

AD-A063 093

OGDEN AIR LOGISTICS CENTER HILL AFB UTAH PROPELLANT L--ETC F/G 21/9.2
PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1 PHASE E, --ETC(U)
OCT 78 J A THOMPSON
MANCP-405(78)

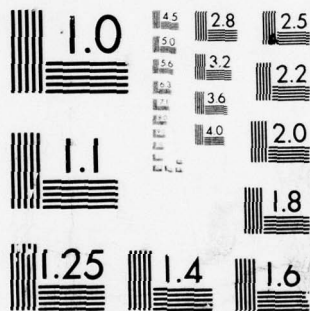
UNCLASSIFIED

NL

1 OF 2

AD
A063 093





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

ADA063093

DDC FILE COPY

HEADQUARTERS
OGDEN AIR LOGISTICS CENTER
UNITED STATES AIR FORCE
HILL AIR FORCE BASE, UTAH 84056

P
NW

⑥ PROPELLANT
SURVEILLANCE REPORT
LGM-30 ^{and} FOG STAGE 1
PHASE E, SERIES VI
TP-H1011.

LEVEL

⑨ Semi-Annual Rept.
PROPELLANT LABORATORY SECTION

⑩ John A. Thompson

DDO
JAN 10 1979
F

⑭ MANCP REPORT
-405(78)

⑪ OCT 1978

⑫ 127p.

APPROVED FOR PUBLIC RELEASE, DISTRIBUTION UNLIMITED

79 01 10 057
407387

✓

PROPELLANT SURVEILLANCE REPORT
LGM-30 F & G STAGE I (TP-H1011)

Author

John A. Thompson
JOHN A. THOMPSON, Chemist
Component & Combustion Test Unit

Engineering & Statistical Review By

John K. Scambia
JOHN K. SCAMBIA, Project Engineer
Service Engineering

Edward J. Erickson
EDWARD J. ERICKSON, Statistician
Data Analysis Unit

Recommended Approval By

Leónidas A. Brown
LEÓNIDAS A. BROWN, Chief
Component & Combustion Test Unit

Ronald F. Larsen
RONALD F. LARSEN, Chief
Physical & Mechanical Test Unit

Approved By

Don F. Woods
DON F. WOODS, Chief
Propellant Laboratory Section

October 1978

Industrial Products & Ldg Gear Division
Directorate of Maintenance
Ogden Air Logistics Center
United States Air Force
Hill Air Force Base, Utah 84056

ABSTRACT

↓

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M82934C-WNL17514.

The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (twelve and one half years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point.

Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system.

↙

ACCESSION NO.	
HTS	State Section ☒
HTG	B.I.F. Section ☐
TRANSITION	☐
I.S. SECTION	
DISTRIBUTION/AVAILABILITY CODES	
SPECIAL	
A	

TABLE OF CONTENTS

Abstract	<u>Page</u> ii
List of Figures	iv
List of References	ix
Glossary of Terms and Abbreviations	xiii
Introduction	1
Table 1 - Test Program	3
Statistical Approach	4
Test Results	6
Conclusions	10
Distribution List	109
DD 1473	110

LIST OF FIGURES

<u>Figure Nr</u>		<u>Page</u>
	Regression Plot, Very Low Rate Tensile	
1	Strain at Maximum Stress	12
2	Maximum Stress	13
3	Strain at Rupture	14
4	Stress at Rupture	16
5	Modulus	17
	Regression Plot, Low Rate Biaxial Tensile	
6	Strain at Maximum Stress	19
7	Maximum Stress	20
8	Strain at Rupture	21
9	Stress at Rupture	22
10	Modulus	23
	Regression Plot, Low Rate Tensile	
11	Strain at Maximum Stress	25
12	Maximum Stress	26
13	Strain at Rupture	27
14	Stress at Rupture	28
15	Modulus	29
	Regression Plot, High Rate Triaxial Tensile	
16	Strain at Maximum Stress	31
17	Maximum Stress	32
18	Strain at Rupture	33

LIST OF FIGURES (cont)

<u>Figure Nr</u>		<u>Page</u>
19	Stress at Rupture	34
20	Modulus	35
	Regression Plot, High Rate Hydrostatic Tensile	
21	Strain at Maximum Stress	37
22	Maximum Stress	38
23	Strain at Rupture	39
24	Stress at Rupture	40
25	Modulus	41
	Regression Plot, Stress Relaxation .5% Strain, -65°F	
26	Modulus at 10 sec	43
27	Modulus at 50 sec	44
28	Modulus at 100 sec	45
29	Modulus at 1000 sec	46
	Regression Plot, Stress Relaxation .5% Strain, -40°F	
30	Modulus at 10 sec	48
31	Modulus at 50 sec	49
32	Modulus at 100 sec	50
33	Modulus at 1000 sec	51
	Regression Plot, Stress Relaxation 3% Strain, 20°F	
34	Modulus at 10 sec	53
35	Modulus at 50 sec	54

LIST OF FIGURES (cont)

<u>Figure Nr</u>		<u>Page</u>
36	Modulus at 100 sec	55
37	Modulus at 1000 sec	56
	Regression Plot, Stress Relaxation 3% Strain, 77°F	
38	Modulus at 10 sec	58
39	Modulus at 50 sec	59
40	Modulus at 100 sec	60
41	Modulus at 1000 sec	61
	Regression Plot, Stress Relaxation 3% Strain, 100°F	
42	Modulus at 10 sec	63
43	Modulus at 50 sec	64
44	Modulus at 100 sec	65
45	Modulus at 1000 sec	66
	Regression Plot, Stress Relaxation 3% Strain, 140°F	
46	Modulus at 10 sec	68
47	Modulus at 50 sec	69
48	Modulus at 100 sec	70
49	Modulus at 1000 sec	71
	Regression Plot, Stress Relaxation 3% Strain, 180°F	
50	Modulus at 10 sec	73
51	Modulus at 50 sec	74
52	Modulus at 100 sec	75
53	Modulus at 1000 sec	76

LIST OF FIGURES (cont)

<u>Figure Nr</u>		<u>Page</u>
	Regression Plot, Sol Gel	
54	Percent Extractables	78
55	Gel Swell Ratio	79
56	Sol Gel Density	80
57	Cross Link Density	82
58	Regression Plot, Constant Strain	84
59	Regression Plot, Hardness	86
	Regression Plot, Pressure Time	
60	Maximum Pressure	88
61	Time to Maximum Pressure	89
	Regression Plot, TCLE	
62	Thermal Coefficient of Linear Expansion Below tg	91
63	Thermal Coefficient of Linear Expansion Above tg	92
	Regression Plot, TGA, 9°C rise/min	
64	Ignition Temperature	94
65	Percent Weight Loss at Ignition	95
66	Percent Weight Loss at 250°C Hold	97
	Regression Plot, DTA, 12°C rise/min	
67	Endotherm	99
68	Exotherm 1	100
69	Exotherm 2	102
70	Exotherm 3	104

LIST OF FIGURES (cont)

<u>Figure Nr</u>		<u>Page</u>
71	Ignition Temperature	105
72	Regression Plot, Tear Energy	107
	Failure Envelope	
73	Motor S/N 0013913	108

LIST OF REFERENCES

<u>Report Nr</u>	<u>Title</u>	<u>Report Date</u>
	LGM-30 First Stage, Wing I Test Reports	
29A	Test Report (Missile in silo)	13 Jan 64
29B	Zero Time Test Results	29 Jan 64
29C	Zero Time Test Results (Supplement 1)	30 Mar 64
29D	Zero Time Test Results (Aft Closure)	9 Jun 64
29E	Zero Time (Aft Closure Supplement 1)	24 Jun 64
29F	ATP Phase I Test Results	30 Mar 65
29G	ATP Phase I Test Results	19 Aug 65
29H	ATP Phase I Test Results	10 Sep 65
32A	Zero Time, Wings II-V Test Results	17 Mar 65
32B	Zero Time, Wings II-V Test Results (Aft Closure)	18 Mar 65
32C	ATP Phase I, Wings II-V Test Results	3 Nov 65
49	ATP Phase I, Wings II-V (First Group)	18 Mar 66
53	ATP Phase I, Wings II-V (Second Group)	22 Apr 66
55	ATP Phase I, Wings II-V (Third Group)	29 Apr 66
58	ATP Phase I, Wings II-V (Fourth Group)	6 May 66
61	ATP Phase I, Wings II-V (Fifth Group)	10 Jun 66
66	ATP Phase I, Wings II-V (Sixth Group)	22 Jul 66
76	ATP Phase II, Wing I Test Results	24 Jan 67
78	Zero Time, Wing VI Test Results	3 Feb 67
104	ATP Phase I, Wing VI (First Group)	12 Oct 67
118	ATP Phase II, Wings II-V (First Group)	5 Mar 68

LIST OF REFERENCES (CONT)

<u>Report Nr</u>	<u>Title</u>	<u>Report Date</u>
126	ATP Phase II, Wings II-V (Second Group	11 Apr 68
130	ATP Phase II, Wings II-V (Third Group)	3 May 68
162	ATP Phase I, Wing VI (Second Group)	30 Sep 69
176	ATP Phase II, Wing VI (First Group)	15 Apr 70
181	ATP Phase III, Wing I	7 May 70
185	ATP Phase I, Wing VI (Third Group)	22 Jun 70
195	ATP Phase III, Wings II-V (Retest)	29 Oct 70
223	Surveillance Report LGM-30 Stage I(TP-H1011)	Sep 71
239	Surveillance Report LGM-30 Stage I (TP-H1011 and TP-H1043)	Apr 72
258	Surveillance Report LGM-30 A & B Stage I (TP-H1011)	Nov 72
268	Surveillance Report LGM-30 A & B Stage I (TP-H1011)	May 73
271	Surveillance Report LGM-30 F & G Stage I Phase A Series II, (TP-H1011)	Jul 73
277	Surveillance Report LGM-30 F & G Stage I Phase A Series III, (TP-H1011)	Oct 73
280	Surveillance Report LGM-30 A & B Stage I (TP-H1011)	Nov 73
288	Propellant Surveillance Report LGM-30 A & B, Stage I, TP-H1043	Mar 74
290	Propellant Surveillance Report LGM-30 F & G, Stage I, Phase B, Series I TP-H1011	Mar 74
300	Minuteman Stage I Motor Reliability Improvement Program Surveillance	May 74

LIST OF REFERENCES (CONT)

<u>Report Nr</u>	<u>Title</u>	<u>Report Date</u>
302	Propellant Surveillance Report LGM-30	Nov 74
313	Stage 1 Propellant Surveillance Report, Propellant Containing Glacial Acrylic Acid	Oct 74
315	Propellant Surveillance Report LGM-30 F & G Stage 1, TP-H1011	Jan 75
316	Propellant Surveillance Report LGM-30 A & B Stage 1, TP-H1011	Feb 75
319	Propellant Surveillance Report LGM-30 Dissected Motors, Phase VI, TP-H1011	Apr 75
321	Propellant Surveillance Report LGM-30 F & G Stage 1, Phase B, Series II, TP-H1011	Apr 75
325	Propellant Surveillance Report LGM-30 A & B Stage 1, TP-H1011	Jun 75
328	Propellant Surveillance Report LGM-30 A & B Stage 1, TP-H1011	Sep 75
330	Propellant Surveillance Report LGM-30 F & G Stage 1, TP-H1011	Oct 75
335	Stage 1 Motor Reliability Improvement Program	Dec 75
337	Propellant Surveillance Report LGM-30 A & B, Stage 1, TP-H1043	Feb 76
339	Stage 1, New MAPO & ERL-510 Qualification	Mar 76
341	Propellant Surveillance Report LGM-30 Dissected Motors, Phase VII, TP-H1011	Mar 76

LIST OF REFERENCES (CONT)

<u>Report Nr</u>	<u>Title</u>	<u>Report Date</u>
343	Propellant Sureveillance Report LGM-30 A & B, Stage 1, TP-H1011	Jun 76
345	Propellant Surveillance Report LGM-30 F & G, Stage 1 Phase B, Series III, TP-H1011	Jun 76
350	Qualification of a New MAPO Source and ERL-510 Curing Agent for Minuteman, Stage 1, UF-2121 Liner	Sep 76
351	Propellant Surveillance Report LGM-30 A & B, Stage 1, TP-H1011	Sep 76
354	Minuteman Stage 1 Motor Reliability Improvement Program Surveillance	Sep 76
358	Propellant Surveillance Report LGM-30 Dissected Motors, Phase VIII, TP-H1011	Oct 76
360	Propellant Surveillance Report LGM-30 F & G, Stage 1 Phase E, Series III, TP-H1011	Nov 76
367	Propellant Surveillance Report LGM-30 A & B, Stage 1, TP-H1011	Apr 77
370	Propellant Surveillance Report LGM-30 F & G, Stage 1, Phase E, Series II, TP-H1011	Apr 77
377	Qualification of a New MAPO Source and ERL-510 Curing Agent for Minuteman Stage 1, UF-2121 Liner	Oct 77
379	Final RIP Report, Minuteman Stage 1 Motor Reliability Improvement Program Surveillance	Oct 77
385	Propellant Surveillance Report LGM-30 A, B, F, & G, Stage 1, TP-H1043	Dec 77
388	Propellant Surveillance Report LGM-30 A & B Stage 1, TP-H1011	Jan 78
390	Propellant Surveillance Report LGM-30 F & G Stage 1, Phase E, Series IV, TP-H1011	Feb 78
392	Propellant Surveillance Report LGM-30 Dissected Motors, Phase IX, TP-H1011	Mar 78
393	Propellant Surveillance Report LGM-30 A & B Stage I, TP-H1011	May 78

LIST OF REFERENCES (CONT)

<u>Report Nr</u>	<u>Title</u>	<u>Report Date</u>
396	Propellant Surveillance Report LGM-30 F & G Stage I, TP-H1011	Jun 78

GLOSSARY OF TERMS AND ABBREVIATIONS

Aging Trend	A change in properties or performance resulting from aging of material or component
CSA	Cross Sectional Area
DB	Dogbone
Degradation	Gradual deterioration of properties or performance
E	Modulus (psi), defined as stress divided by strain along the initial linear portion of the curve.
EB	End Bonded
EGL	Effective Gage Length
em	Strain at maximum stress
er	Strain at rupture
"F" ratio	The ratio of the variance accounted for by the regression function to the random unexplained variance. The regression function having the most significant "F" ratio is used for plotting data. The ratio is also used in detecting significant changes in random variation between succeeding time points
JANNAF	Joint Army, Navy, NASA, Air Force Committee
MANCP	Propellant Lab Section at Ogden Air Logistics Center
Ogden ALC	Ogden Air Logistics Center, Air Force Logistics Command
r or R	The Correlation Coefficient is a measure of the degree of closeness of the linear relationship between two variables
Linear Regression Equation	The general form of the linear regression equation is $Y = a + bx$
Regression Line	Line representing mean test values with respect to time
S_b	Standard error of estimate of the regression coefficient

GLOSSARY OF TERMS AND ABBREVIATIONS (cont)

S_e or $S_{Y.X}$	Standard deviation of the data about the regression line
S_m	Maximum Stress
S_r	Stress at rupture
Standard Deviation (S_y)	Square root of variance
Strain Rate	Crosshead speed divided by the EGL
"t" test	A statistical test used to detect significant differences between a measured parameter and an expected value of the parameter (determines if regression slope differs from zero at the 95% confidence level)
Variance	The sum of squares of deviations of the test results from the mean of the series after division by one less than the total number of test results
3 Sigma Band	The area between the upper and lower 3 sigma limit. It can be expected that 99.73% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed.
90-90 Band	It can be stated with 90% confidence that 90% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed
Significant	As used in the statistical sense, means a difference unlikely to have been the result of random sampling from some specified population.

INTRODUCTION

A. PURPOSE:

Laboratory testing has been performed for twelve and one half years on First Stage LGM-30 F and G Minuteman Motor propellant blocks to evaluate the effects of aging on TP-H1011 propellant. This report contains those tests conducted on propellant as instructed in MMWRM Test Directive GTD-1C, Amendment 2, LGM-30 First Stage Operational Propellant Laboratory Testing.

Statistical analysis of the data from tests performed will provide early warning if serious degradation trends develop. Annual evaluation of the propellant provides data for input into engineering reliability analysis for service life predictions.

B. BACKGROUND:

LGM-30 F and G testing was started in 1966 with phase testing at 24 month intervals (Report Numbers 78 - zero time; 104, 162, 185-Phase I; 176, 239, 257-Phase II; 271-Phase III). Report Number 257 was the first time that LGM-30 F and G data were statistically analyzed separately from LGM-30A and B data. The present report is a continuation of testing and statistical analysis.

Zero time testing for LGM-30A, B, F and G was started as soon as possible after receipt of the propellant by MANCP. Data from these tests were used to establish a base line for each test parameter.

The LGM-30F and G propellant test matrix (Table 1) is used to determine the number of specimens to be taken from each propellant loaf and the specific test or tests to which these specimens are to be subjected. Very low rate and low rate tensile specimens are taken on all LGM-30F and G blocks. Specimens for other physical and combustion tests are taken from every third (LGM-30F and G) block.

TABLE 1

SAMPLE PLAN

The Procedure for determining tests to be performed on propellant batch samples of LGM-30 F & G First Stage Motors are as follows:

1. Divide the USAF motor serial numbers into three groups by dividing the last three digits of each serial number by three to determine the remainder integer, e.g., $154 \div 3 = 51$ with a remainder integer of 1.
2. Use the remainder integer to enter the following matrix to determine the group of tests to be performed on the forward, middle, and aft batch samples associated with a particular motor serial number.

TP-H1011 PROPELLANT BATCH SAMPLE	GROUP MATRIX		
	GROUP I	GROUP II	GROUP III
Forward	1	2	0
Middle	0	1	2
Aft	2	0	1

Each group will receive the following tests:

TEST MATRIX		
GROUP I	GROUP II	GROUP III
High Rate Triaxial	Dynamic Response	High Rate Hydrostatic
Creep	Stress Relaxation	Sol Gel
Biaxial Low Rate	Burning Rate	DSC
TCLE	Heat of Explosion	TGA
Hardness	Pressure Time	DTA
Ignitability		Impact

NOTE: Low Rate and Very Low Rate Tensile tests are performed on all blocks.

STATISTICAL APPROACH

In order to determine aging trends for shelf/service life predictions, as directed by Service Engineering, First Stage LGM-30 F and G Minuteman TP-H1011 propellant blocks have been undergoing testing since 1966, statistically analyzed and reported on a regular test cycle by this laboratory.

The primary reason for performing statistical analysis on test data is for the detection of propellant changes due to aging that would affect motor reliability. Regression analysis was the method used to examine data and to aid in drawing conclusions about dependency relationships that may exist i.e., relationship between age versus test results.

In selecting the best fit model for the regression equation, the linear model $Y = a + bX$ was found to be the best fit model for 96% of the regression plots. The model used is shown in the regression equation at the top of every regression plot and those which are not linear will also be listed and discussed in the test results section.

Individual data points from different time periods were used to establish a least squares trend line for the data. The variance about the regression line, obtained using individual values of the dependent variable, was used to compute a tolerance interval such that at the 90% confidence level 90% of the sample distribution falls within this interval. This tolerance interval was extrapolated to a maximum of 24 months into the future from age of the oldest motor tested. The 't' value and the

significance of this statistic, which are reported for each regression model, give an indication of the "statistical significance" of the slope of the trend line as compared to a line of zero slope. Data were plotted by computer. The 'y' axis is computed so that the values at one inch intervals are peculiar to the data spread of the parameter tested. Plotted data points represent means at the particular ages at which testing occurred. The number of specimens at each age point is indicated on the sample size summary sheet accompanying the regression plot. Variance at each test age can be determined by consulting the G085 data storage system.

A post cure effect (propellant stabilizing after the first year or two) has been observed on some of the early test data (stress relaxation at -65°F, -40°F, and 20°F; TGA percent weight loss at 250°C; DTA exotherm 1, and exotherm 2); which tended to bias and skew the projected trend lines. To overcome this factor, two methods of analysis were performed: First, where possible, non-linear models were used that would best fit the total data (TGA % weight loss at 250°C, DTA exotherm 1 and exotherm 2 data); second, where non-linear models did not fit the data as good as the linear model this early data was eliminated (Stress Relaxation at -60°F, -40°F, and 20°F data). By compensating for this post cure biasing a more accurate aging trend line for service life prediction is provided.

TEST RESULTS

VERY LOW RATE TENSILE:

Very low rate regressions show no significant change for strain at maximum stress with strain at rupture showing a statistically significant decrease. The stresses and modulus show a statistically significant increase (Figures 1 thru 5). The trends are gradual for the respective regressions and no operational problems from the propellant are expected for at least two years beyond the last test date.

LOW RATE BIAXIAL TENSILE:

The strain regressions show a statistically significant gradual decrease. The stresses and modulus show a statistically significant increase (Figures 6 thru 10).

LOW RATE TENSILE:

Low rate tensile data regressions show a statistically significant gradual decrease for strains and a statistically significant increase for stresses and modulus (Figures 11 thru 15).

HIGH RATE TRIAXIAL TENSILE:

The strain at maximum stress, strain at rupture and modulus regressions show a statistically significant decrease. Maximum stress and stress at rupture do not show a significant change (Figures 16 thru 20).

HIGH RATE HYDROSTATIC TENSILE:

The strains show a statistically significant decrease and the stresses show a statistically significant increase. The modulus did not show a significant change (Figures 21 thru 25).

TENSILE SUMMARY:

The test data regressions show that the strain is gradually decreasing and the stress and modulus gradually increasing.

Based on the analysis of test data regressions, it does not appear that meaningful degradation is occurring at this time and no operational problems are expected in the propellant for at least two years beyond the last data point.

STRESS RELAXATION MODULUS:

For the 0.5% strain at -65°F, the regressions for data at 10, 50 and 100 seconds show a statistically significant gradual increase with the 1000 second regression showing no significant change (Figures 26 thru 29).

At -40°F, the 10 second regression shows no significant change while the 50, 100 and 1000 second regressions show a statistically significant decrease (Figures 30 thru 33).

The 3% strain regressions at 20°F, 77°F, 100°F, 140°F, and 180°F show a statistically significant gradual increase except for the 20°F at 10 second regression which does not show a change (Figures 34 thru 53).

SOL GEL:

The percent extractables and density do not show a significant change. Gel swell ratio and crosslink density regressions show a statistically significant increase (Figures 54 thru 57).

CONSTANT STRAIN:

A statistically significant gradual decrease is shown for constant strain (Figure 58).

HARDNESS:

Shore A ten second hardness shows a statistically significant increase (Figure 59).

SUMMARY OF SOL GEL, TENSILE AND HARDNESS DATA:

The crosslink density, constant strain and hardness data regressions correlate with the tensile data. As the polymer continues to crosslink, the strains decrease and the stresses and hardness increases.

PRESSURE TIME:

Maximum pressure and time to maximum pressure shows a statistically significant gradual decrease (Figures 60 and 61).

TCLE (Thermal Coefficient of Linear Expansion)

The thermal coefficient of linear expansion for both above and below the glass transition point (T_g) shows a statistically significant gradual increase (Figures 62 and 63).

TGA (Thermal Gravimetric Analysis):

A statistically significant increase is shown for the ignition temperature (9°C rise/min) and the percent weight loss at 250°C hold (12°C rise/min to

hold) with the weight loss at ignition showing no significant change (Figures 64 thru 66). The model $Y = a + b \left(\frac{1}{X}\right)$ was found to better represent the data than the linear model in Figure 66.

DTA (Differential Thermal Analysis):

The endotherm and first and second exotherms show a statistically significant decrease. The third exotherm and ignition temperature shows a statistically significant increase (Figures 67 thru 71). The model $Y = a + b (\text{LOG } X)$ was found to better represent the data on Figures 68 and 69 than the linear model.

THERMAL AND COMBUSTION SUMMARY:

The thermal and combustion regressions show good correlation. The time to maximum pressure and ignition temperature for TGA and DTA are all increasing.

TEAR ENERGY:

The regression shows a statistically significant gradual decrease (Figure 72).

FAILURE ENVELOPE:

The failure envelope is shown in Figure 73.

CONCLUSIONS

Twelve and one half years of aging at ambient temperature (77°F) has not greatly changed the properties of the propellant. Some test parameters indicate slight aging trends, but nothing that would adversely affect the operational characteristics of the rocket motor propellant.

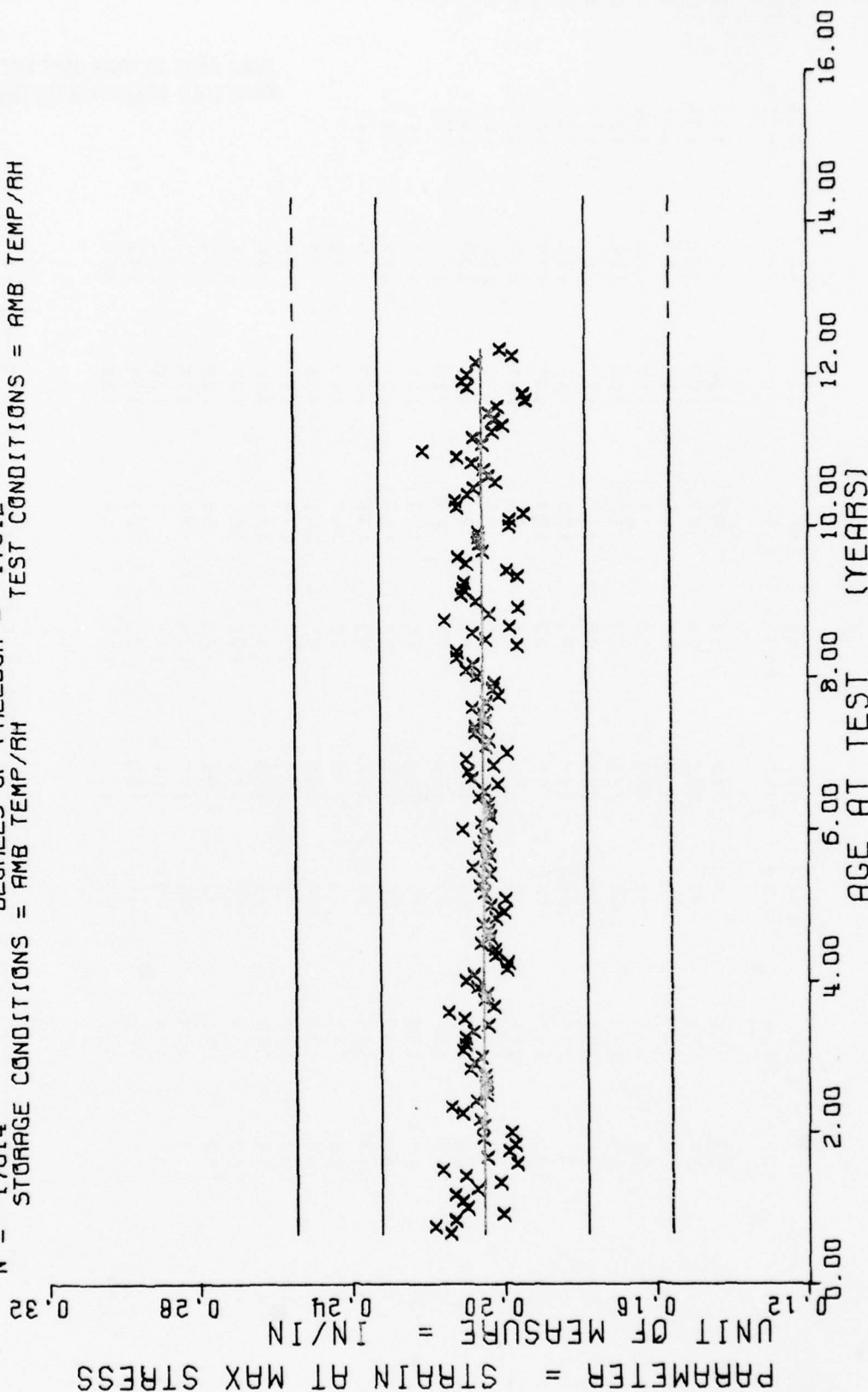
From the statistical analysis, it does not appear that significant propellant degradation is occurring. Based on the twelve and one half years of accumulated data, there is no reason to suspect that properties will show much change for at least two years past the last data point. Therefore, propellant reliability should not change appreciably over that time period. Since failure limits are not available for the parameters tested, this statement is based on the fact that the slope of the regression curves where statistically significant are, with few exceptions, relatively flat or close to the line of zero slope and have not changed appreciably from the last test period.

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
3	3	33	152	59	352	83	80	108	90
3	13	34	154	59	305	84	47	109	108
10	11	35	113	50	406	85	45	110	51
11	15	36	226	61	265	86	71	111	30
12	30	37	147	62	316	87	113	112	112
13	49	38	126	53	228	88	127	113	282
14	29	39	113	54	142	89	150	114	141
15	38	40	122	65	90	90	129	115	118
15	46	41	156	66	61	91	86	116	297
17	55	42	123	57	24	92	61	117	241
18	28	43	142	58	134	93	99	118	137
19	40	44	106	69	198	94	84	119	129
20	24	45	135	70	245	95	122	120	195
21	55	46	122	71	117	96	167	121	117
22	27	47	165	72	116	97	135	122	9

WING 6.V.L.F. TENSILE, STRAIN AT MAX STRESS, CHS=C.002 IN/MIN TP-HIC11

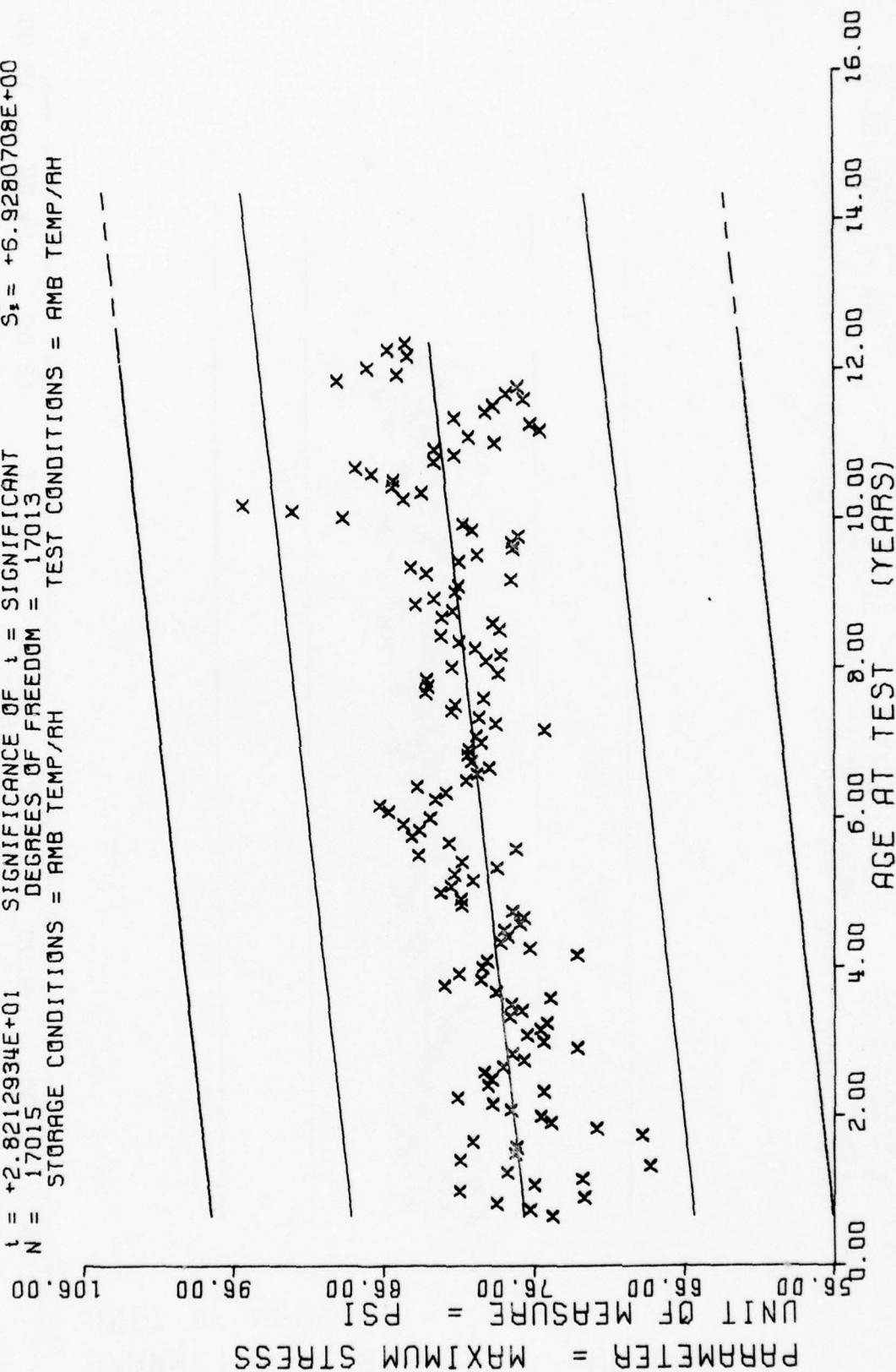
This sample size summary is applicable to figures 1 thru 3 and 5.

$Y = ((+2.0536191E-01) + (+2.0097250E-06) * X)$
 $F = +2.8327236E-01$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G = +1.6542945E-02$
 $R = +4.0805696E-03$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S = +3.7760223E-06$
 $t = +5.3223337E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_2 = +1.6543293E-02$
 $N = 17014$ DEGREES OF FREEDOM = 17012
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, V.L.R. TENSILE, STRAIN AT MAX STRESS, CHS=0.002 IN/MIN TP-H1011

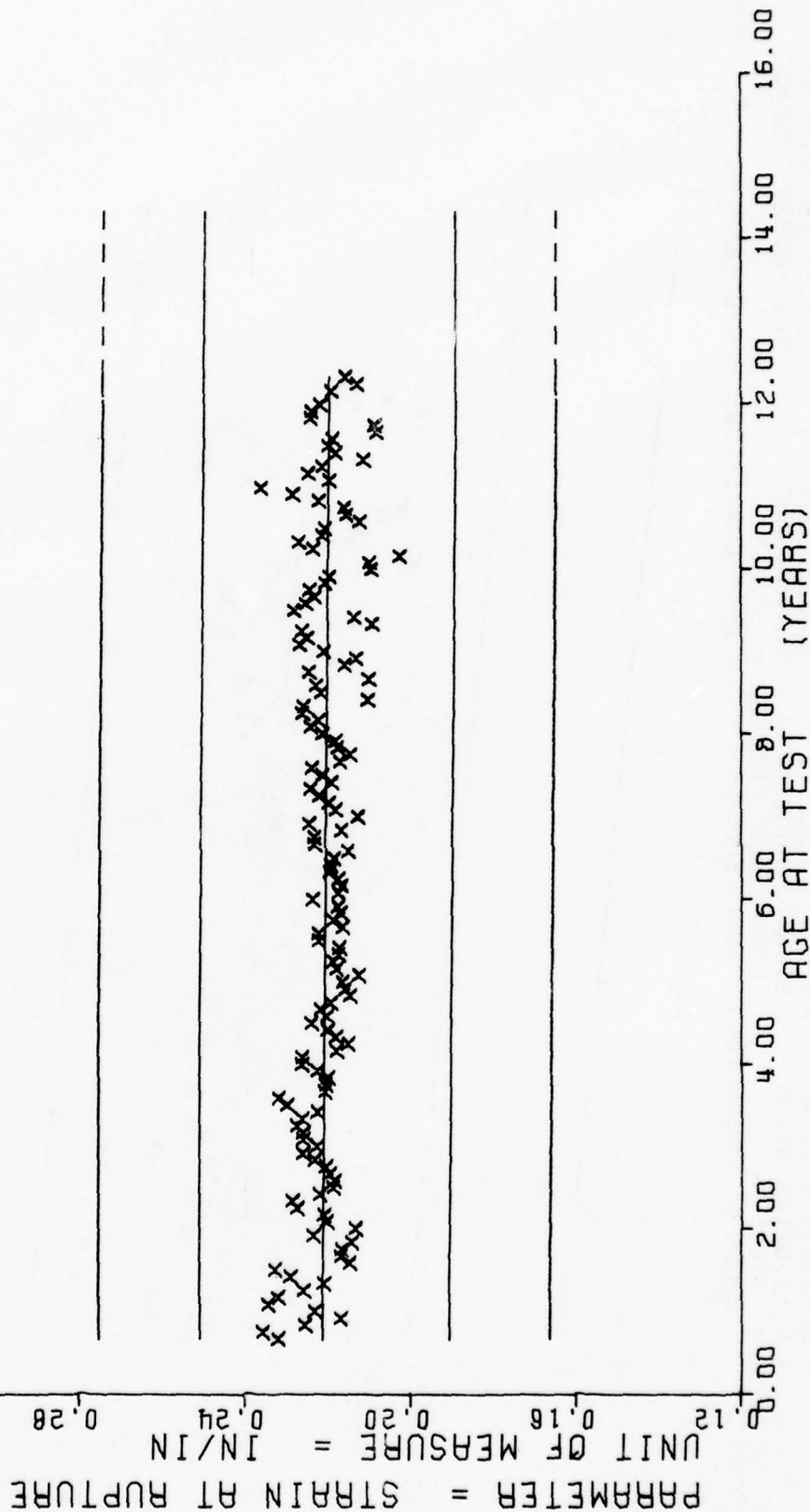
$Y = ((+7.6417395E+01) + (+4.4612588E-02) * X)$
 F = +7.9596969E+02 SIGNIFICANCE OF F = SIGNIFICANT $\sigma_1 = +7.0880782E+00$
 R = +2.1141162E-01 SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +1.5812813E-03$
 t = +2.8212934E+01 SIGNIFICANCE OF t = SIGNIFICANT $S_2 = +6.9280708E+00$
 N = 17015 DEGREES OF FREEDOM = 17013
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, V.L.R. TENSILE, MAXIMUM STRESS, CHS=0.002 IN/MIN TP-H1011

Figure 2

$Y = ((+2.2141455E-01) + (-1.5348631E-05) * X)$
 $F = +1.3745487E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +1.8144966E-02$
 $R = -2.8412814E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_a = +4.1398975E-06$
 $t = +3.7074907E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_f = +1.8138173E-02$
 $N = 17015$ DEGREES OF FREEDOM = 17013
 STORAGE CONDITIONS = AMB TEMP/°H TEST CONDITIONS = AMB TEMP/°H



WING 6, V.L.A. TENSILE, STRAIN AT RUPTURE, CHS=0.002 IN/MIN TP-H1011

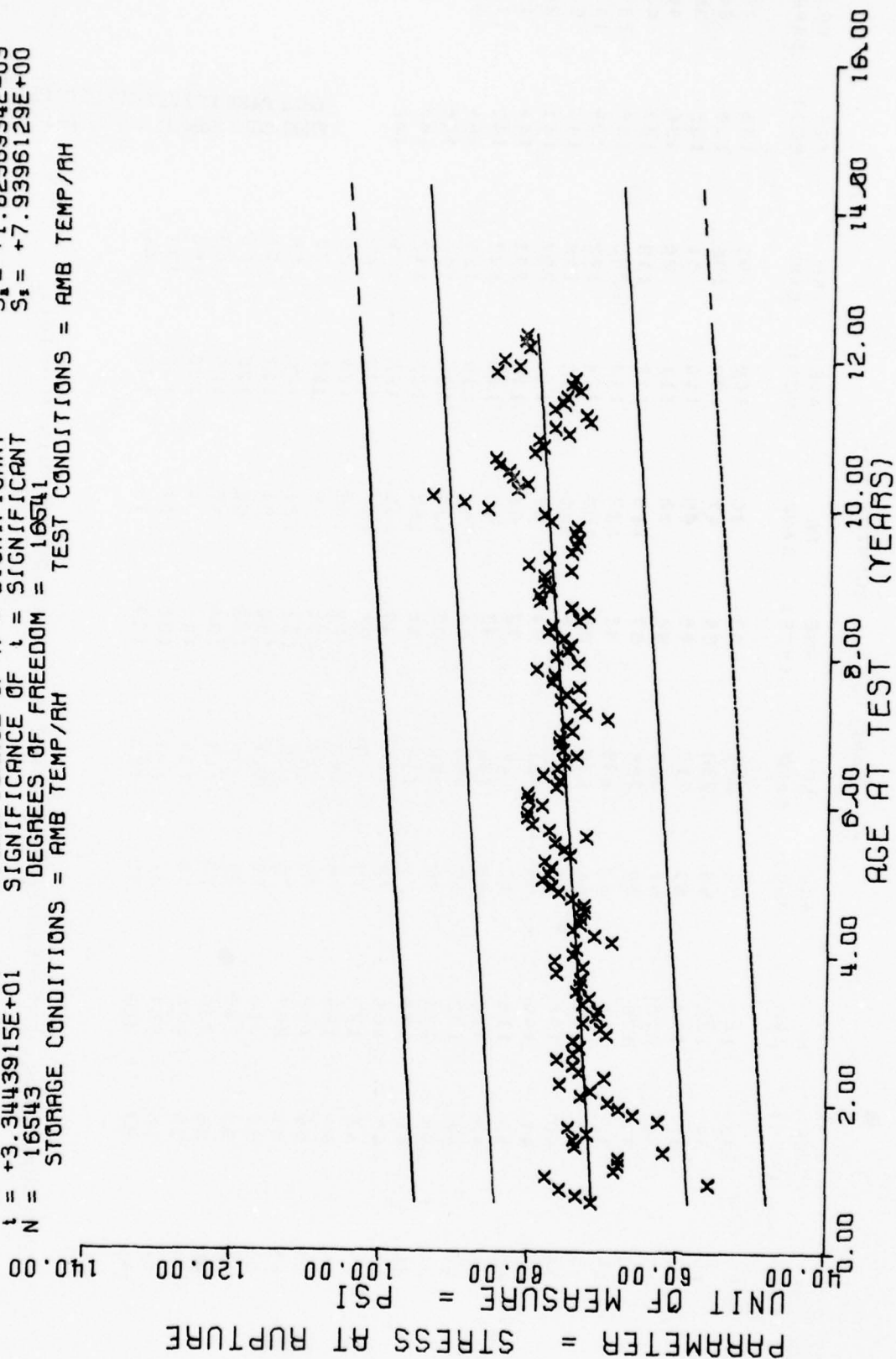
Figure 3

[illegible]

WING 6.V.L.R.TENSILE, STRESS AT RUPTURE, CFS=0.002 IN/MIN TP-H1011

This sample size summary is applicable to figure 4.

