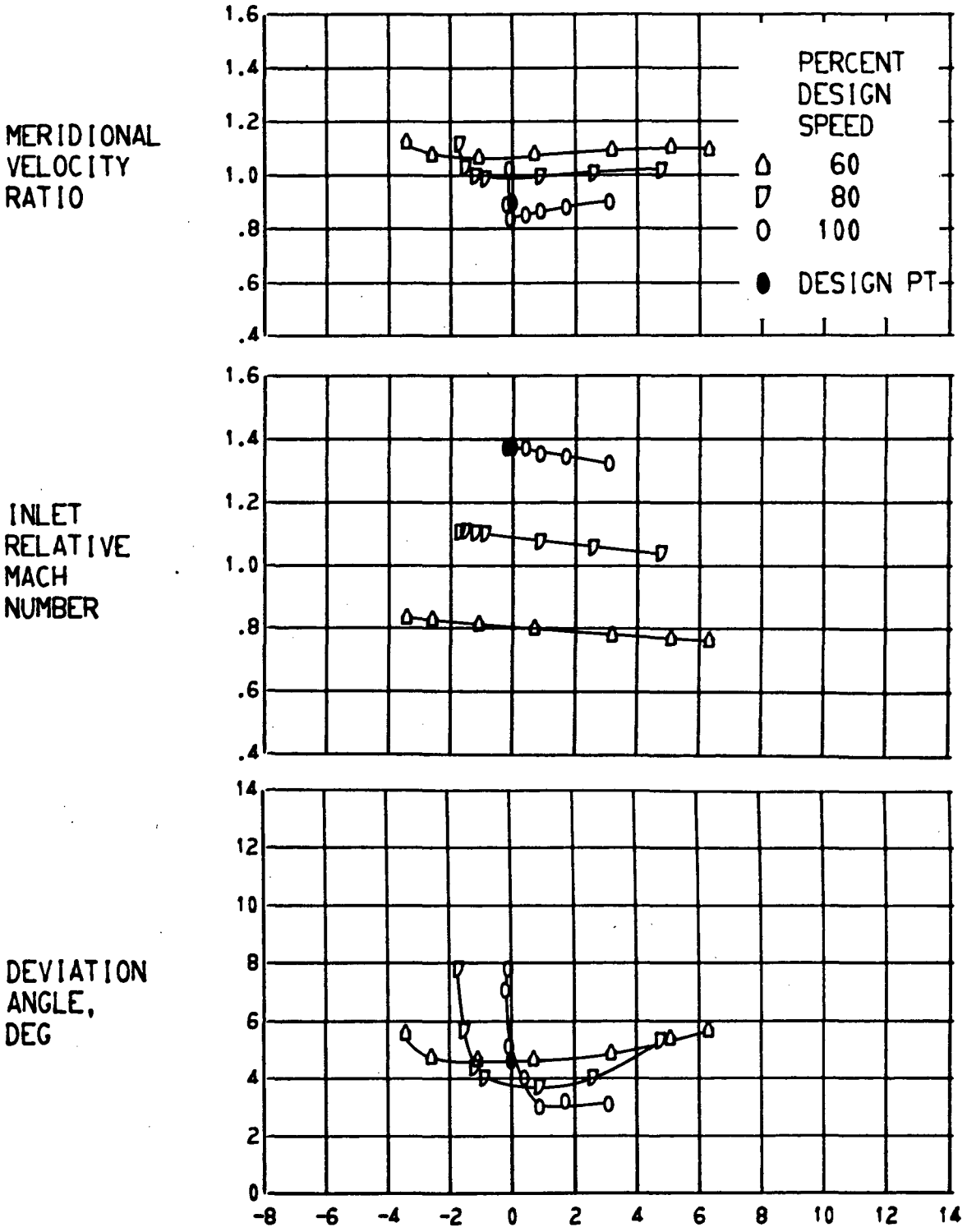

(A) CONCLUDED. 6.9 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



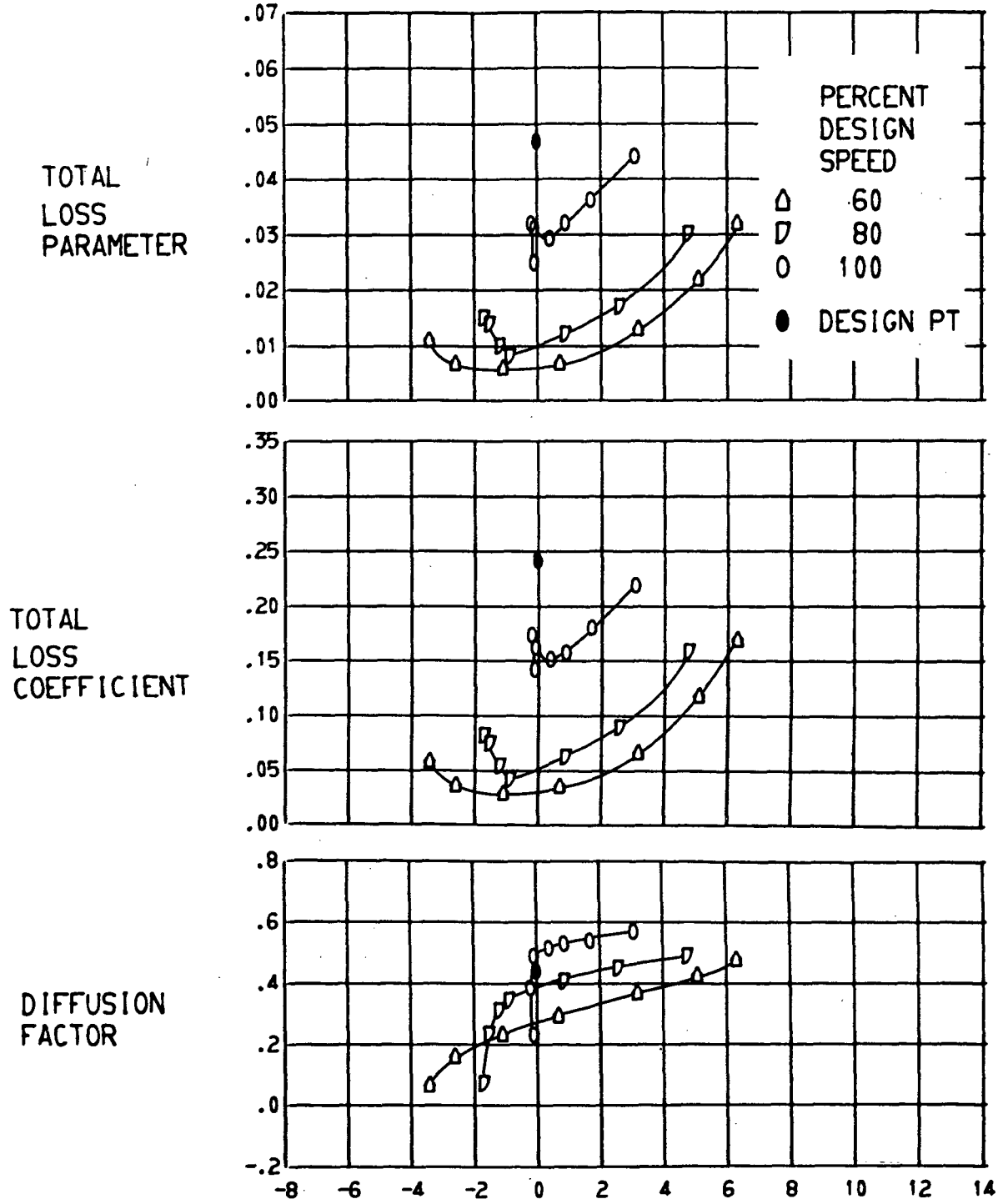

(B) 11.7 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



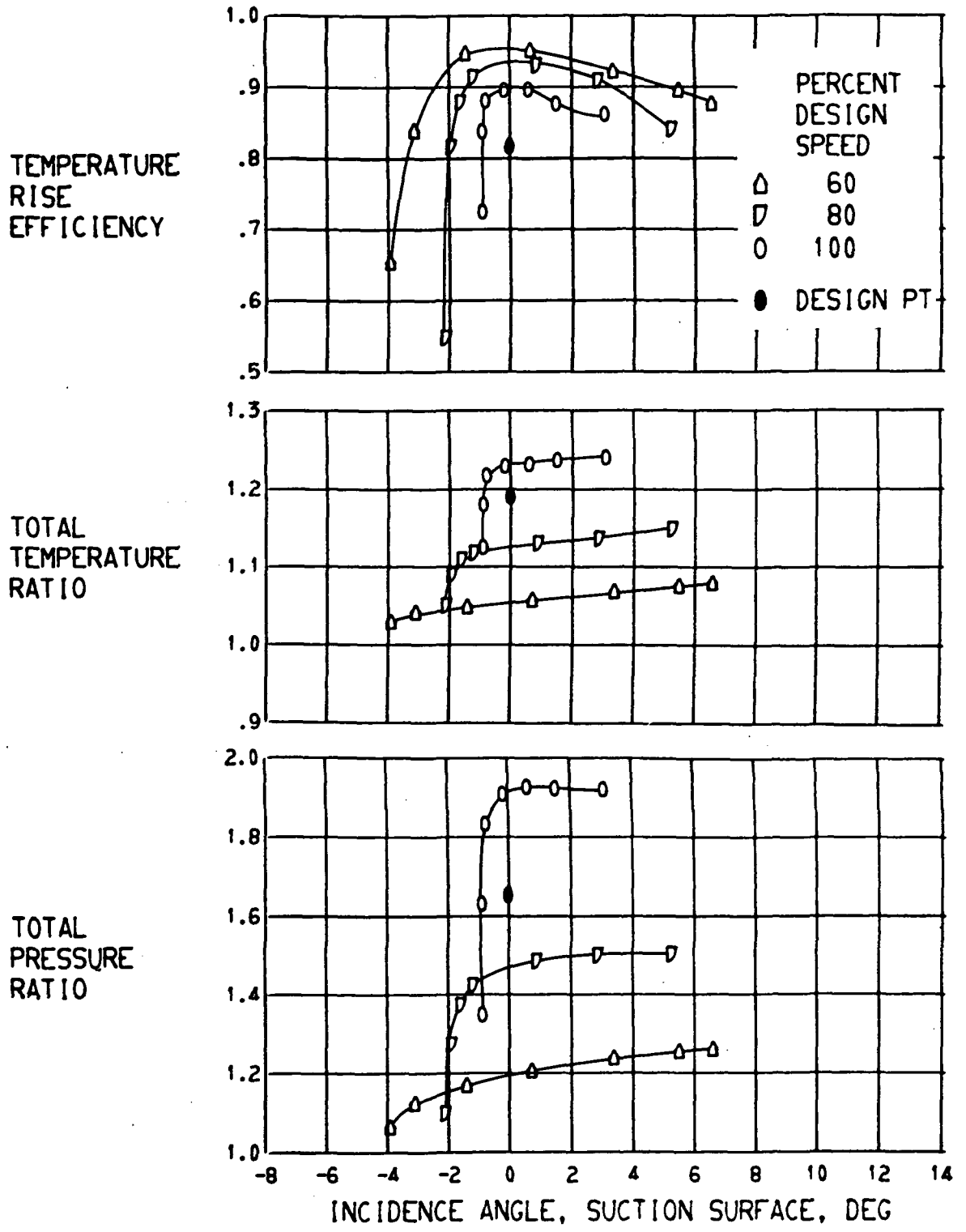

