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LGM-30B, STAGE II DISSECTED MOTORS.(U)
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UNCLASSIFIED MANCP-414(79) NL

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

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LGM-30 B
STAGE II
DISSECTED
MOTORS
TEST REPORT

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PROPELLANT LAB SECTION

MANCP REPORT NR 414(79)

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ABSTRACT

This report contains test data from propellant and case bond materials from Minuteman Stage II dissected motors. Testing was performed in accordance with Service Engineering General Test Directive GTD-1 Dissect dated 28 June 1974 and Project M83258C. Statistical analysis includes data from both inner (ANP 2864) and outer (ANP 2862) propellant. Test samples were obtained from two dissected motors this test period. Data obtained from these two motors have been combined with earlier test data from these same two motors and from a third motor.

Linear regression plots using unique symbols to identify the three motors were used to indicate trends. Most of the propellant specimens were prepared and tested in the axial orientation, that is, parallel to the longitudinal axis of the motor.

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REFERENCES

Title and Report Nr	
Minuteman Stage II Surveillance Quarterly Report Weapon System 133A, Report Nr 214(71)	Jun 1971
Propellant Test Report, LGM-30 A & B Stage II Phase VI Series II, Report Nr 259(72)	Nov 1972
Air Force Contract F42600-72-2002 Aerojet Solid Propulsion Company	1972
LGM-30 Second Stage Component Materials Laboratory Testing, Service Engineering Division Directorate of Material Management, Test Directive Nr GTD-2C Amendment 3	Jul 1972
LGM-30 Stage II Dissected Motors Test Report Nr 269(73)	Jun 1973
LGM-30B Stage II Dissected Motors Test Report Nr 338(76)	May 1976
Ten Year Aging and Storage Program, Wings I Through V Minuteman Second-Stage Motors And Components, Aerojet-General Report 0162-01FAS-R	Nov 1967
LGM-30 Stage II Dissected Motors Test Report Nr 384(77)	Dec 1977

GLOSSARY OF SYMBOLS AND TERMS

Symbol	Definition
Crosshead Speed	The rate of travel of the crosshead which pulls on a tensile specimen. Dimensions: in/min
CSA	Cross-sectional Area. Dimensions: in^2
DSC	Differential Scanning Calorimetry
D(t)	Creep Compliance - ratio between strain and stress at a given time following application of a constant stress. Dimensions: in/in/psi
DTA	Differential Thermal Analysis
E	Young's Modulus - ratio between stress (acting to change length) and the strain produced by this stress. It is calculated from a portion of the curve where stress and strain are linearly related. Dimensions: lbs/in^2
EGL	Effective Gage Length. Dimensions: in
em	Tensile strain (fractional change in length) at maximum stress. Listed as EM in G085. Dimensions: in/in
er	Tensile strain at rupture. Listed as ER in G085. Dimensions: in/in
E(t)	Stress Relaxation Modulus - ratio between stress and strain at a given time following application of a constant strain. Dimensions: lbs/in^2
F	The ratio of the sum of the deviations from the regression line to $(S_E)^2$. This calculated value is compared with a table of critical values to determine whether or not the variation from the regression line is significant.
γ	Cohesive Tear Energy. Dimensions: lb/in

GLOSSARY OF SYMBOLS AND TERMS (CONT)

Symbol	Definition
JANNAF	Joint Army, Navy, NASA & Air Force Committee
MANCP	Propellant Laboratory Section, Ogden ALC
N	Number of test specimens represented
Ogden ALC	Ogden Air Logistics Center, Air Force Logistics Command
Linear Regression	A line with the general equation $Y = a + bx$ which best represents the trend of the mean test values with respect to time.
R	Linear Correlation Coefficient. It is the slope of the regression line corrected by the standard deviation of x over the standard deviation of y. The calculated value of R is compared with a table of critical values to determine whether or not the correlation of the samples is significant.
Sm	Maximum tensile stress (normal force per unit cross-sectional area). Listed as SM in GO-85, Dimensions: psi
Sr	Tensile stress at rupture. Listed as SR in GO-85, Dimensions: psi
S_y	Standard deviation (square root of variance)
S_B	Standard error of estimate of the regression coefficient.
S_E	Standard deviation of the data about the regression line (also $S_{y.x}$).
Strain Rate	The crosshead speed divided by the EGL. Dimensions: in/in/min
t	The ratio of the slope of the regression line to S_B. The calculated value of t is compared with a table of critical values to determine whether or not the slope of the regression line is significant.