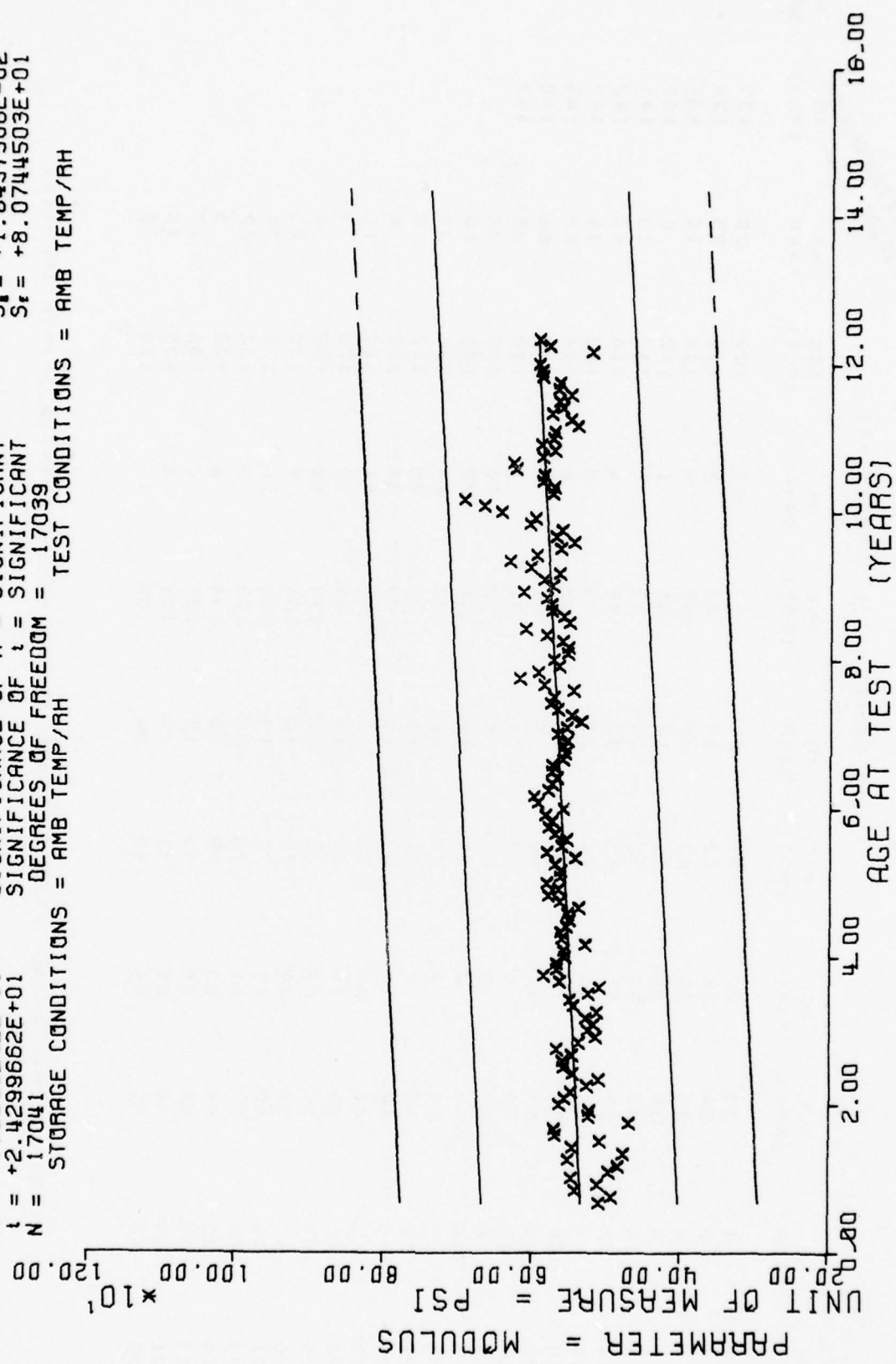
$Y = ((+7.1018286E+01) + (+6.1058339E-02) * X)$
 $F = +1.1184954E+03$ SIGNIFICANCE OF $F =$ SIGNIFICANT $\sigma_1 = +8.2034109E+00$
 $R = +2.5166798E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT $S_1 = +1.8256934E-03$
 $t = +3.3443915E+01$ SIGNIFICANCE OF $t =$ SIGNIFICANT $S_2 = +7.9396129E+00$
 $N = 16543$ DEGREES OF FREEDOM = 16541
 STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = AMB TEMP/AM



WING 6, V.L.R. TENSILE STRESS AT RUPTURE, CHS=0.002 IN/MIN TF-H1011

Figure 4

$Y = ((+5.3210285E+02) + (+4.4851117E-01) * X)$
 $F = +5.9047361E+02$ SIGNIFICANCE OF $F =$ SIGNIFICANT $\sigma_f = +8.2129248E+01$
 $R = +1.8301242E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT $S_e = +1.8457506E-02$
 $t = +2.4299662E+01$ SIGNIFICANCE OF $t =$ SIGNIFICANT $S_t = +8.0744503E+01$
 $N = 17041$ DEGREES OF FREEDOM = 17039
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, V.L.R. TENSILE, MODULUS, CHS=0.002 IN/MIN TP-H1011
 Figure 5

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDG

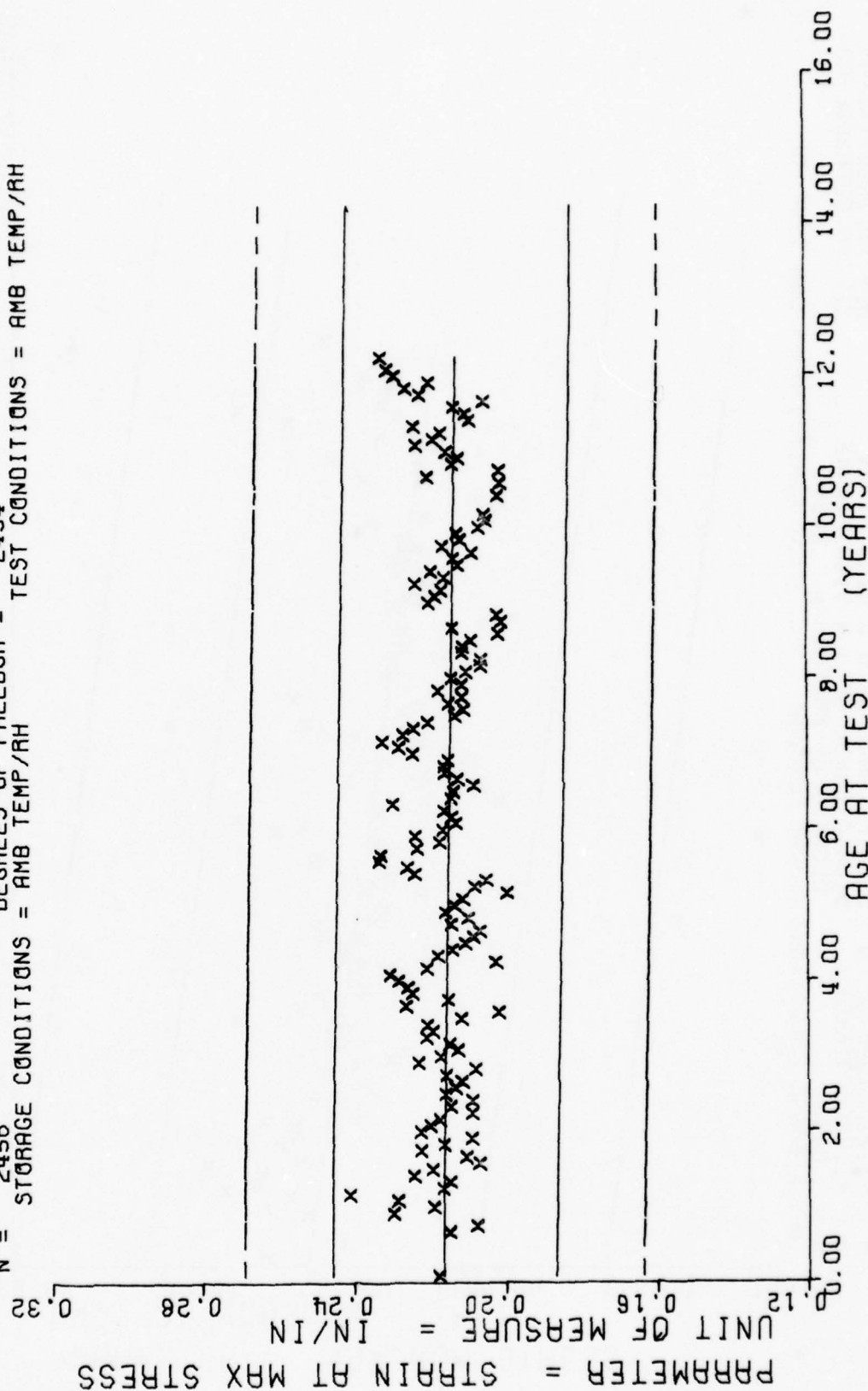
*** SAMPLE SIZE SUMMARY ***

AGE (MCS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MCS)	NR SAMP	AGE (MCS)	NR SAMP
1	1	33	22	53	32	83	16	109	20
8	2	34	26	59	18	84	6	110	23
9	4	35	24	60	28	85	4	111	10
11	6	36	29	61	12	86	1	112	8
12	14	37	12	62	36	87	6	113	13
13	22	38	10	63	30	88	4	114	60
14	4	39	14	64	20	89	4	115	14
15	16	40	14	65	10	90	6	116	48
16	12	41	12	66	9	91	5	117	66
17	14	42	6	67	6	92	8	118	28
18	16	43	2	68	4	93	10	119	32
19	14	44	2	69	12	94	20	120	40
20	16	45	4	70	22	95	24	121	30
21	12	46	8	71	10	96	28	122	6
22	10	47	14	72	10	97	34	125	4
23	13	48	24	73	16	98	46	127	10
24	16	49	34	74	19	99	38	128	3
25	25	50	24	75	35	100	16	129	6
26	22	51	34	76	14	101	8	130	20
27	24	52	49	77	19	102	8	131	74
28	28	53	41	78	22	103	2	132	22
29	23	54	20	79	20	104	4	133	6
30	26	55	28	80	15	105	2	134	17
31	26	56	26	81	24	106	6	135	10
32	42	57	38	82	24	108	12	136	2

WING 6.L.F. BIAXIAL TENSILE STRAIN AT MAX STRESS, CHS=0.2 IN/MIN TPH-1011

This sample size summary is applicable to figures 6 thru 10.

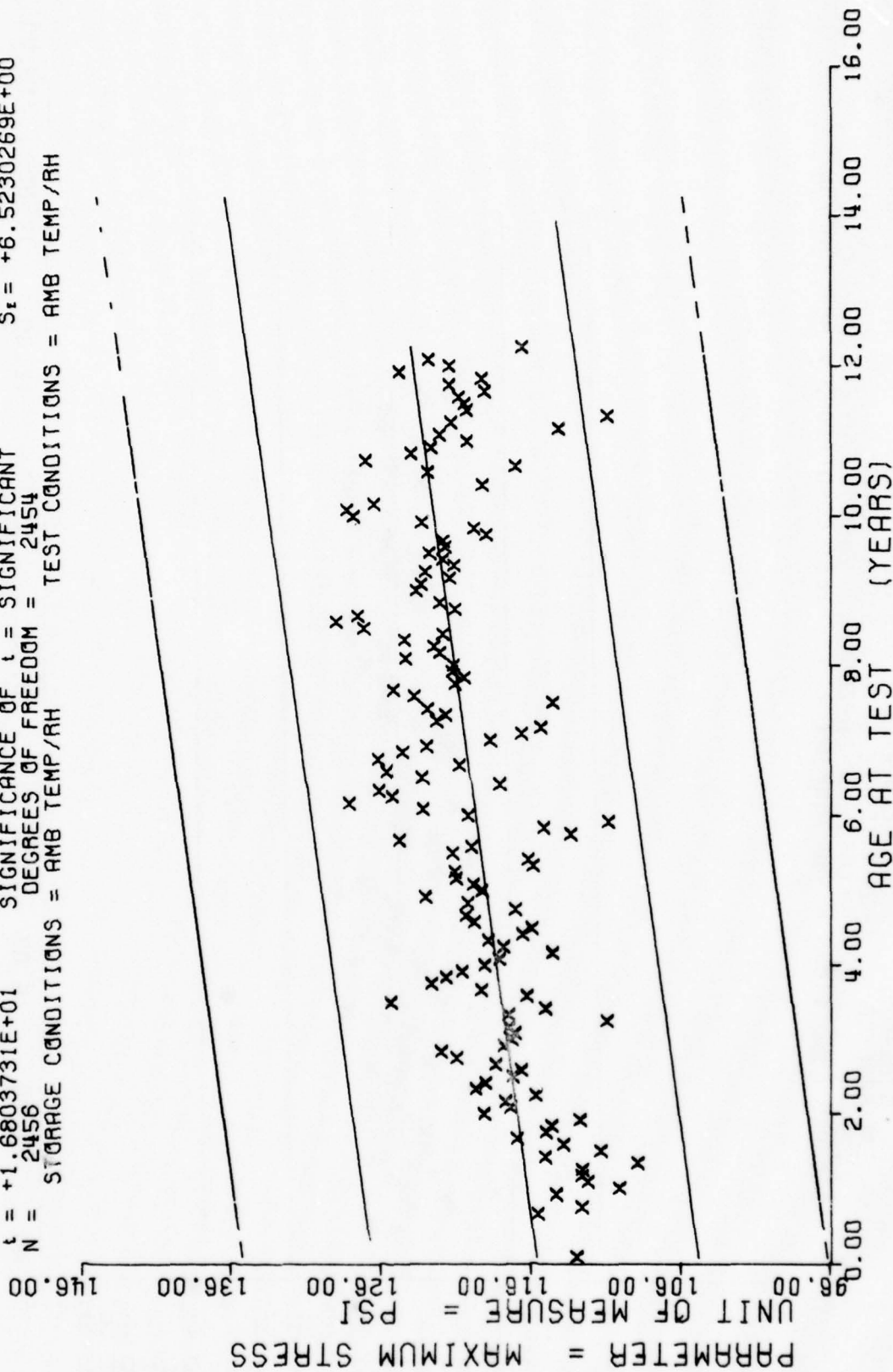
$Y = ((+2.1682445E-01) + (-3.2511536E-05) * X)$
 $F = +1.2764060E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +1.7537097E-02$
 $R = -7.1933406E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_a = +9.1000348E-06$
 $t = +3.5726826E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +1.7495230E-02$
 $N = 2456$ DEGREES OF FREEDOM = 2454
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L.A. BIAXIAL TENSILE, STRAIN AT MAX STRESS, CHS=0.2 IN/MIN TPH-1011

Figure 6

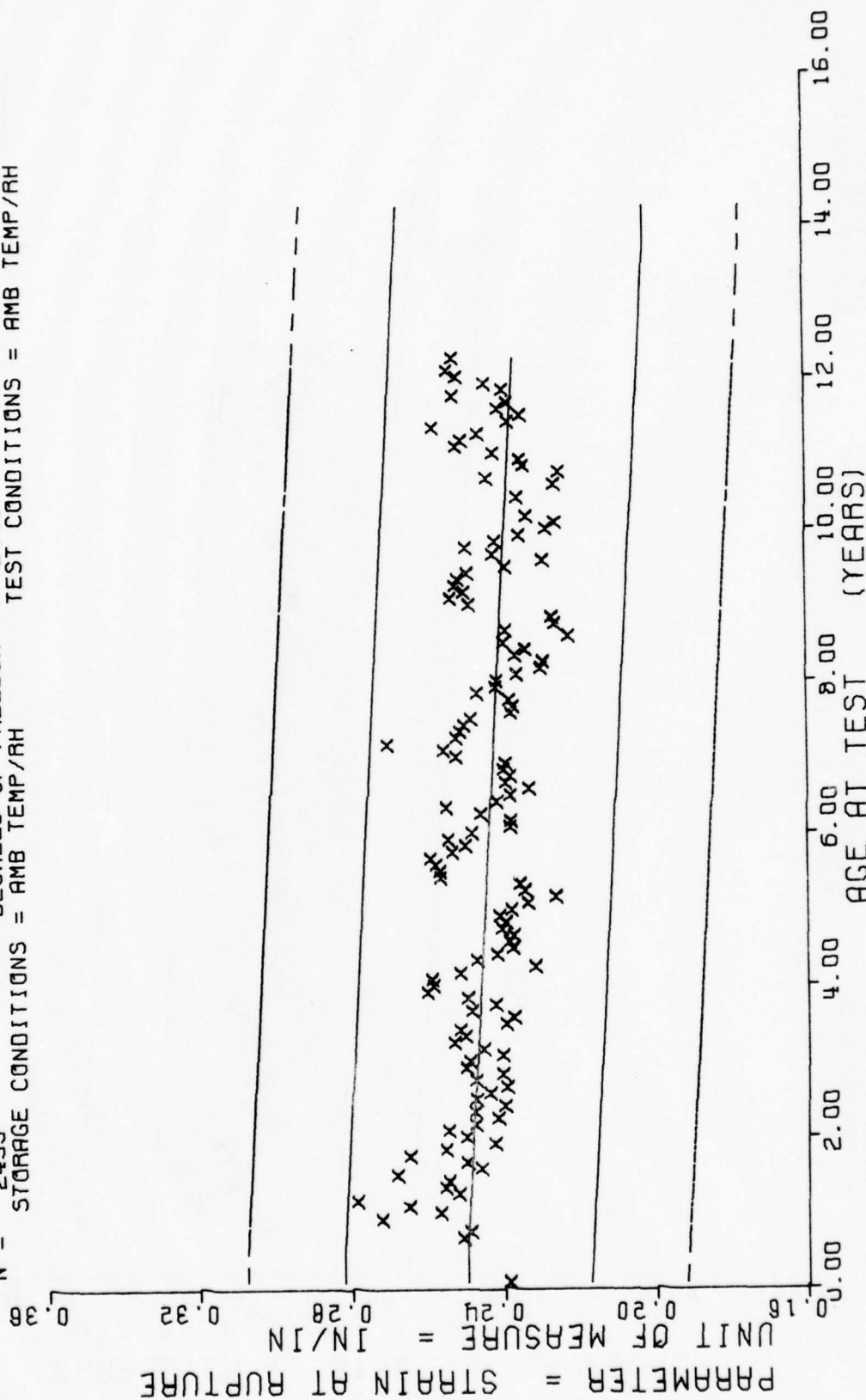
$Y = ((+1.1569307E+02) + (+5.7013578E-02) * X)$
 $F = +2.8236540E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +6.8866890E+00$
 $R = +3.2123192E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_a = +3.3929117E-03$
 $t = +1.6803731E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +6.5230269E+00$
 $N = 2456$ DEGREES OF FREEDOM = 2454
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L.R. BIAxIAL TENSILE, MAXIMUM STRESS, CHS=0.2 IN/MIN TPH-1011

Figure 7

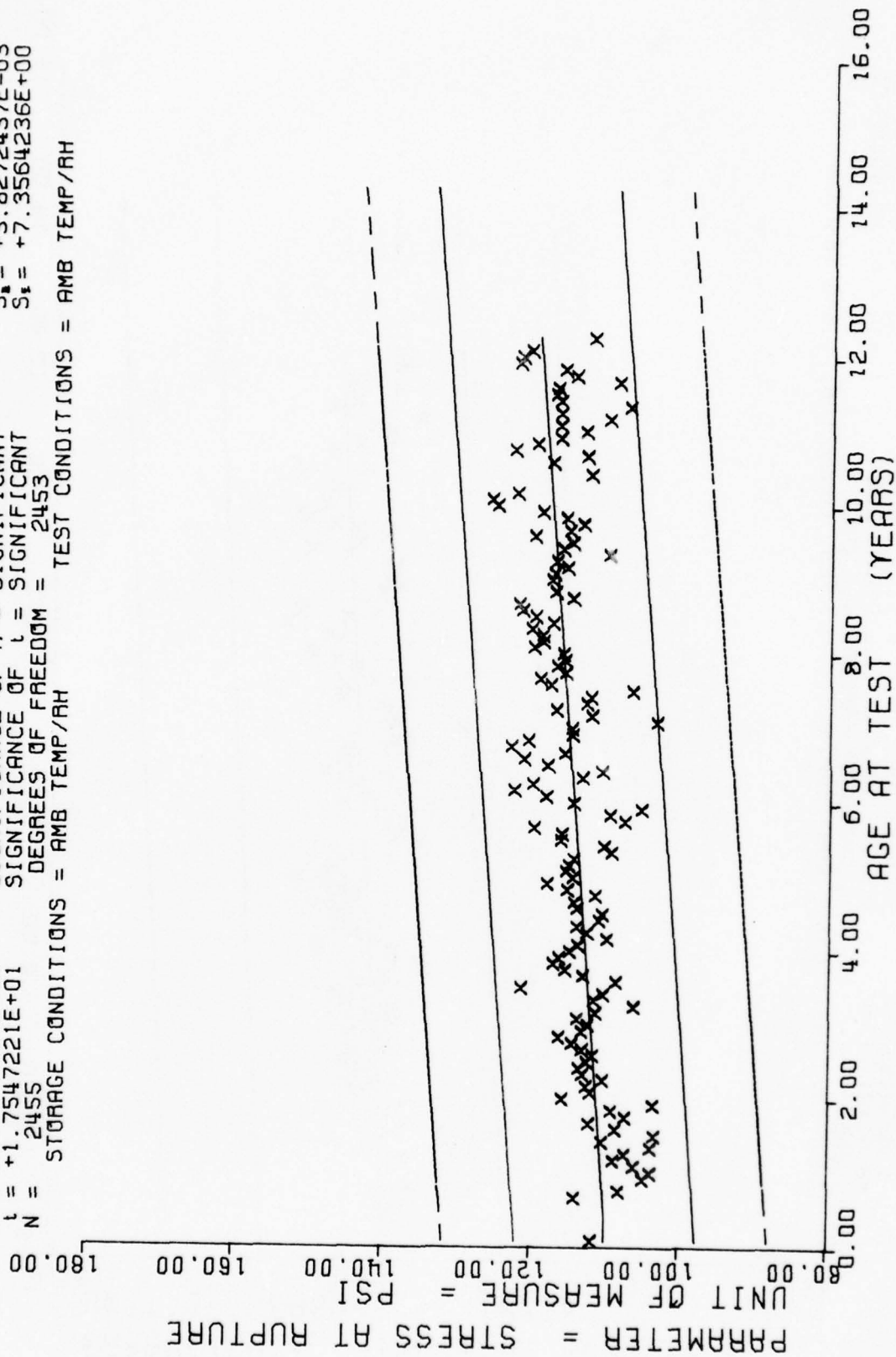
$Y = ((+2.5033397E-01) + (-9.5130689E-05) * X)$
 $F = +9.0463143E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G_1 = +1.9572254E-02$
 $R = -1.8859193E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +1.0001952E-05$
 $t = +9.5112114E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_2 = +1.9224958E-02$
 $N = 2455$ DEGREES OF FREEDOM = 2453
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L. R. BIAXIAL TENSILE, STRAIN AT RUPTURE, CHS=0.2 IN/MIN TPH-1011

Figure 8

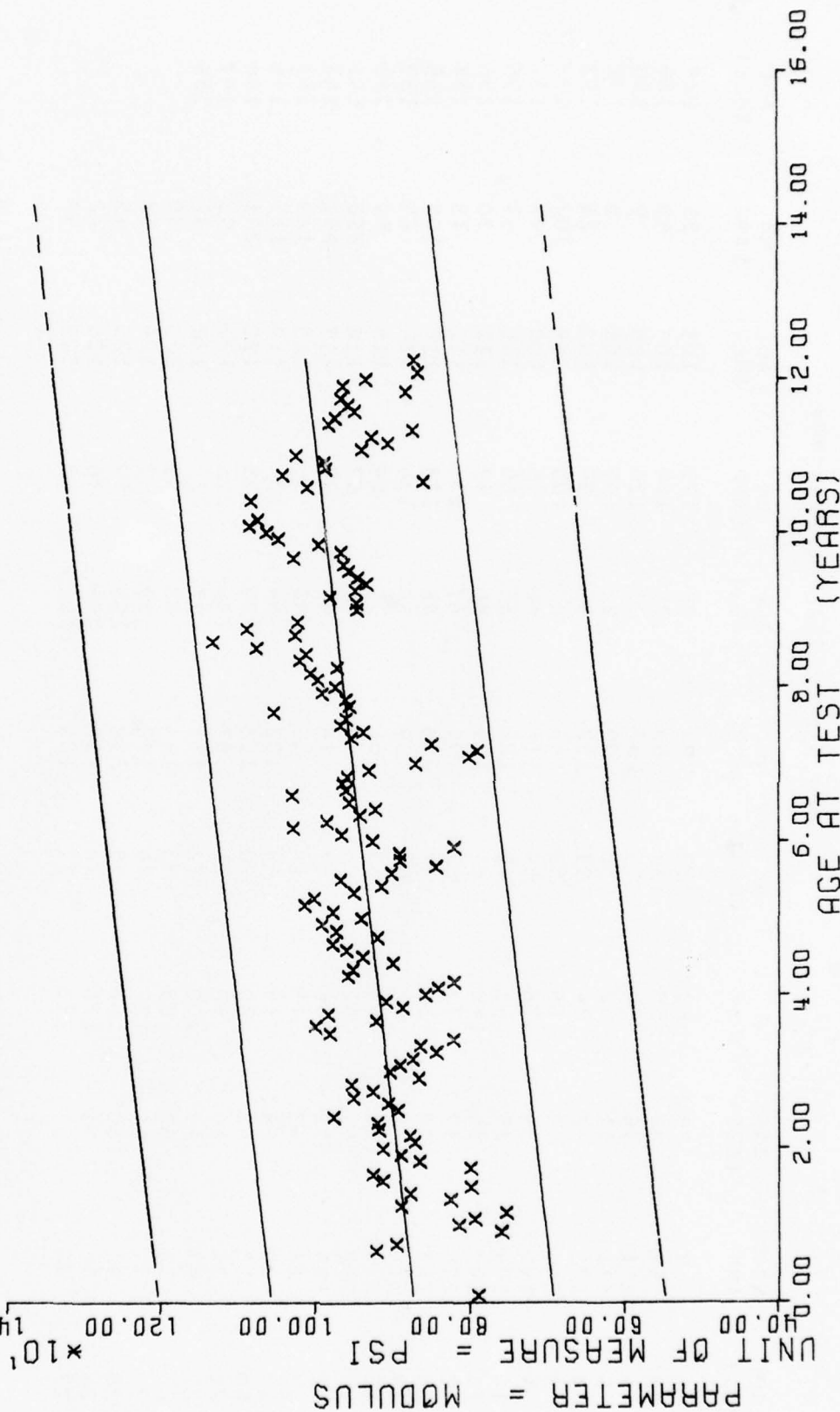
$Y = ((+1.0980828E+02) + (+6.7157494E-02) * X)$
 $F = +3.0790499E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_f = +7.8028845E+00$
 $R = +3.3395091E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +3.8272437E-03$
 $t = +1.7547221E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +7.3564236E+00$
 $N = 2455$ DEGREES OF FREEDOM = 2453
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6, L.A. BIAXIAL TENSILE, STRESS AT RUPTURE, CHS=0.2 IN/MIN TPH-1011

Figure 9

$Y = ((+8.7502020E+02) + (+9.3030271E-01) * X)$
 $F = +2.6490338E+02$ SIGNIFICANCE OF F = SIGNIFICANT $G = +1.1554229E+02$
 $R = +3.1225302E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +5.7158461E-02$
 $t = +1.6275852E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_1 = +1.0978743E+02$
 $N = 2454$ DEGREES OF FREEDOM = 2452
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



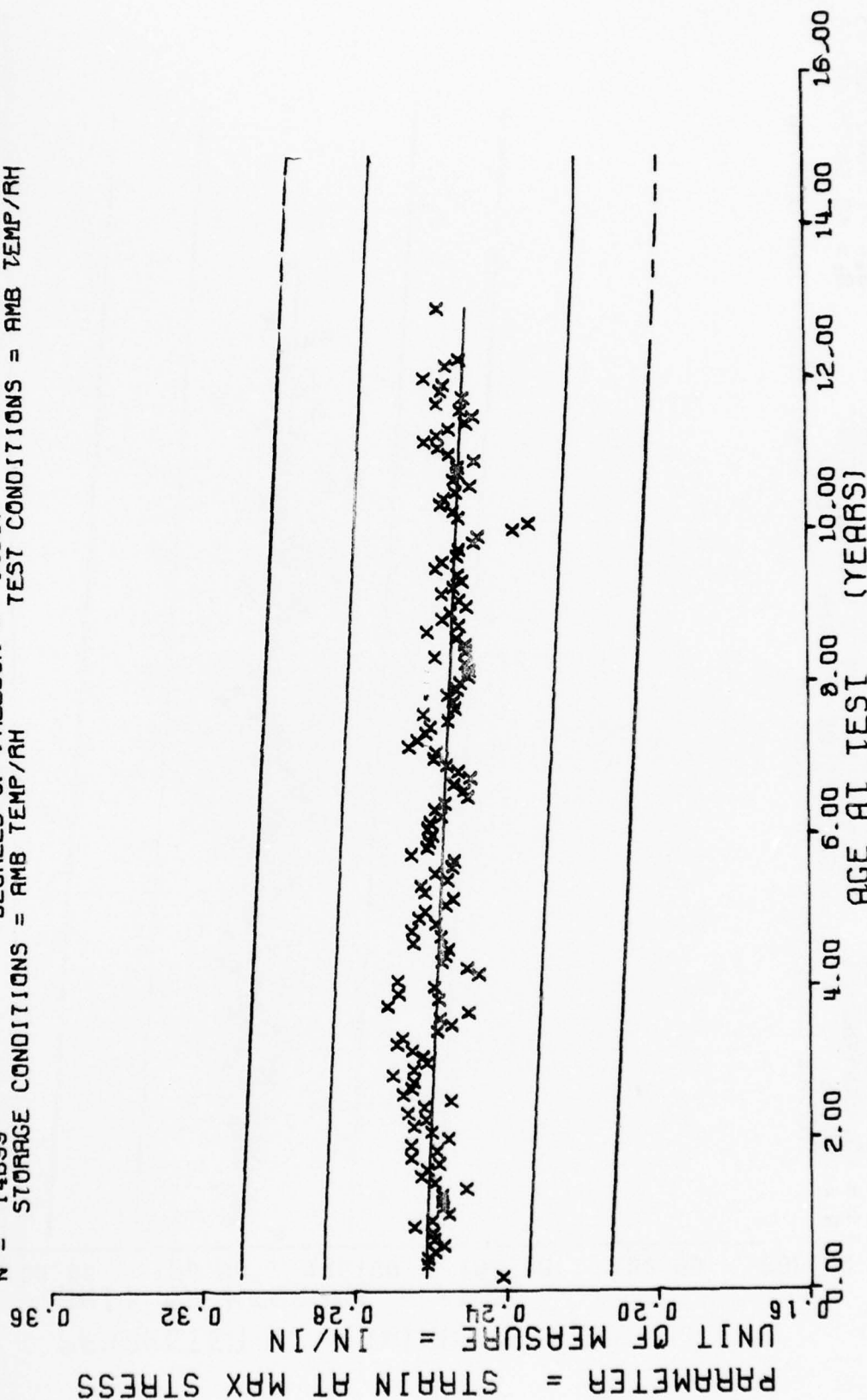
WING 6, L.A. BIAXIAL TENSILE, MODULUS, CHS=0.2 IN/MIN TPH-1011
 Figure 10

[illegible]

WING 6,L.R.TENSILE,STRAIN AT MAX STRESS,CHS=2.0 IN/MIN TP-H1011

This sample size summary is applicable to figures 11 thru 15.

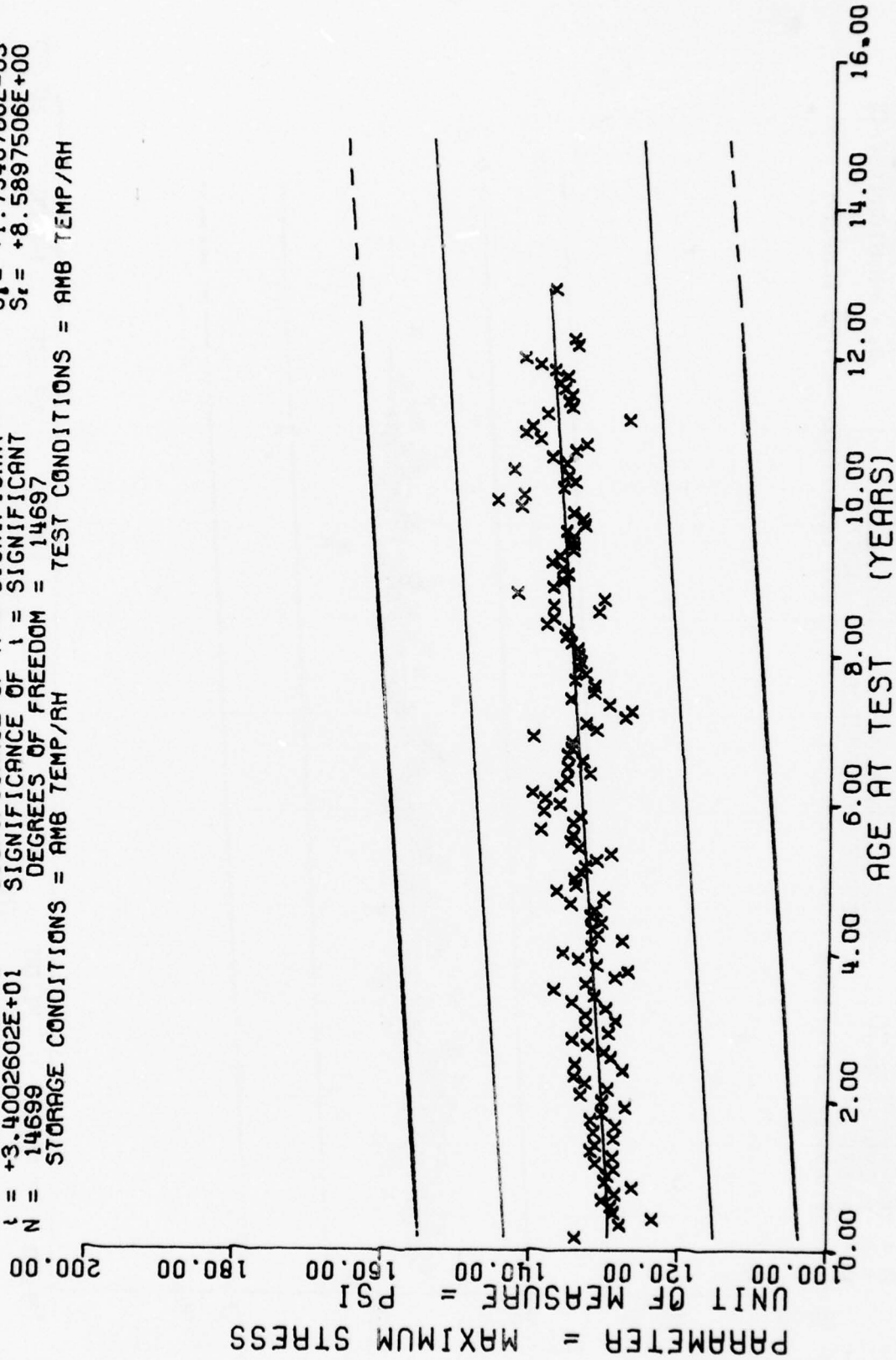
$Y = ((+2.6174070E-01) + (-8.4762066E-05) * X)$
 $F = +6.7502779E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +1.0526812E-02$
 $R = -2.0955365E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +3.2624262E-06$
 $t = +2.5981297E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +1.6160419E-02$
 $N = 14699$ DEGREES OF FREEDOM = 14697
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L. R. TENSILE, STRAIN AT MAX STRESS, CHS=2.0 IN/MIN TP-H1011

Figure 11

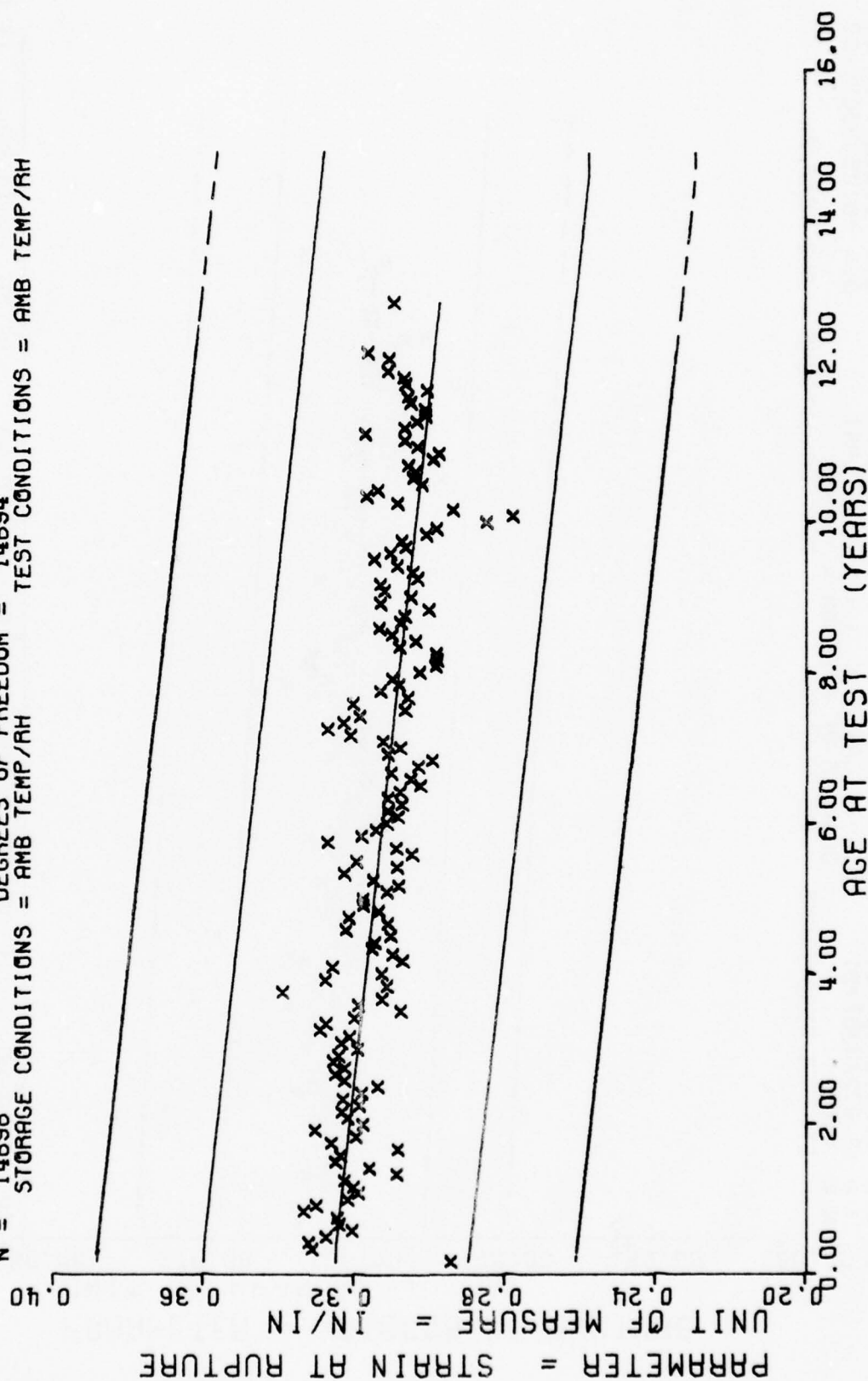
$Y = ((+1.2924883E+02) + (+5.8963166E-02) * X)$
 $F = +1.1561769E+03$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +2.7005611E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +3.4002602E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 14699$ DEGREES OF FREEDOM = 14697
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L.R. TENSILE, MAXIMUM STRESS, CHS=2.0 IN/MIN TP-H1011

Figure 12

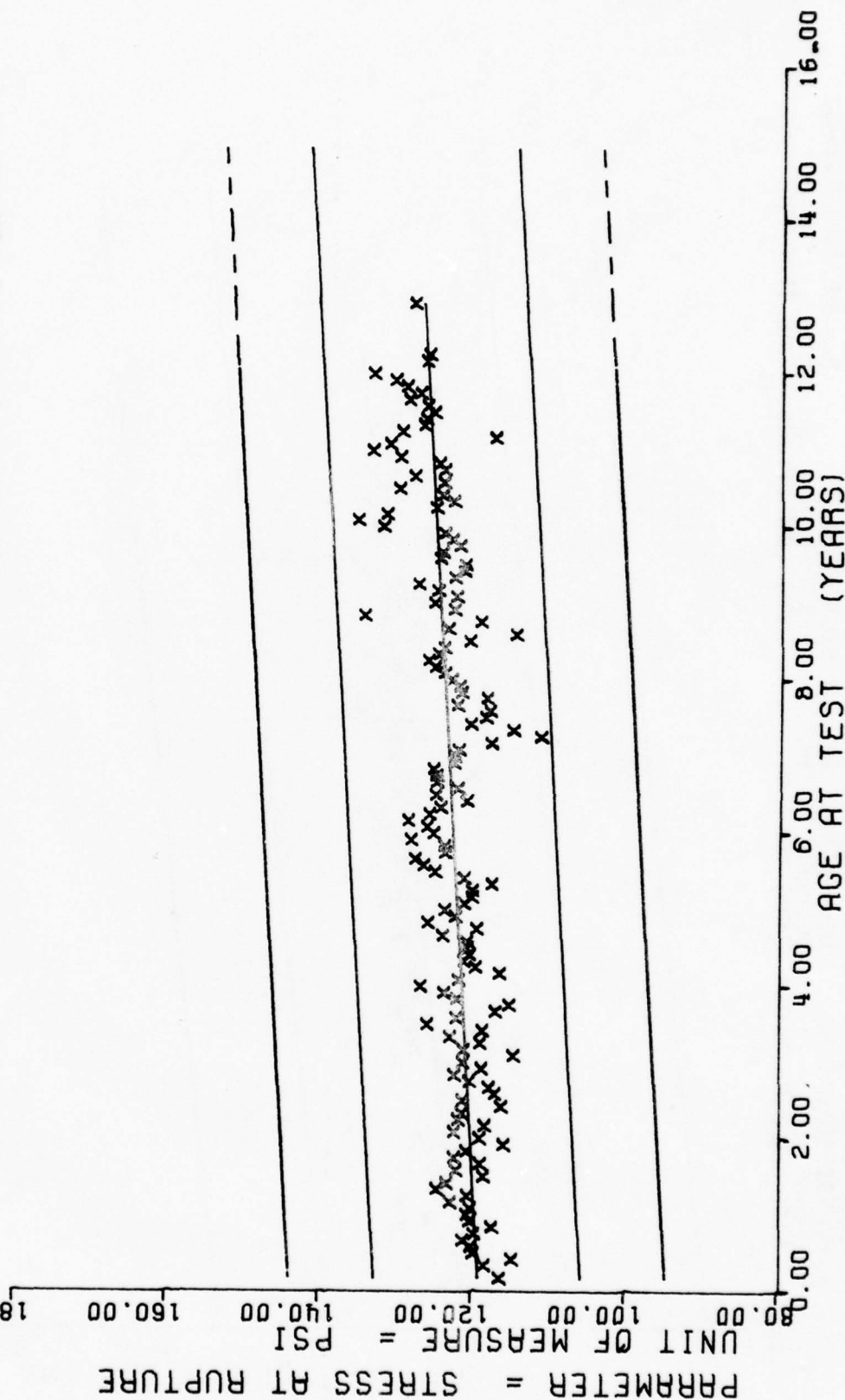
$Y = ((+3.2543274E-01) + (-1.8618766E-04) * X)$
 $F = +1.9024123E+03$ SIGNIFICANCE OF F = SIGNIFICANT $\alpha = +2.2467910E-02$
 $R = -3.3856745E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +4.2687288E-06$
 $t = +4.3616651E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +2.1141722E-02$
 $N = 14696$ DEGREES OF FREEDOM = 14694
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L. A. TENSILE, STRAIN AT RUPTURE, CHS=2.0 IN/MIN TP-H1011