(B) CONTINUED. 11.7 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



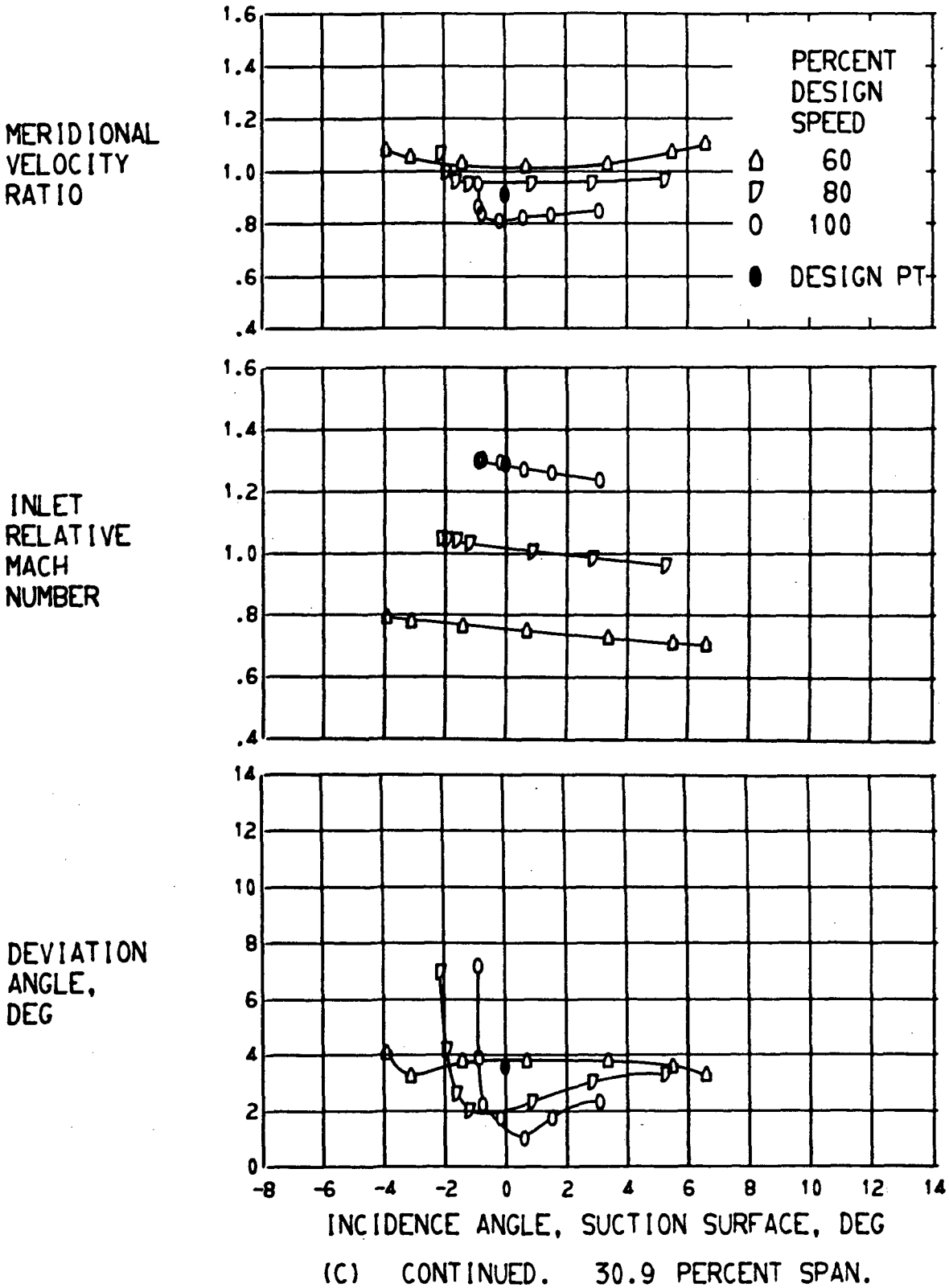

(B) CONCLUDED. 11.7 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



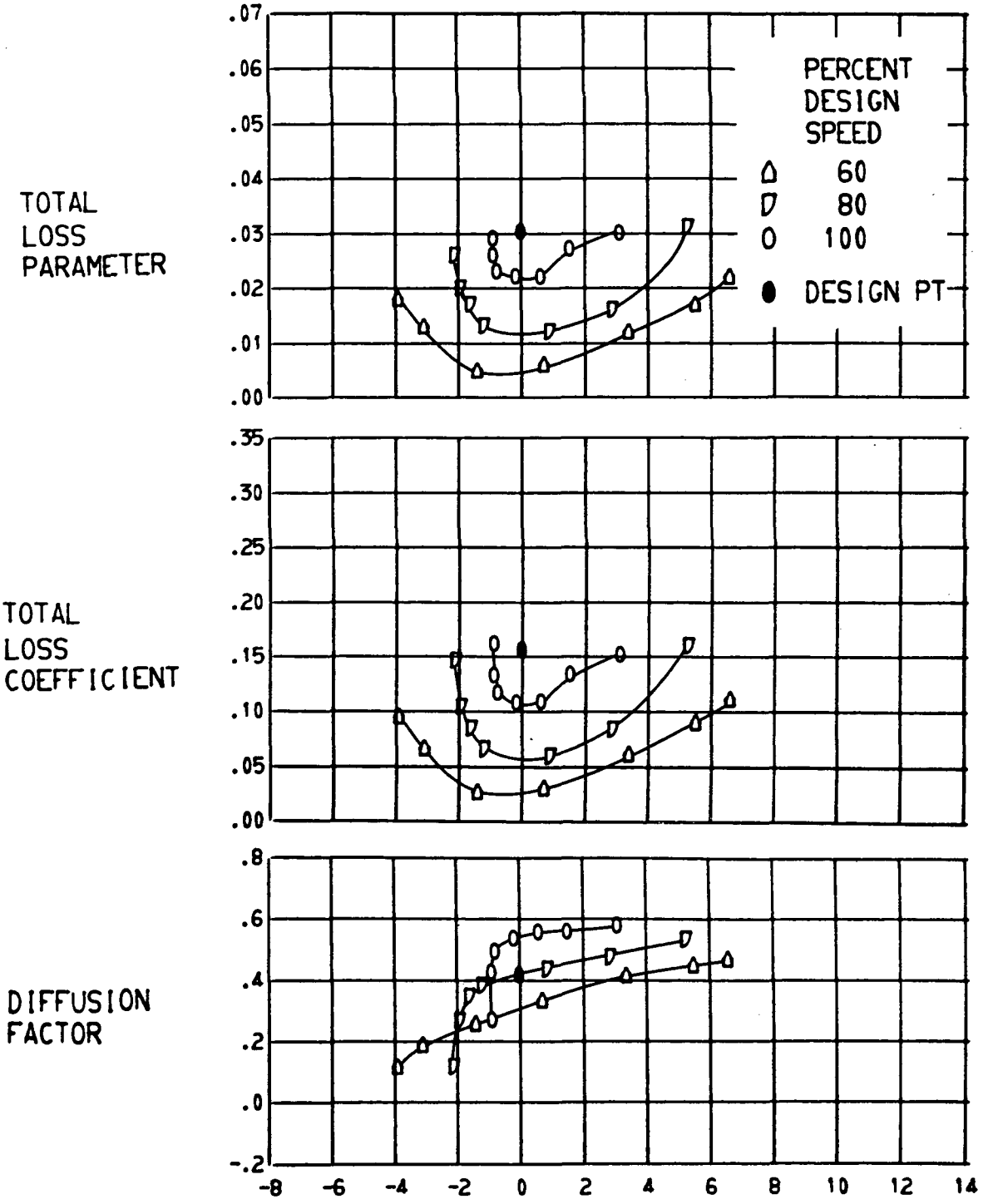

(C) 30.9 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