GLOSSARY OF SYMBOLS AND TERMS (CONT)

Symbol	Definition
TCLE	Thermal Coefficient of Linear Expansion. Dimensions: $in/in/^{o}C$
T_g	Glass Transition Temperature. Dimension: ^{o}C
TGA	Thermogravimetric Analysis
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 limits. Presuming normal distribution, it can be expected that 99.73% of the inventory represented by the test samples would fall within this range.
90-90 Band	Assuming normal distribution, it can be stated with 90% confidence that 90% of the inventory represented by the test samples would fall within this range.
Significant	As used in the statistical sense, means a difference unlikely to have been the result of random sampling from some specified population.
S.D.	Standard Deviation

INTRODUCTION

A. PURPOSE:

1. To provide information on the structural reliability of the propellant and insulation materials in LGM-30 Stage II Motors in support of the Safeguard Program.

2. To provide age versus physical property trends, using statistical analysis as an aid in determining shelf/service life predictions of the motor's propellant.

3. To detect degradation of propellant and insulation materials physical properties, due to aging or environmental conditions.

B. BACKGROUND:

Since 1963, materials property testing has been performed on propellant specimens prepared from cartons of propellant used in motor manufacture. Similarly, insulation materials have been tested.

In 1971, all laboratory prepared insulation materials and case to propellant bond specimens were destroyed in a conditioning chamber malfunction. This incident, coupled with near depletion of propellant carton samples, necessitated a search for other sources of test materials. From a Force Modernization Program, some older motors became available for testing. Three motors were selected as being representative of the inventory and were dissected for testing. The oldest one, Motor S/N 0022135 is 6.9 months older than Motor S/N 0022583, which in turn is 6.2 months older than Motor S/N 0022788. To date, five test periods have been completed at annual intervals. There are no test results on Motor S/N 0022583 propellant this test period because the last of the available

material was tested the previous test period. Dissection of a replacement is being negotiated.

The last of the insulation materials from all three motors was tested the previous test period, thus there are no insulation materials test results in this report. Some case bond material from the two remaining motors was available and test results are included.

C. DISSECTION:

The motors were dissected and cut into segments as shown in Figures 1 and 2. Propellant specimen orientations are shown in Figure 3. The case bond shear and tensile specimens are illustrated in Figures 4 and 5 respectively.

D. MOTOR DATA:

Motor Nr	Cast Date	Age at Test
0022135	63162	15.0 years
0022583	64008	Not applicable
0022788	64197	13.7 years

Each motor contains ANP 2862 (Outer) and ANP 2864 (Inner) propellant.

Manufacturer: Aerojet Solid Propulsion Company.

STATISTICAL ANALYSIS

The objective of this statistical analysis is to determine whether or not any aging trends are demonstrated by accumulated test data in order to assist Service Engineering to more accurately predict motor serviceability.

Propellant was made available for testing and statistical analysis to obtain an overall view of the aging trends affecting the Second Stage Dissected Motor Program. In the past, carton data and dissected motor data were combined to yield sufficient samples to perform the analysis. Since there is now sufficient dissected motor data, carton data will not be included in the analysis. This will eleminate a further biasing factor in the results.

A Multi-symbol Regression Analysis Program was used to determine aging trends. The sampling is combined for each test parameter in a single regression analysis. The linear equation ($Y = a + bX$) was found to be the best fit model for the data in this report. A composite population aging trend line was then calculated accepting the fact that individual aging of different motors may be masked.