Figure 13

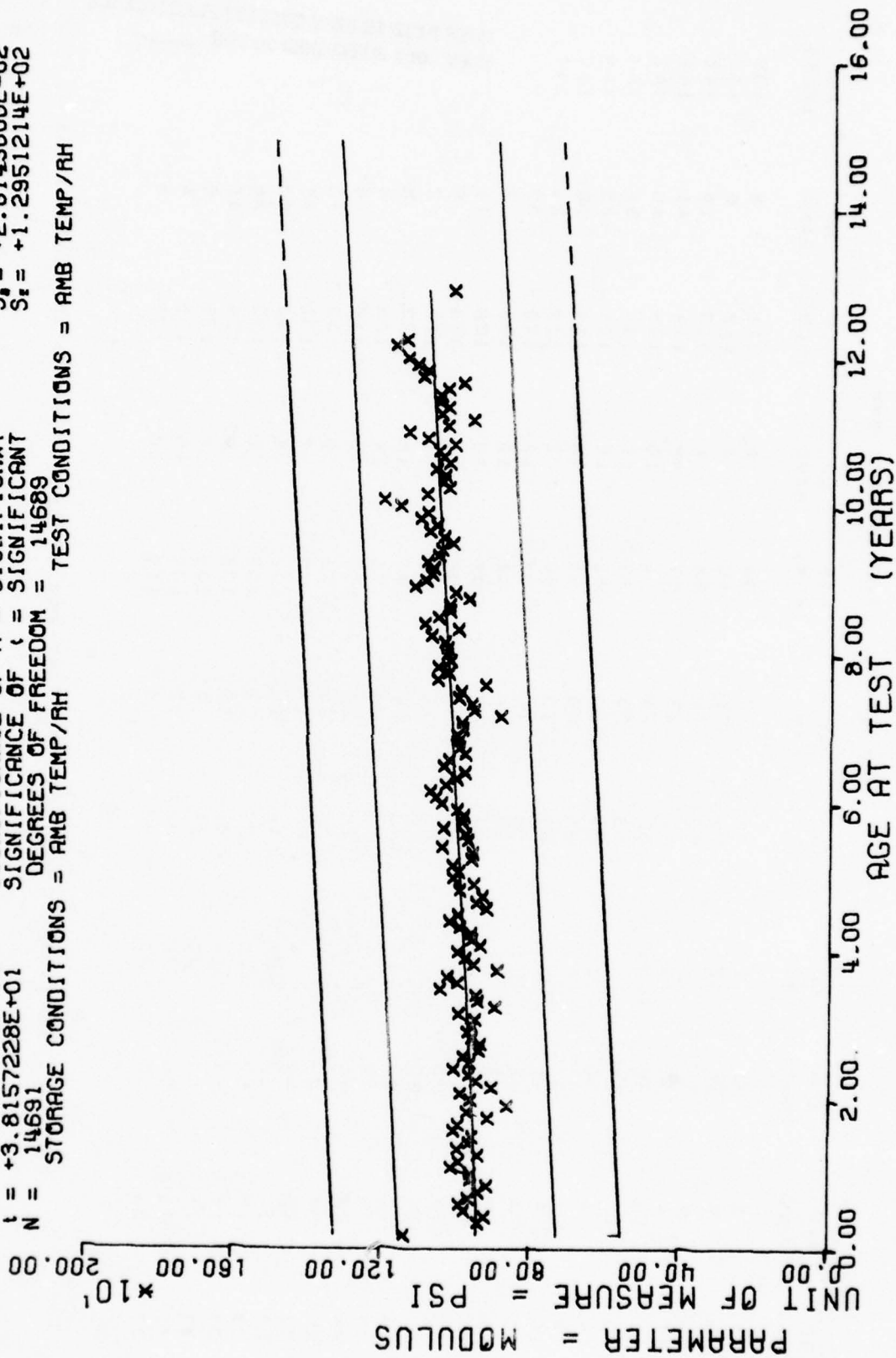
$Y = ((+1.1924642E+02) + (+4.9427705E-02) * X)$
 $F = +8.8401699E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +8.4772162E+00$
 $R = +2.3822545E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +1.6624176E-03$
 $t = +2.9732423E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_r = +8.2334363E+00$
 $N = 14695$ DEGREES OF FREEDOM = 14693
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L.A. TENSILE, STRESS AT RUPTURE, CHS=2.0 IN/MIN TP-H1011

Figure 14

$Y = ((+9.3812082E+02) + (+9.9764385E-01) * X)$
 $F = +1.4559740E+03$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +3.0030194E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +3.8157228E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 14691$ DEGREES OF FREEDOM = 14689
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, L.R. TENSILE MODULUS, CHS=2.0 IN/MIN TP-H1011

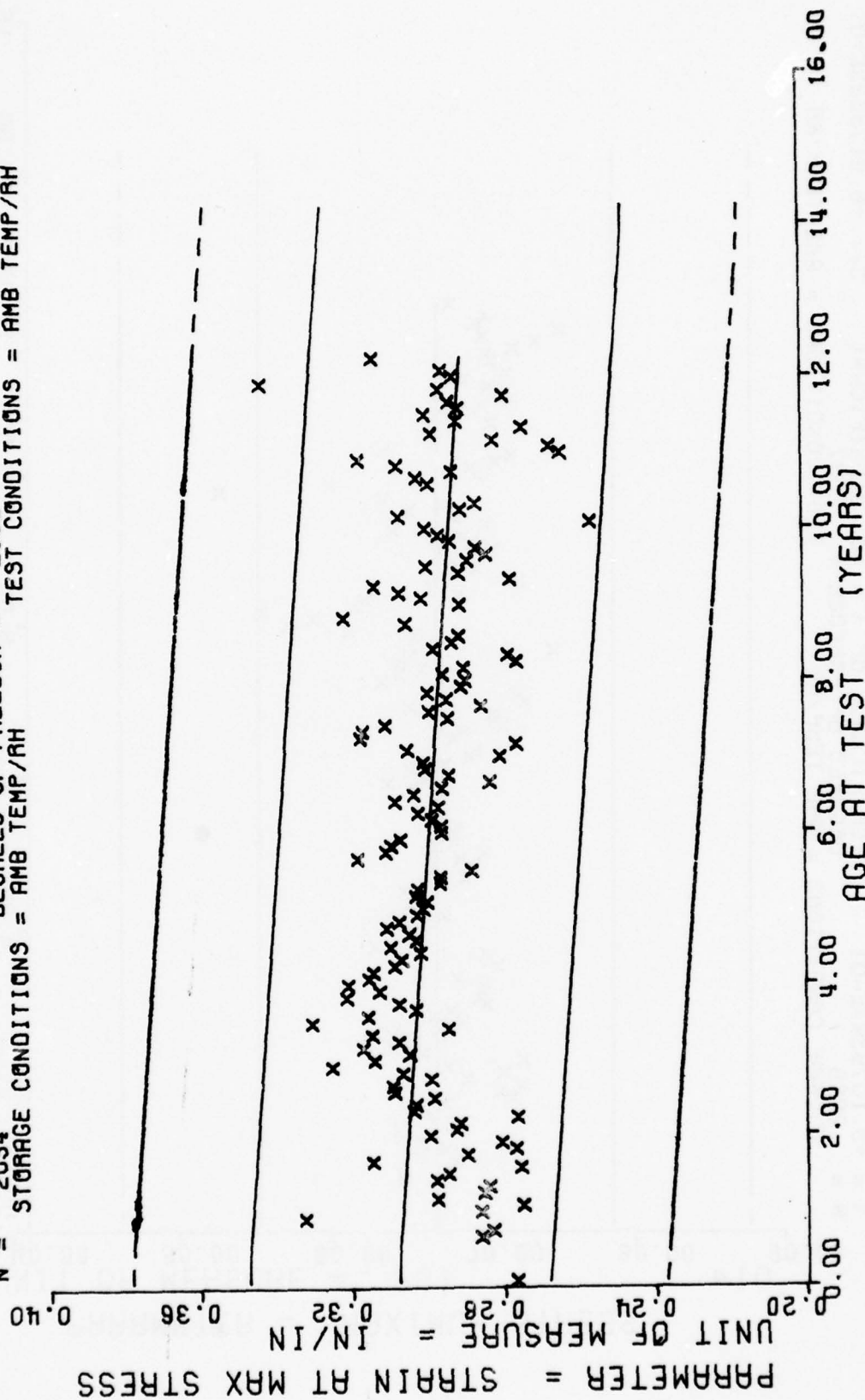
Figure 15

[illegible]

WING 6, H. F. TRIAXIAL TENSILE, STRAIN AT MAX STRESS, CHS=1750 IN/MIN, 300 PSI

This sample size summary is applicable to figures 16 thru 20.

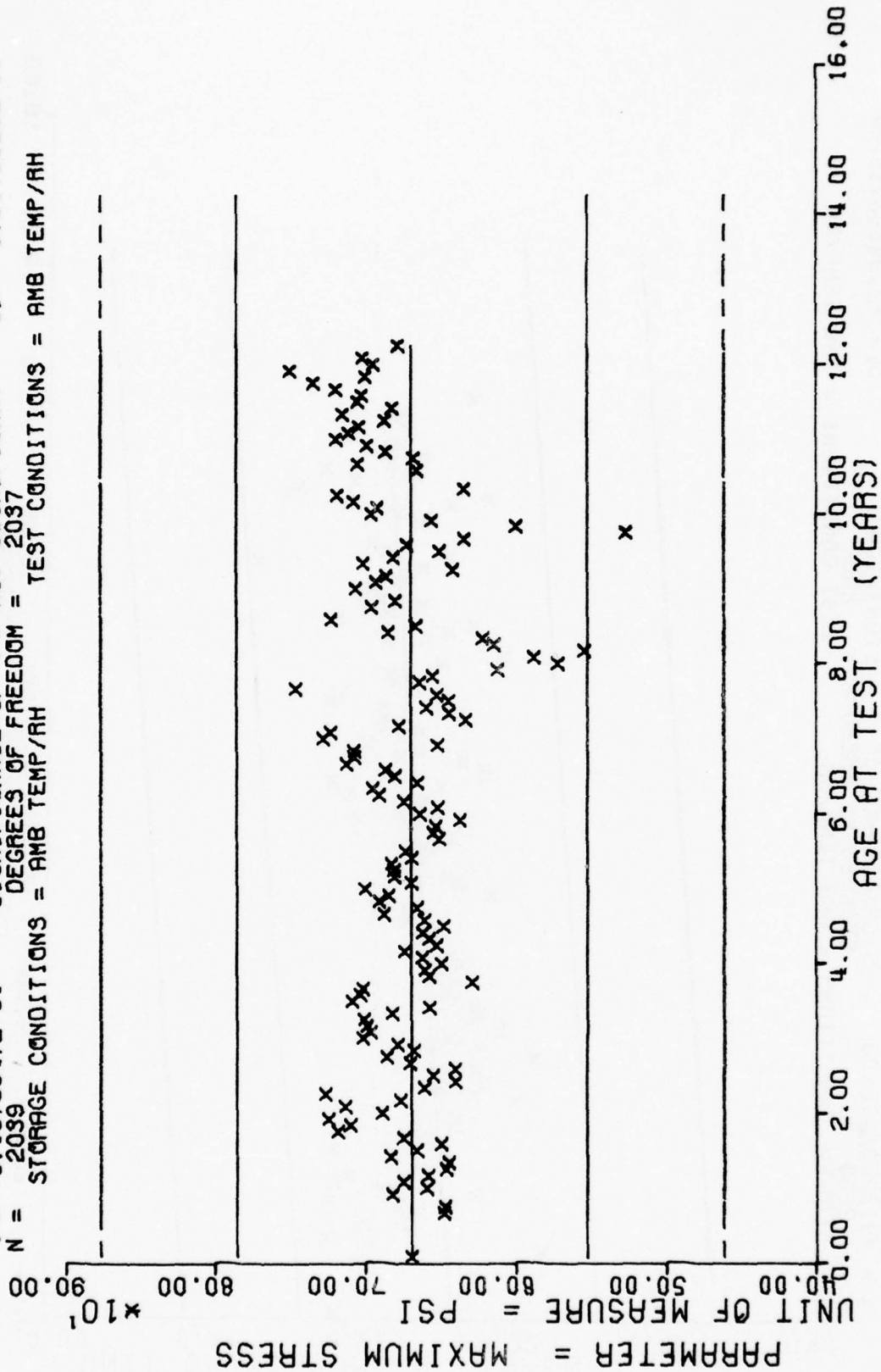
$Y = ((+3.0832591E-01) + (-1.2922178E-04) * X)$
 $F = +8.5851986E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -2.0039475E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +9.2656347E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 2054$ DEGREES OF FREEDOM = 2052
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6, H.A. TRIAXIAL TENSILE, STRAIN AT MAX STRESS, CH9=1750 IN/MIN, 800 PSI

Figure 16

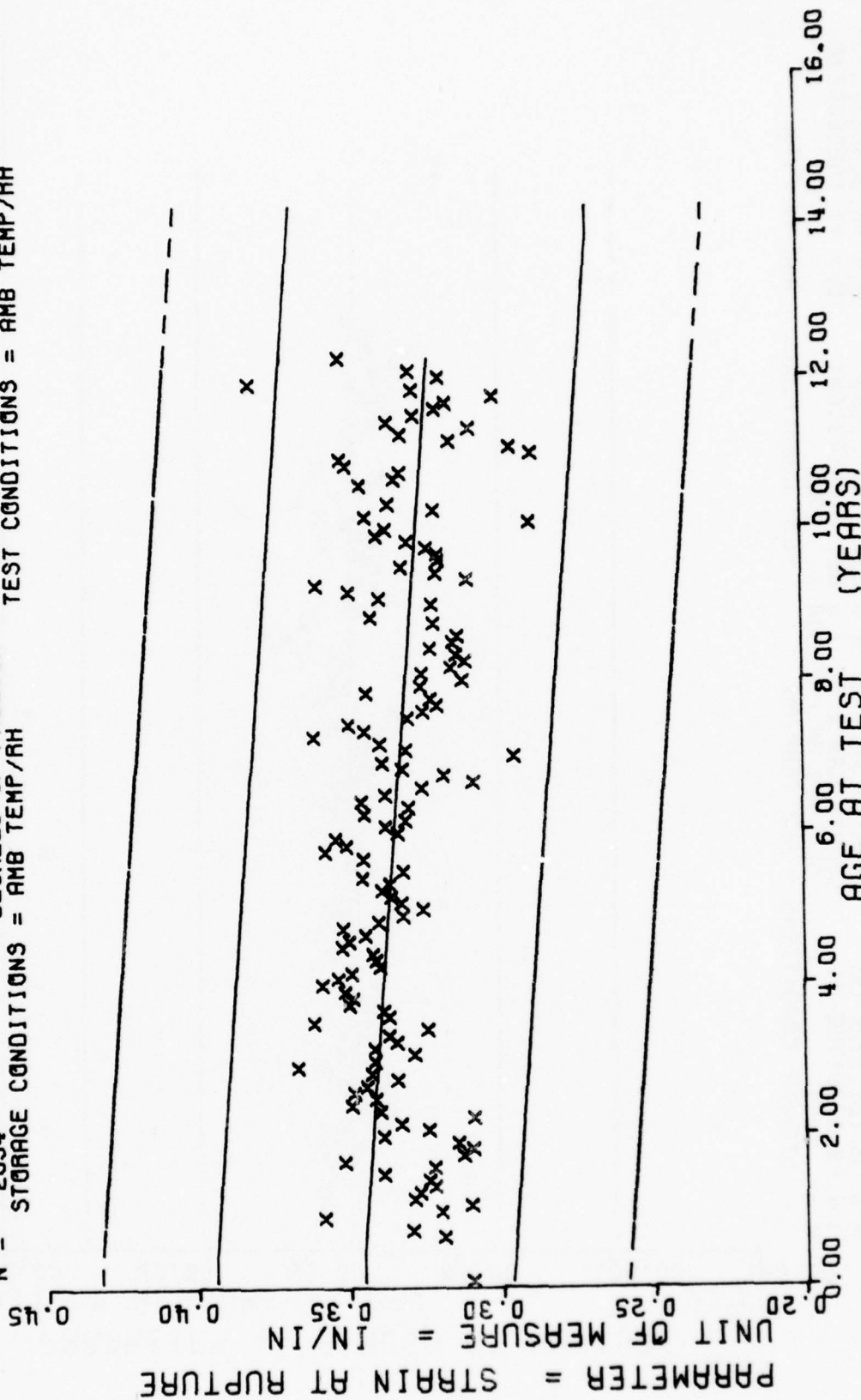
$Y = ((+6.7056083E+02) + (-1.2791772E-02) * X)$
 $F = +9.6567720E-02$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +6.9163288E+01$
 $R = -6.8850988E-03$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_1 = +4.1163739E-02$
 $t = +3.1075347E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_2 = +6.9178623E+01$
 $N = 2039$ DEGREES OF FREEDOM = 2037
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6,H.A.TRIAXIAL TENSILE,MAXIMUM STRESS,CH3=1750 IN/MIN, 800 PSI

Figure 17

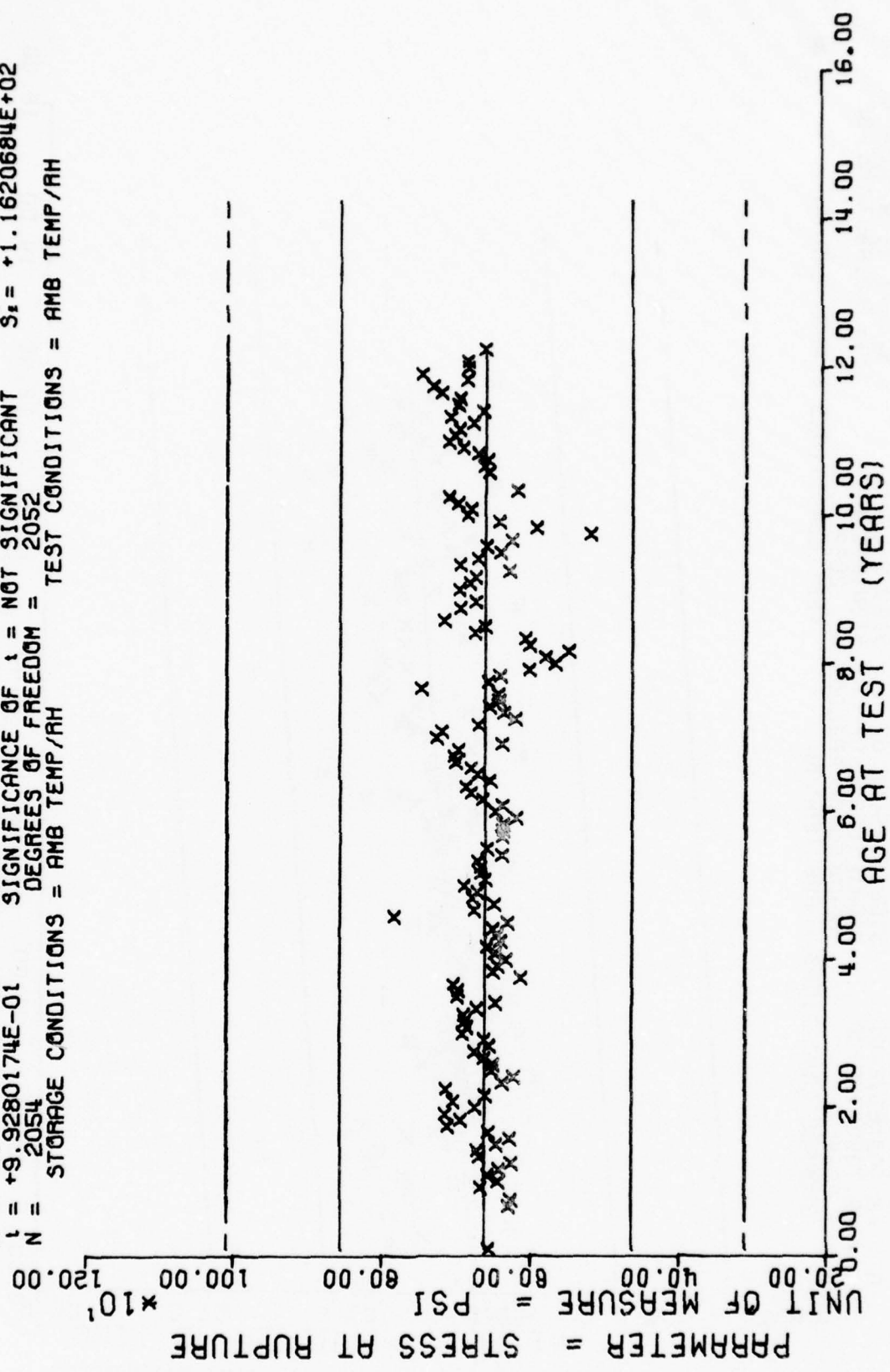
$Y = ((+3.4657112E-01) + (-1.6741287E-04) * X)$
 $F = +9.4966730E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -2.1031637E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +9.7450875E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 2054$ DEGREES OF FREEDOM = 2052
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6, H.R. TRIAXIAL TENSILE, STRAIN AT RUPTURE, CHS=1750 IN/MIN, 800 PSI

Figure 18

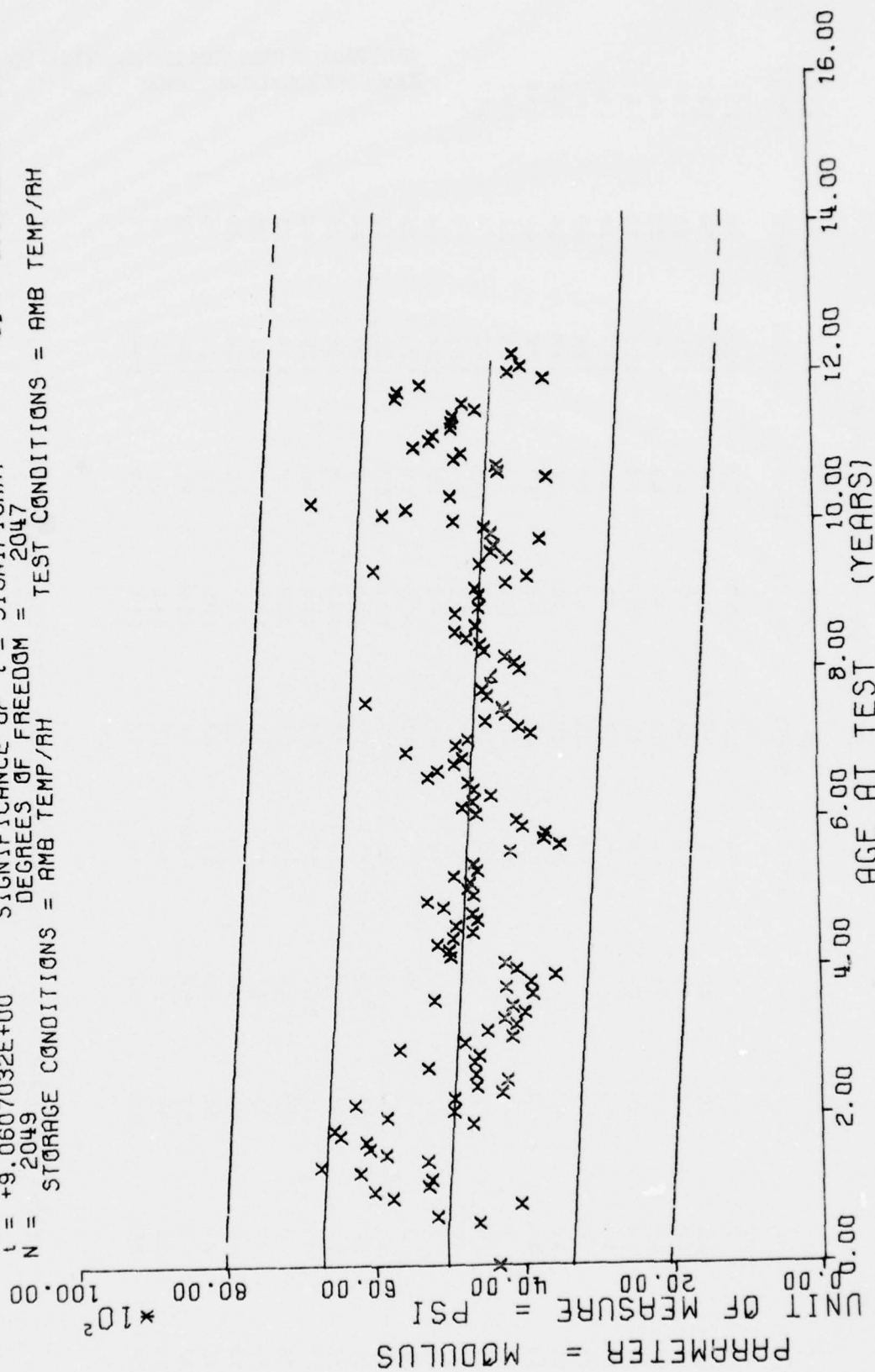
$Y = ((+6.6171367E+02) + (-6.8585566E-02) * X)$
 $F = +9.8565530E-01$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +1.1620643E+02$
 $R = -2.1911372E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_1 = +6.9082842E-02$
 $l = +9.9280174E-01$ SIGNIFICANCE OF l = NOT SIGNIFICANT $S_2 = +1.1620684E+02$
 $N = 2054$ DEGREES OF FREEDOM = 2052
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6, H.A. TRIAXIAL TENSILE, STRESS AT RUPTURE, CHS=1750 IN/MIN, 800 PSI

Figure 19

$Y = ((+5.0778648E+03) + (-5.3597931E+00) * X)$
 $F = +8.2096343E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -1.9636507E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +9.0607032E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 2049$ DEGREES OF FREEDOM = 2047
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6,H.R.TRIAXIAL TENSILE,MODULUS,CHS=1750 IN/MIN AT 800 PSI

Figure 20

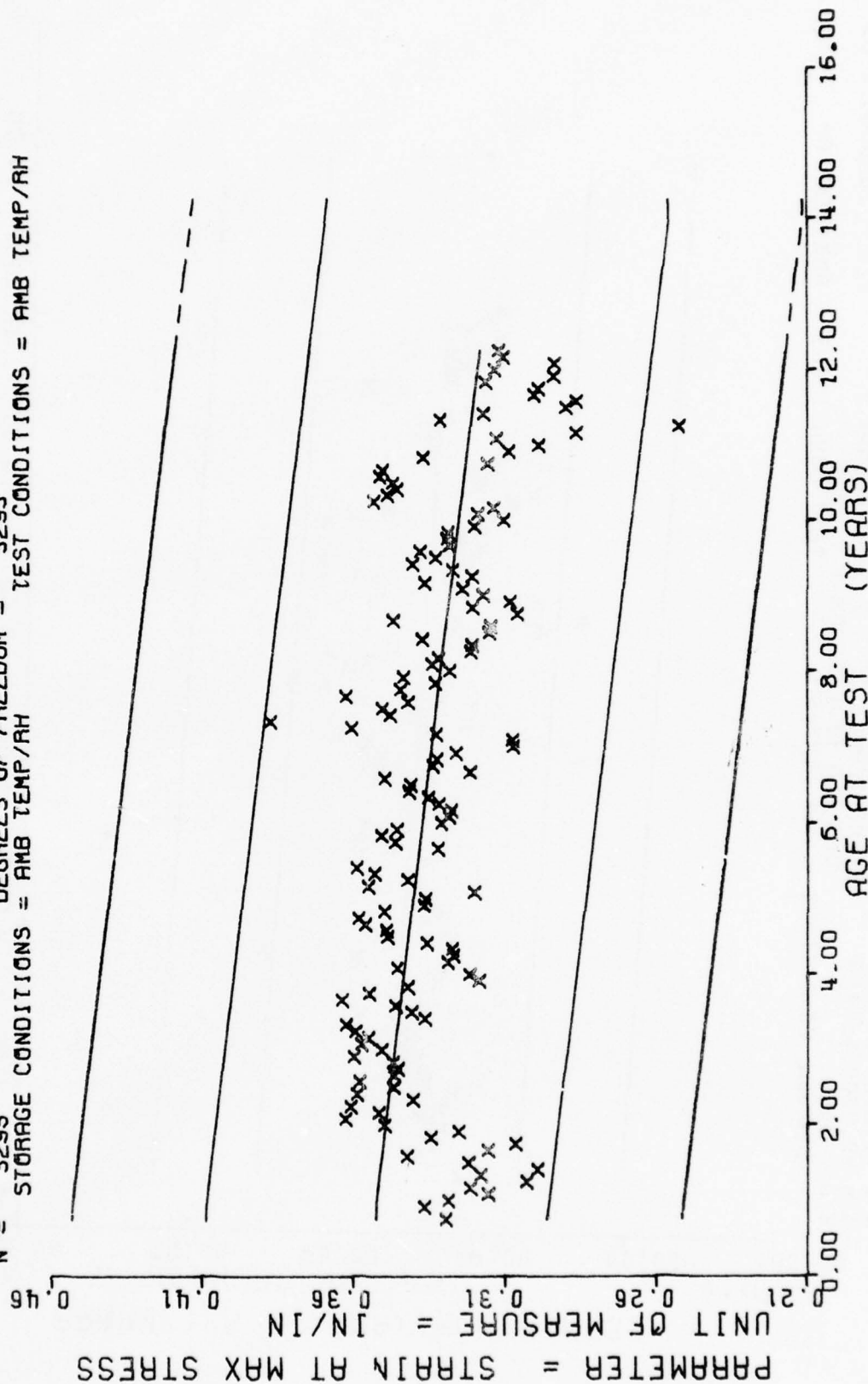
AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
9	2	35	5	60	26	87	23	112	10
11	12	36	20	51	33	88	15	113	79
12	12	37	24	52	52	89	44	114	51
13	18	38	22	53	100	90	48	115	23
14	4	39	24	54	31	91	21	116	32
15	12	40	9	55	27	92	14	117	114
16	8	41	21	56	26	93	26	118	29
17	12	42	7	59	29	94	24	119	34
18	14	43	7	70	27	95	16	120	44
19	4	44	12	71	26	96	23	121	21
20	4	45	5	72	32	97	32	122	6

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

WING 6, H. R. HYDROSTATIC, STRAIN AT MAX STRESS, 175 CIN/MIN, 800 PSI

This sample size summary is applicable to figures 21 thru 25.

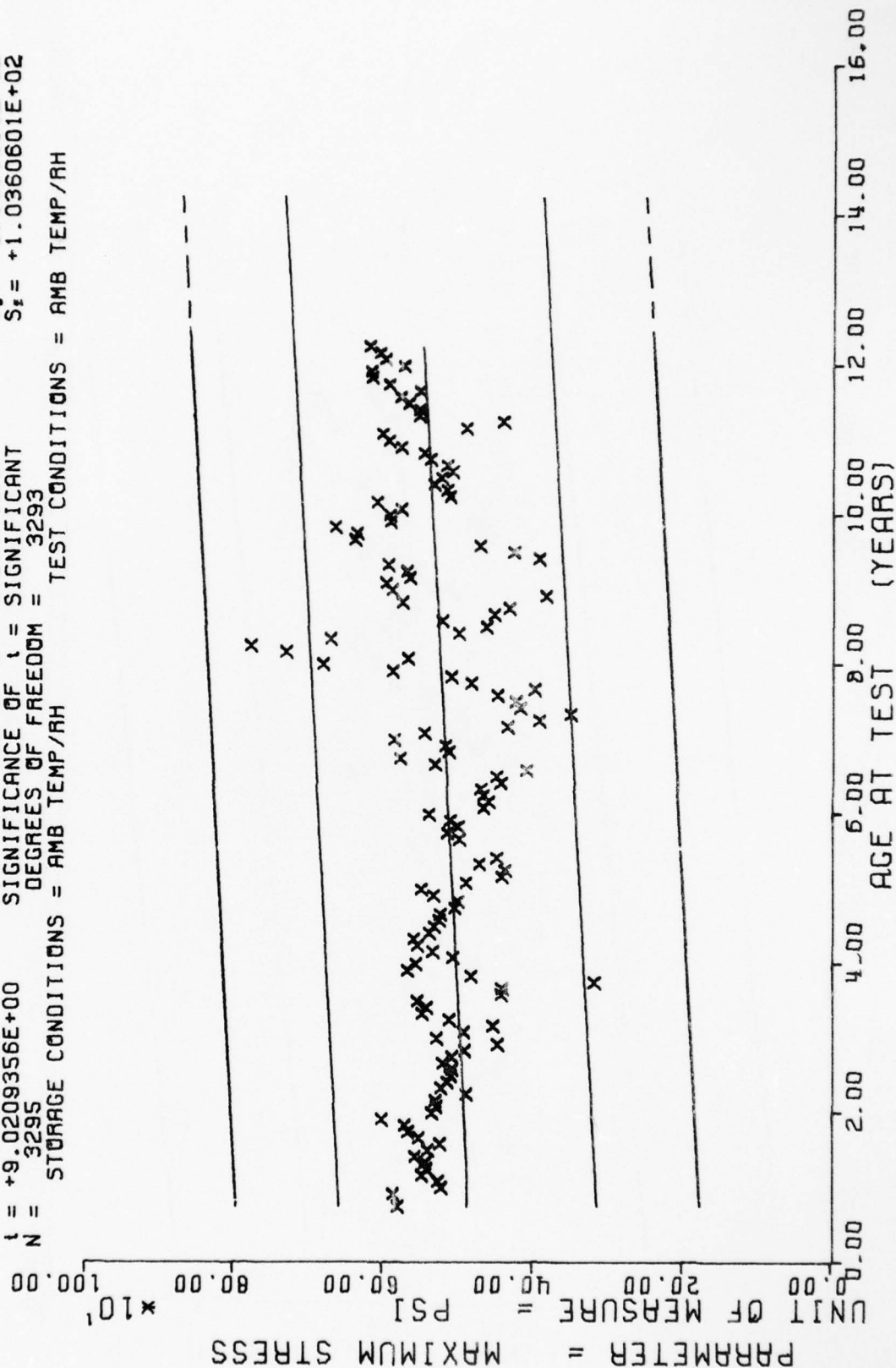
$F = +2.4418266E+02$ SIGNIFICANCE OF $F =$ SIGNIFICANT $G = +3.4795522E-02$
 $R = -2.6274149E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT $S = +1.6377113E-05$
 $t = +1.5626345E+01$ SIGNIFICANCE OF $t =$ SIGNIFICANT $S_t = +3.3578123E-02$
 $N = 3295$ DEGREES OF FREEDOM = 3293
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6, H.R. HYDROSTATIC, STRAIN AT MAX STRESS, 1750 IN/MIN, 800 PSI

Figure 21

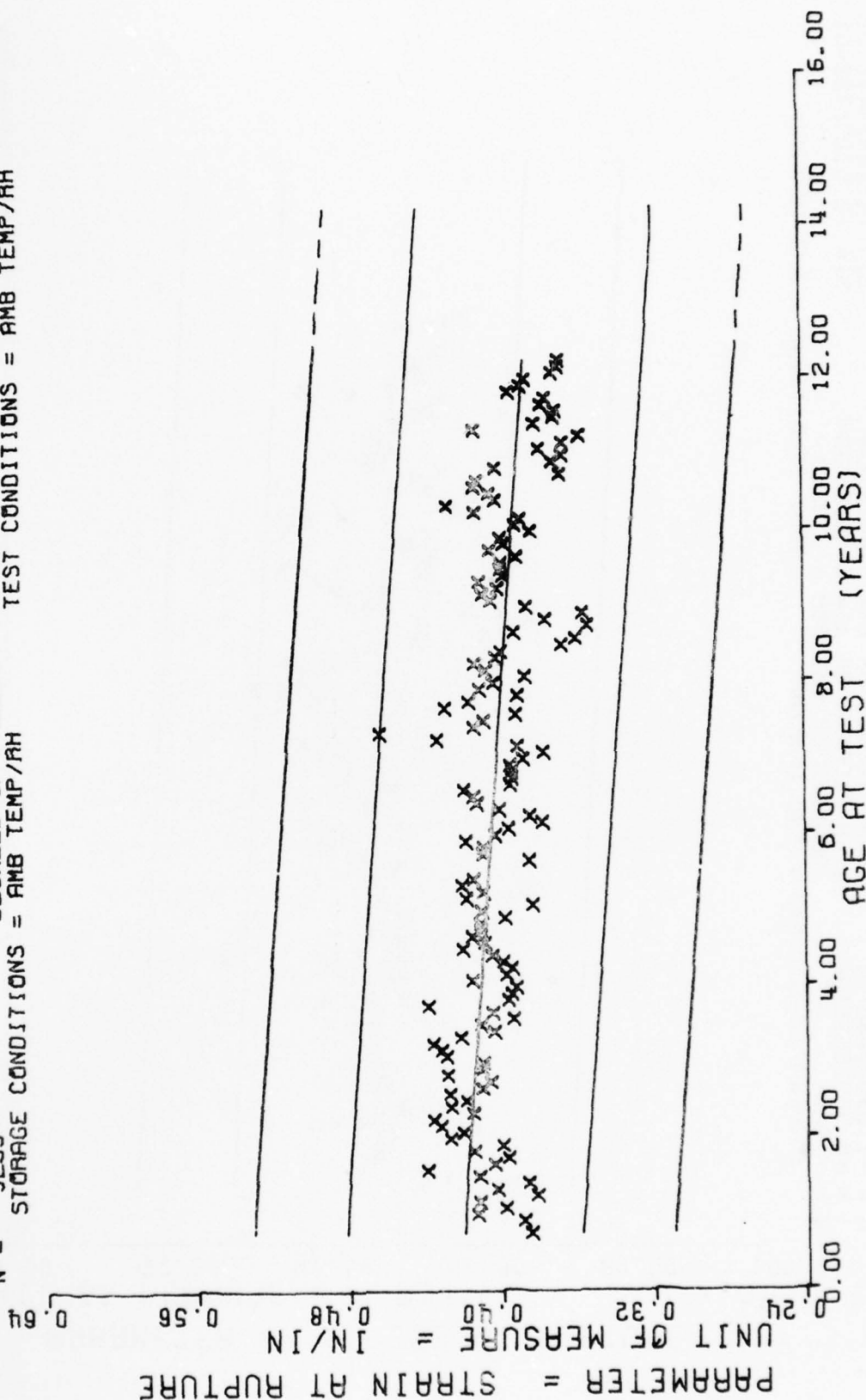
$Y = ((+4.8259455E+02) + (+4.5584529E-01) * X)$
 $F = +8.1377279E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G = +1.0486244E+02$
 $R = +1.5529403E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S = +5.0531931E-02$
 $t = +9.0209356E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_2 = +1.0360601E+02$
 $N = 3295$ DEGREES OF FREEDOM = 3293
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, H.A. HYDROSTATIC, MAXIMUM STRESS, 1750 IN/MIN, 800 PSI

Figure 22

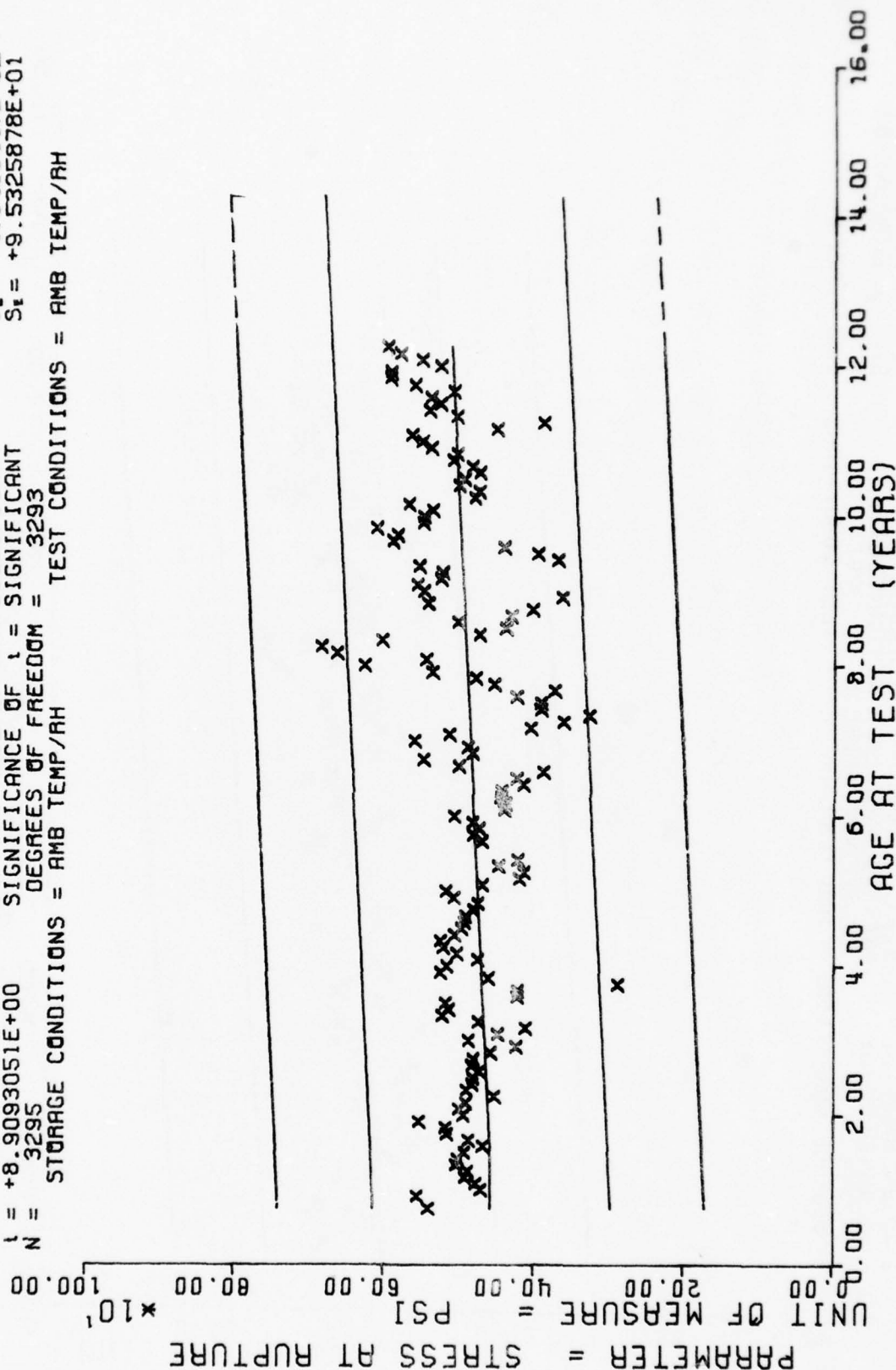
$Y = ((-4.2325564E-01) + (-2.6049562E-04) * X)$
 $F = +2.1150637E+02$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -2.4573796E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +1.4543258E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 3293$ DEGREES OF FREEDOM = 3291
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