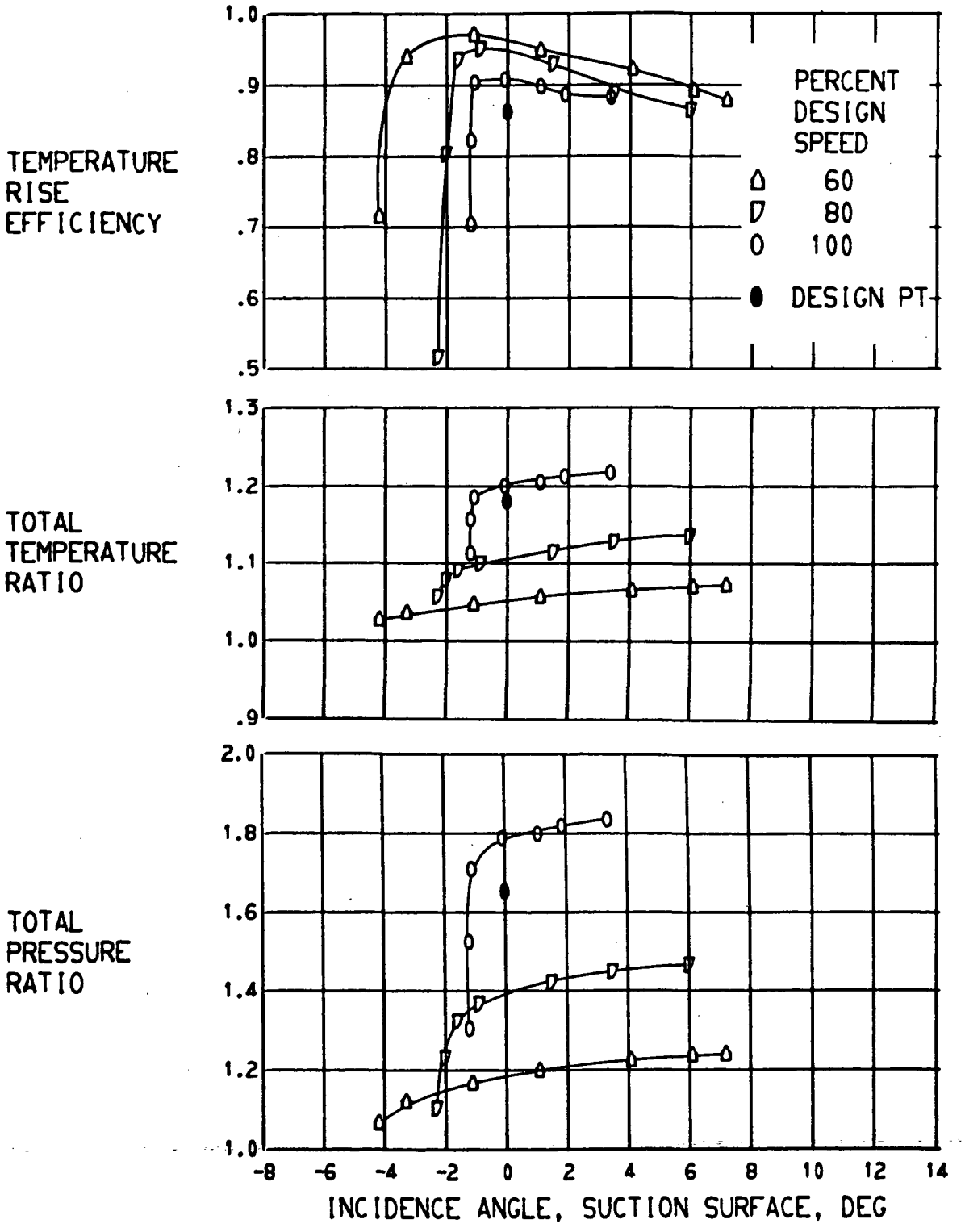

(C) CONTINUED. 30.9 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



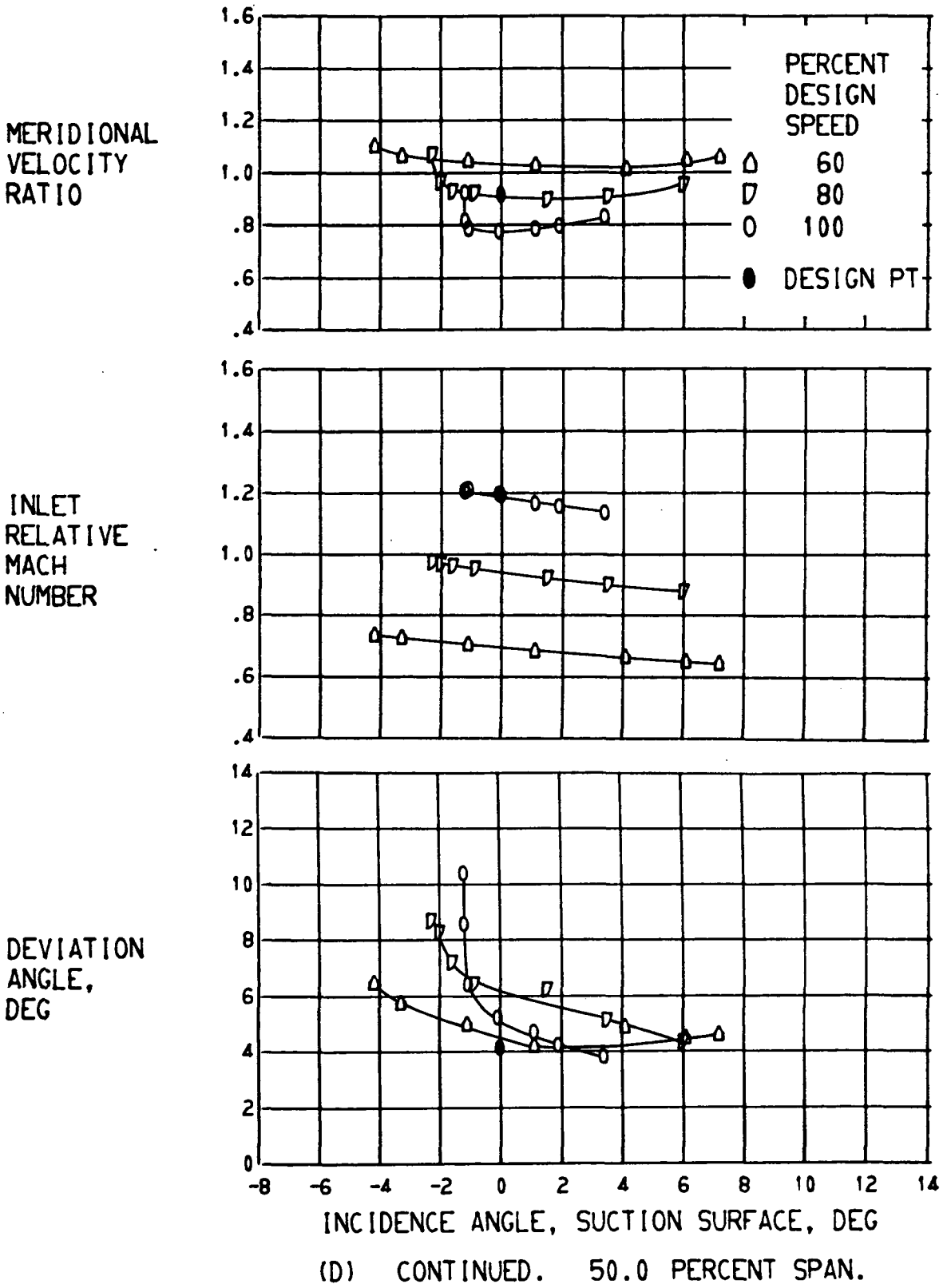

(C) CONCLUDED. 30.9 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



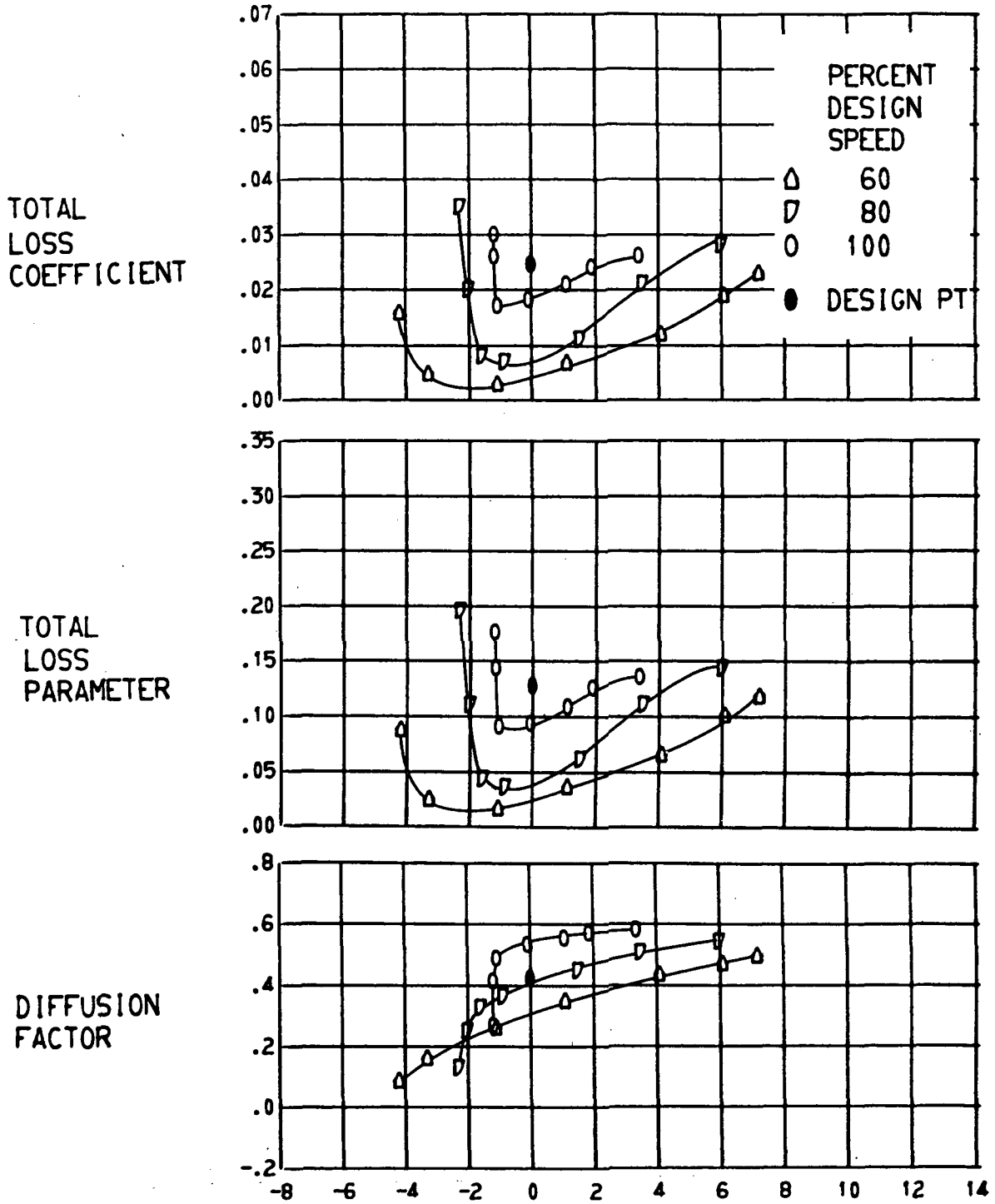

(D) 50.0 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



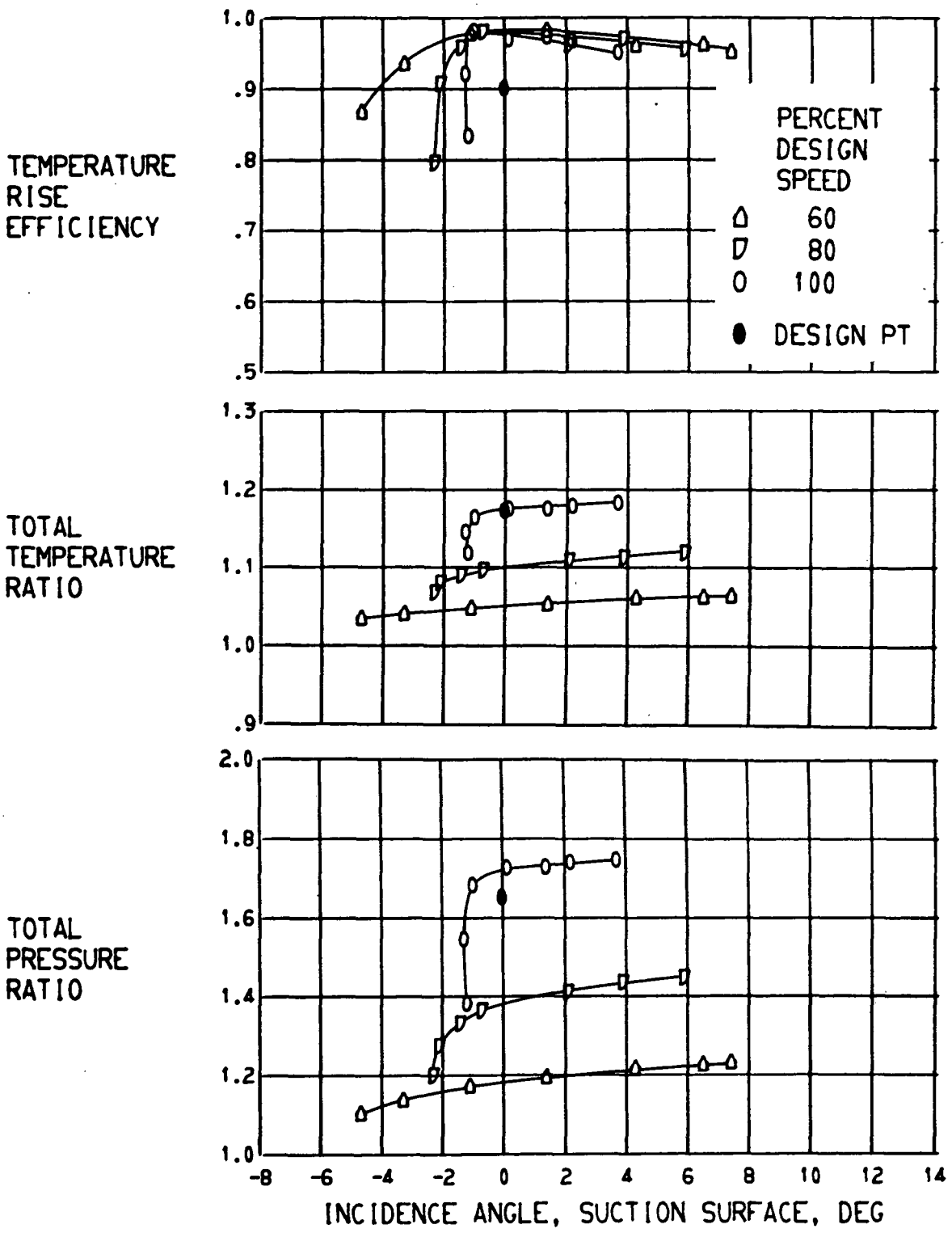

(D) CONTINUED. 50.0 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



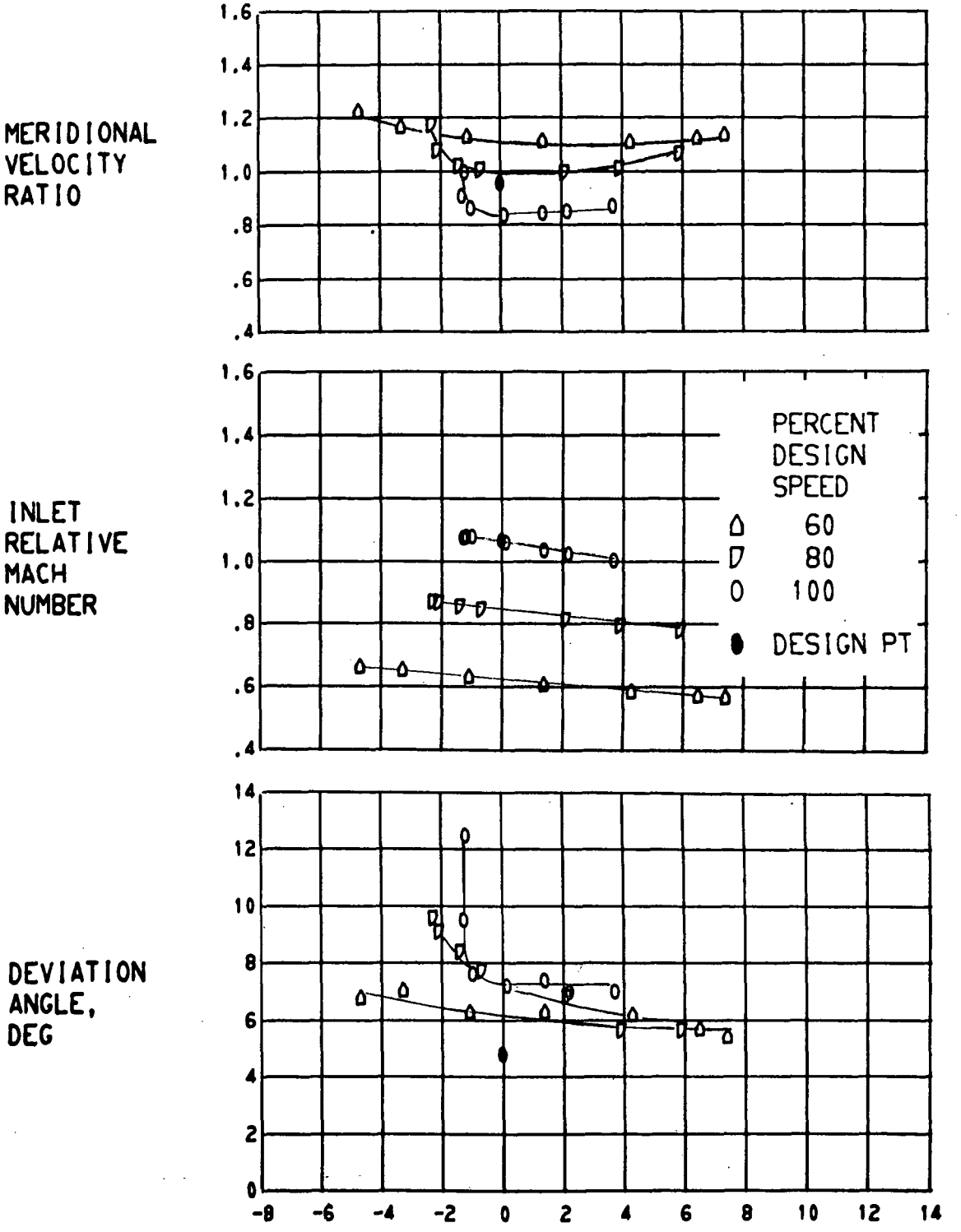

(D) CONCLUDED. 50.0 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