KING 6, H.A. HYDROSTATIC STRAIN AT RUPTURE, 1750 IN/MIN, 800 PSI

Figure 23

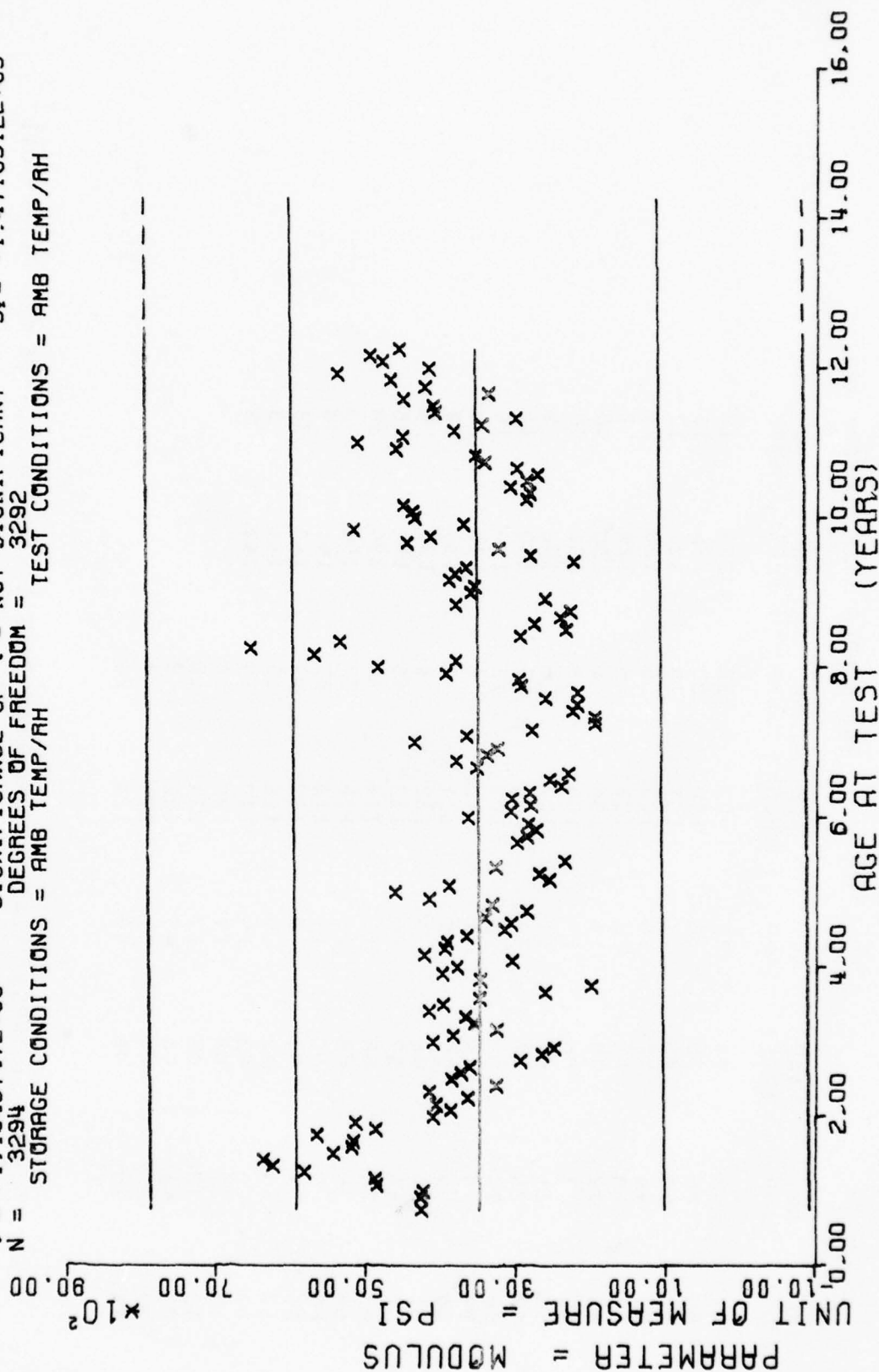
$Y = ((+4.5214410E+02) + (+4.1422430E-01) * X)$
 $F = +7.9375717E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +9.6453278E+01$
 $R = +1.5341783E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +4.6493447E-02$
 $l = +8.9093051E+00$ SIGNIFICANCE OF l = SIGNIFICANT $S_t = +9.5325878E+01$
 $N = 3295$ DEGREES OF FREEDOM = 3293
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



WING 6, H.A. HYDROSTATIC STRESS AT RUPTURE, 1750 IN/MIN, 800 PSI

Figure 24

$Y = ((+3.4753154E+03) + (+8.2847920E-01) * X)$
 $F = +1.3332737E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +1.4711056E+03$
 $R = +2.0120641E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_0 = +7.1750005E-01$
 $t = +1.1546747E+00$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_1 = +1.4710312E+03$
 $N = 3294$ DEGREES OF FREEDOM = 3292
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



WING 6, H.A. HYDROSTATIC MODULUS, 1750 IN/MIN, 800 PSI

Figure 25

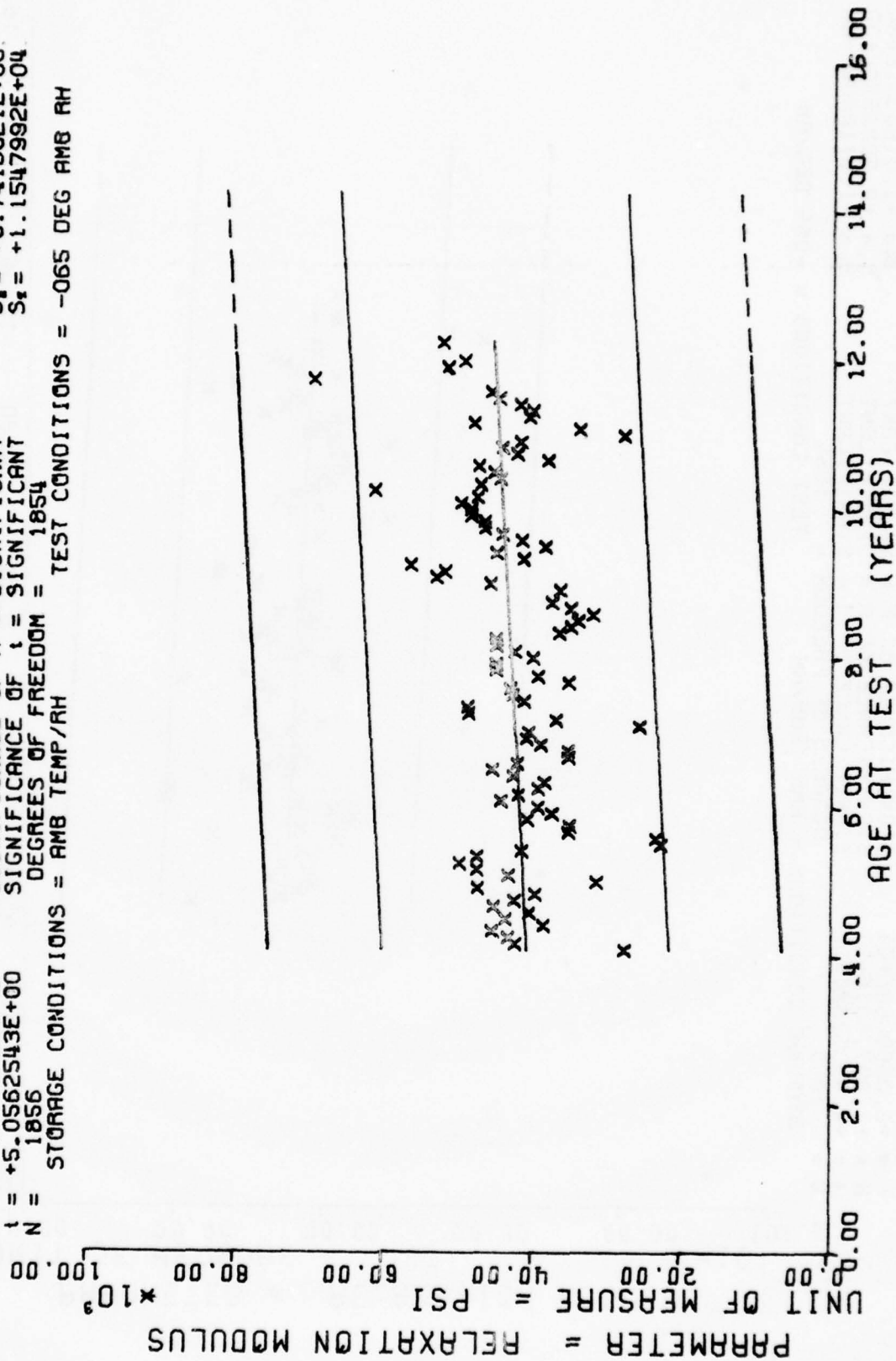
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
49	2	74	32	99	32	125	17
50	26	75	32	100	20	126	18
51	49	76	17	101	18	127	12
52	46	77	40	102	5	128	21
53	18	78	28	103	6	129	2
54	27	79	15	104	6	130	30
55	27	80	14	105	6	131	30
56	21	81	11	107	6	132	8
57	24	82	35	108	12	133	12
58	20	83	12	109	12	134	19
59	9	84	11	110	6	135	9
60	9	85	9	111	3	136	2
61	21	86	3	112	8	137	6
62	46	87	24	113	45	138	28
63	23	88	16	114	30	139	39
64	30	89	18	115	37	140	3
65	9	90	12	116	33	141	9
66	2	91	8	117	27	143	33
67	9	92	9	118	15	144	3
68	9	93	19	119	19	147	3
69	20	94	17	120	30		
70	30	95	17	121	18		
71	41	96	45	122	3		
72	30	97	51	123	3		
73	39	98	49	124	21		

WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 10 SEC, -65 DEG F, TPH-1011

This sample size summary is applicable to figures 26 thru 29.

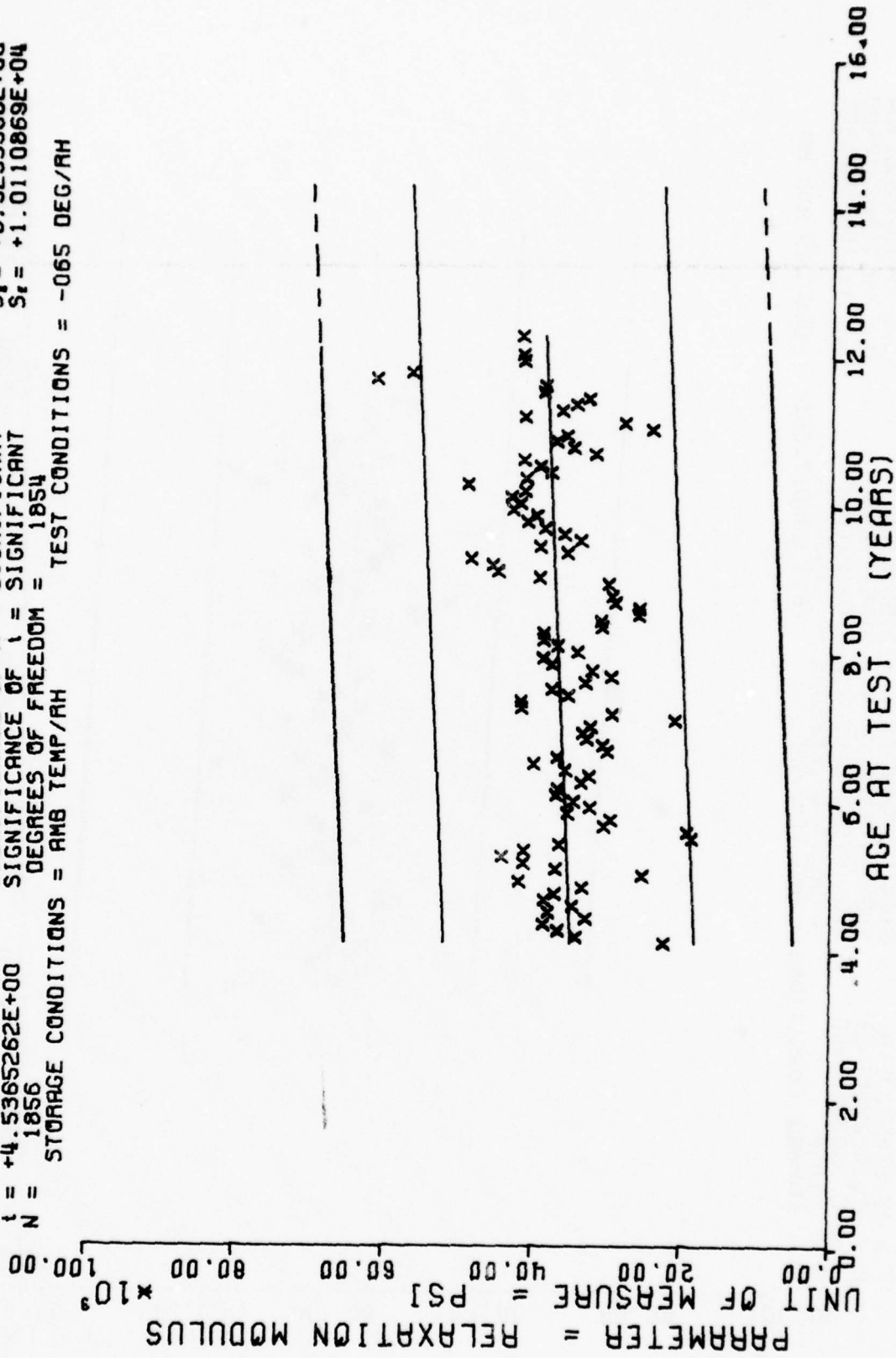
$Y = ((+3.8569993E+04) + (+4.9256472E+01) * X)$
 $F = +2.5565707E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G = +1.1624205E+04$
 $R = +1.1662728E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +9.7416921E+00$
 $t = +5.0562543E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_1 = +1.1547992E+04$
 $N = 1856$ DEGREES OF FREEDOM = 1854
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = -065 DEG AMB RH



WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 10 SEC, -65 DEG F, TPH-1011

Figure 26

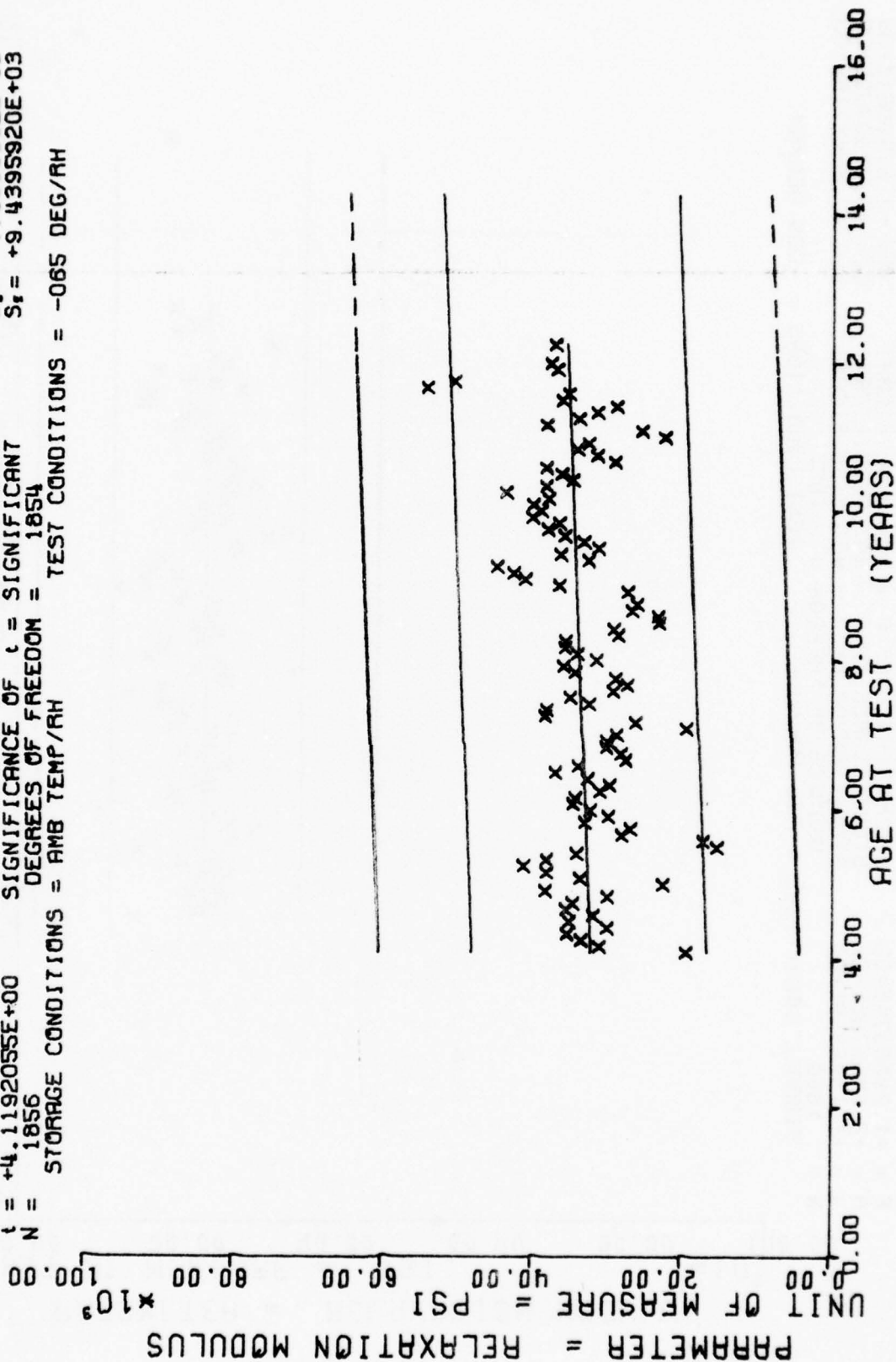
$F = +2.0580069E+01$
 $R = +1.0477831E-01$
 $t = +4.5365262E+00$
 $N = 1856$
 $Y = ((+3.3174514E+04) + (+3.8693664E+01) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 1854
 STORAGE CONDITIONS = AMB TEMP/AH
 TEST CONDITIONS = -065 DEG/AH



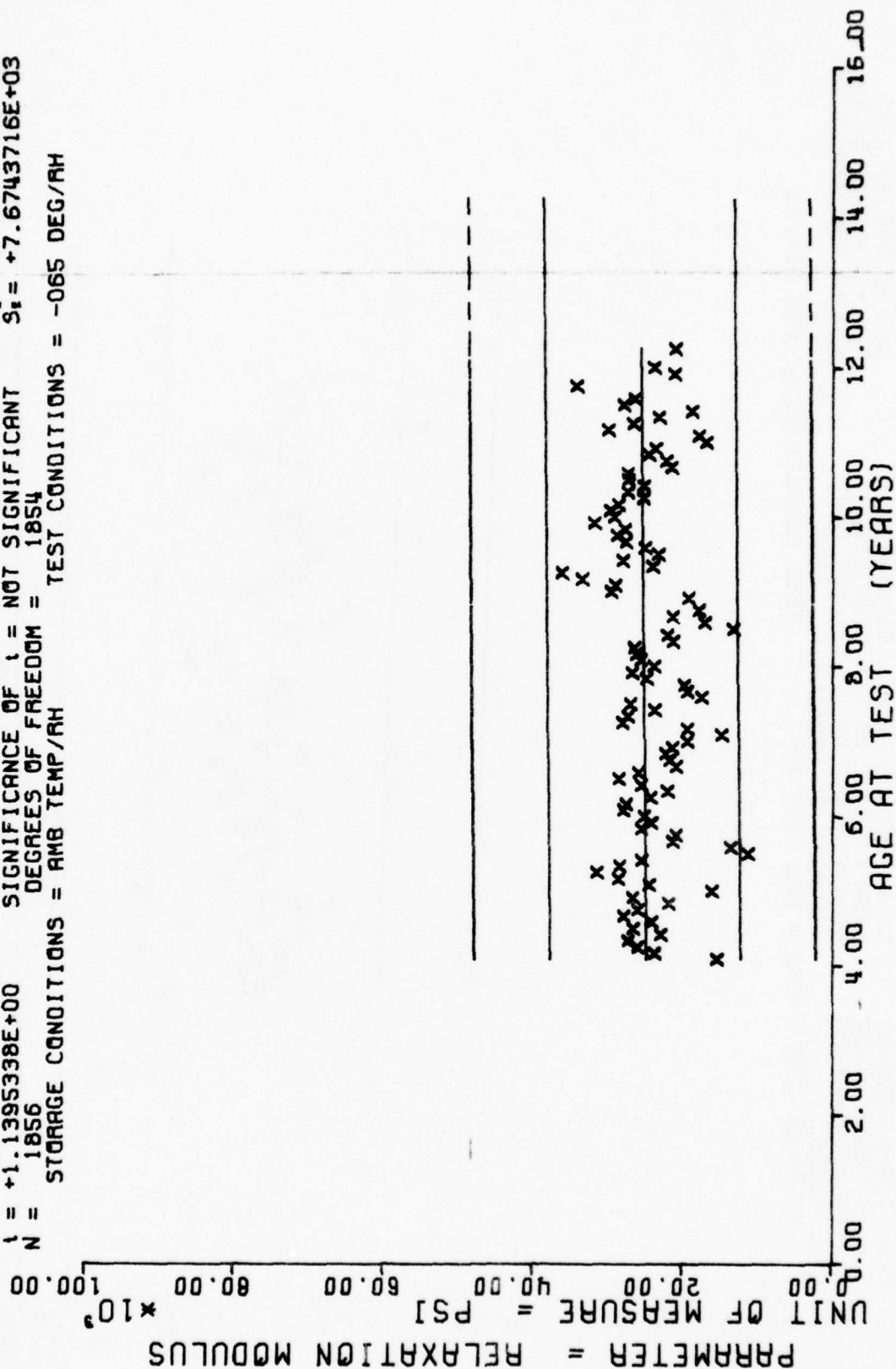
WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 50 SEC. -65 DEG F, TPH-1011

Figure 27

$Y = ((+3.0844610E+04) + (+3.2801568E+01) * X)$
 $F = +1.6967854E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +9.4801330E+03$
 $R = +9.5231429E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +7.9630812E+00$
 $t = +4.1192055E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_r = +9.4395920E+03$
 $N = 1856$ DEGREES OF FREEDOM = 1854
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = -065 DEG/RH



$Y = ((+2.4689860E+04) + (+7.3773090E+00) * X)$
 $F = +1.2985374E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +7.6749891E+03$
 $R = +2.6455765E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_1 = +6.4739709E+00$
 $t = +1.1395338E+00$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_2 = +7.6743716E+03$
 $N = 1856$ DEGREES OF FREEDOM = 1854
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = -065 DEG/AH



WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 1000 SEC, -65 DEG F, TFM-1011

Figure 29

*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
49	6	74	34	99	33	125	13
50	27	75	28	100	18	126	16
51	51	76	29	101	15	127	44
52	47	77	36	102	6	128	17
53	14	78	35	103	9	129	1
54	30	79	15	104	3	130	27
55	18	80	16	105	6	131	39
56	12	81	15	107	6	132	9
57	27	82	33	108	15	133	6
58	19	83	9	109	9	134	31
59	9	84	18	110	6	135	6
60	12	85	9	111	3	136	3
61	20	86	9	112	12	137	12
62	48	87	18	113	53	138	38
63	24	88	20	114	31	139	45
64	24	89	18	115	48	140	3
65	9	90	11	116	40	141	9
66	6	91	12	117	21	142	9
67	6	92	21	118	15	143	31
68	12	93	12	119	15	144	3
69	21	94	16	120	23	147	3
70	30	95	15	121	18		
71	44	96	51	122	3		
72	36	97	62	123	5		
73	35	98	51	124	10		

WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 10 SEC., -40 DEG F, TPI-1011

This sample size summary is applicable to figures 30 thru 33.

PARAMETER = RELAXATION MODULUS

UNIT OF MEASURE = PSI $\times 10^2$

AGE AT TEST (YEARS)

TEST CONDITIONS = -040 DEG/AH

STORAGE CONDITIONS = AMB TEMP/AH

DEGREES OF FREEDOM = 1966

$t = +1.1838671E+00$

$S_t = +4.5/138/6E+03$

$t = 1968$

$N =$

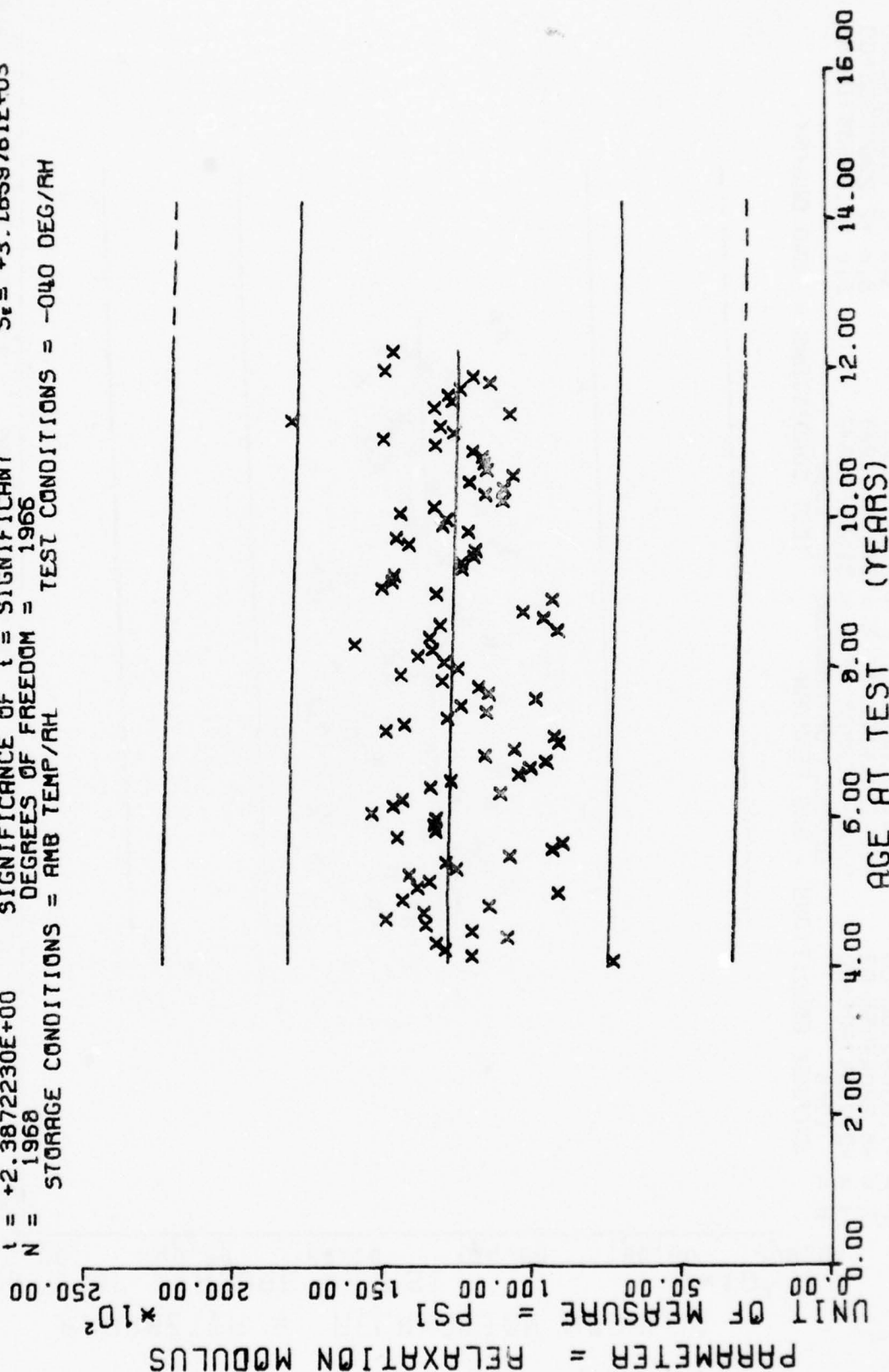
SIGNIFICANCE OF $t =$ NOT SIGNIFICANT

Age at Test (Years)	Relaxation Modulus (PSI $\times 10^2$)
4.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
5.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
6.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
7.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
8.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
9.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
10.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
11.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240
12.0	120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250

WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 10 SEC, -40 DEG F, TPH-1011

Figure 30

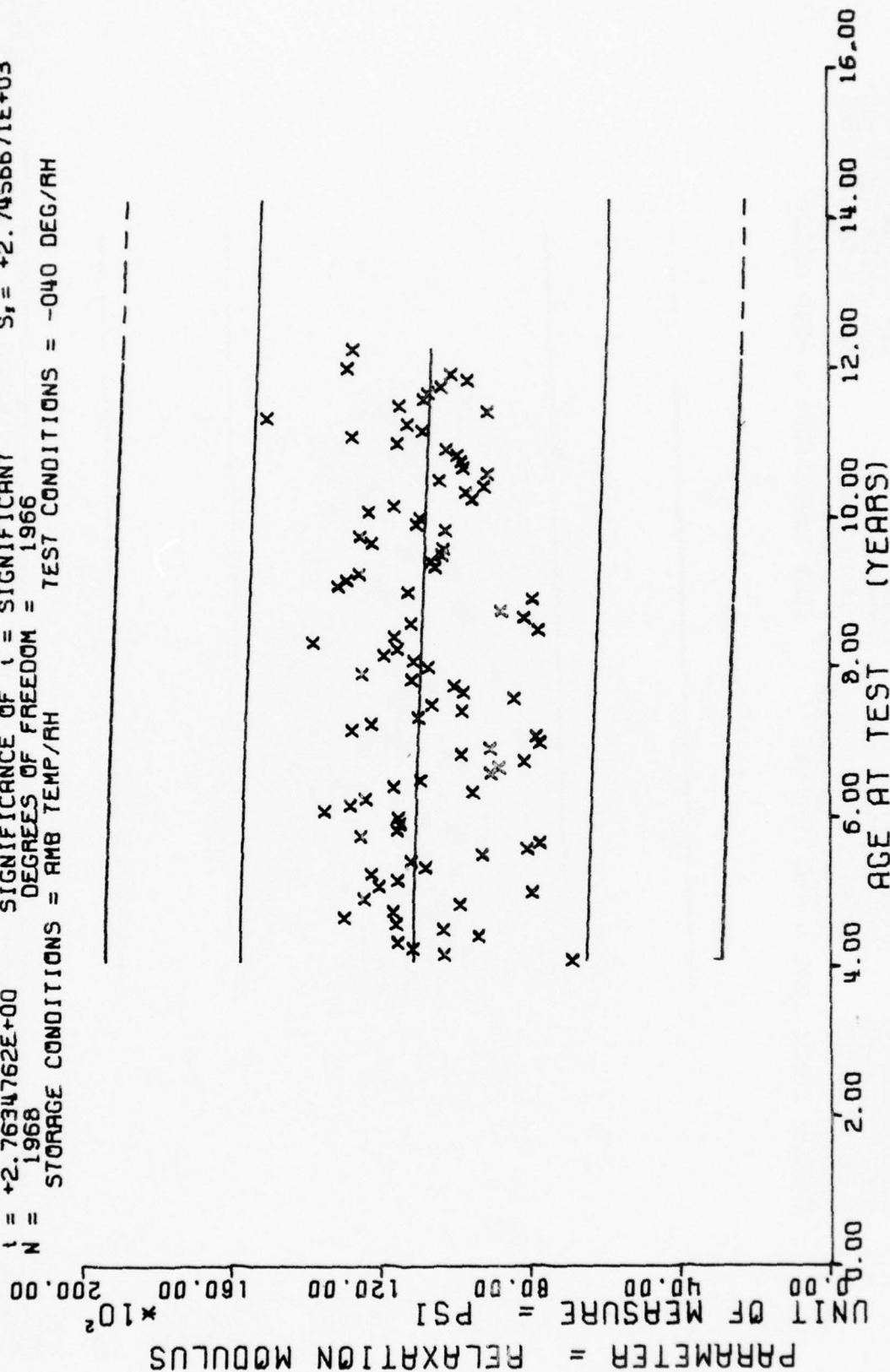
$F = +5.6988340E+00$
 $R = -5.3761665E-02$
 $t = +2.3872230E+00$
 $N = 1968$
 $Y = ((+1.3114807E+04) + (-6.1622450E+00) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 1966
 STORAGE CONDITIONS = AMB TEMP/AH
 TEST CONDITIONS = -040 DEG/AH



WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 50 SEC, -40 DEG F, TPN-1011

Figure 31

$\gamma = ((+1.1466305E+04) + (-6.1864563E+00) * X)$
 $F = +7.6368010E+00$ SIGNIFICANCE OF F = SIGNIFICANT $G_1 = +2.7502953E+03$
 $R = -6.2204545E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +2.2386500E+00$
 $t = +2.7634762E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_2 = +2.7456671E+03$
 $N = 1968$ DEGREES OF FREEDOM = 1966
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = -040 DEG/AH

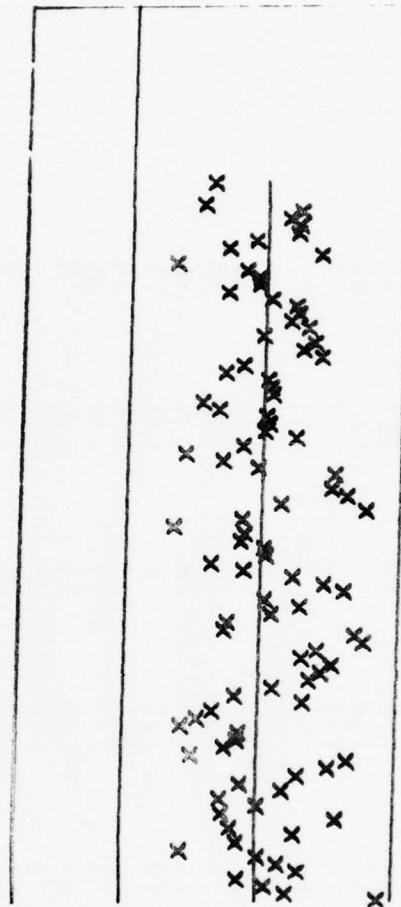


WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 100 SEC, -40 DEG F, TPH-1011

Figure 32

$Y = ((+7.6084301E+03) + (-6.0708389E+00) * X)$
 $F = +1.6733933E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_1 = +1.8274327E+03$
 $R = -9.1868536E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +1.4840539E+00$
 $t = +4.0907130E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_1 = +1.8201675E+03$
 $N = 1968$ DEGREES OF FREEDOM = 1966
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = -040 DEG/RH

PARAMETER = RELAXATION MODULUS
 UNIT OF MEASURE = PSI
 *10²



WING 6, STRESS RELAXATION MODULUS, 0.5% STRAIN, 1000 SEC, -40 DEG F, TPH-1011

Figure 33

*** SAMPLE SIZE SUMMARY ***

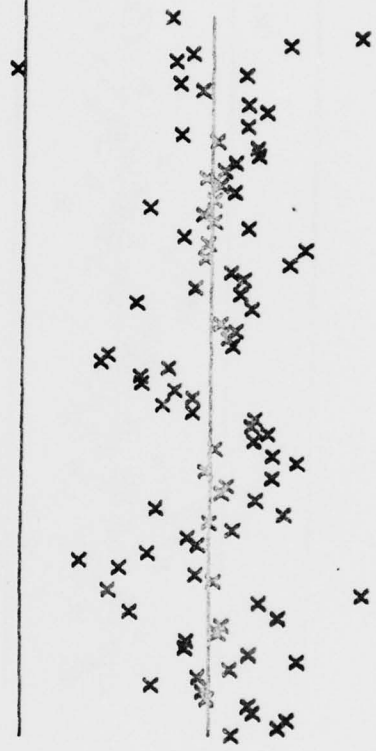
AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
49	6	74	39	99	36	125	15
50	27	75	38	100	18	126	17
51	59	76	26	101	18	127	11
52	48	77	37	102	5	128	21
53	15	78	36	103	9	129	3
54	32	79	18	104	3	130	27
55	18	80	21	105	6	131	42
56	18	81	27	107	9	132	15
57	30	82	27	108	15	134	30
58	16	83	15	109	6	135	6
59	6	84	18	110	6	137	12
60	22	85	3	111	3	138	20
61	21	86	18	112	27	139	60
62	49	87	17	113	47	140	3
63	24	88	21	114	35	141	9
64	27	89	21	115	33	142	9
65	12	90	18	116	42	143	17
66	9	91	15	117	21	144	3
67	10	92	18	118	15	147	3
68	9	93	15	119	27		
69	29	94	15	120	21		
70	24	95	23	121	18		
71	46	96	51	122	6		
72	42	97	51	123	6		
73	24	98	48	124	17		

WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 20 DEG F, TPF-1011

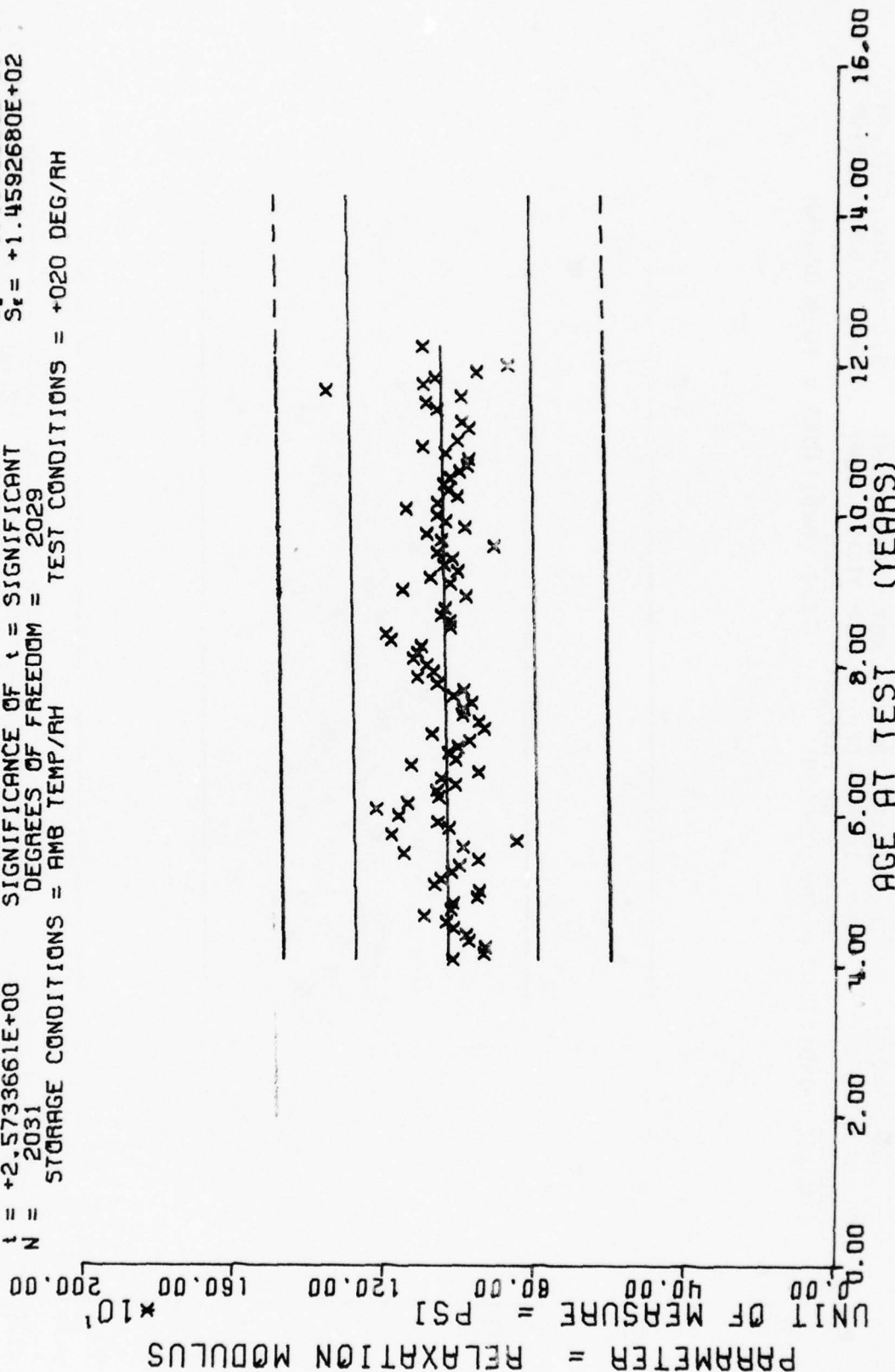
This sample size summary is applicable to figures 34 thru 37.