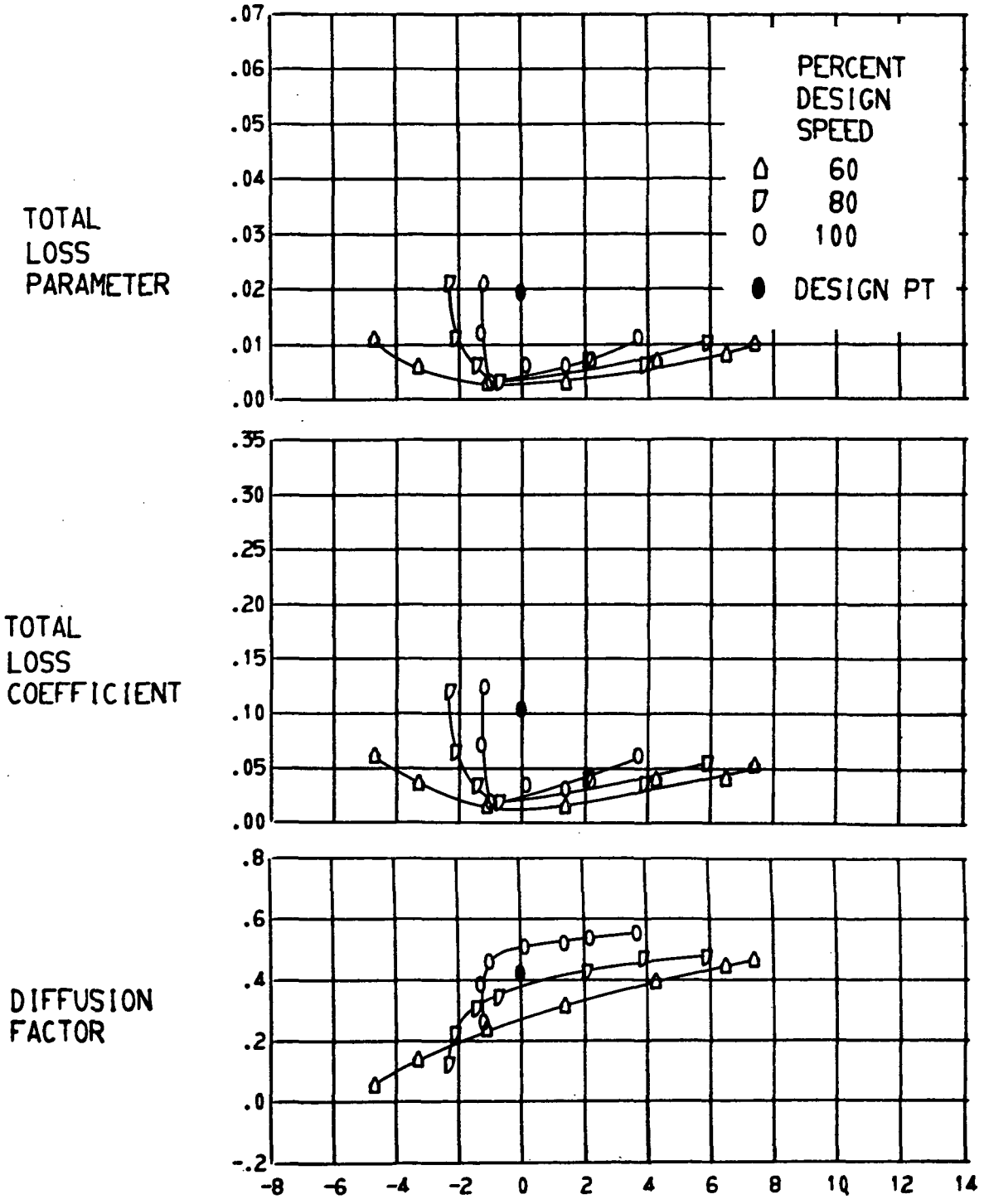

(E) 71.8 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



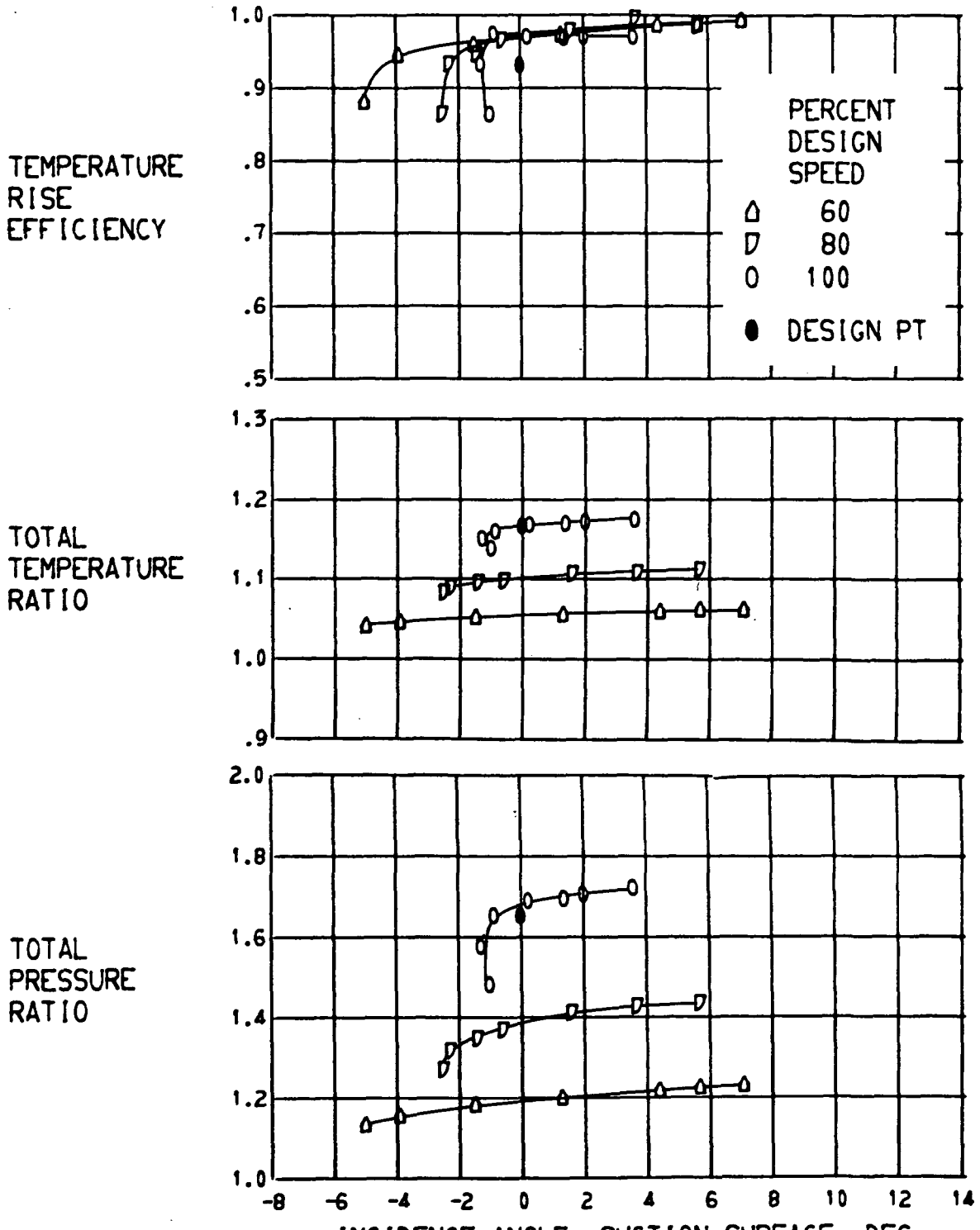

(E) CONTINUED. 71.8 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



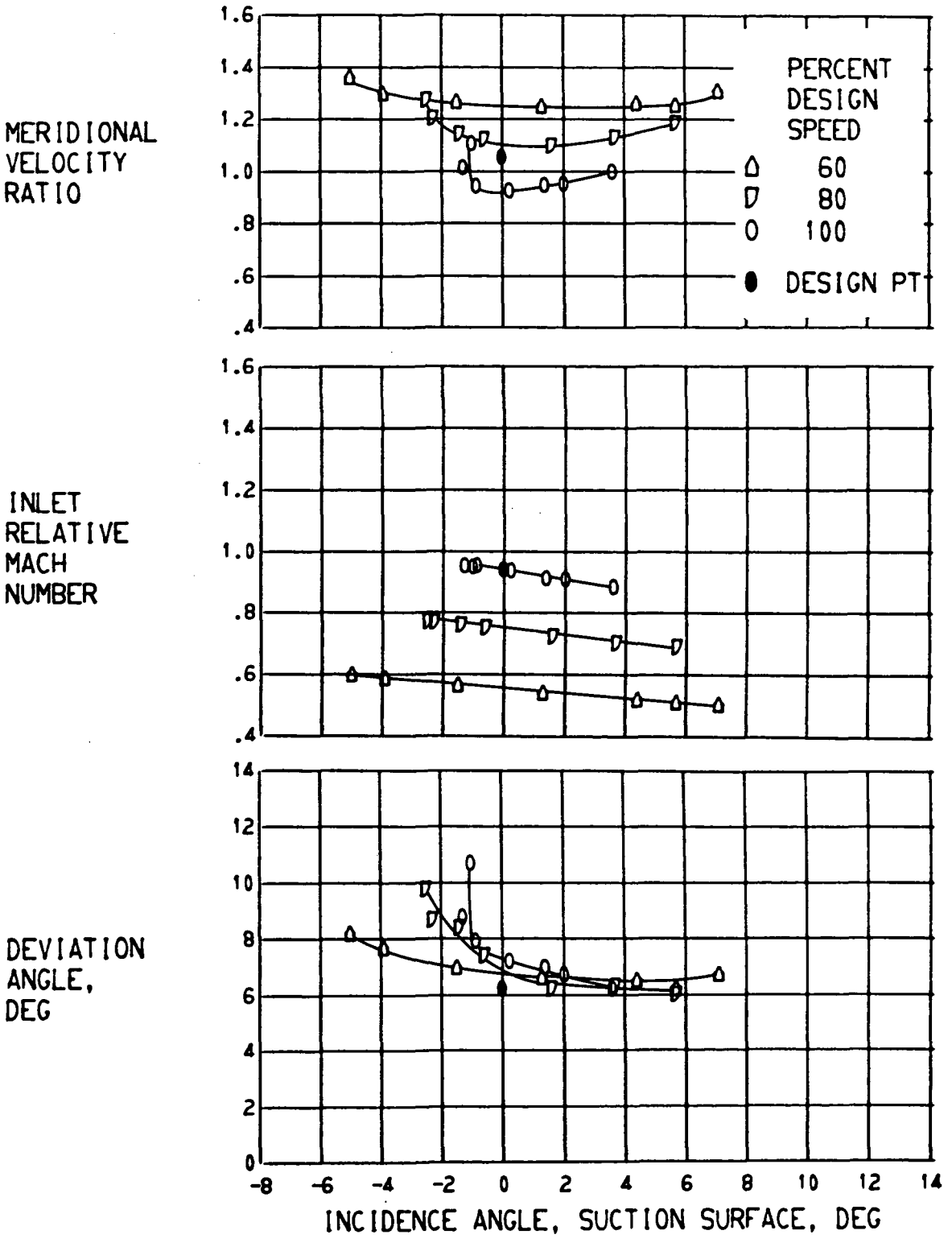