$F = +9.8156432E-01$ SIGNIFICANCE OF $F =$ NOT SIGNIFICANT $S_0 = +2.0661501E-01$
 $t = -2.1989397E-02$ SIGNIFICANCE OF $t =$ NOT SIGNIFICANT $S_1 = +2.5314179E+02$
 $N = +9.9073928E-01$ SIGNIFICANCE OF $N =$ NOT SIGNIFICANT 2029
 $Y = ((+1.7159597E+03) + (-2.0470161E-01) * X)$
 STORAGE CONDITIONS = AMB TEMP/AH DEGREES OF FREEDOM = TEST CONDITIONS = +020 DEG/AH

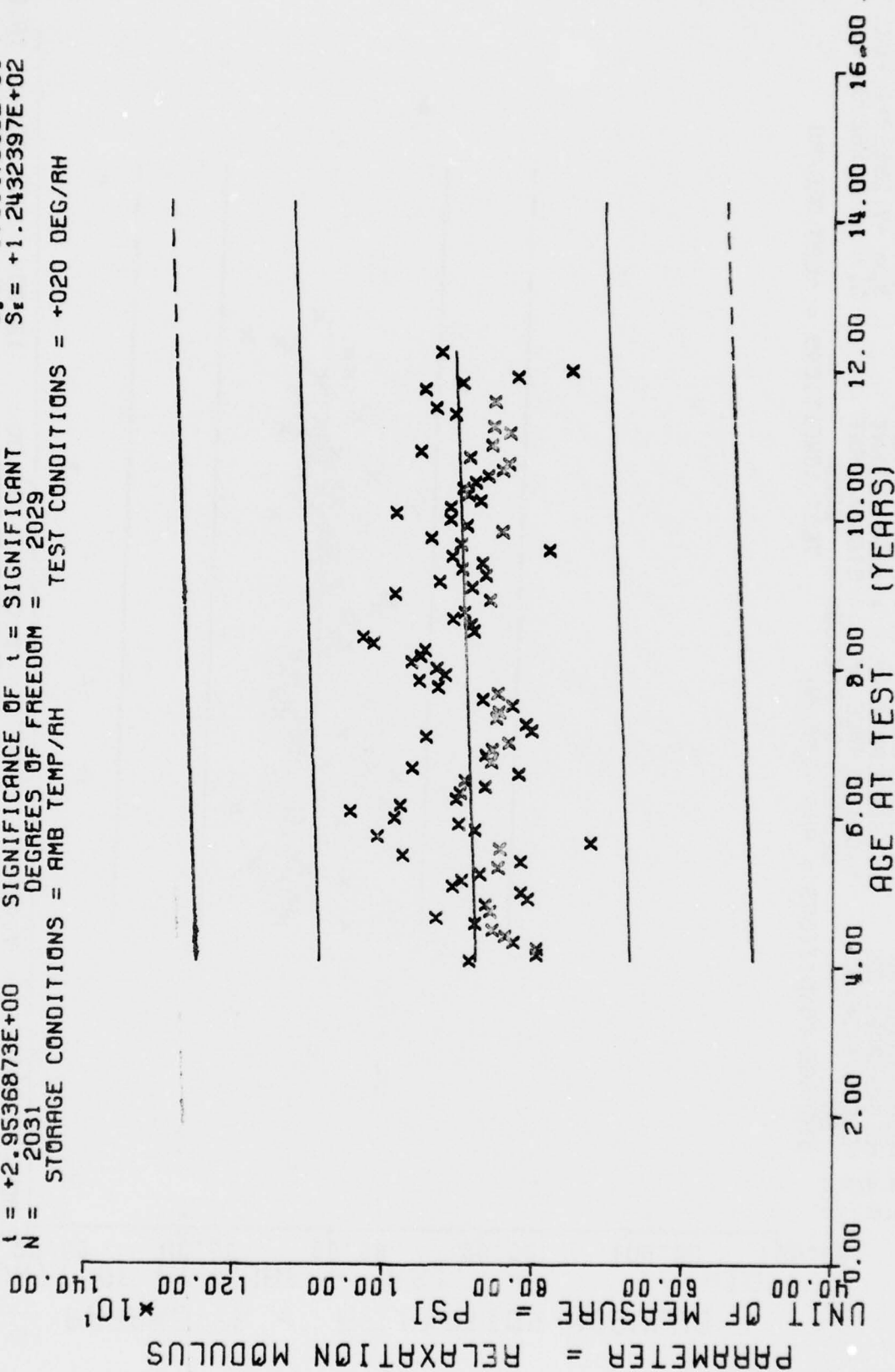
PARAMETER = RELAXATION MODULUS
 UNIT OF MEASURE = PSI
 *10¹



$Y = ((+1.0166531E+03) + (+3.0650297E-01) \times X)$
 $F = +6.6222133E+00$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +5.7036516E-02$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +2.5733661E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 2031$ DEGREES OF FREEDOM = 2029
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +020 DEG/RH



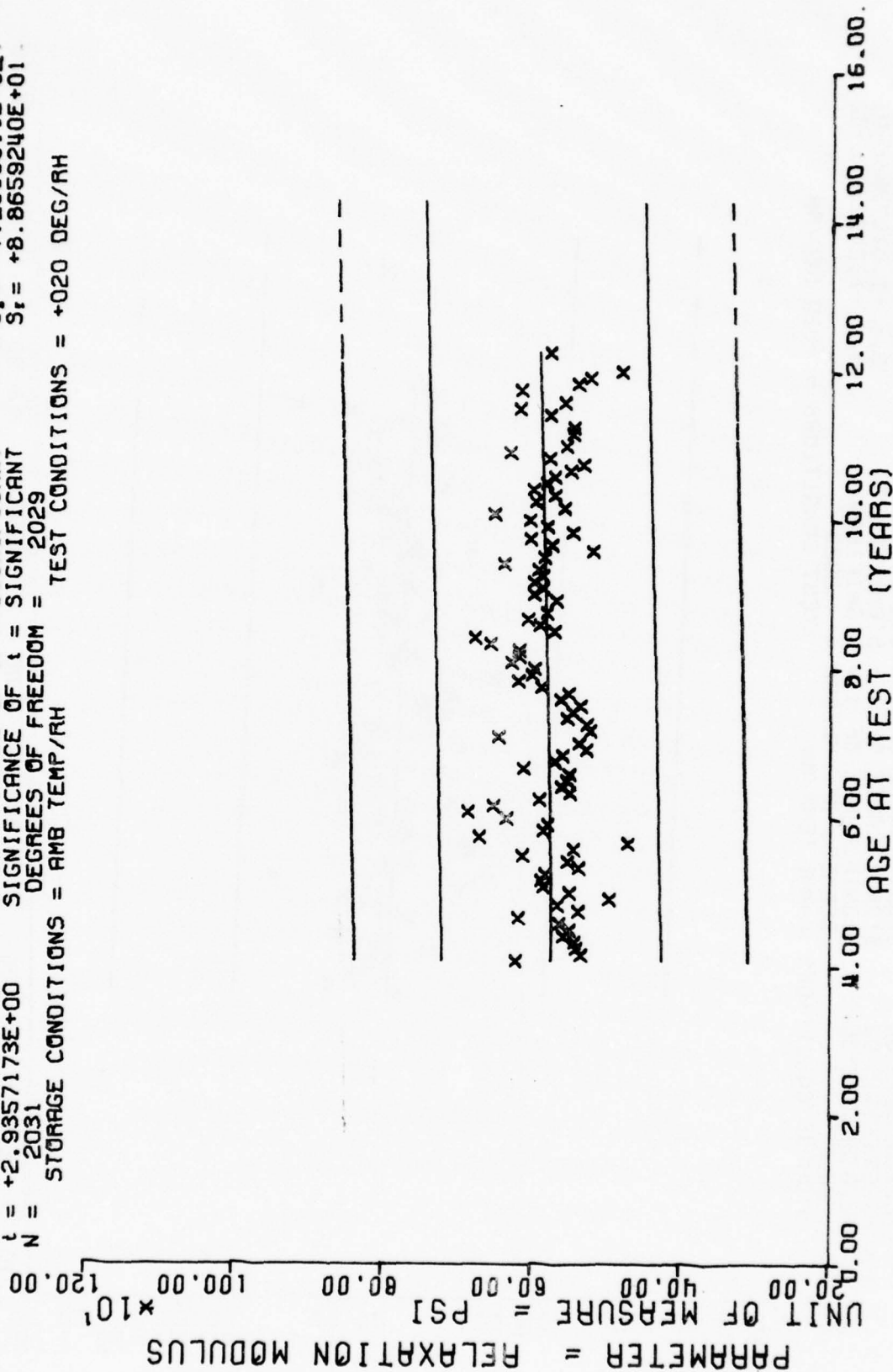
F =	+8.7242690E+00	Y = ((+8.6341886E+02) + (+2.9972118E-01) * X)	S _F =	+1.2456028E+02	
R =	+6.5432244E-02	SIGNIFICANCE OF F =	SIGNIFICANT	S _R =	+1.0147356E-01
N =	+2.9536873E+00	SIGNIFICANCE OF A =	SIGNIFICANT	S _N =	+1.2432397E+02
		SIGNIFICANCE OF t =	SIGNIFICANT		
		DEGREES OF FREEDOM =	2029		
		STORAGE CONDITIONS =	AMB TEMP/RAH		
				TEST CONDITIONS =	+020 DEG/RAH



RUNNING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 100 SEC, 20 DEG F, TPH-1011

Figure 36

$Y = ((+5.6269133E+02) + (+2.1243999E-01) * X)$
 $F = +8.6184364E+00$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +8.8825450E+01$
 $R = +6.5035848E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +7.2363911E-02$
 $t = +2.9357173E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +8.8659240E+01$
 $N = 2031$ DEGREES OF FREEDOM = 2029
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +020 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 1000 SEC, 20 DEG F, TPH-1011

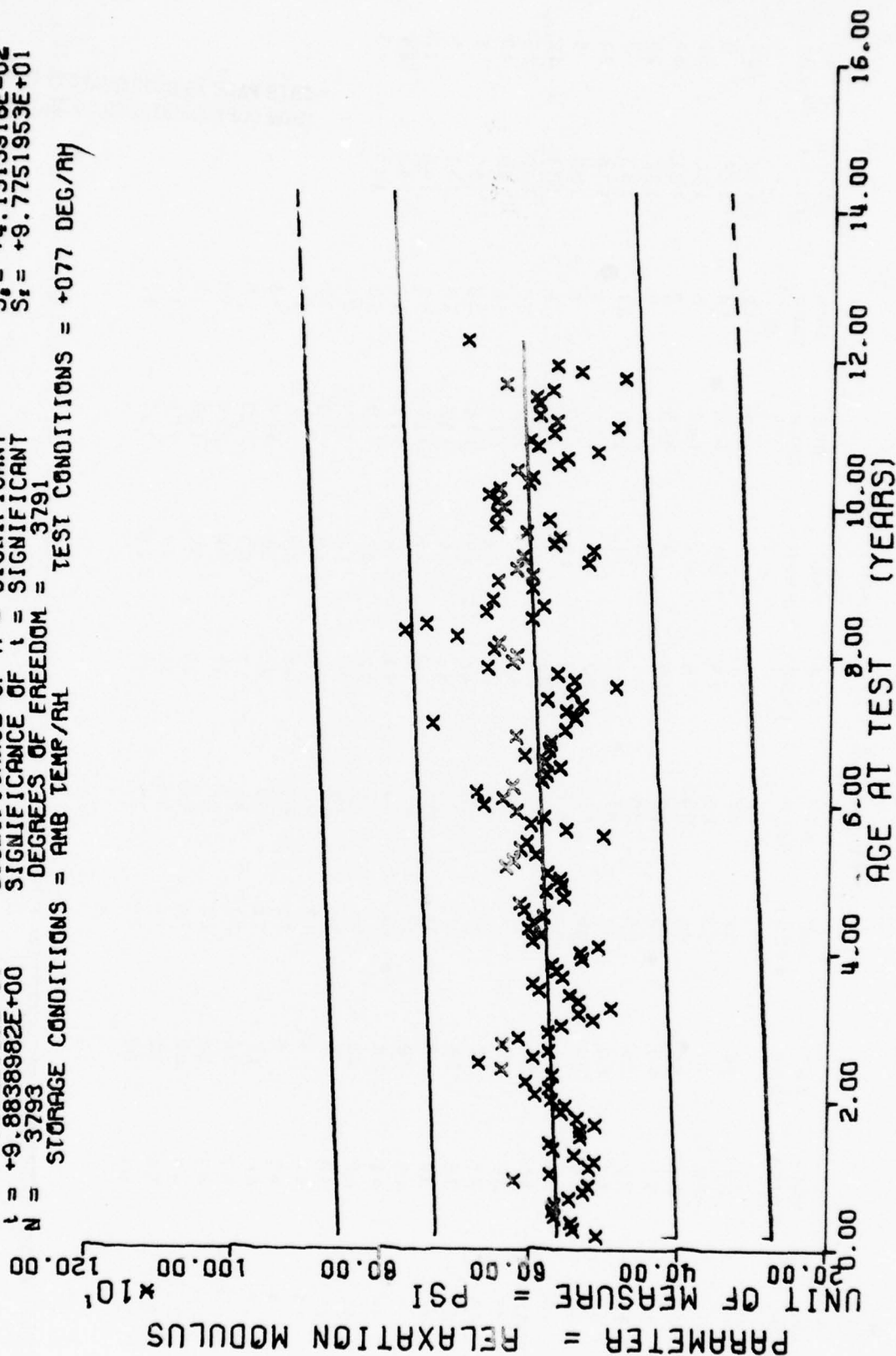
Figure 37

[illegible]

WING 6,STRESS RELAXATION MODULUS,3.0% STRAIN,10 SEC, 77 DEG F,TPT-1011

This sample size summary is applicable to figures 38 thru 41.

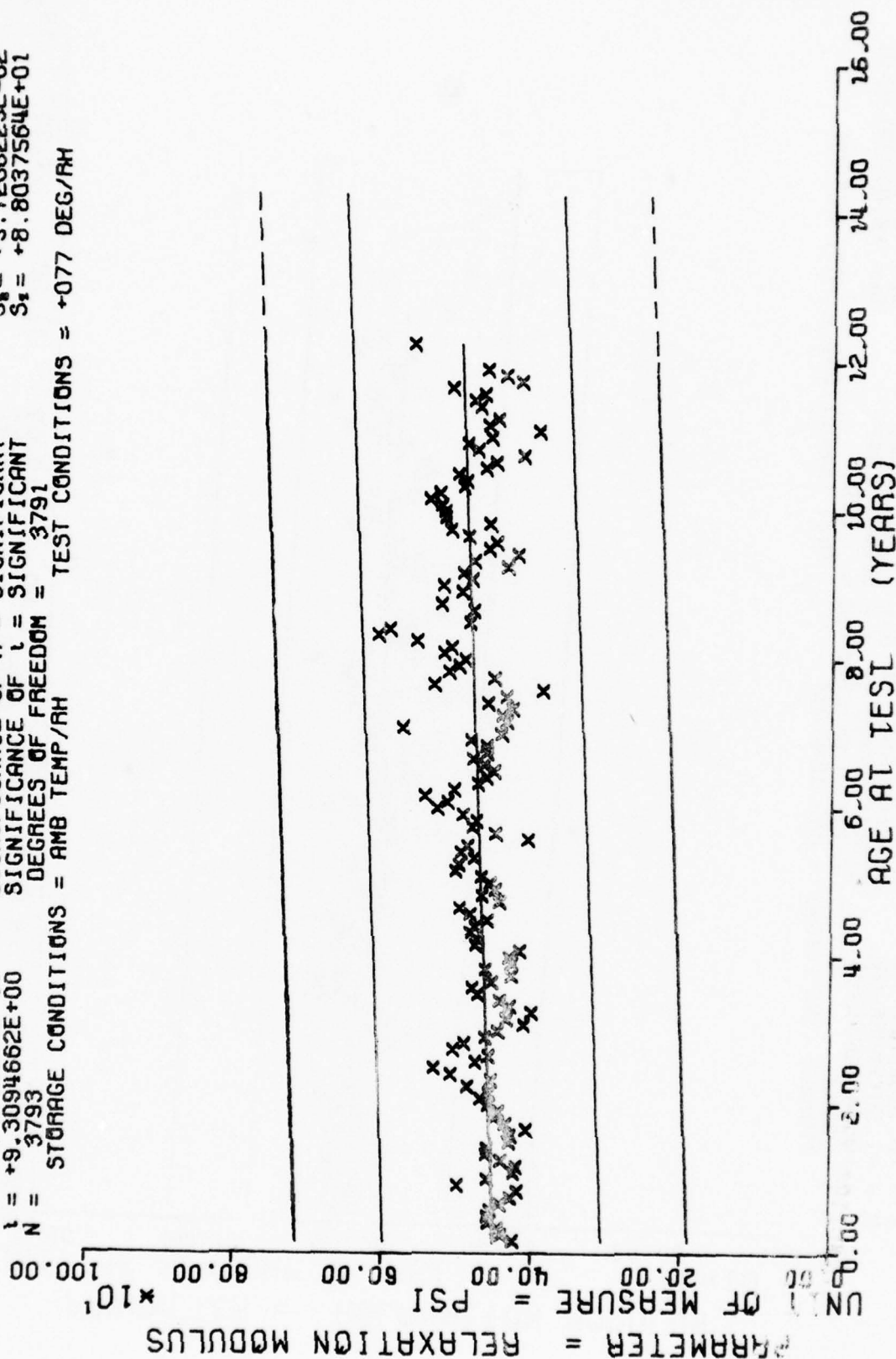
$Y = ((+5.6317027E+02) + (+4.0834254E-01) * X)$
 $F = +9.7691445E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\alpha = +9.8990387E+01$
 $R = +1.5849899E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +4.1313916E-02$
 $t = +9.8838982E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +9.7751953E+01$
 $N = 3793$ DEGREES OF FREEDOM = 3791
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +077 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 77 DEG F, TPH-1011

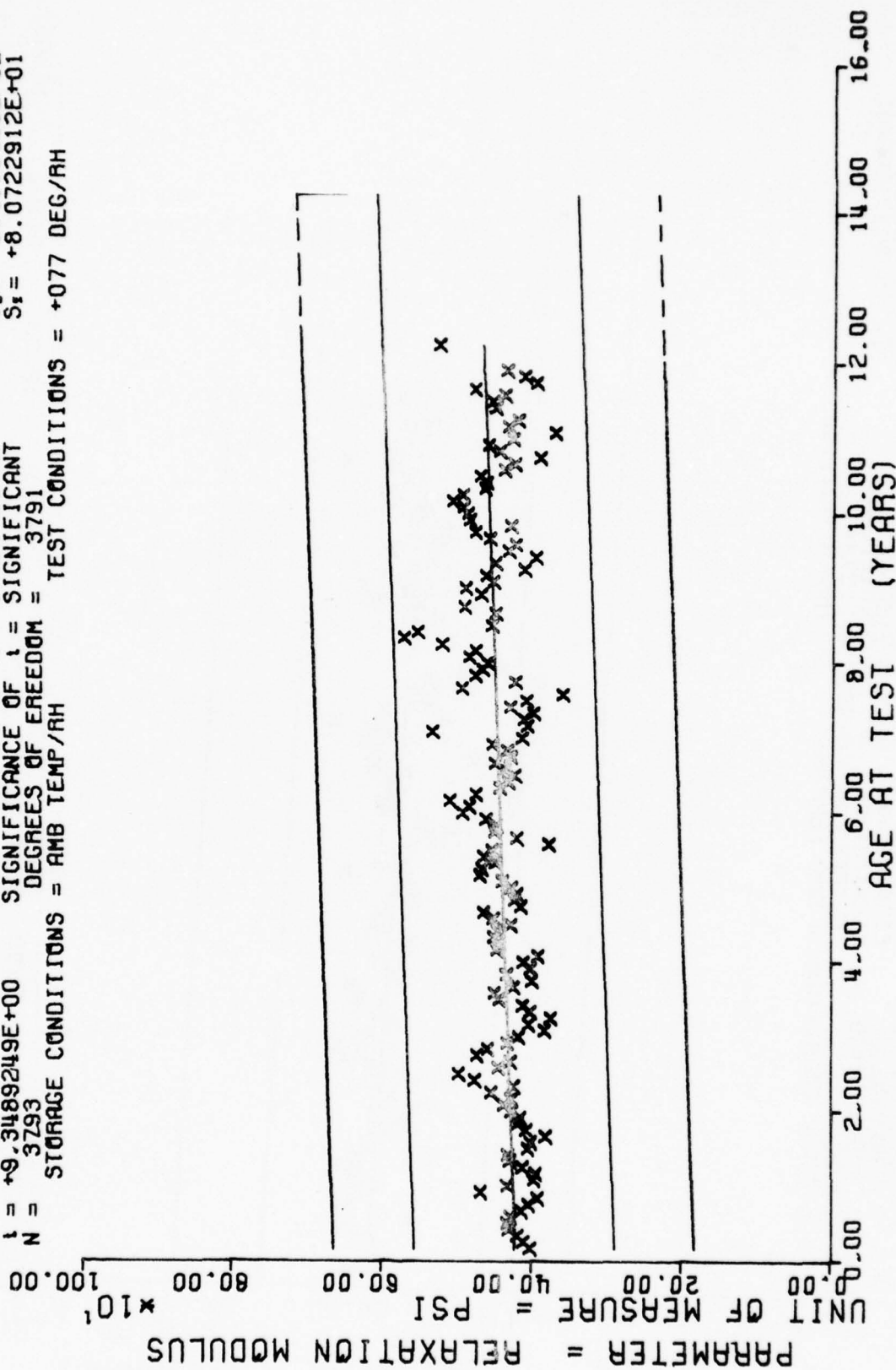
Figure 38

$F = +8.6666162E+01$
 $R = +1.4949944E-01$
 $t = +9.3094662E+00$
 $N = 3793$
 $Y = ((+4.5235042E+02) + (+3.4638870E-01) * X)$
 SIGNIFICANCE OF $F =$ SIGNIFICANT
 SIGNIFICANCE OF $R =$ SIGNIFICANT
 SIGNIFICANCE OF $t =$ SIGNIFICANT
 DEGREES OF FREEDOM = 3791
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +077 DEG/RH



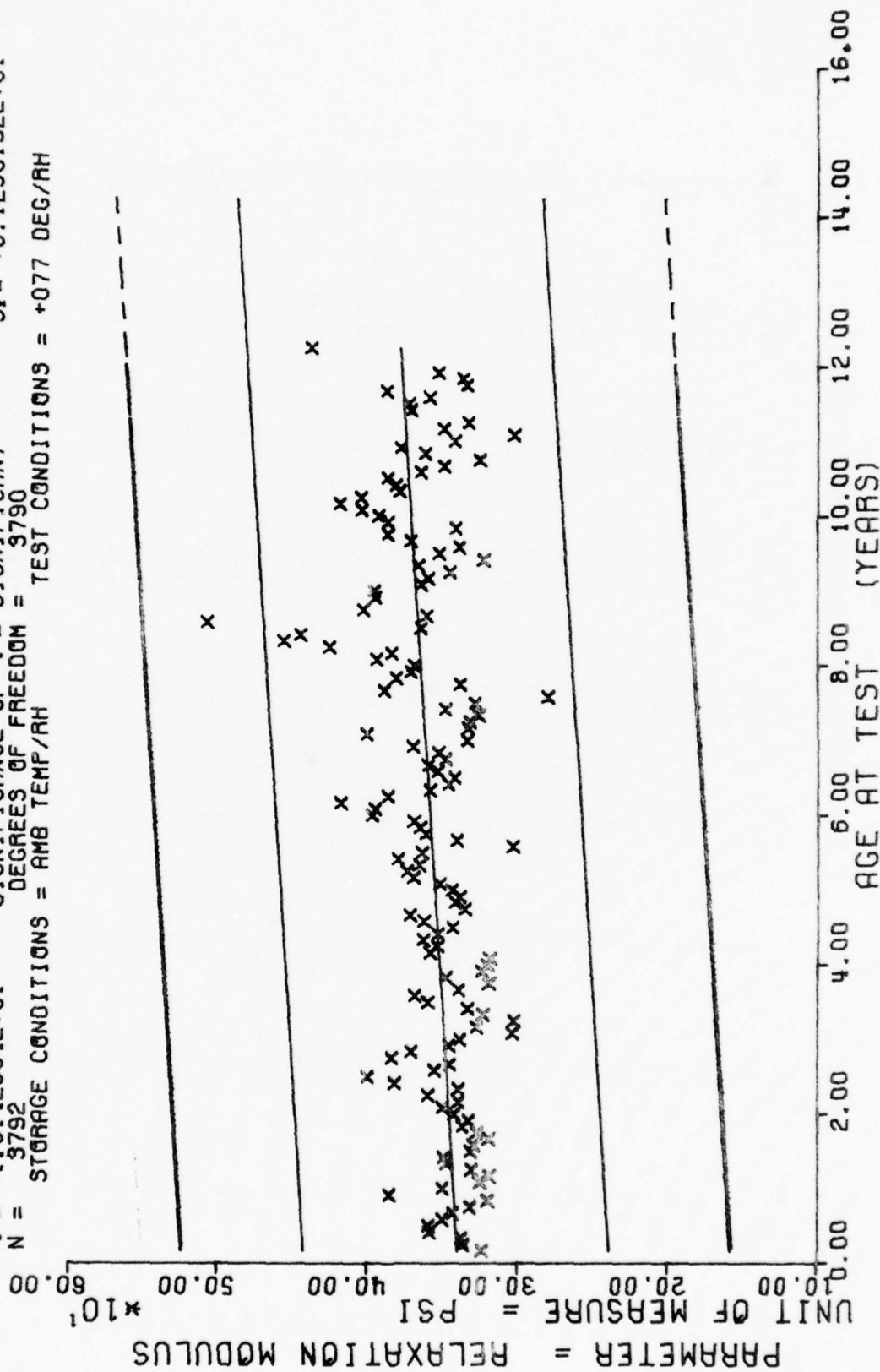
WING 6, STRESS RELAXATION MODULUS, 5.0% STRAIN, 50 SEC, 72 DEG F, IPN-1011

$F = +8.7402398E+01$ SIGNIFICANCE OF $F = (+3.1895499E-01) * X$ $\sigma = +8.1637385E+01$
 $R = +1.5011885E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT $S_e = +3.4116756E-02$
 $t = +9.3489249E+00$ SIGNIFICANCE OF $t =$ SIGNIFICANT $S_t = +8.0722912E+01$
 $N = 3793$ DEGREES OF FREEDOM = 3791
 STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = +077 DEG/AM



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 100 SEC, 77 DEG F, IPH-1011
 Figure 40

$Y = ((+3.4081547E+02) + (+2.6248347E-01) * X)$
 $F = +1.0287648E+02$ SIGNIFICANCE OF F = SIGNIFICANT $S_e = +6.2047425E+01$
 $R = +1.6256339E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_b = +2.5878785E-02$
 $t = +1.0142804E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_c = +6.1230152E+01$
 $N = 3792$ DEGREES OF FREEDOM = 3790
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = +077 DEG/AH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 1000 SEC, 77 DEG F, TPH-1011

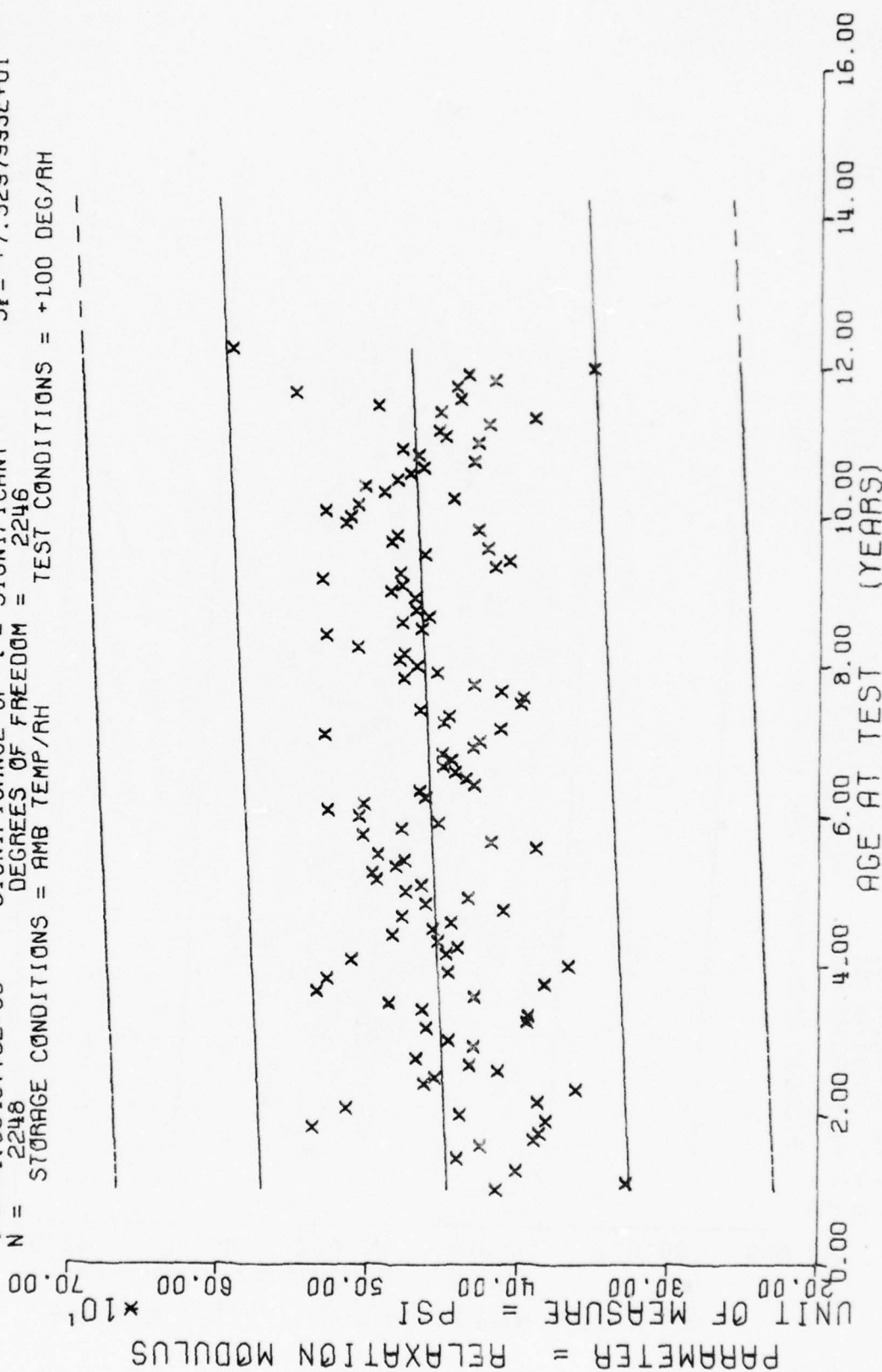
Figure 41

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
12	3	43	9	68	12	93	15	119	21
13	3	44	3	69	24	94	15	120	27
15	6	45	9	70	27	95	21	121	15
17	15	46	6	71	48	96	51	122	6
19	6	47	9	72	42	97	54	123	9
20	3	48	3	73	24	98	51	124	15
21	9	49	6	74	42	99	36	125	15
22	6	50	27	75	36	100	15	126	18
23	3	51	57	76	29	101	15	127	12
24	6	52	45	77	33	102	6	128	21
25	9	53	12	78	36	103	9	129	3
26	9	54	28	79	18	104	6	130	36
28	3	55	27	80	21	105	3	131	36
29	9	56	27	81	30	107	5	132	9
30	9	57	31	82	24	108	18	133	6
31	3	58	24	83	18	109	6	134	27
32	9	59	12	84	15	110	6	135	6
33	9	60	15	85	3	111	6	136	3
35	15	61	20	86	12	112	24	137	15
36	24	62	48	87	9	113	45	138	45
38	6	63	21	88	11	114	39	139	45
39	9	64	33	89	12	115	18	140	3
40	9	65	9	90	21	116	30	141	9
41	12	66	12	91	12	117	18	142	12
42	6	67	6	92	21	118	15	143	21

WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 100 DEG F, TPH-1011

This sample size summary is applicable to figures 42 thru 45.

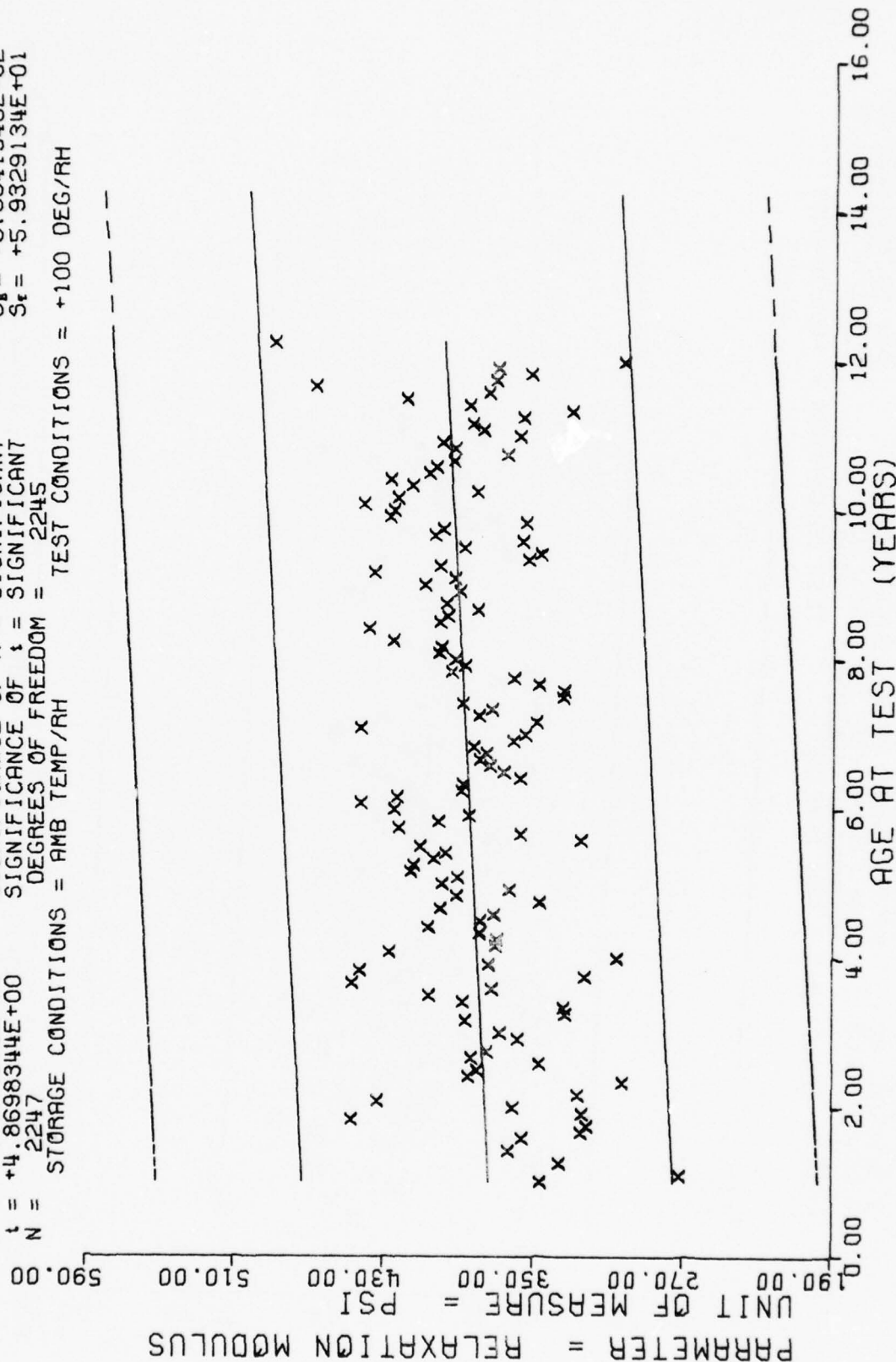
$F = +1.0516728E+01$
 $R = +8.5440960E-02$
 $t = +4.0640778E+00$
 $N = 2248$
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = +100 DEG/RH
 $Y = ((+4.4564305E+02) + (+1.9492115E-01) * X)$
 $\sigma_f = +7.3550639E+01$
 $S_f = +4.7961962E-02$
 $S_t = +7.3297993E+01$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 2246



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 100 DEG F, TPH-1011

Figure 42

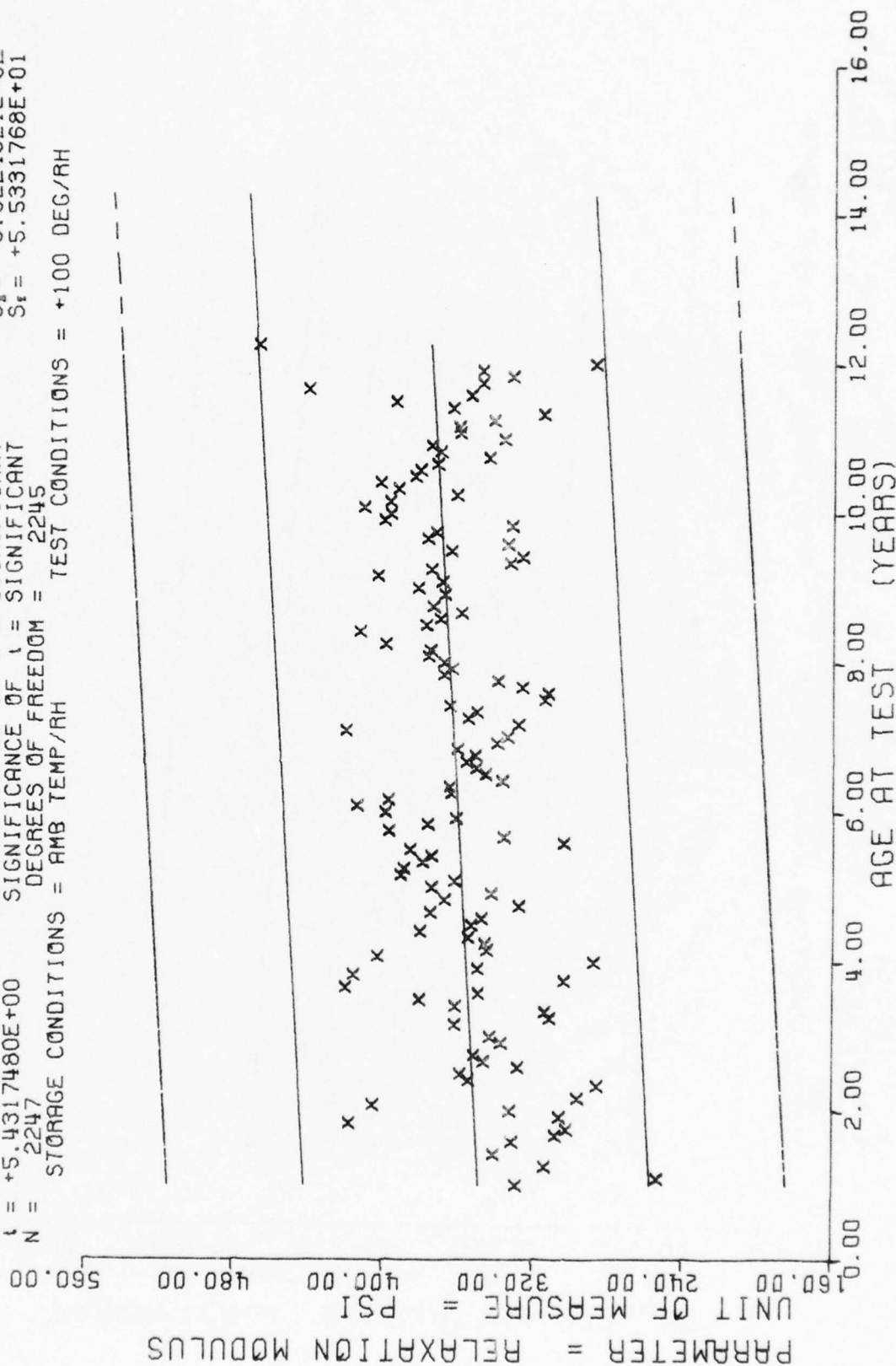
$Y = ((+3.7209164E+02) + (+1.8915381E-01) * X)$
 $F = +2.3715287E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G_1 = +5.9628396E+01$
 $R = +1.0224078E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +3.8841940E-02$
 $t = +4.8698344E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_r = +5.9329134E+01$
 $N = 2247$ DEGREES OF FREEDOM = 2245
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +100 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 50 SEC, 100 DEG F, 7PH-1011

Figure 43

$F = +2.9503886E+01$
 $R = +1.1389280E-01$
 $t = +5.4317480E+00$
 $N = 2247$
 $Y = ((+3.4749013E+02) + (+1.9676464E-01) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 2245
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = +100 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 100 SEC, 100 DEG F, 7PH-1011

Figure 44

F	= +3.7432189E+01	Y = ((+2.7526482E+02) + (+1.7565259E-01) * X)	S _r = +4.4143602E+01
R	= +1.2823165E-01	SIGNIFICANCE OF F = SIGNIFICANT	S _a = +2.8709917E-02
t	= +6.1181851E+00	SIGNIFICANCE OF R = SIGNIFICANT	S _f = +4.3788939E+01
N	= 2241	SIGNIFICANCE OF t = SIGNIFICANT	
		DEGREES OF FREEDOM = 2239	
		STORAGE CONDITIONS = AMB TEMP/RH	TEST CONDITIONS = +100 DEG/RH

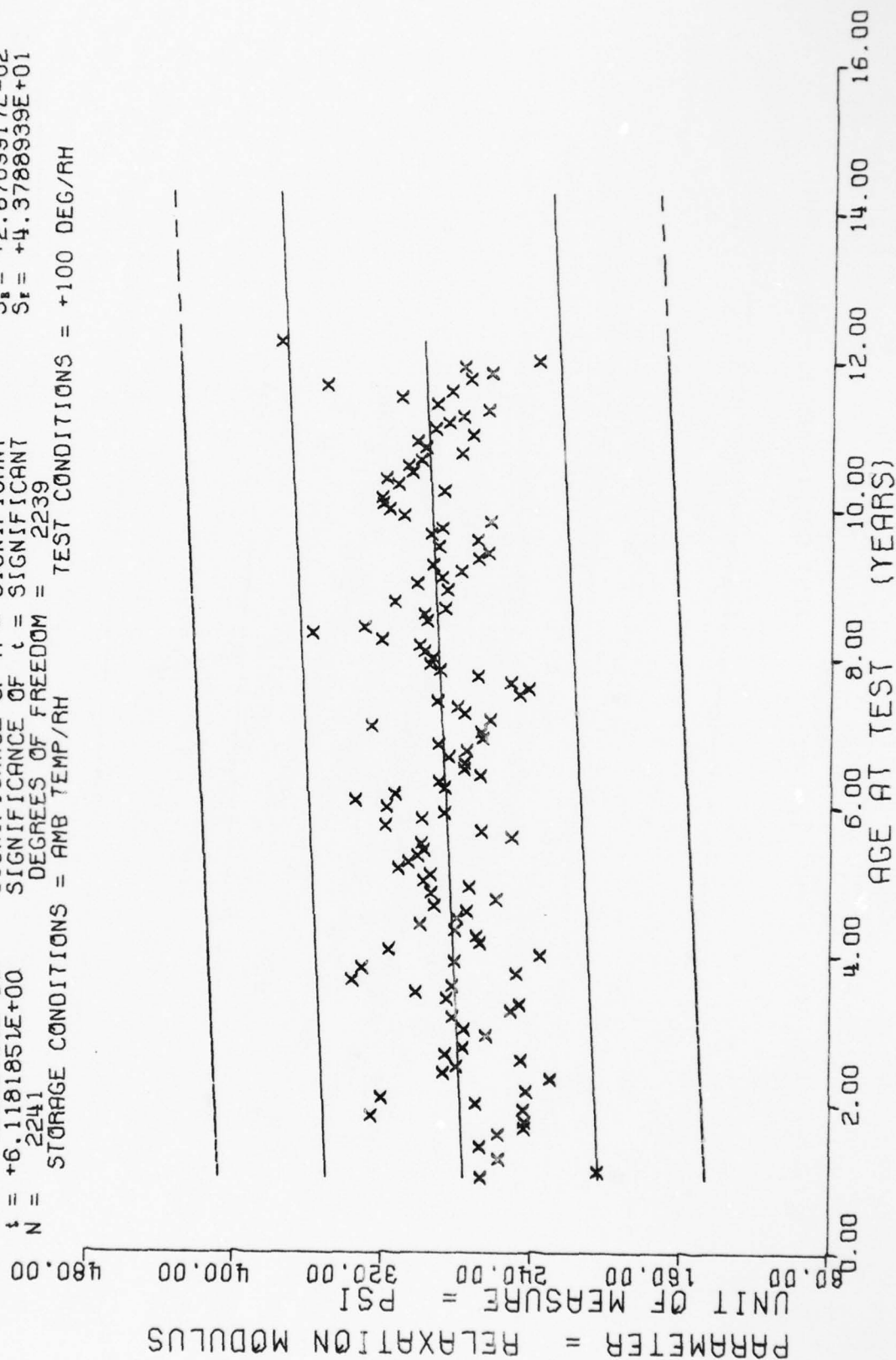


Figure 45

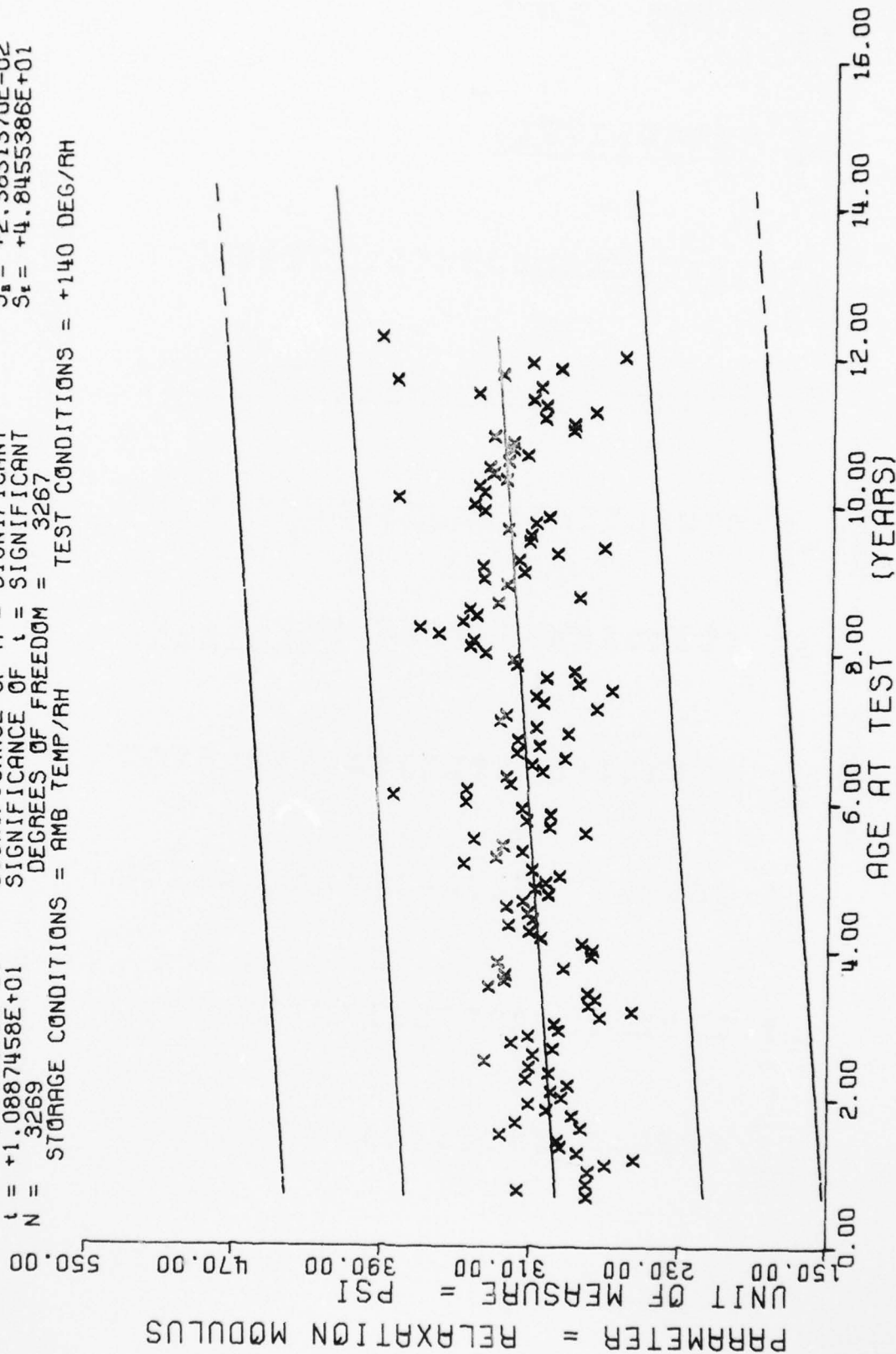
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
8	3	34	57	59	33	84	15	110	9	135	6	135	6
9	9	35	33	60	47	85	3	111	6	136	3	136	3
10	6	36	48	61	48	86	12	112	21	137	15	137	15
12	24	37	18	62	57	87	15	113	45	138	36	138	36
13	27	38	18	63	27	88	12	114	39	139	48	139	48
14	9	39	48	64	45	89	15	115	15	140	3	140	3
15	27	40	18	65	9	90	15	116	33	141	9	141	9
16	15	41	21	66	12	91	15	117	18	142	12	142	12
17	39	42	15	67	6	92	18	118	21	143	24	143	24
18	10	43	9	68	12	93	15	119	21	144	3	144	3
19	6	44	9	69	48	94	18	120	24	147	3	147	3
20	6	45	3	70	45	95	17	121	18				
21	18	46	12	71	57	96	54	122	6				
22	6	47	30	72	42	97	53	123	9				
23	9	48	39	73	24	98	48	124	15				
24	33	49	39	74	38	99	36	125	15				
25	30	50	36	75	33	100	18	126	18				
26	30	51	66	76	36	101	12	127	12				
27	21	52	69	77	36	102	5	128	18				
28	27	53	27	78	36	103	9	129	2				
29	48	54	30	79	17	104	3	130	30				
30	45	55	33	80	20	105	3	131	42				
31	33	56	42	81	24	107	6	132	9				
32	57	57	51	82	24	108	18	133	6				
33	27	58	57	83	18	109	6	134	27				

WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 140 DEG F, TPH-1011

This sample size summary is applicable to figures 46 thru 49.

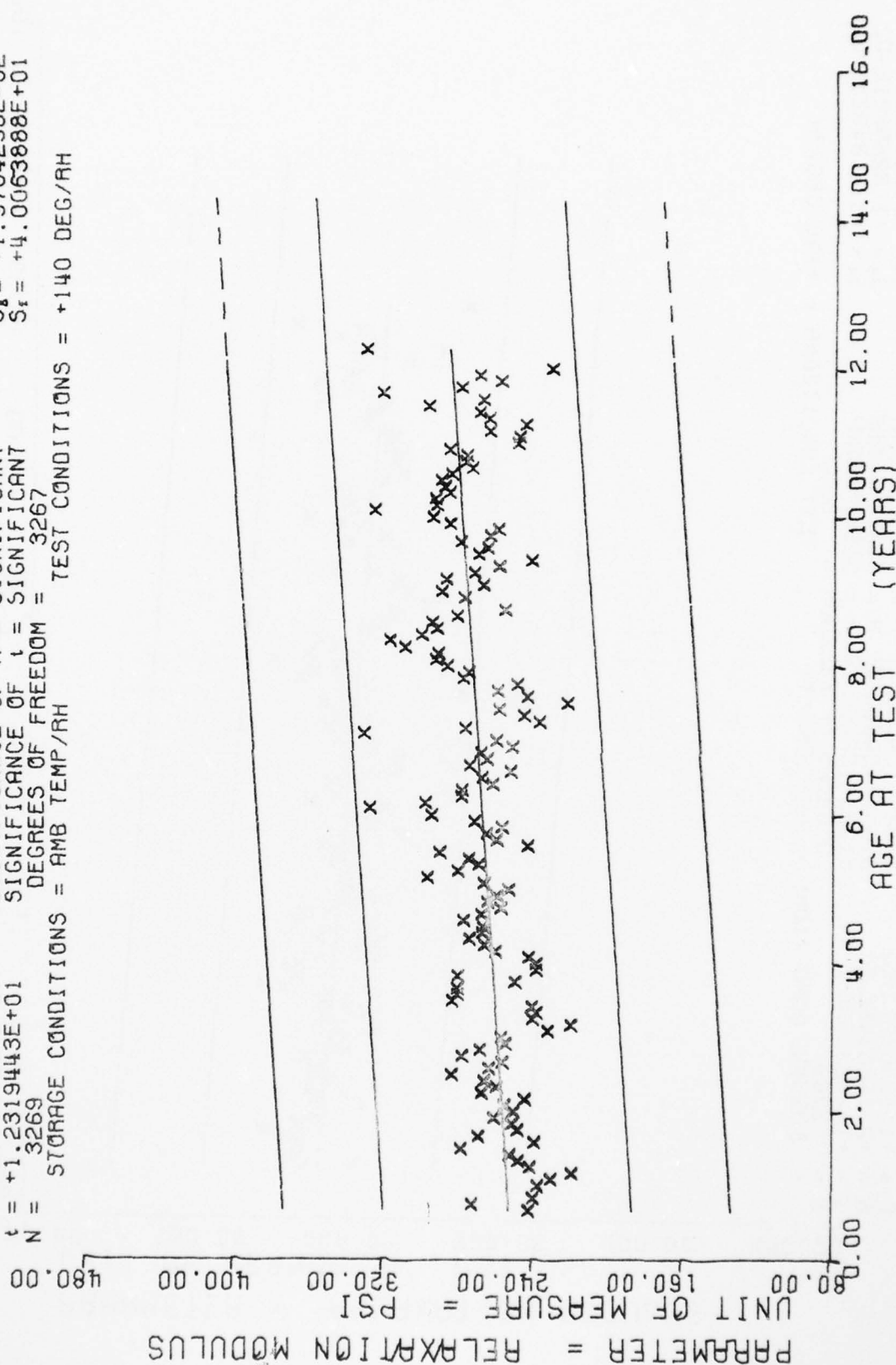
$F = +1.1853676E+02$
 $R = +1.8711679E-01$
 $t = +1.0887458E+01$
 $N = 3269$
 $Y = ((+2.9463796E+02) + (+2.5946306E-01) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 3267
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = +140 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 140 DEG F, 7PH-1011

Figure 46

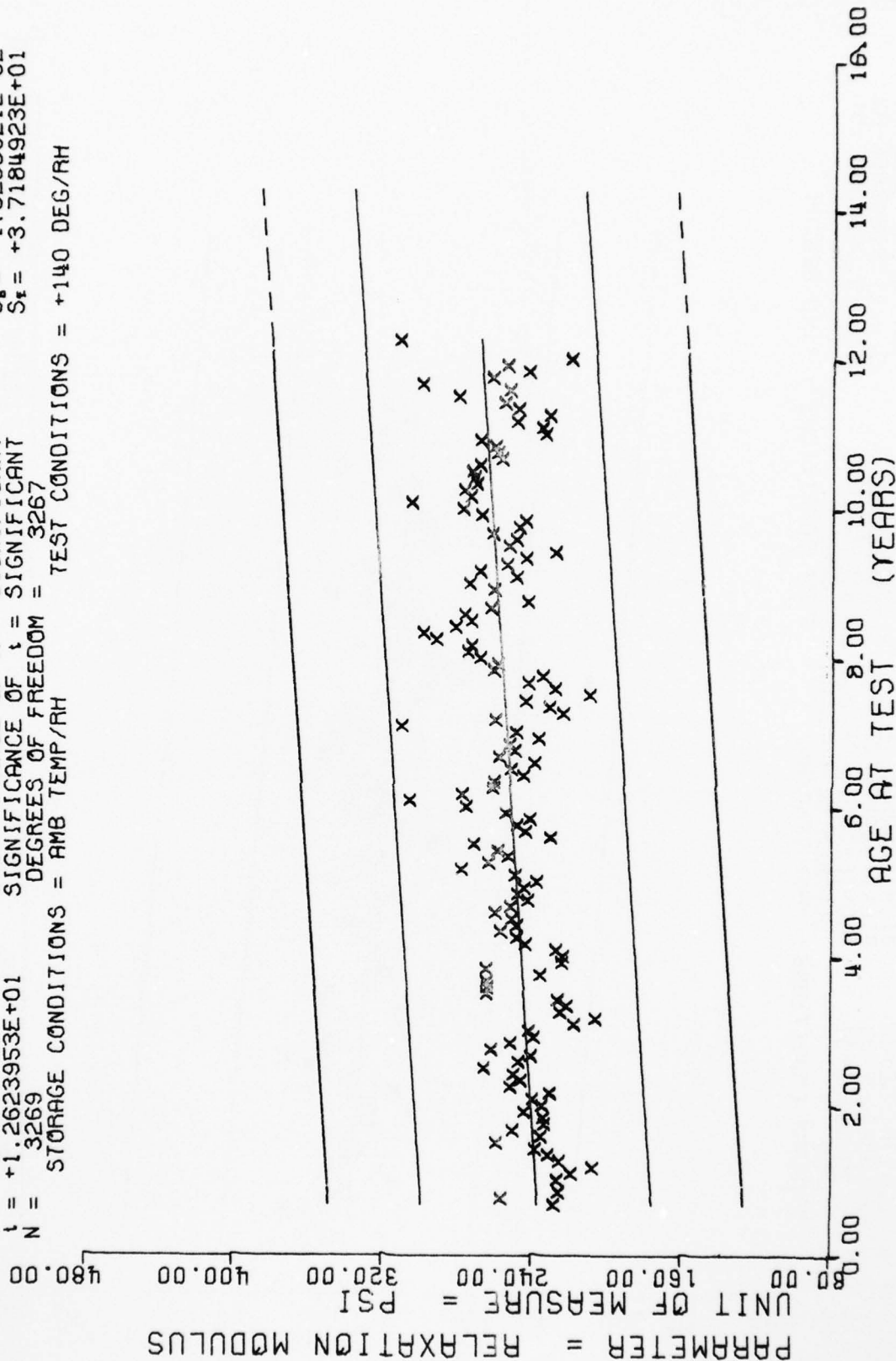
$Y = ((+2.5143355E+02) + (+2.4274546E-01) * X)$
 $F = +1.5176868E+02$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +2.1069597E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +1.2319443E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 3269$ DEGREES OF FREEDOM = 3267
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +140 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 50 SEC, 140 DEG F, 7PH-1011

Figure 47

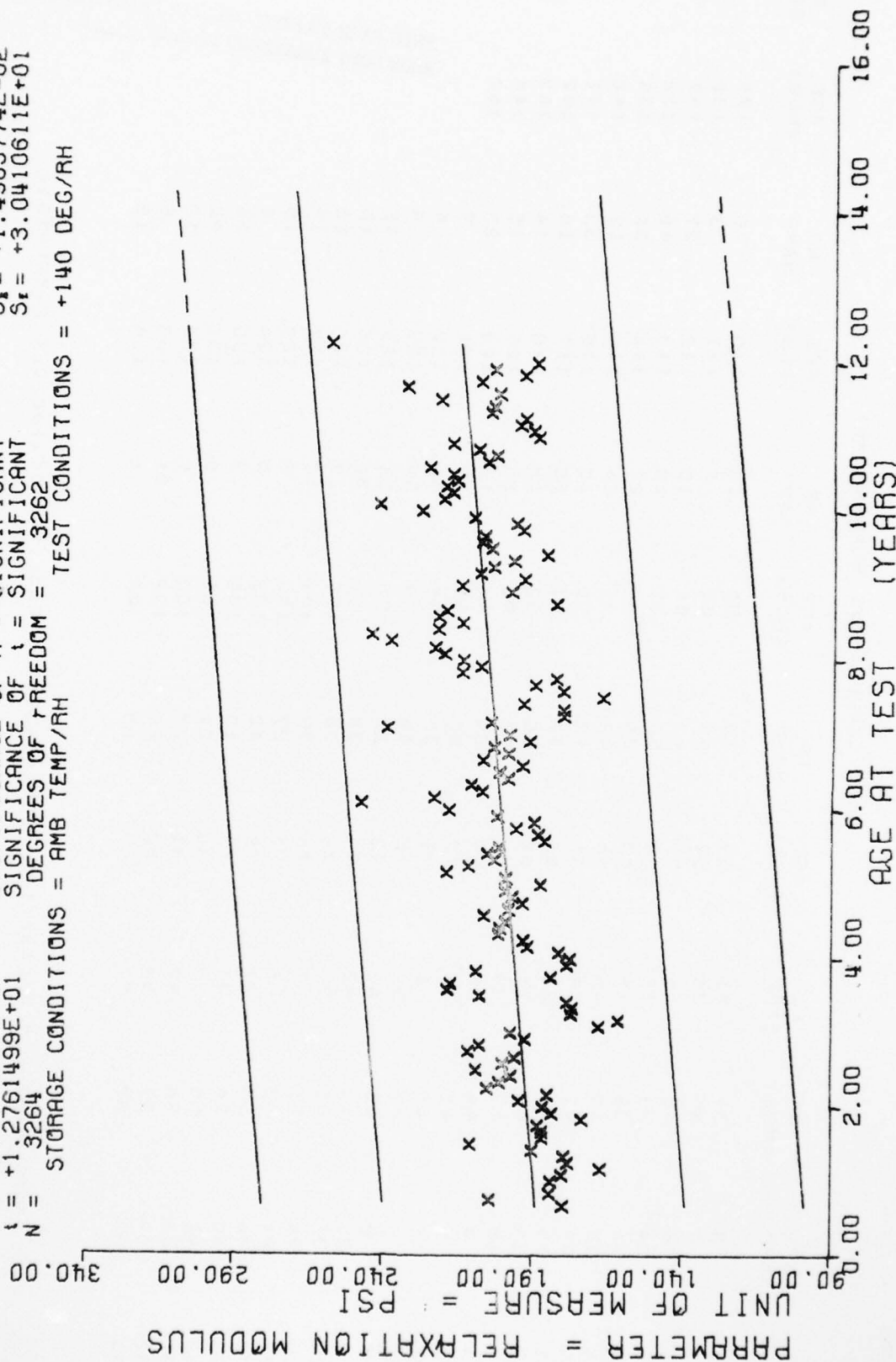
$Y = ((+2.3596334E+02) + (+2.3087092E-01) * X)$
 $F = +1.5936421E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma^2 = +3.8075238E+01$
 $R = +2.1566448E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_b = +1.8288321E-02$
 $t = +1.2623953E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +3.7184923E+01$
 $N = 3269$ DEGREES OF FREEDOM = 3267
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +140 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 100 SEC, 140 DEG F, TPH-1011

Figure 48

$Y = ((+1.8788250E+02) + (+1.9096020E-01) * X)$
 $F = +1.6285587E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +3.1155718E+01$
 $R = +2.1806228E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +1.4963774E-02$
 $t = +1.2761499E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_r = +3.0410611E+01$
 $N = 3264$ DEGREES OF FREEDOM = 3262
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +140 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 1000 SEC, 140 DEG F, TPH-1011

Figure 49

*** SAMPLE SIZE SUMMARY ***

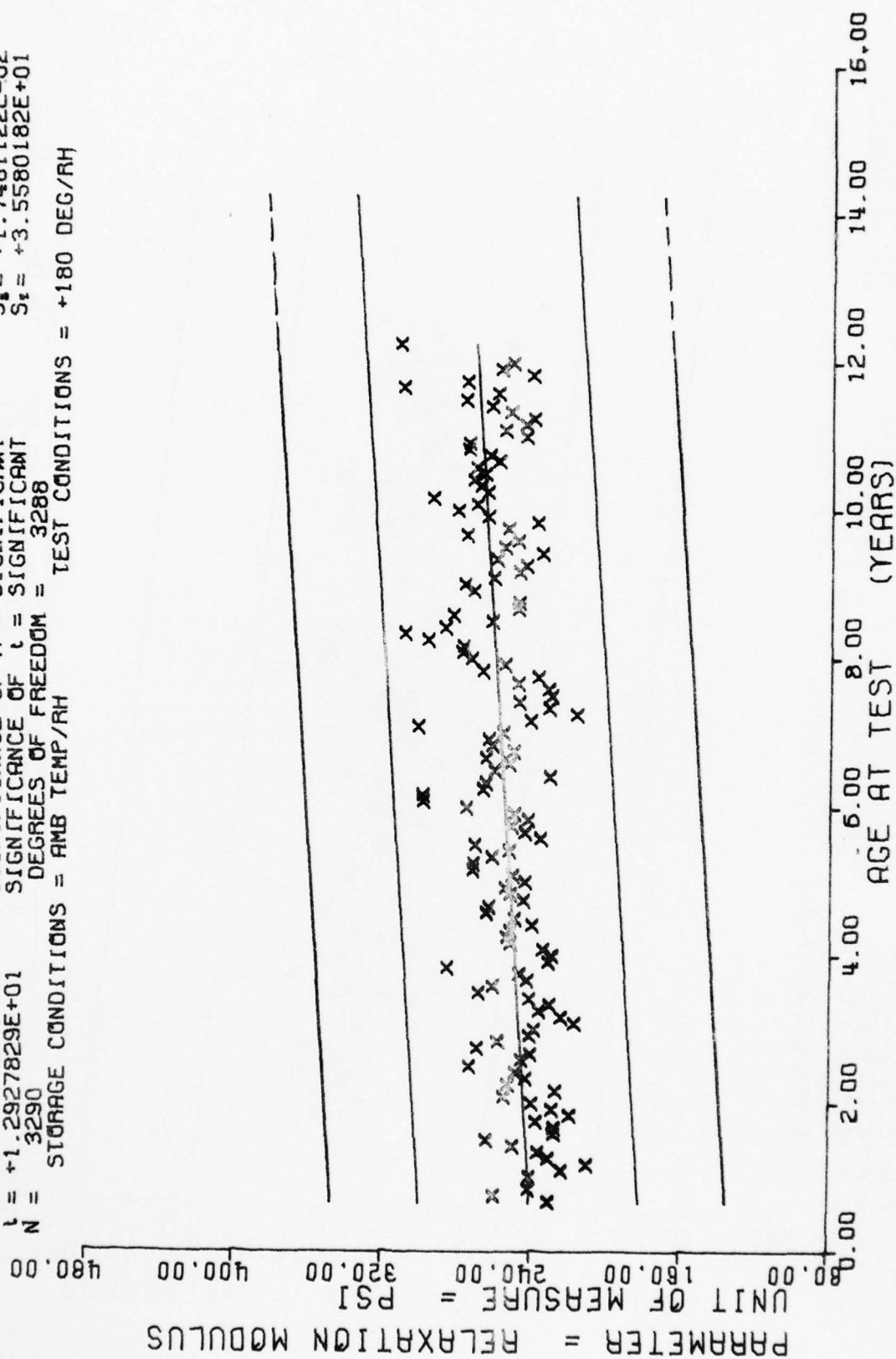
AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
8	3	34	51	59	33	84	18	110	6	135	6	135	6
9	9	35	30	60	45	85	3	111	3	136	3	136	3
10	6	36	54	61	42	86	15	112	27	137	15	137	15
12	24	37	18	62	58	87	18	113	48	138	54	138	54
13	24	38	18	63	30	88	27	114	36	139	44	139	44
14	12	39	48	64	42	89	24	115	12	140	3	140	3
15	24	40	18	65	12	90	30	116	33	141	9	141	9
16	18	41	21	66	12	91	15	117	18	142	11	142	11
17	33	42	18	67	6	92	18	118	14	143	30	143	30
18	18	43	9	68	12	93	15	119	15	144	3	144	3
19	9	44	6	69	39	94	17	120	23	147		147	
20	6	45	6	70	50	95	18	121	9				
21	18	46	6	71	33	96	54	122	6				
22	9	47	30	72	48	97	54	123	9				
23	9	48	42	73	27	98	51	124	15				
24	30	49	42	74	36	99	36	125	15				
25	35	50	36	75	36	100	17	126	18				
26	24	51	57	76	39	101	12	127	12				
27	24	52	68	77	27	102	6	128	15				
28	26	53	27	78	42	103	9	129	6				
29	50	54	33	79	18	104	3	130	24				
30	42	55	33	80	21	105	6	131	42				
31	33	56	42	81	27	107	6	132	12				
32	54	57	54	82	24	108	21	133	6				
33	30	58	57	83	18	109	6	134	15				

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 180 DEG F, TPT-1011

This sample size summary is applicable to figures 50 thru 53.

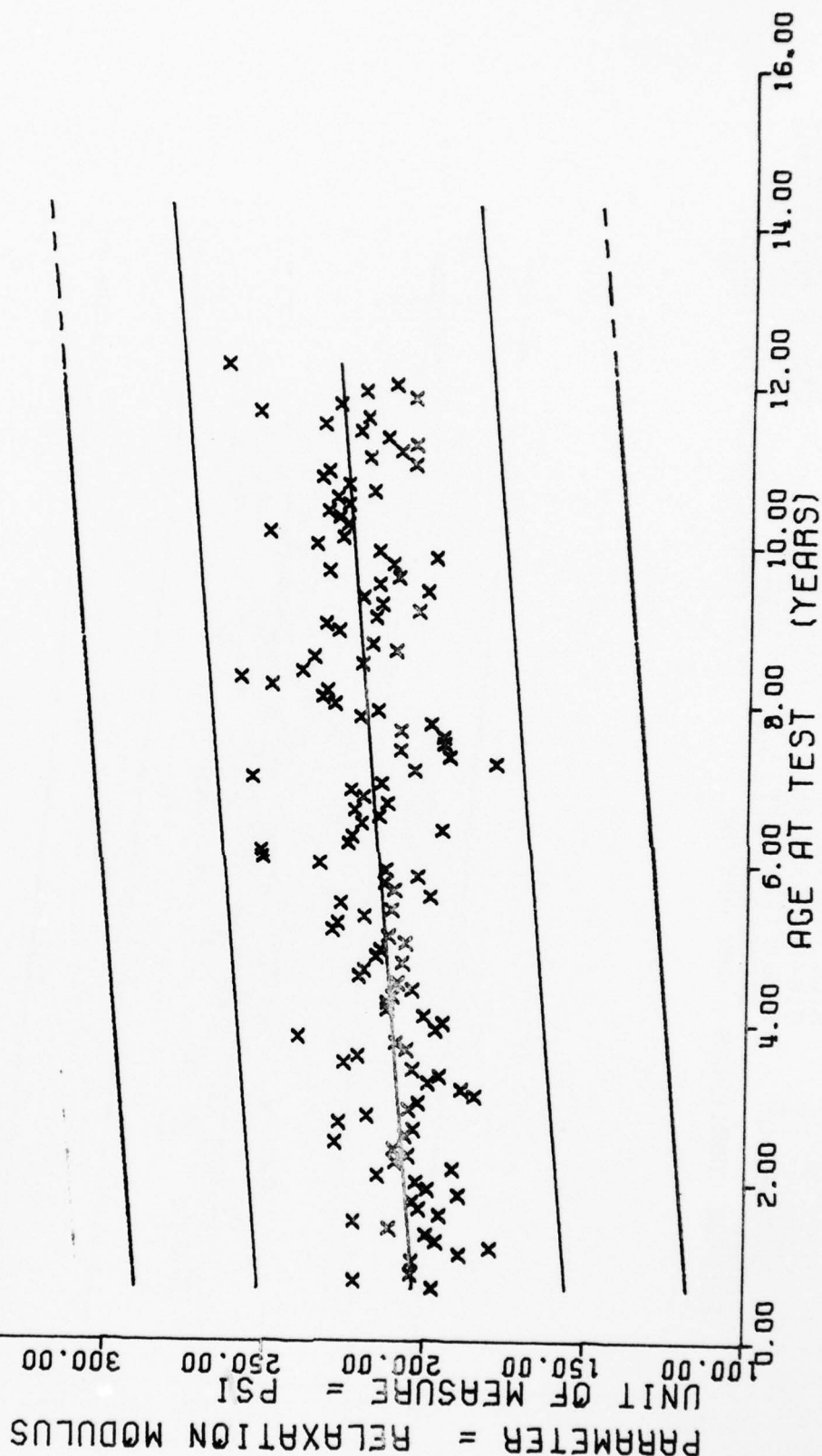
$Y = ((+2.3957032E+02) + (+2.2599296E-01) * X)$
 $F = +1.6712876E+02$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +2.1993456E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +1.2927829E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 3290$ DEGREES OF FREEDOM = 3288
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +180 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 10 SEC, 180 DEG F, TPH-1011

Figure 50

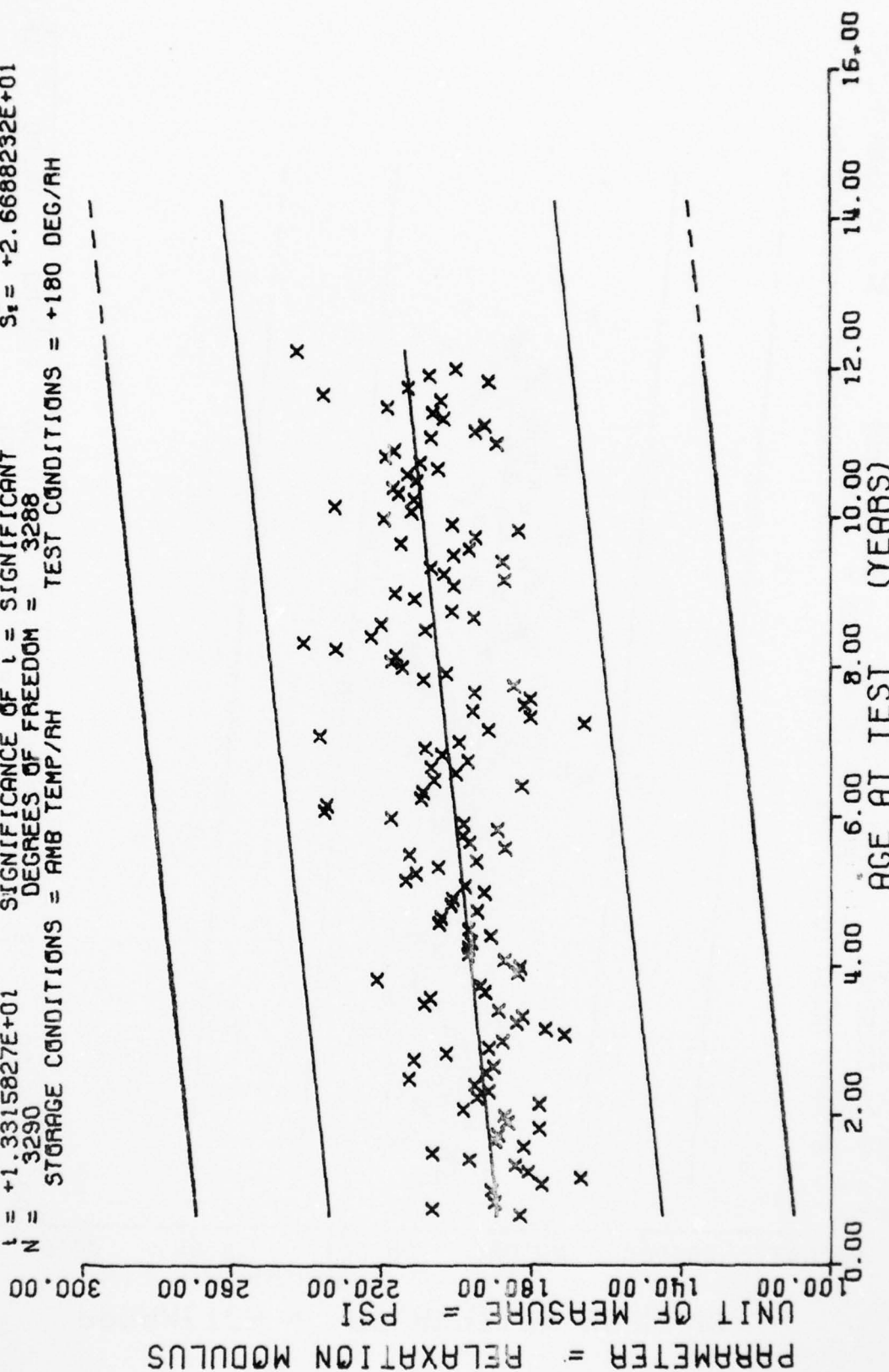
$Y = ((+2.0248537E+02) + (+1.8823491E-01) * X)$
 $F = +1.7579438E+02$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +2.2528197E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +1.3258747E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 3290$ DEGREES OF FREEDOM = 3288
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = +180 DEG/AH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 50 SEC, 180 DEG F, TPH-1011

Figure 51

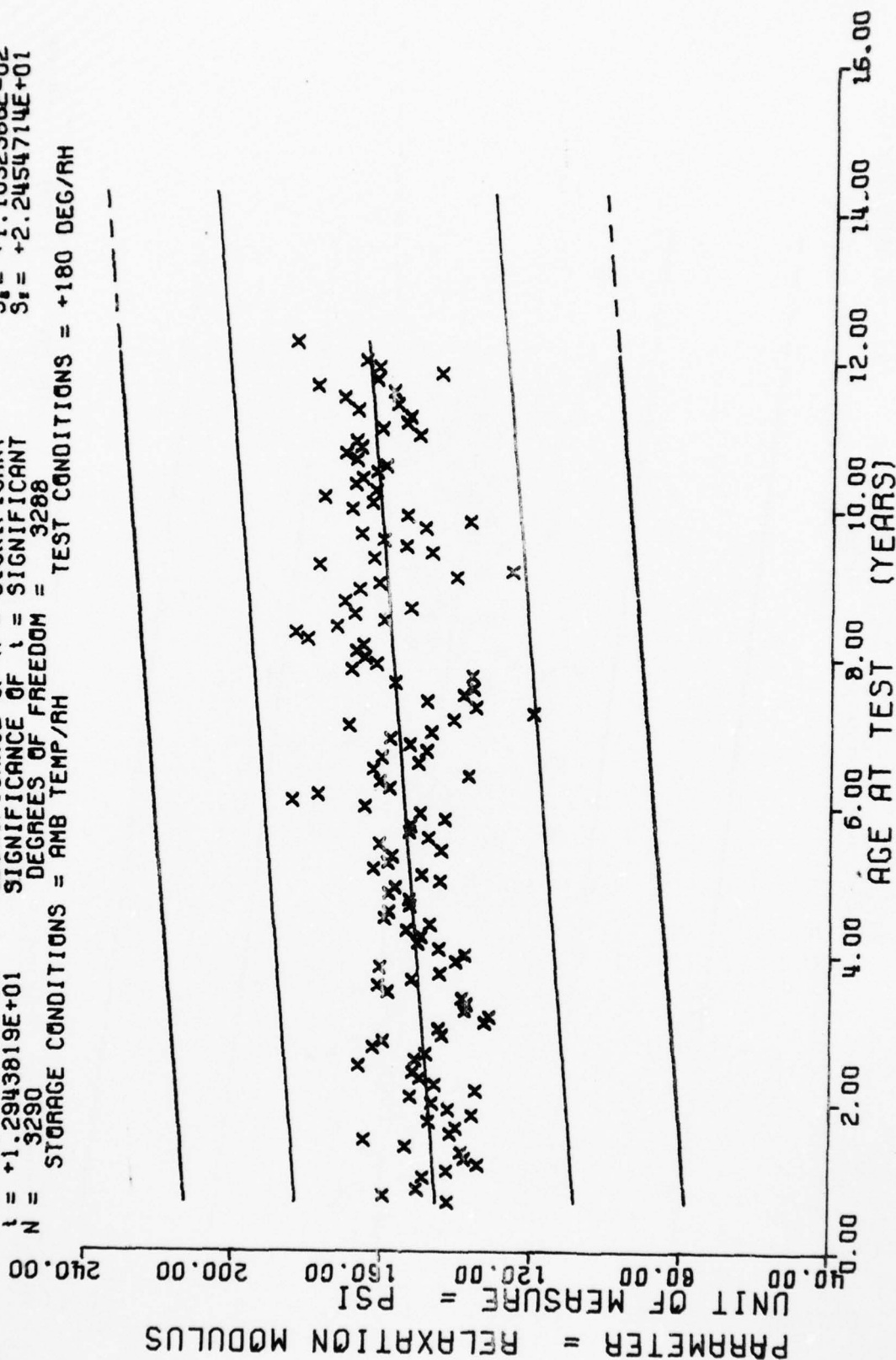
$Y = ((+1.8824703E+02) + (+1.7460196E-01) * X)$
 $F = +1.7731126E+02$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +2.2620230E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +1.3315827E+01$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 3290$ DEGREES OF FREEDOM = 3288
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +180 DEG/RH



WING 6, STRESS RELAXATION MODULUS, 3.0% STRAIN, 100 SEC, 180 DEG F, TPH-101

Figure 52

$Y = ((+1.4455916E+02) + (+1.4280095E-01) * X)$
 F = +1.6754245E+02 SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +2.3016204E+01$
 R = +2.2019341E-01 SIGNIFICANCE OF R = SIGNIFICANT $S_e = +1.1032366E-02$
 t = +1.2943819E+01 SIGNIFICANCE OF t = SIGNIFICANT $S_f = +2.2454714E+01$
 N = 3290 DEGREES OF FREEDOM = 3288
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = +180 DEG/RH



WING 6. STRESS RELAXATION MODULUS, 3.0% STRAIN, 1000 SEC, 180 DEG F, TPH-1011

Figure 53

*** SAMPLE SIZE SUMMARY ***

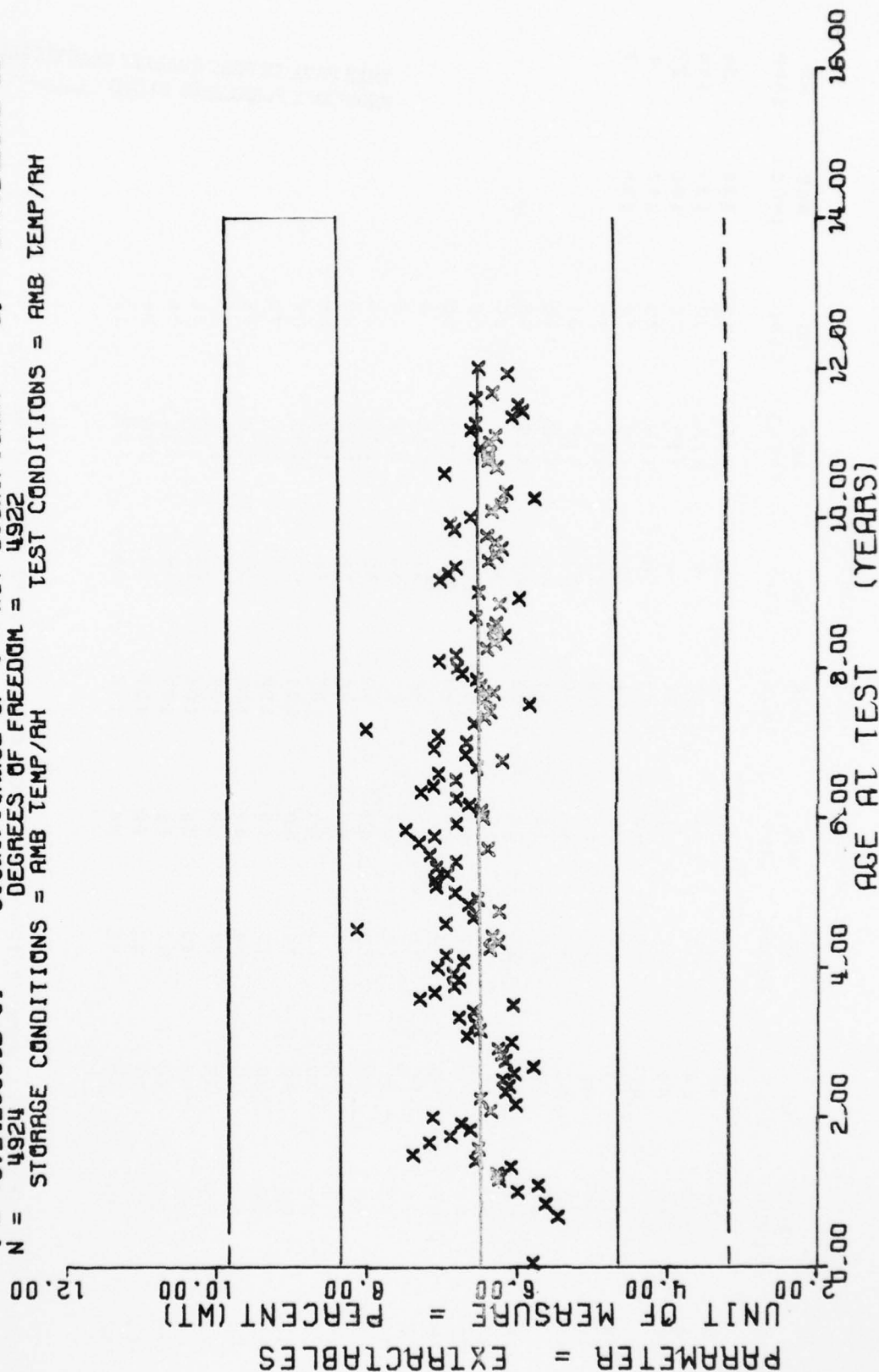
AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
1	3	34	48	59	32	84	16	111	52	138	34		
8	4	35	64	60	32	85	9	112	20	139	114		
10	24	36	44	61	31	86	4	113	20	140	27		
12	12	37	48	62	40	87	8	114	76	141	4		
13	32	38	44	63	36	88	24	115	72	142	4		
14	36	39	32	64	56	89	36	116	58	143	4		
15	20	40	40	65	44	90	32	117	31	144	4		
16	20	41	28	66	16	91	40	118	116				
17	28	42	12	67	28	92	24	119	95				
18	32	43	16	68	16	93	20	120	100				
19	52	44	4	69	12	94	28	121	68				
20	12	45	8	70	12	95	28	122	56				
21	32	46	16	71	40	96	31	123	4				
22	28	47	36	72	52	97	39	124	8				
23	24	48	32	73	40	98	32	127	24				
24	8	49	44	74	80	99	72	128	20				
25	40	50	20	75	56	100	76	129	48				
26	56	51	52	76	40	101	52	130	20				
27	32	52	100	77	44	102	32	131	70				
28	44	53	99	78	42	103	28	132	116				
29	43	54	38	79	38	104	8	133	79				
30	44	55	42	80	50	105	12	134	48				
31	72	56	70	81	31	107	16	135	36				
32	64	57	36	82	20	108	4	136	28				
33	52	58	70	83	24	110	24	137	12				

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

STAGE 1. WING 6 TP-H1011, SOL GEL, PERCENT EXTRACTABLES

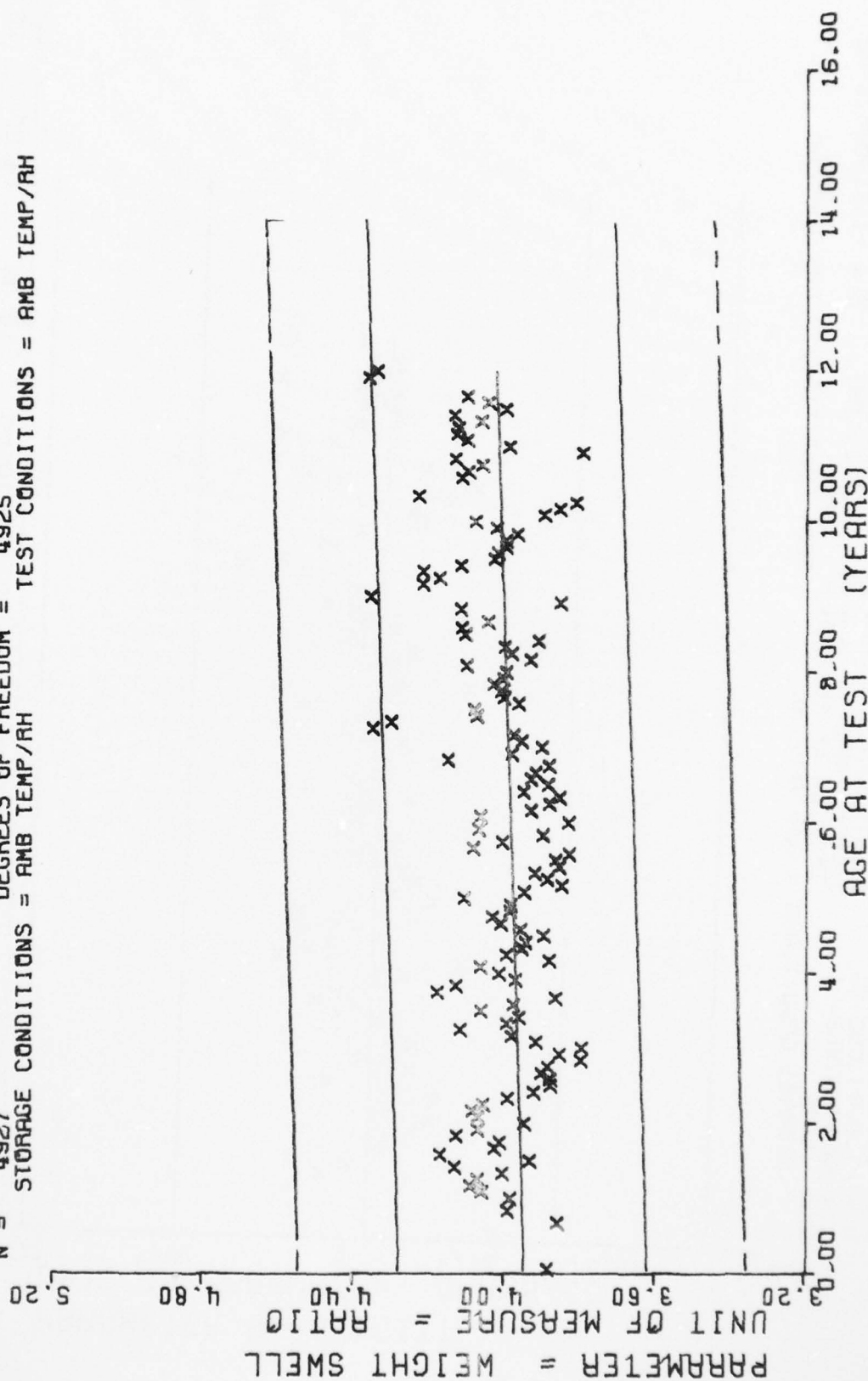
This sample size summary is applicable to figures 54 thru 56.