(E) CONCLUDED. 71.8 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



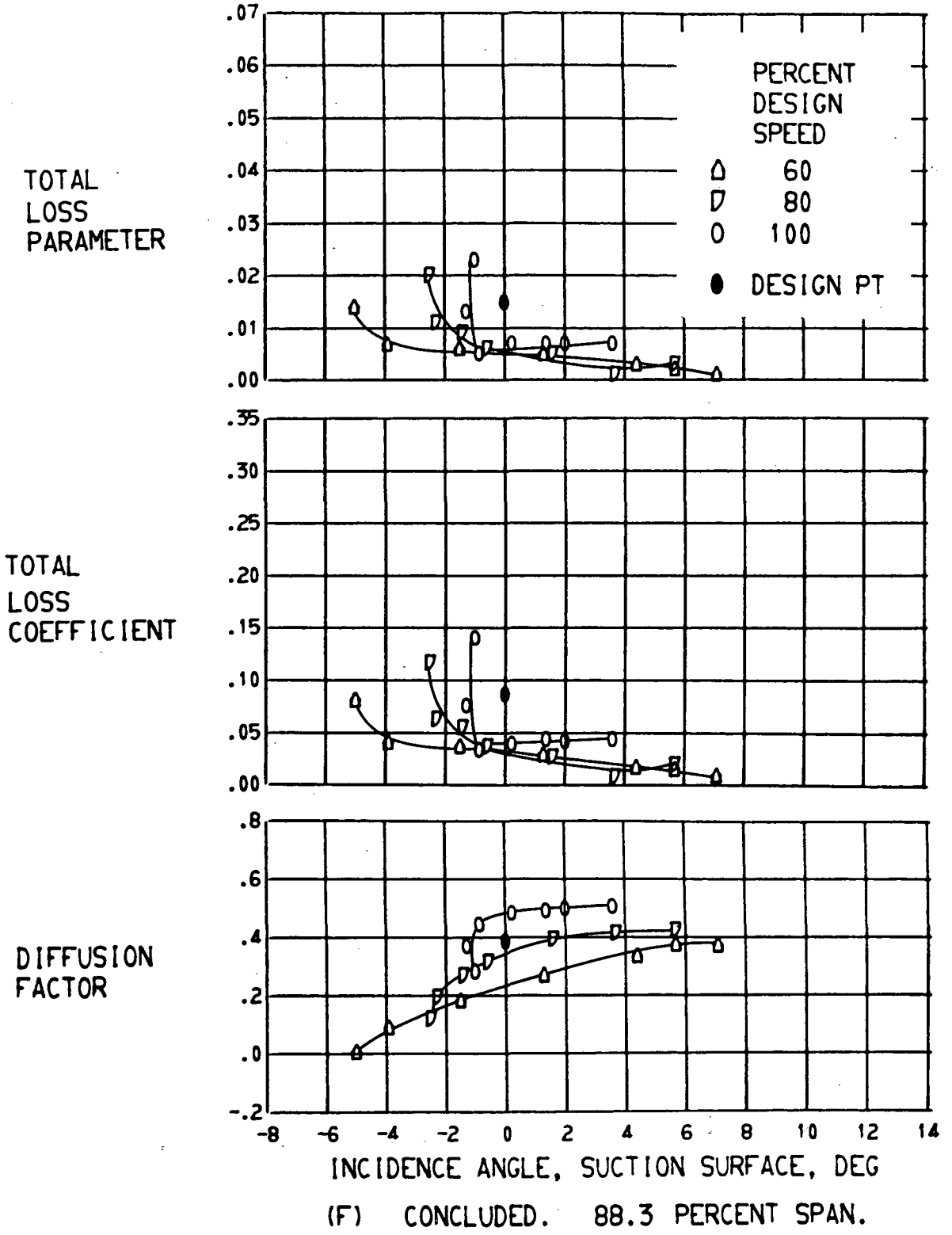

(F) 88.3 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



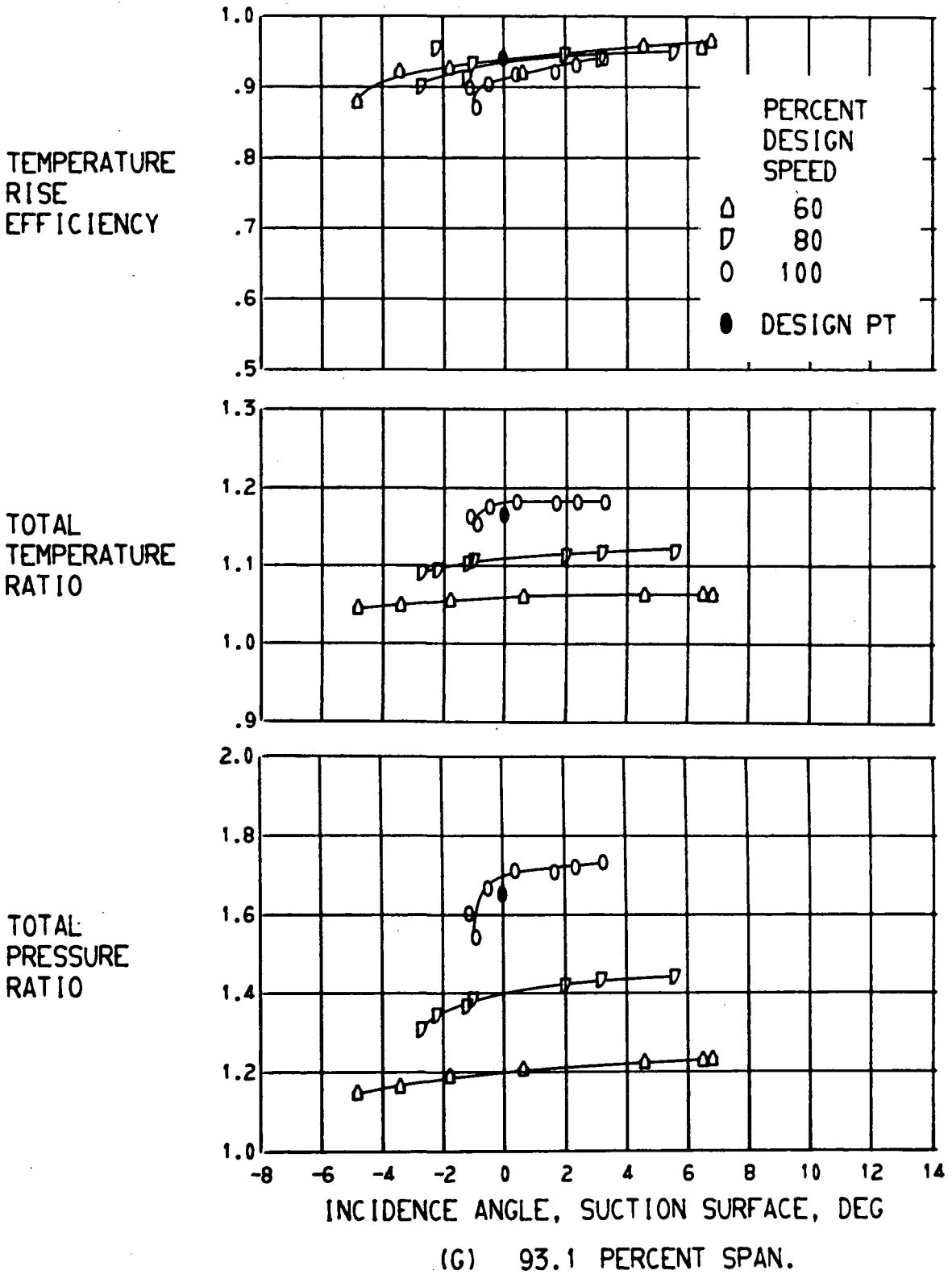

(F) CONTINUED. 88.3 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



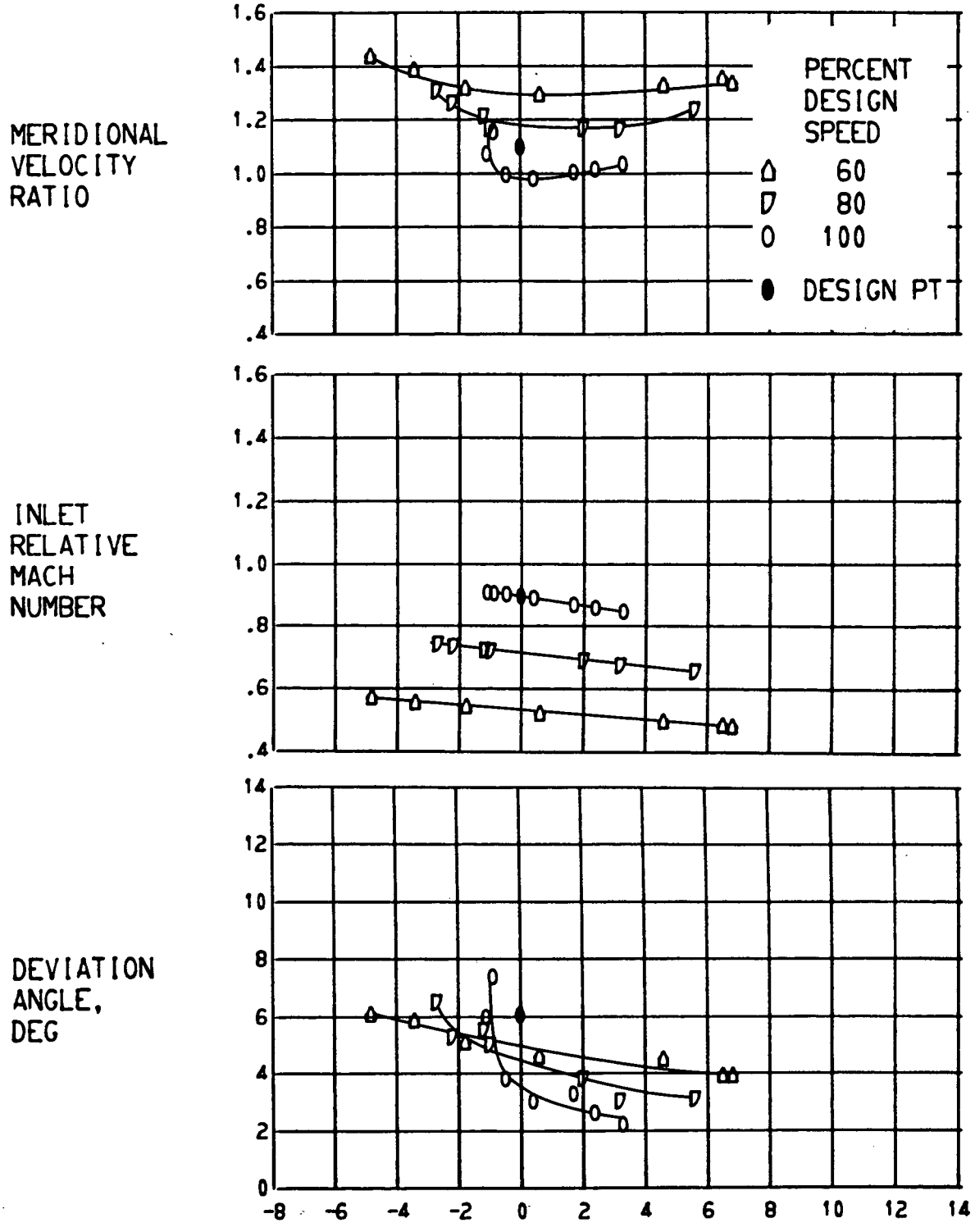

(F) CONCLUDED. 88.3 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.



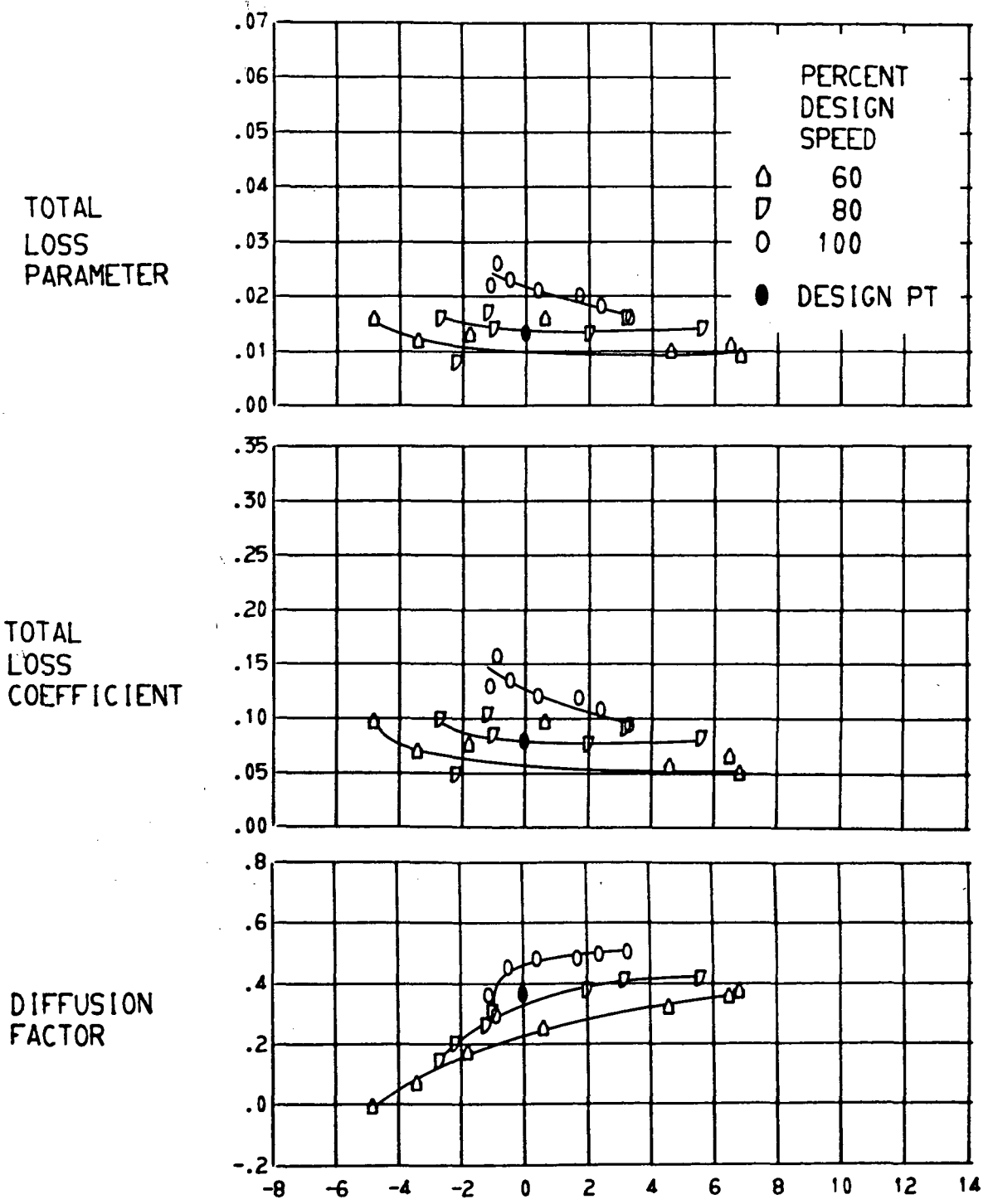

(G) 93.1 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.




(G) CONTINUED. 93.1 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.




(G) CONCLUDED. 93.1 PERCENT SPAN.

FIGURE 12. - BLADE ELEMENT PERFORMANCE FOR ROTOR 5.

*"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."*

—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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