$Y = ((+6.5051413E+00) + (+2.5878919E-04) * X)$
 $F = +3.8966411E-01$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\alpha = +1.1124198E+00$
 $R = +8.8972790E-03$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_e = +4.1457292E-04$
 $t = +6.2423081E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_e = +1.1124887E+00$
 $N = 4924$ DEGREES OF FREEDOM = 4922
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1. WING 6 IP-H1011, SOL GEL, PERCENT EXTRACTABLES

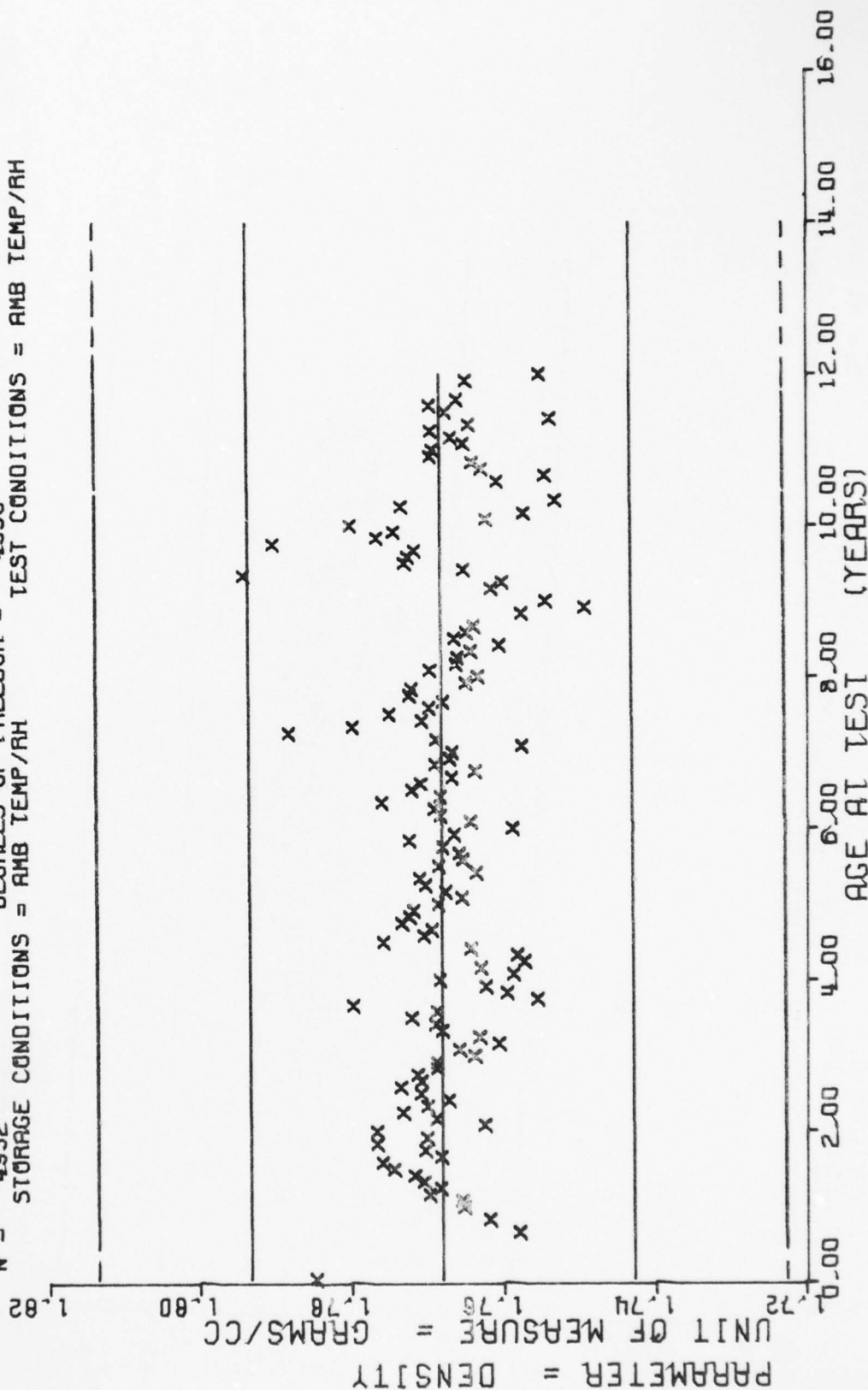
$Y = ((+3.9503108E+00) + (+5.3806274E-04) * X)$
 $F = +5.2635462E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +1.0283185E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $l = +7.2550301E+00$ SIGNIFICANCE OF l = SIGNIFICANT
 $N = 4927$ DEGREES OF FREEDOM = 4925
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1, WING 6, TP-M1011, SOL GEL, GEL SWELL RATIO

Figure 55

$F = +2.8890399E-01$
 $R = +7.6549188E-03$
 $t = +5.3749790E-01$
 $N = 4932$
 $Y = ((+1.7681209E+00) + (+3.0414244E-06) * X)$
 SIGNIFICANCE OF F = NOT SIGNIFICANT
 SIGNIFICANCE OF R = NOT SIGNIFICANT
 SIGNIFICANCE OF t = NOT SIGNIFICANT
 DEGREES OF FREEDOM = 4930
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



STAGE 1, WING 6, TP-H1011, 90L GEL, DENSITY

Figure 56

AD-A063 093

OGDEN AIR LOGISTICS CENTER HILL AFB UTAH PROPELLANT L--ETC F/G 21/9.2
PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1 PHASE E, --ETC(U)
OCT 78 J A THOMPSON
MANCP-405(78)

UNCLASSIFIED

2 OF 2

88093

NL



END
DATE
FILMED

3--79
DDC

55 IF 12

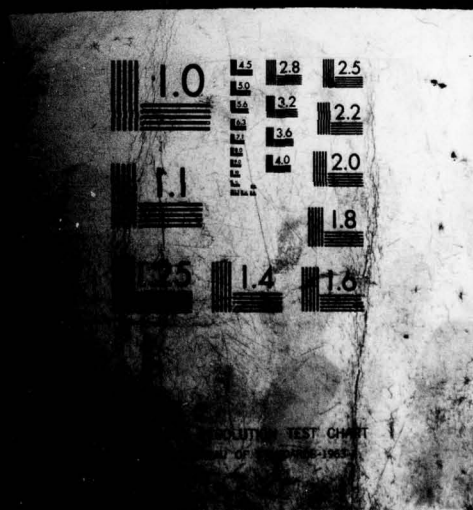
2

OF

2

AD

063 093



*** SAMPLE SIZE SUMMARY ***

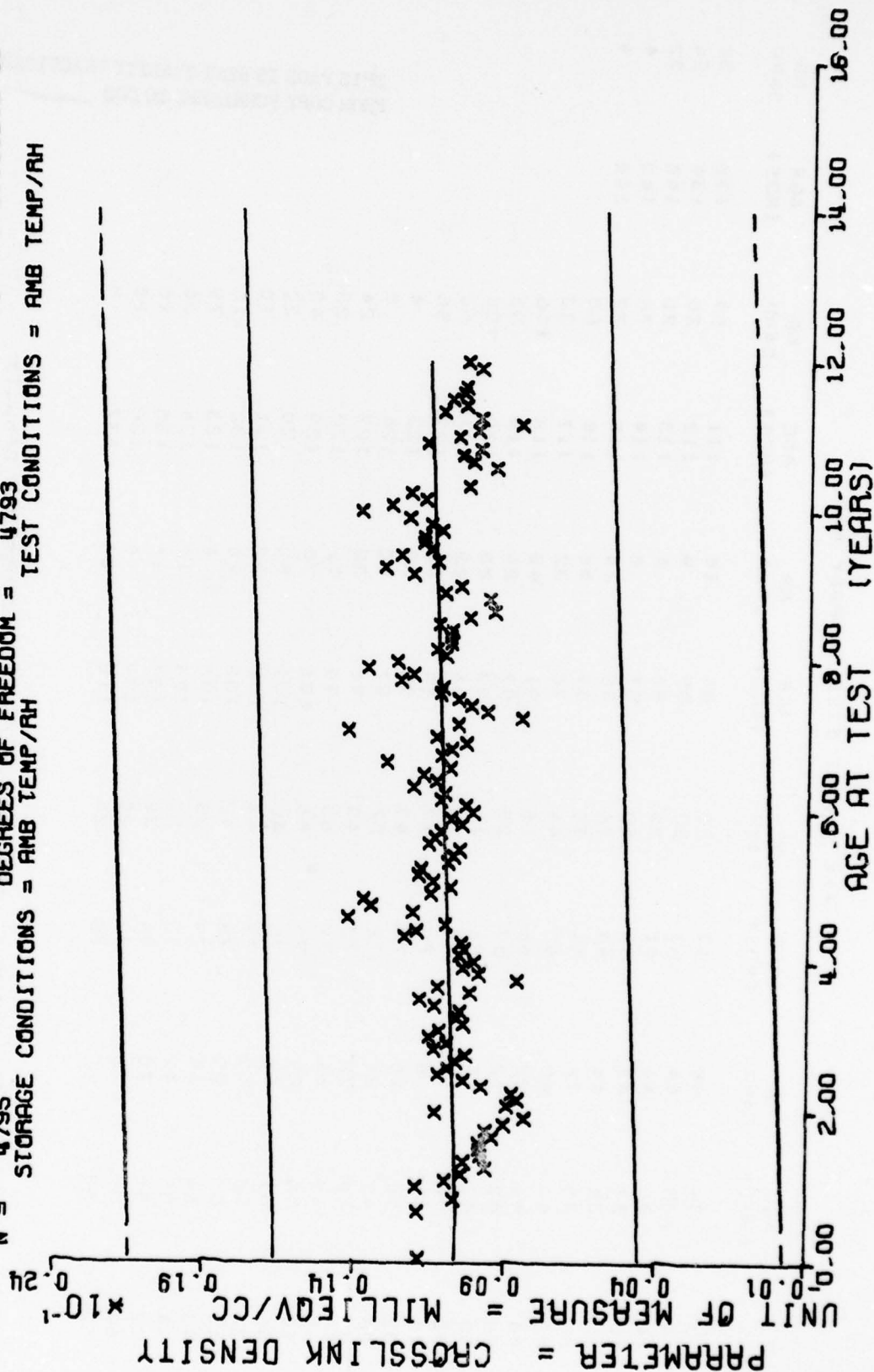
AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
1	3	34	48	59	32	84	16	111	52	138	30		
8	4	35	64	60	32	85	9	112	20	139	54		
10	24	36	44	61	32	86	4	113	20	140	22		
12	12	37	48	62	40	87	8	114	76	143	4		
13	32	38	44	63	36	88	24	115	72	144	4		
14	36	39	32	64	56	89	36	116	60				
15	20	40	40	65	44	90	32	117	32				
16	20	41	28	66	16	91	40	118	116				
17	28	42	12	67	28	92	24	119	95				
18	32	43	16	68	16	93	20	120	100				
19	52	44	4	69	12	94	28	121	68				
20	12	45	8	70	12	95	28	122	56				
21	32	46	16	71	40	96	32	123	4				
22	28	47	36	72	52	97	40	124	8				
23	24	48	32	73	40	98	32	127	24				
24	8	49	44	74	80	99	72	128	20				
25	40	50	20	75	56	100	76	129	48				
26	56	51	52	76	40	101	52	130	20				
27	32	52	100	77	44	102	32	131	70				
28	44	53	100	78	42	103	28	132	116				
29	43	54	14	79	38	104	8	133	79				
30	44	55	42	80	50	106	12	134	36				
31	72	56	70	91	32	107	16	135	16				
32	64	57	36	82	20	108	4	136	20				
33	52	58	70	83	24	110	24	137	8				

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDG

STAGE 1. WING 6. TP-H1011. SOL GEL. CROSSLINK DENSITY

This sample size summary is applicable to figure 57.

$Y = ((+1.0580440E-02) + (+7.8672377E-06) * X)$
 $F = +3.1725302E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G = +3.6496717E-03$
 $R = +8.1089867E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +1.3967522E-06$
 $t = +5.6325218E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_1 = +3.6380321E-03$
 $N = 4795$ DEGREES OF FREEDOM = 4793
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1, WING 6, TP-H1011, SOL GEL, CROSSLINK DENSITY

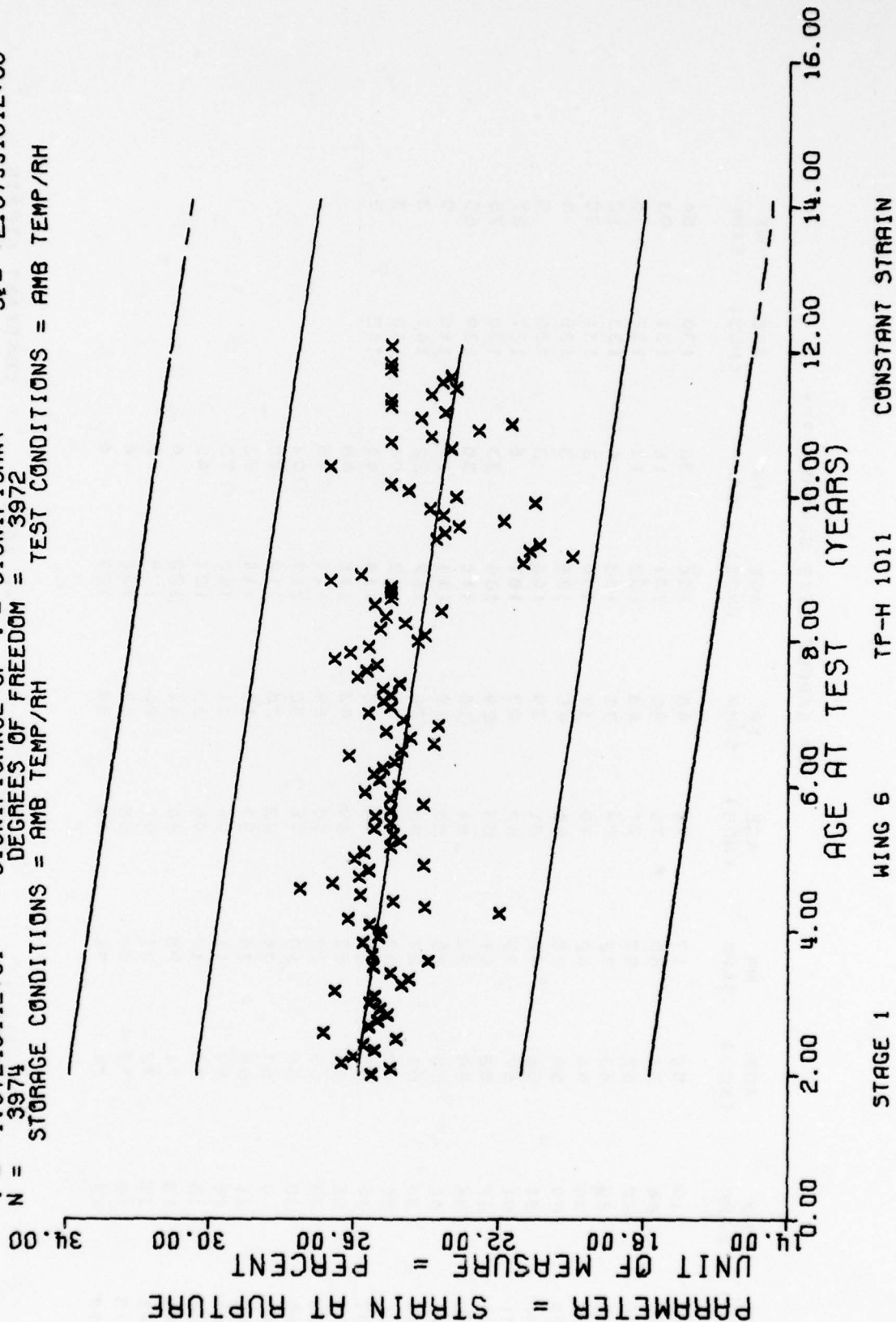
Figure 57

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
24	19	50	17	75	48	100	36	130	54
25	64	51	60	76	46	101	18	131	93
26	22	52	90	77	43	102	11	132	18
27	29	53	72	78	72	103	6	133	12
28	34	54	42	79	17	104	3	134	30
29	59	55	28	80	48	105	3	135	6
30	31	56	62	81	39	106	3	136	9
31	51	57	69	82	23	107	6	137	27
32	67	58	51	83	29	108	33	138	75
33	56	59	22	84	16	110	30	139	60
34	61	60	20	85	18	111	17	140	9
35	36	61	27	86	24	112	22	141	3
36	26	62	63	87	30	113	104	142	3
37	34	63	58	88	23	114	44	145	3
38	26	64	65	89	43	115	48		
39	33	65	22	90	54	116	45		
40	30	66	10	91	30	117	101		
41	9	67	36	92	26	118	28		
42	21	68	26	93	16	119	63		
43	24	69	11	94	31	120	75		
44	10	70	17	95	33	121	42		
46	13	71	28	96	41	122	6		
47	15	72	21	97	86	123	6		
48	19	73	66	98	67	124	6		
49	43	74	54	99	38	125	6		

STAGE 1	WING 6	TP-H 1011	CCASTANT STRAIN
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
43	43	43	43
44	44	44	44
45	45	45	45
46	46	46	46
47	47	47	47
48	48	48	48
49	49	49	49
50	50	50	50
51	51	51	51
52	52	52	52
53	53	53	53
54	54	54	54
55	55	55	55
56	56	56	56
57	57	57	57
58	58	58	58
59	59	59	59
60	60	60	60
61	61	61	61
62	62	62	62
63	63	63	63
64	64	64	64
65	65	65	65
66	66	66	66
67	67	67	67
68	68	68	68
69	69	69	69
70	70	70	70
71	71	71	71
72	72	72	72
73	73	73	73
74	74	74	74
75	75	75	75
76	76	76	76
77	77	77	77
78	78	78	78
79	79	79	79
80	80	80	80
81	81	81	81
82	82	82	82
83	83	83	83
84	84	84	84
85	85	85	85
86	86	86	86
87	87	87	87
88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

This sample size summary is applicable to figure 58.

$Y = ((+2.6480863E+01) + (-2.3701098E-02) * X)$
 $F = +3.5061230E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\alpha = +2.7884521E+00$
 $R = -2.8480029E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +1.2657703E-03$
 $t = +1.8724644E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +2.6733101E+00$
 $N = 3974$ DEGREES OF FREEDOM = 3972
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



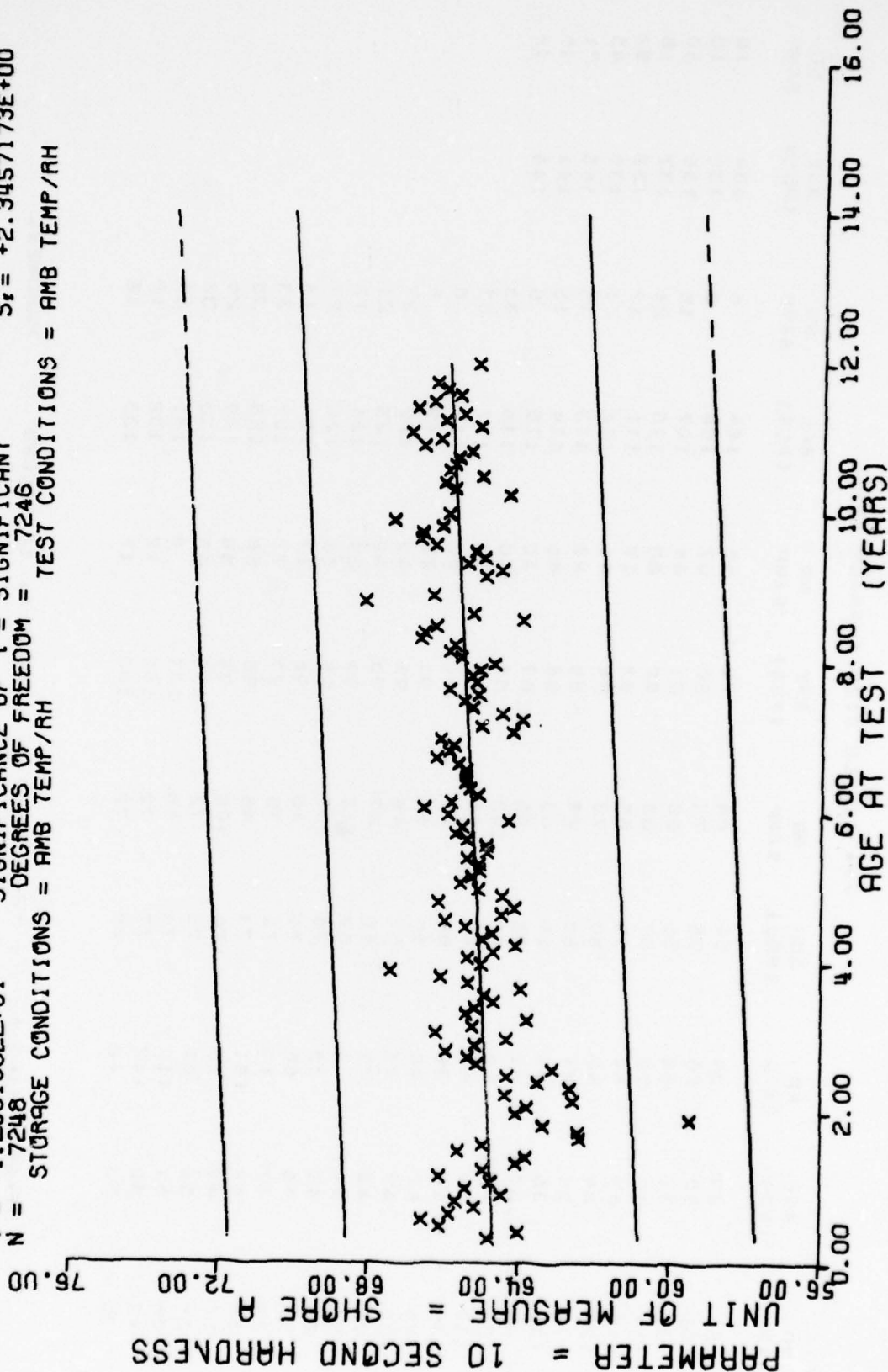
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
4	66	29	39	54	54	75	46	104	6	134	18
5	108	30	66	55	73	80	57	106	5	135	18
6	126	31	59	56	60	81	84	107	18	136	30
7	117	32	70	57	83	82	68	110	21	137	18
8	117	33	59	58	69	83	17	111	12	138	52
9	129	34	47	59	73	84	41	112	21	139	45
10	114	35	64	60	85	85	20	113	45	140	21
11	126	36	91	61	60	86	46	114	15	141	15
12	93	37	35	62	66	87	30	115	6	144	18
13	108	38	66	63	102	88	50	116	33		
14	110	39	46	64	64	89	33	117	33		
15	139	40	35	65	56	90	64	118	6		
16	126	41	48	66	63	91	25	119	9		
17	136	42	33	67	48	92	40	120	27		
18	108	43	31	68	87	93	32	123	21		
19	52	44	3	69	113	94	29	124	12		
20	27	45	35	70	137	95	56	125	27		
21	50	46	66	71	46	96	17	126	18		
22	33	47	49	72	75	97	73	127	33		
23	35	48	101	73	45	98	58	128	33		
24	57	49	70	74	100	99	58	129	24		
25	36	50	61	75	73	100	48	130	36		
26	66	51	112	76	80	101	8	131	35		
27	42	52	112	77	72	102	12	132	18		
28	36	53	42	78	72	103	16	133	18		

STAGE I WING 6 TP-H 1011 SHORE A. 10 SECOND HARDNESS

This sample size summary is applicable to figure 59.

$Y = ((+6.4675035E+01) + (+9.4631888E-03) * X)$
 $F = +1.5829872E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +2.3710380E+00$
 $R = +1.4621662E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +7.5214019E-04$
 $t = +1.2581682E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_f = +2.3457173E+00$
 $N = 7248$ DEGREES OF FREEDOM = 7246
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 WING 6 7P-H 1011 SHORE A, 10 SECOND HARDNESS

Figure 59

*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
8	3	34	39	59	24	84	9	115	56
10	15	35	50	60	13	85	3	116	55
11	1	36	39	61	10	86	3	117	7
12	6	37	10	62	17	87	3	118	10
13	15	38	5	63	20	88	12	120	39
14	13	39	10	64	40	89	24	121	12
15	16	40	11	65	27	90	36	129	3
16	17	41	4	66	18	91	24	130	36
17	18	42	12	67	8	92	9	131	33
18	19	43	4	68	5	93	17	132	5
19	22	44	7	69	4	94	15	133	6
20	35	45	4	70	7	95	19	134	18
21	13	46	9	71	2	96	18	135	25
22	13	47	13	72	6	97	38	136	3
23	15	48	4	73	2	98	40	139	12
24	13	49	30	74	1	99	26	140	12
25	22	50	13	75	30	100	23		
26	27	51	38	76	26	101	21		
27	36	52	39	77	22	102	8		
28	38	53	47	78	13	103	6		
29	43	54	37	79	7	105	9		
30	24	55	25	80	21	106	6		
31	51	56	18	81	24	108	3		
32	42	57	19	82	7	113	3		
33	54	58	16	83	9	114	11		

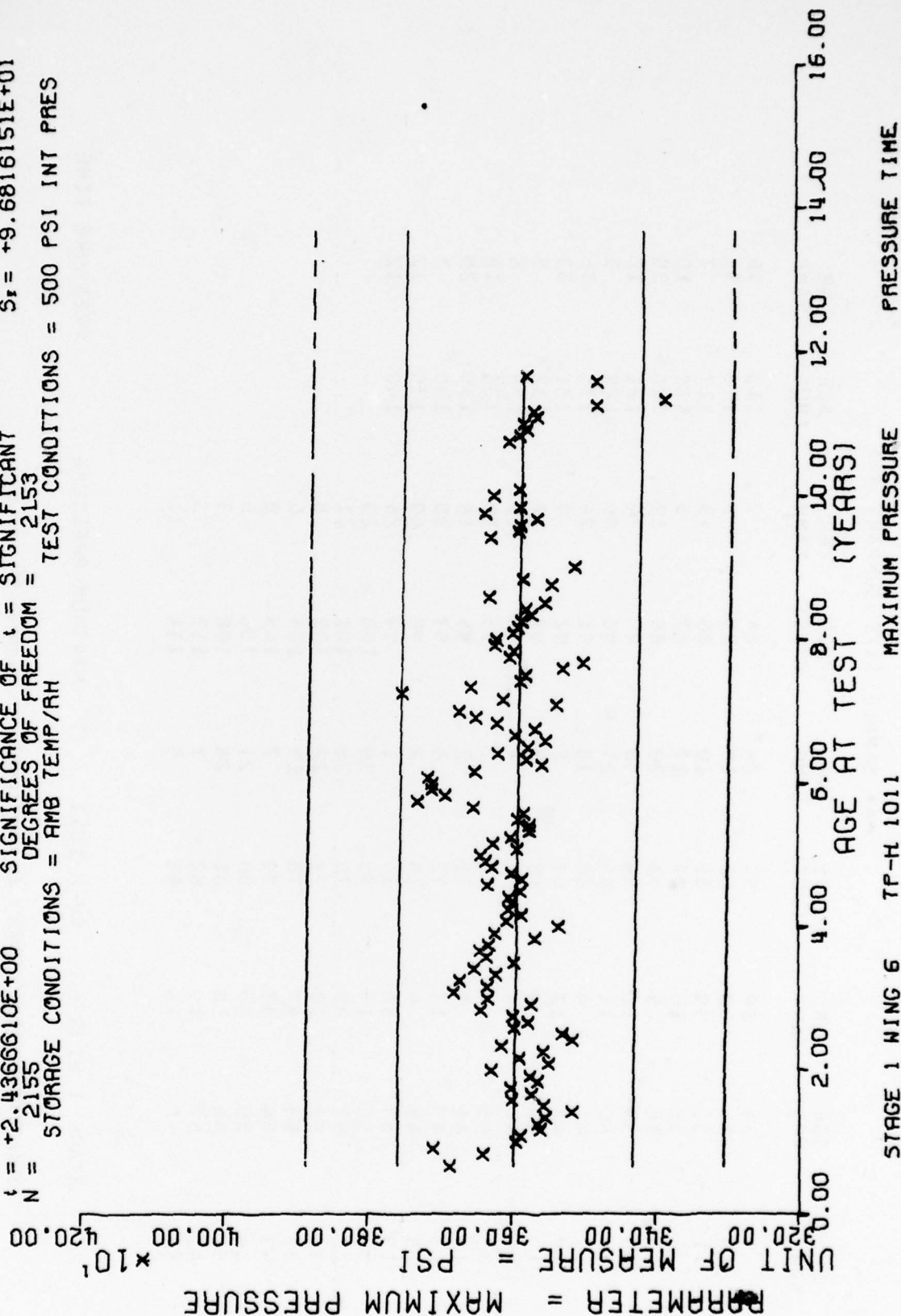
PRESSURE TIME

MAXIMUM PRESSURE

STAGE 1 WING 6 TP-H 1011

This sample size summary is applicable to figures 60 and 61.

$Y = ((+3.5983647E+03) + (-1.4161747E-01) * X)$
 $F = +5.9373170E+00$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -5.2441499E-02$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +2.4366610E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 2155$ DEGREES OF FREEDOM = 2153
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 500 PSI INT PRES



$Y = ((+6.914411E-01) + (-1.4635562E-04) * X)$
 $F = +L.7140301E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_1 = +5.9108143E-02$
 $R = -8.8872076E-02$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +3.5350876E-05$
 $t = +4.1400847E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +5.8887926E-02$
 $N = 2155$ DEGREES OF FREEDOM = 2153
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = 500 PSI INT PRES

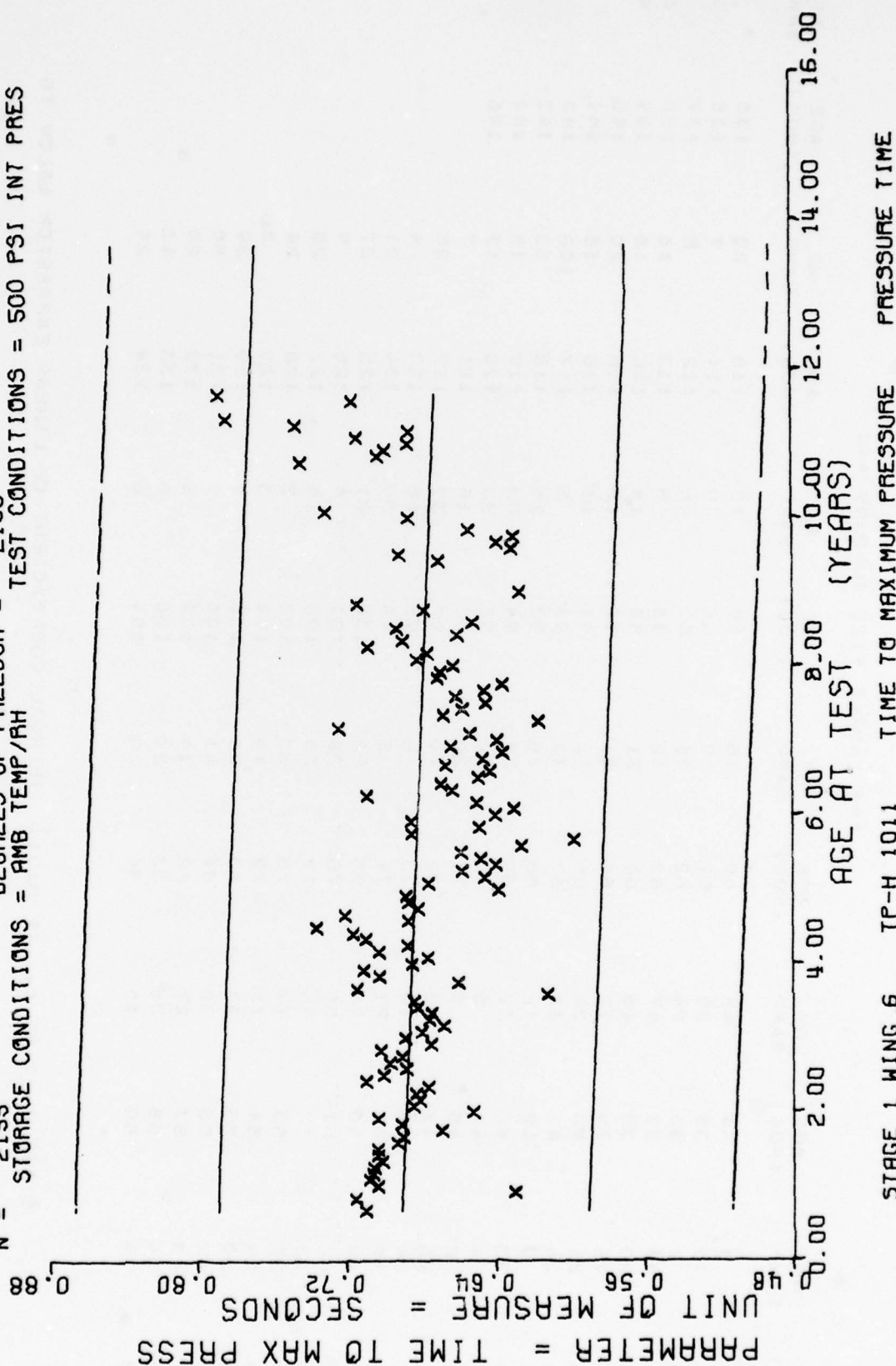


Figure 61

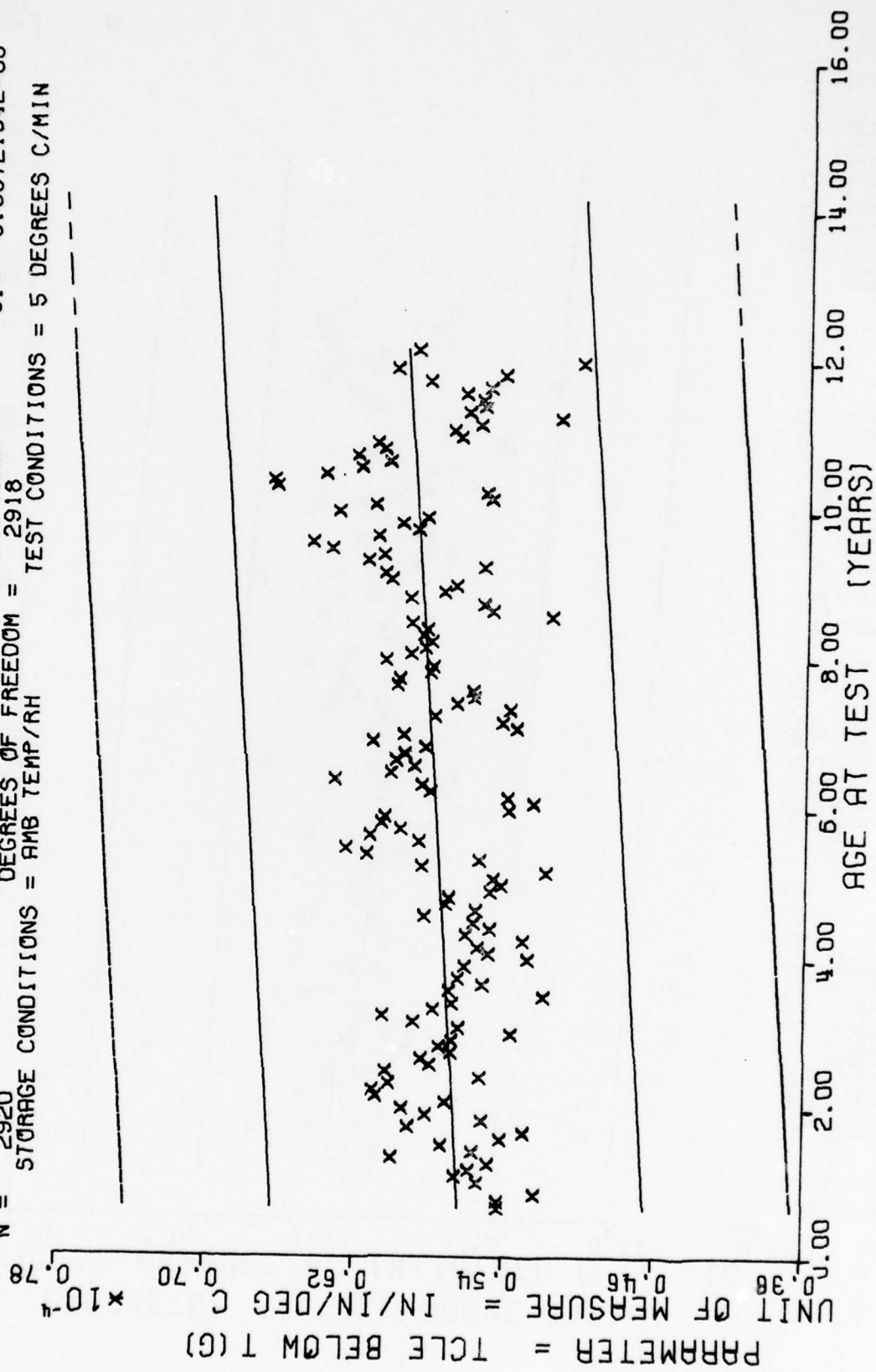
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
8	3	34	48	60	15	85	13	110	20	135	8	135	20	135	8	135	20	135	8	135	20
9	10	35	36	61	9	86	9	111	7	136	11	136	7	136	11	136	7	136	11	136	7
10	7	36	24	62	15	87	6	112	5	137	9	137	5	137	9	137	5	137	9	137	5
12	22	37	47	63	12	88	5	113	16	138	60	138	16	138	60	138	16	138	60	138	16
13	29	38	15	64	21	89	14	114	18	139	41	139	18	139	41	139	18	139	41	139	18
14	15	39	12	65	21	90	15	115	20	140	6	140	20	140	6	140	20	140	6	140	20
15	21	40	24	66	12	91	11	116	15	141	2	141	15	141	2	141	15	141	2	141	15
16	24	41	18	67	14	92	5	117	108	142	2	142	108	142	2	142	108	142	2	142	108
17	9	42	12	68	25	93	25	118	63	143	2	143	63	143	2	143	63	143	2	143	63
18	33	43	12	69	32	94	23	119	15	144	2	144	15	144	2	144	15	144	2	144	15
19	4	44	6	70	12	95	33	120	13	146	2	146	13	146	2	146	13	146	2	146	13
20	8	45	9	71	20	96	16	121	7				7				7				
21	25	47	32	72	10	97	32	122	28				28				28				
22	24	48	11	73	8	98	68	123	4				4				4				
23	12	49	27	74	5	99	36	124	21				21				21				
24	18	50	25	75	22	100	21	125	27				27				27				
25	42	51	64	76	23	101	4	126	9				9				9				
26	15	52	66	77	20	102	14	127	29				29				29				
27	27	53	77	78	35	103	5	128	24				24				24				
28	24	54	15	79	14	104	3	129	8				8				8				
29	39	55	33	80	28	105	9	130	39				39				39				
30	42	56	30	81	41	106	9	131	50				50				50				
31	48	57	27	82	14	107	8	132	20				20				20				
32	54	58	36	83	20	108	8	133	10				10				10				
33	39	59	15	84	9	109	6	134	29				29				29				

STAGE 1, WING 6, TP-H1011 THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TG

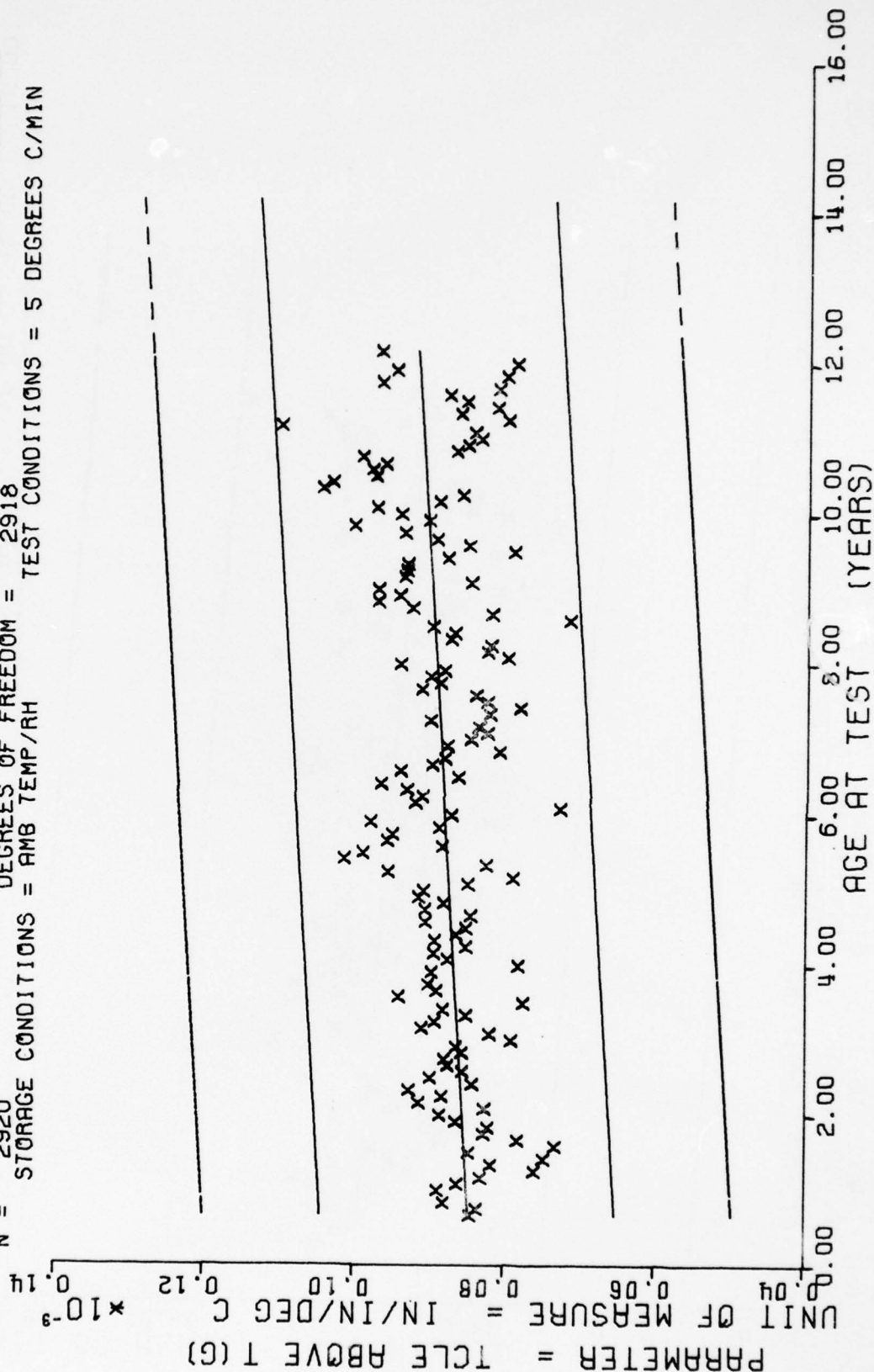
This sample size summary is applicable to figures 62 and 63.

$Y = ((+5.6257271E-05) + (+2.2973086E-08) * X)$
 F = +6.4527954E+01 SIGNIFICANCE OF F = SIGNIFICANT $\sigma_f = +6.0318039E-06$
 R = +1.4708950E-01 SIGNIFICANCE OF R = SIGNIFICANT $S_e = +2.8598641E-09$
 t = +8.0329293E+00 SIGNIFICANCE OF t = SIGNIFICANT $S_r = +5.9672194E-06$
 N = 2920 DEGREES OF FREEDOM = 2918
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 5 DEGREES C/MIN



STAGE 1, WING 6, 7P-H1011 THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TC
 Figure 62

$F = +9.3037801E+01$ SIGNIFICANCE OF F = (+5.4445243E-08) * X)
 $R = +1.7578087E-01$ SIGNIFICANT
 $t = +9.6456104E+00$ SIGNIFICANT
 $N = 2920$ DEGREES OF FREEDOM = 2918
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 5 DEGREES C/MIN



STAGE 1, WING 6, TP-H1011, THERMAL COEFFICIENT OF LINEAR EXPANSION ABOVE TG

Figure 63

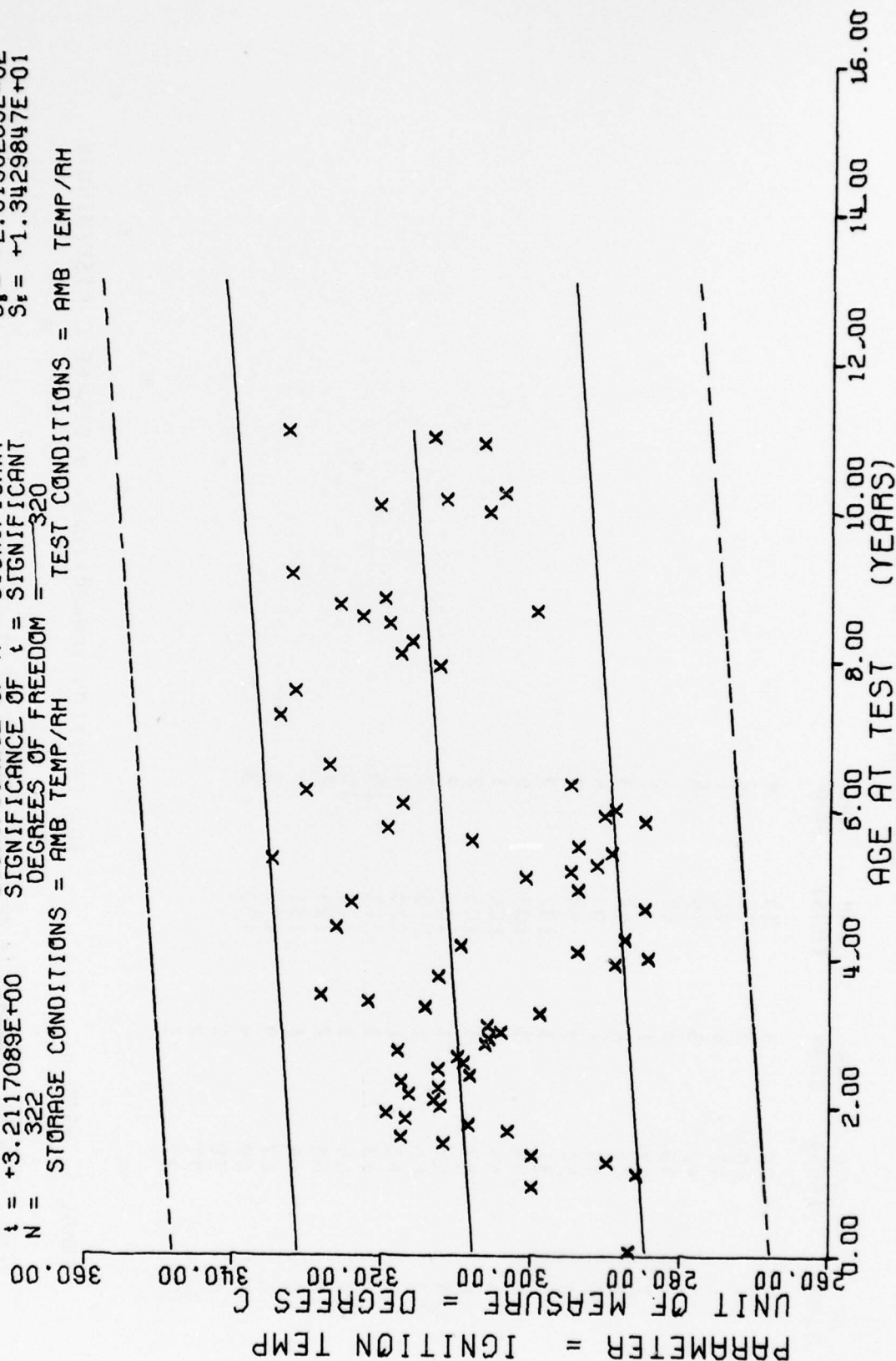
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
1	3	39	3	73	4
11	1	40	3	75	2
13	1	41	3	76	1
15	1	42	3	79	6
16	1	45	3	87	1
18	7	47	1	91	1
19	2	48	2	95	3
20	4	49	1	97	6
21	4	50	3	99	3
22	20	51	3	102	3
23	4	53	3	103	6
24	4	56	1	104	3
25	6	57	3	105	2
26	14	59	1	106	2
27	2	61	1	110	2
28	4	62	1	120	4
29	14	63	2	121	10
30	12	64	3	122	16
31	10	65	2	123	2
32	2	66	1	131	4
33	6	67	4	132	8
34	10	69	4	133	3
35	9	70	1		
36	22	71	2		
37	12	72	1		

STAGE I WING 6 TGA IGNITION TEMPERATURE, 9 DEGREE C RISE/MINUTE

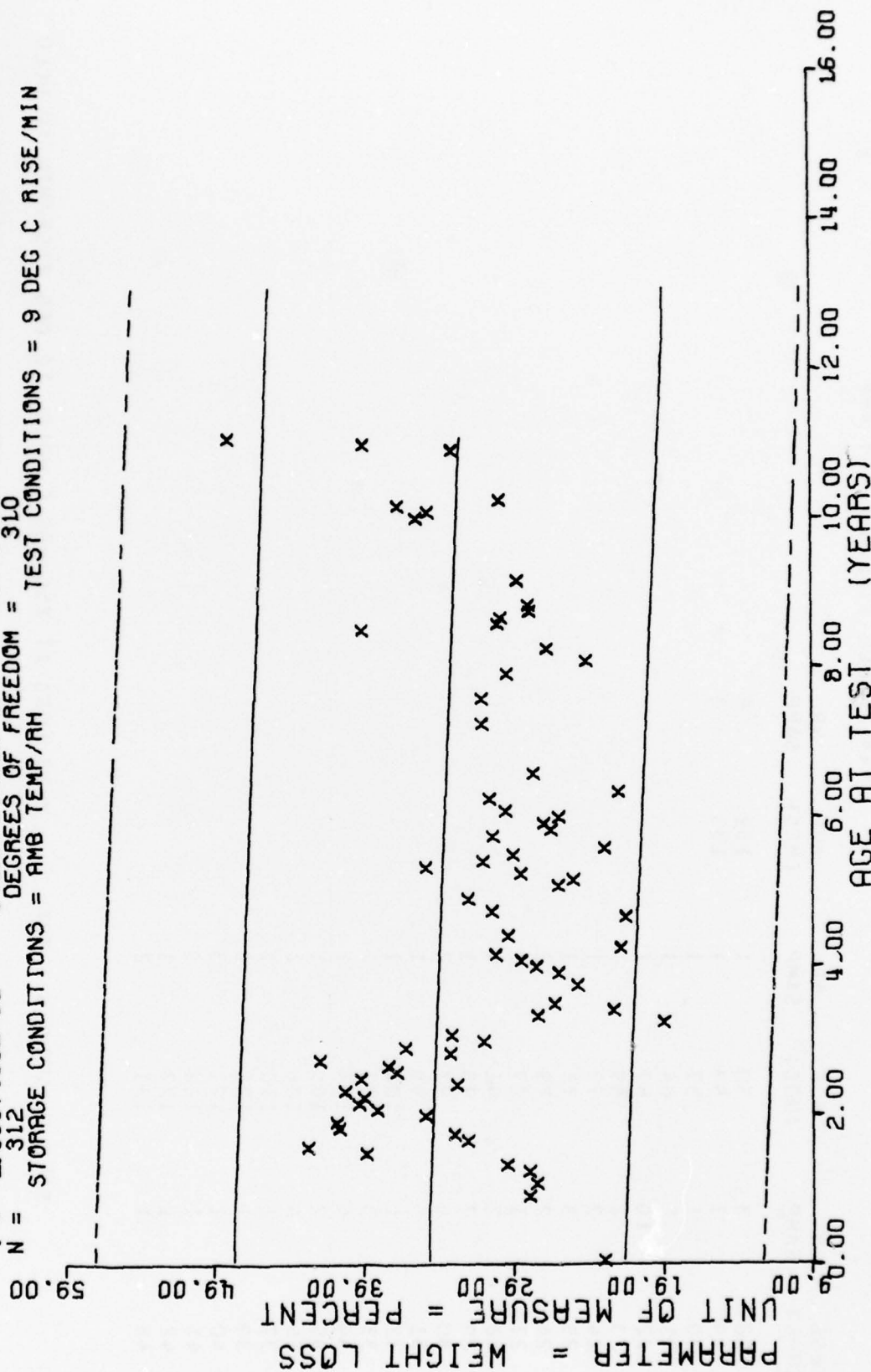
This sample size summary is applicable to figures 64 and 65.

$Y = ((+3.0797055E+02) + (+6.4652611E-02) * X)$
 $F = +1.0315074E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_f = +1.3623313E+01$
 $R = +1.7671442E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +2.0130283E-02$
 $t = +3.2117089E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +1.3429847E+01$
 $N = 322$ DEGREES OF FREEDOM = 320
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE I WING 6
 TGA IGNITION TEMPERATURE, 9 DEGREE C RISE/MINUTE
 Figure 64

$Y = ((+3.4776418E+01) + (-L8157176E-02) * X)$
 $F = +2.5816251E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $S_f = +7.4606631E+00$
 $R = -9.0879279E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_R = +1.1300605E-02$
 $t = +L6067436E+00$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_t = +7.4417641E+00$
 $N = 312$ DEGREES OF FREEDOM = 310
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 9 DEG C RISE/MIN



STAGE I WING 6 TGA PERCENT WEIGHT LOSS AT IGNITION, 9 DEG C RISE/MIN

Figure 65

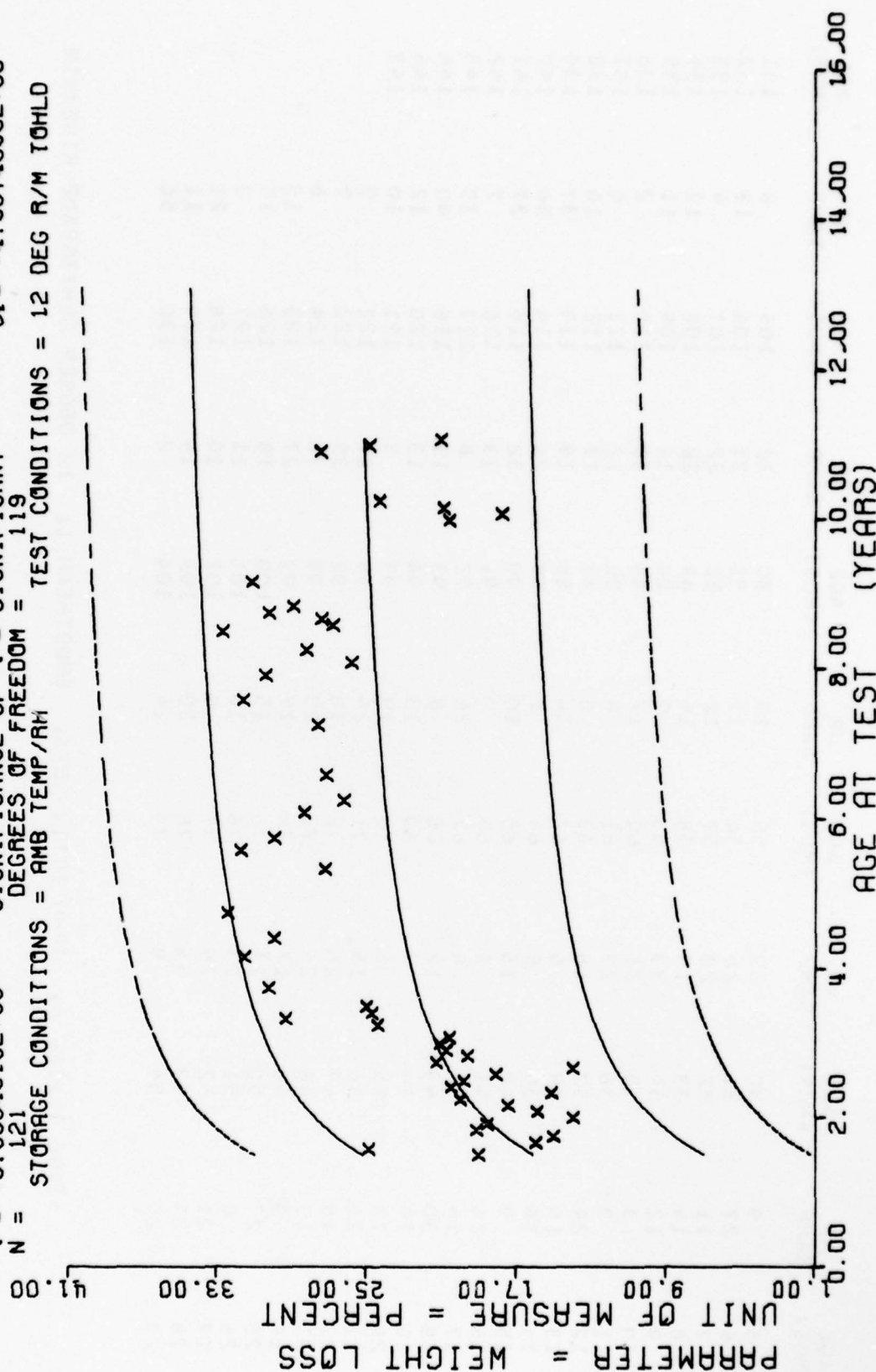
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
18	3	50	1	132	4
19	1	53	1	133	2
20	1	57	1		
21	2	64	1		
22	10	67	1		
23	2	69	1		
24	2	73	1		
25	3	75	1		
26	7	79	2		
27	1	87	1		
28	2	91	1		
29	7	95	1		
30	6	97	2		
31	5	99	1		
32	1	102	1		
33	3	103	2		
34	4	104	1		
35	2	105	1		
36	6	106	1		
37	1	110	1		
39	1	120	2		
40	1	121	5		
41	1	122	8		
42	1	123	1		
45	1	131	2		

SAGE I WING 6 TGA % WT LOSS AT 250 DEG C HOLD, 12 DEG RISE/MIN TO HCLO

This sample size summary is applicable to figure 66.

$Y = ((+2.6615207E+01) + (-1.8902122E+02) / X)$
 $F = +3.6463374E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +5.6539679E+00$
 $R = -4.8429990E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +3.1302723E+01$
 $t = +6.0384910E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +4.9674090E+00$
 $N = 121$ DEGREES OF FREEDOM = 119
 STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = 12 DEG R/M TOHLD



SAGE I WING 6 TGA % WT LOSS AT 250 DEG C HOLD, 12 DEG RISE/MIN TO HOLD

Figure 66

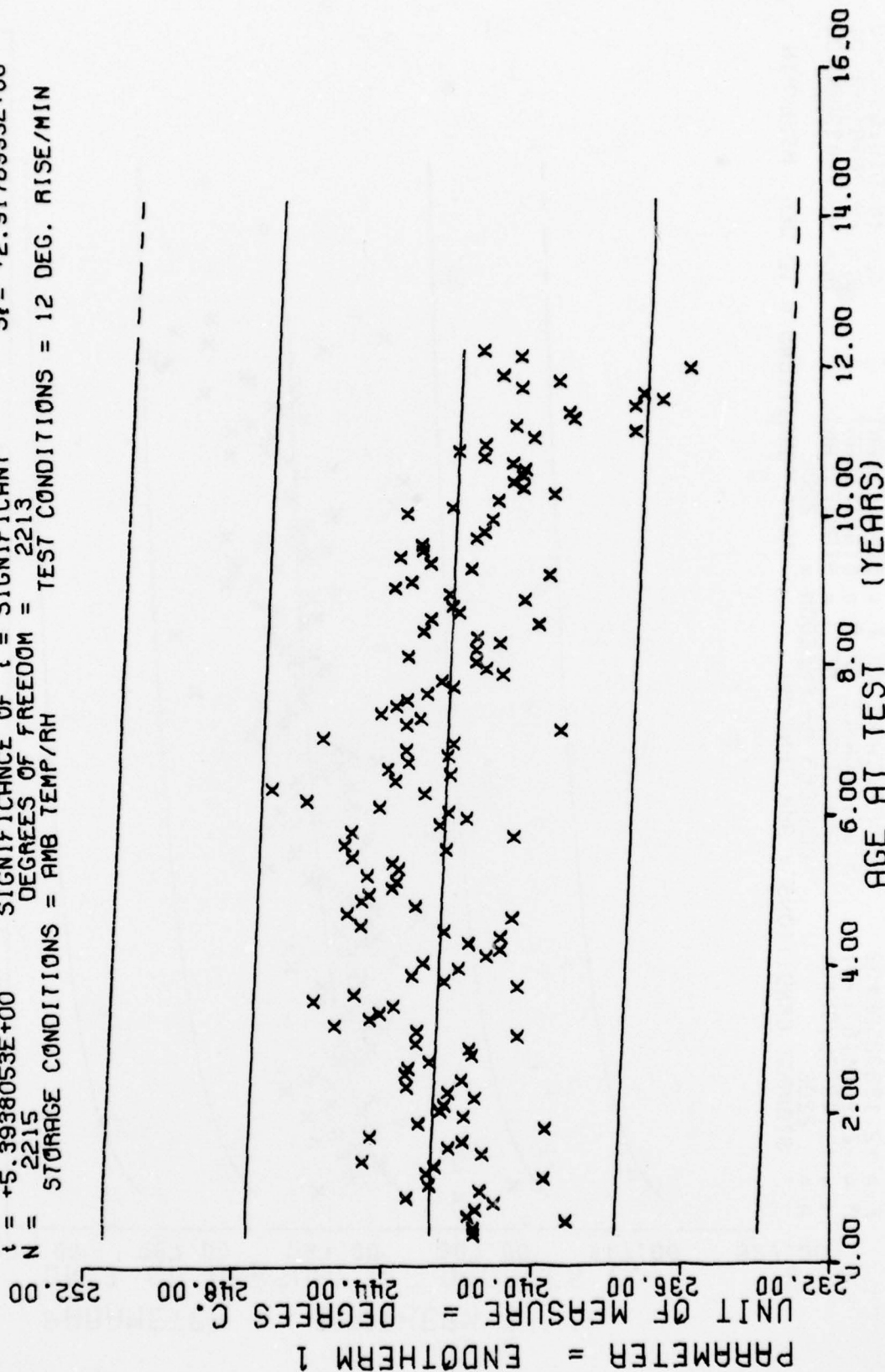
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
5	9	30	29	55	15	80	32	105	8	131	37	131	37
6	27	31	28	56	11	81	27	106	13	132	24	132	24
7	11	32	20	57	12	82	22	107	4	133	10	133	10
8	14	33	19	58	14	83	28	108	12	134	2	134	2
9	12	34	33	59	9	84	14	109	11	135	6	135	6
10	3	35	21	60	17	85	10	110	2	136	8	136	8
11	3	36	29	61	8	86	12	111	6	137	8	137	8
12	24	37	18	62	8	87	17	112	10	138	2	138	2
13	15	38	6	63	14	88	14	113	37	139	4	139	4
14	18	39	5	64	7	89	26	114	56	140	4	140	4
15	9	40	15	65	10	90	32	115	27	141	2	141	2
16	26	41	2	66	9	91	13	116	7	142	4	142	4
17	14	42	8	67	24	92	8	117	19	143	2	143	2
18	30	43	12	68	8	93	13	118	40	144	2	144	2
19	10	44	3	69	13	94	13	120	12	146	2	146	2
20	11	45	6	70	19	95	5	121	10	147	2	147	2
21	24	46	15	71	24	96	27	122	9				
22	16	47	26	72	18	97	35	123	3				
23	13	48	26	73	20	98	28	124	6				
24	9	49	17	74	15	99	27	125	15				
25	27	50	21	75	15	100	18	126	15				
26	20	51	23	76	18	101	11	127	3				
27	21	52	29	77	9	102	10	128	21				
28	25	53	34	78	20	103	14	129	11				
29	20	54	8	79	24	104	2	130	56				

STAGE 1 WING 6, TP-H 1011, DTA, ENDOTHERM 1, 12 DEGREE CENTIGRADE RISE/MIN

This sample size summary is applicable to figures 67 and 68.

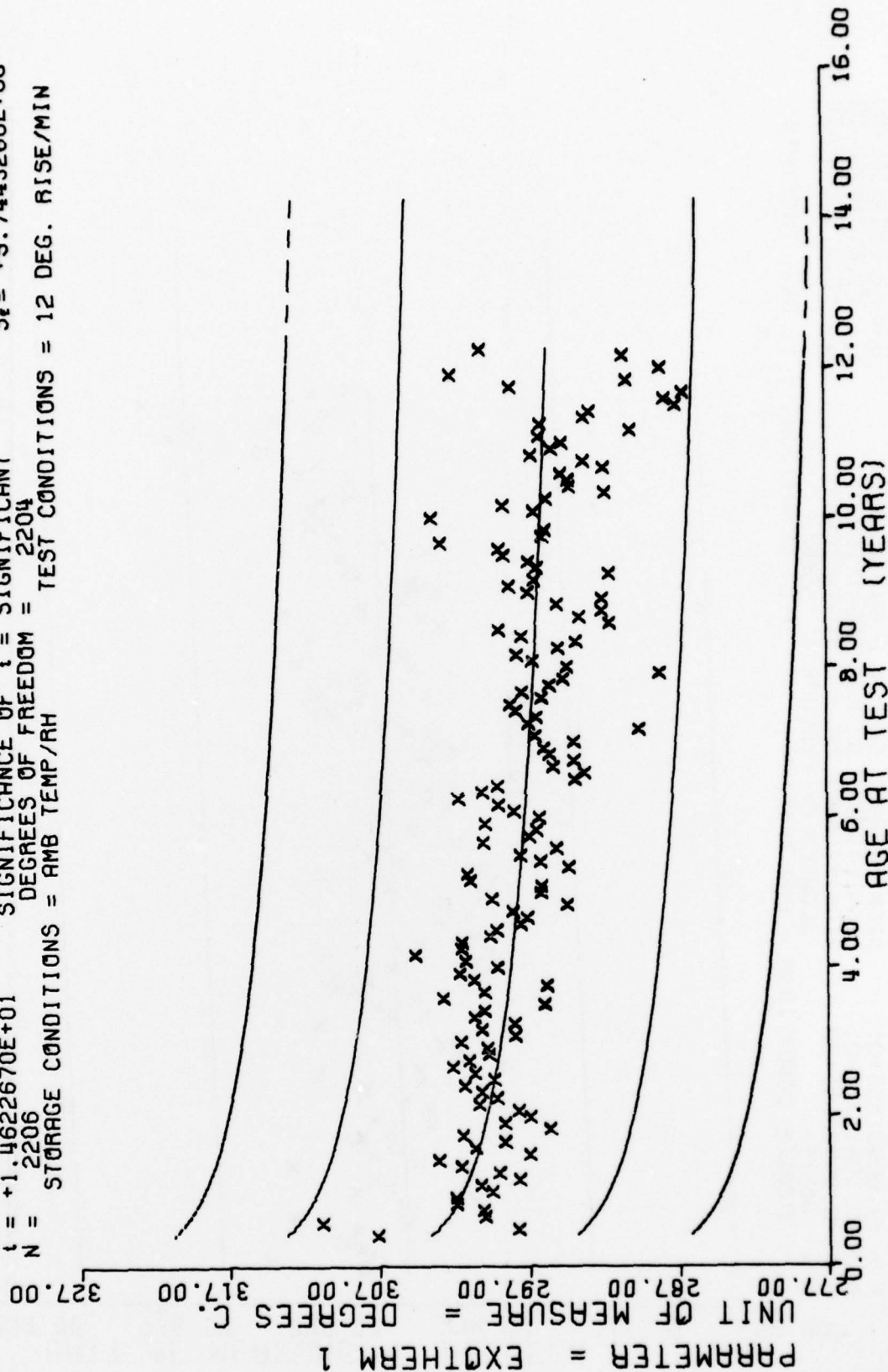
$Y = ((+2.4278316E+02) + (-8.7225697E-03) * X)$
 $F = +2.9093135E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -1.1391172E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +5.3938053E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 2215$ DEGREES OF FREEDOM = 2213
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 12 DEG. RISE/MIN



STAGE 1 WING 6, TP-H 1011, OIA, ENDOTHERM 1, 12 DEGREE CENTIGRADE RISE/MIN

Figure 67

$Y = ((+3.0745467E+02) + (-5.5092604E+00) * LOG(X))$
 $F = +2.1382250E+02$ SIGNIFICANCE OF F = SIGNIFICANT $\alpha = +6.0151594E+00$
 $R = -2.9738187E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +3.7676156E-01$
 $t = +1.4622670E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_e = +5.7443280E+00$
 $N = 2206$ DEGREES OF FREEDOM = 2204
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 12 DEG. RISE/MIN

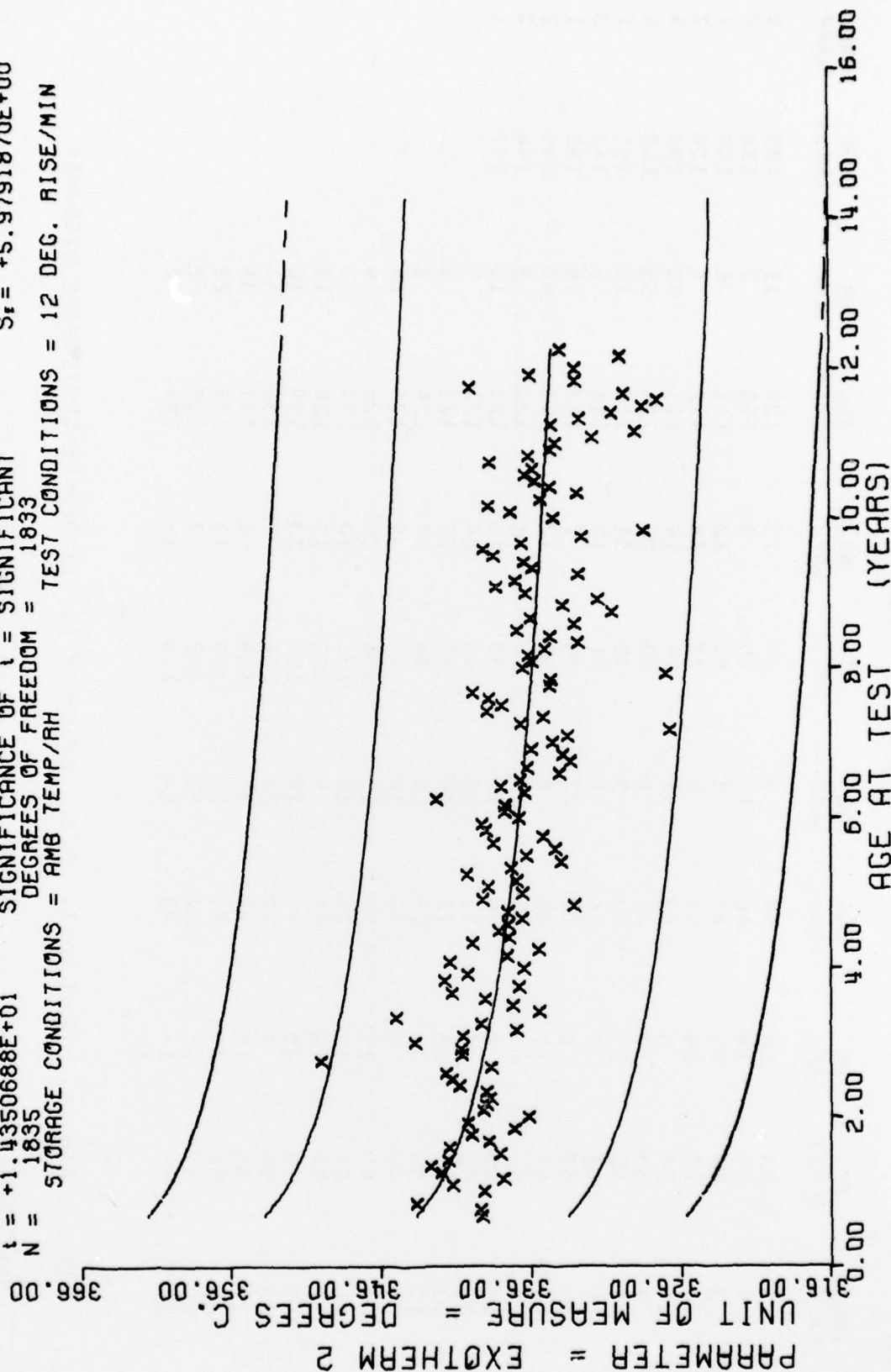


STAGE 1 WING 6, TP-H 1011, DTA, EXOTHERM 1, 12 DEGREE CENTIGRADE RISE/MIN

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
8	3	34	26	59	9	84	13	109	11	135	5
9	5	35	18	60	15	85	9	110	2	136	8
10	3	36	24	61	8	86	12	111	6	137	7
12	17	37	14	62	8	87	15	112	8	138	2
13	10	38	4	63	13	88	14	113	35	139	4
14	9	39	3	64	6	89	26	114	55	140	4
15	5	40	13	65	9	90	31	115	24	141	1
16	19	41	2	66	9	91	13	116	5	142	3
17	14	42	8	67	22	92	7	117	18	143	1
18	18	43	10	68	8	93	12	118	40	144	2
19	4	44	3	69	10	94	12	120	9	146	2
20	11	45	6	70	12	95	4	121	10	147	1
21	22	46	9	71	23	96	24	122	9		
22	13	47	21	72	15	97	27	123	3		
23	10	48	20	73	16	98	27	124	8		
24	9	49	9	74	14	99	25	125	15		
25	20	50	11	75	13	100	14	126	14		
26	16	51	14	76	16	101	10	127	3		
27	12	52	18	77	9	102	10	128	18		
28	19	53	25	78	19	103	13	129	10		
29	18	54	7	79	24	104	2	130	44		
30	22	55	15	80	32	105	7	131	35		
31	21	56	10	81	27	106	13	132	22		
32	20	57	11	82	22	107	2	133	8		
33	11	58	14	83	24	108	10	134	2		

This sample size summary is applicable to figure 69 and 71.

$Y = ((+3.5033314E+02) + (-7.3177867E+00) * LOG(X))$
 $F = +2.0594227E+02$ SIGNIFICANCE OF F = SIGNIFICANT $G = +6.3044170E+00$
 $R = -3.1781199E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +5.0992581E-01$
 $t = +1.4350688E+01$ SIGNIFICANCE OF t = SIGNIFICANT $S_2 = +5.9791870E+00$
 $N = 1835$ DEGREES OF FREEDOM = 1833
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = 12 DEG. RISE/MIN



STAGE 1 WING 6, TP-H 1011, DTA, EXOTHERM 2, 12 DEGREE CENTIGRADE RISE/MIN

Figure 69

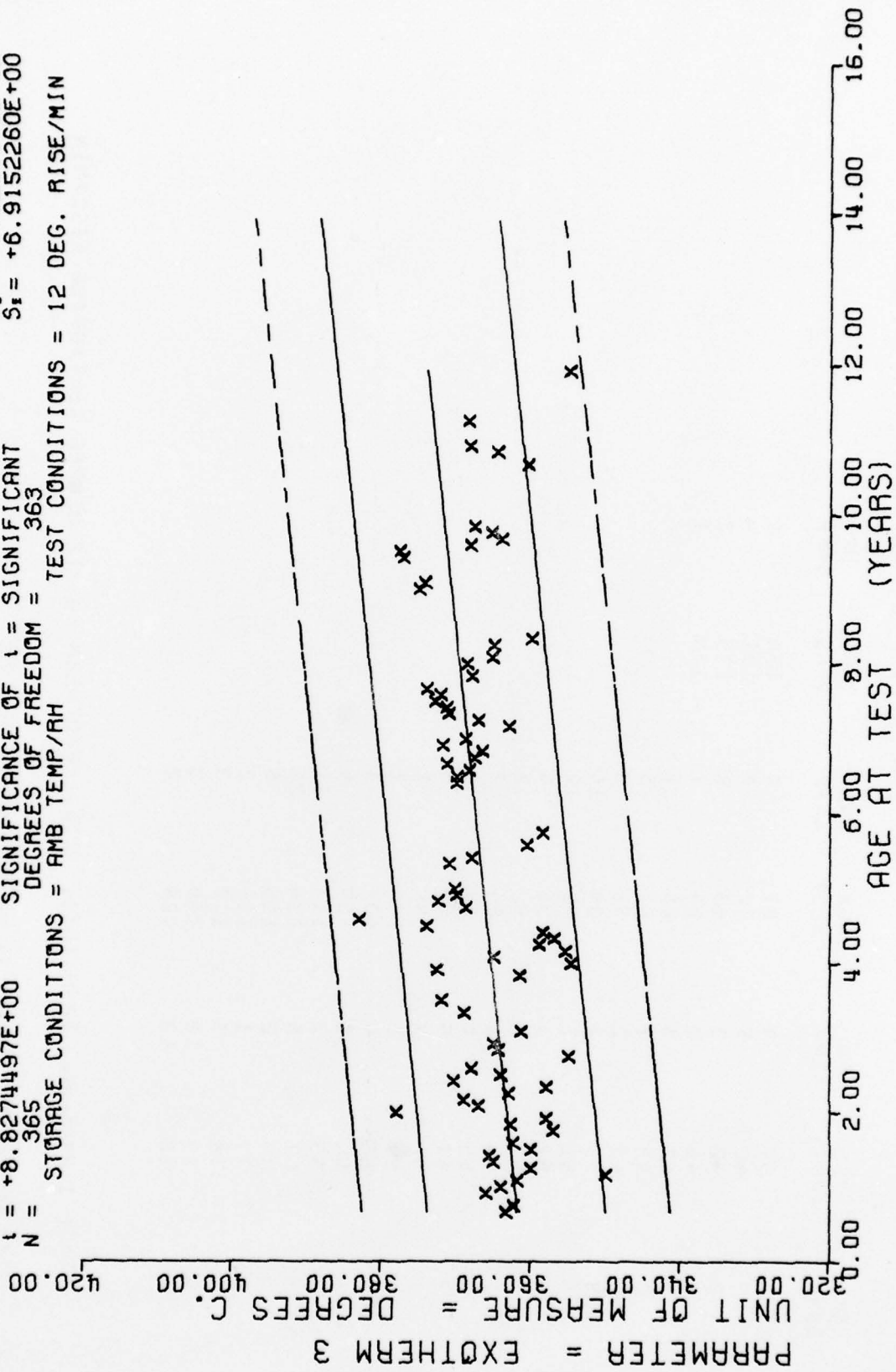
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP	AGE (MOS)	NR SAMP
8	3	37	3	81	9	130	9
9	7	40	5	82	7	131	4
11	3	42	3	83	8	135	2
12	4	46	5	84	7	143	1
13	5	47	3	86	1		
14	3	48	7	87	8		
15	1	49	2	88	8		
16	3	50	2	89	16		
17	5	51	1	90	12		
18	5	52	3	91	6		
19	6	53	4	92	2		
21	2	54	1	94	2		
22	4	55	1	96	6		
23	1	57	5	97	4		
24	1	58	2	99	1		
25	1	59	6	100	1		
26	2	60	4	108	3		
27	4	64	2	109	4		
28	3	65	2	113	11		
29	5	67	6	114	21		
30	9	69	2	115	5		
31	4	77	1	116	2		
33	4	78	3	117	3		
34	5	79	18	118	3		
35	4	80	12	128	2		

STAGE 1 WING 6, TP-H 1011, DTA, EXOTHERM 3, 12 DEGREE CENTIGRADE RISE/MIN

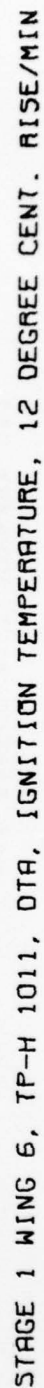
This sample size summary is applicable to figure 70.

$F = +7.7923868E+01$
 $R = +4.2039103E-01$
 $t = +8.8274497E+00$
 $N = 365$
 $Y = ((+3.6119828E+02) + (+9.0628567E-02) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 363
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = 12 DEG. RISE/MIN



STAGE 1 WING 6, TP-H 1011, DTA, EXOTHERM 3, 12 DEGREE CENTIGRADE RISE/MIN
 Figure 70

PARAMETER = IGNITION TEMPERATURE
UNIT OF MEASURE = DEGREES C.
360.00 360.00 400.00 420.00 440.00



- 105 -

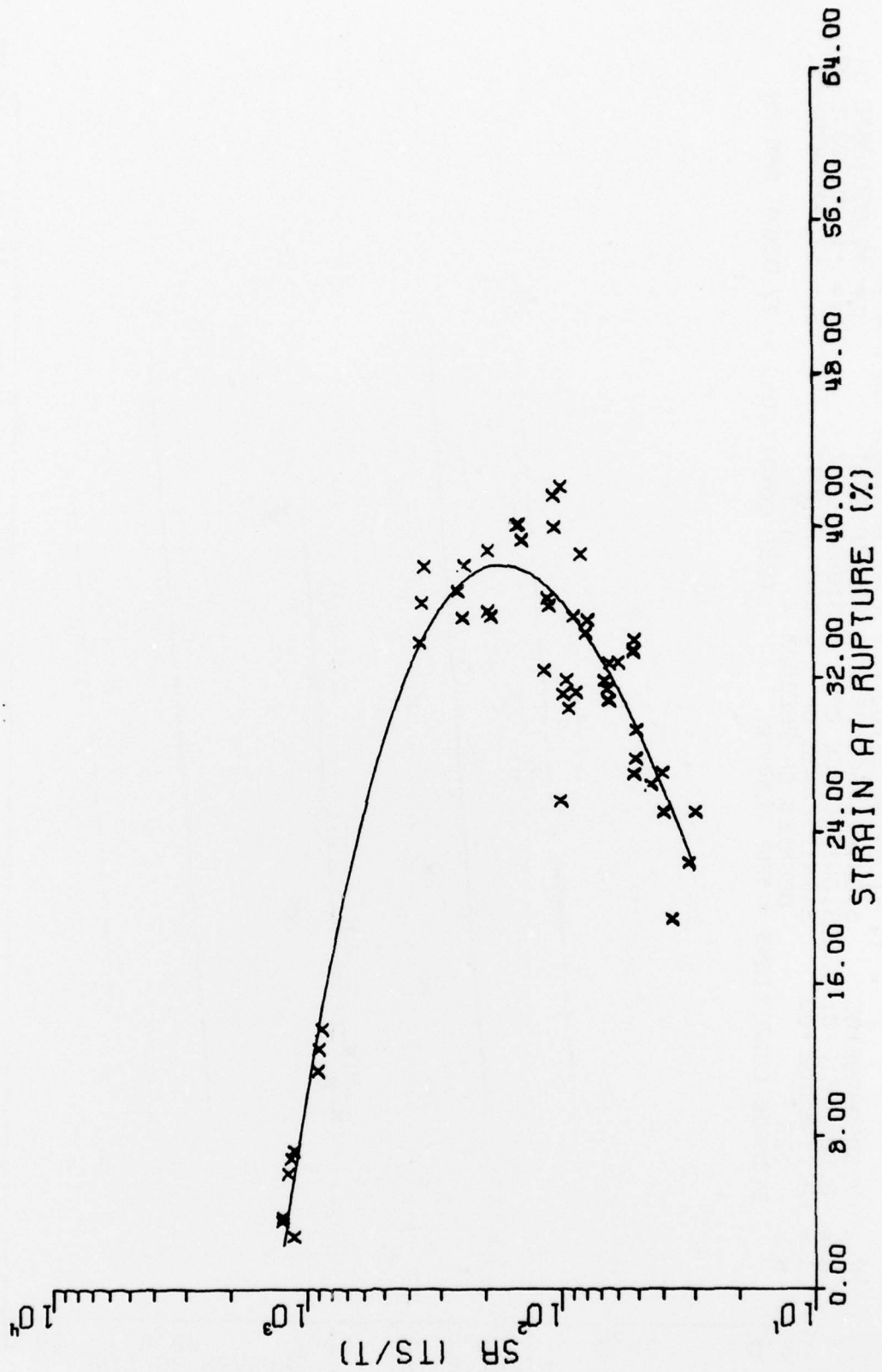
*** SAMPLE SIZE SUMMARY ***

AGE (MOS)	NR SAMP
26	13
31	12
36	11
56	5
57	13
59	14
65	12
91	7
94	14
120	12
121	12

STAGE I WING 6 TP-H1011 TEAR ENERGY TEST/TEMP=77 DEG F

This sample size summary is applicable to figure 72.

TEMPERATURE CORRECTED FAILURE ENVELOPE



FAILURE ENVELOPE (MOTOR/SN 0013913) STAGE 1, WING 6
Figure 73

DISTRIBUTION

	NR <u>COPIES</u>
OOALC	
MMWRME	1
MMWRMT	1
DDC (TISIR) Cameron Station, Alexandria, VA 22314	2
AFPRO, Thiokol Chemical Corporation Wasatch Division P.O. Box 524 Brigham City, Utah 84302 (Cy to R. E. Keating)	2
AFRPL (MKPB) Edwards AFB, CA 93523	1
SAC (LGMB) Offutt AFB, NB 68113	1
U. S. Naval Ordnance Station, Indian Head, MD 20640 Attn: Dr. James H. Wiegand Fleet Support Dept., Propulsion System Development Division, Code FS7	1
CPIA, Applied Physics Laboratory John Hopkins University Johns Hopkins Road Laurel, MD 20810 Attn: Dr. P.L. Nichols	1
Naval Plant Branch Representative Attn: Mr. David W. Pratt P.O. Box 157 Bacchus Works Magna, Utah 84044	1

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 405(78)	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Propellant Surveillance Report LGM-30 F & G Stage 1, Phase E Series VI, TP-H1011		5. TYPE OF REPORT & PERIOD COVERED Test Results-Semi-annual
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) John A. Thompson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Propellant Lab Section Directorate of Maintenance OO/ALC Hill AFB, Utah 84056		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS MMEMP Project M82934C-WNL17514
11. CONTROLLING OFFICE NAME AND ADDRESS Service Engineering Division Directorate of Materiel Management OO/ALC Hill AFB, Utah 84056		12. REPORT DATE Nov 1978
		13. NUMBER OF PAGES 126
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release, Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Solid Propellant Minuteman		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M82934CWNL17514. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (twelve and one half		

years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point.

Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system.