The Multi-symbol Program uses a unique plotting code for each motor on the regression plots. This method of data plotting allows a visual display of the overall relationship between motors and how they relate to the overall least square aging trend line.

The regression program uses an analysis with individual data points from different time periods combined to establish a least squares aging

trend line for the overall 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 population falls within this interval. This tolerance interval was extrapolated to a maximum of 24 months to give an indication of the statistical significance of the slope of any aging trends. The computer tolerance interval about the composite regression line is wider than what the tolerance interval would be about any individual motor regression line because of the increased data spread introduced by combining data from different motors. The 't' values and the significance of this statistic, which are reported for each regression model, gives an indication of the "statistical significance" of the slope of the aging trend in the Y-axis. Data and regression trend lines were plotted utilizing an IBM-360/65 computer.

The accuracy of the statistical inferences improves as the sampling becomes larger. An analysis of the slope of the trend lines revealed the majority are becoming flatter:

Motor	Symbol
0022135	
0022583	
0022788	

TEST RESULTS

Because of rather extensive testing, the propellant tensile test results are presented in tabular form rather than as a narrative.

A. Tensile Test Results:

1. Uniaxial Tensile

Propellant	CHS(1)	Test	Slope (2)	Slope (3)
Outer	0.0002	Maximum Stress	FL	N
		Strain at Rupture	FL	N
		Modulus	N.C.	N
Inner	0.0002	Maximum Stress	FL	S
		Strain at Rupture	FL	S
		Modulus	FL	S
Outer	2.0	Maximum Stress	N.C.	S
		Strain at Rupture	N.C.	N
		Modulus	N.C.	S
Inner	2.0	Maximum Stress	N.C.	S
		Strain at Rupture	N.C.	N
		Modulus	N.C.	N

For regressions see Figures 6 thru 17. Raw data for this test period are in Tables 1 thru 4.

2. Biaxial Tensile

Propellant	CHS(1)	Test	Slope(2)	Slope (3)
Outer	0.2	Maximum Stress (4)	N.C.	S
		Strain at Rupture	N.C.	N
		Modulus	N.C.	N
Inner	0.2	Maximum Stress	N.C.	N
		Strain at Rupture	N.C.	N
		Modulus	N.C.	N

For regressions see Figures 18 thru 23. Raw data for this test period are in Tables 5 thru 8.

3. High Rate Triaxial Tensile

Propellant	CHS (1)	Test	Slope(2)	Slope(3)
Outer	1750 at 500 psi	Maximum Stress	N.C.	N
		Strain at Rupture	FL	S
		Modulus(4)	St	S
Inner	1750 at 500 psi	Maximum Stress	St	S
		Strain at Rupture	FL	S
		Modulus(4)	FL	S

For regressions see Figures 24 thru 29. Raw data for this test period is in Table 9.

4. High Rate Hydrostatic Tensile

Propellant	CHS(1)	Test	Slope(2)	Slope(3)
Outer	1750 at 500 psi	Maximum Stress	St	S
		Strain at Rupture	FL	S
		Modulus	St	S
Inner	1750 at 500 psi	Maximum Stress	N.C.	N
		Strain at Rupture	FL	S
		Modulus	St	S

For regressions see Figures 30 thru 35. Raw data for this test period is in Table 10.

NOTES:

(1) CHS = crosshead speed in inches per minute.

(2) St means the slope obtained this test period may be increasing from that indicated in the last report. FL means that the indicated slope this test period may be flatter than indicated the last test period. N.C. indicates that the slopes obtained this test period could not be directly compared with slopes obtained the previous test period.

(3) S means statistically significant. N means not statistically significant.

(4) The slope indicates a rather sharp decreasing trend. The most probable cause is insufficient data to establish a realistic trend line plus the variance between motors.

B. Stress Relaxation Master Curves at 0.5 and 3.0 Percent Strain:

The relaxation modulus results at -65° and -40°F were not used. For a single plot to include the modulus values covering a temperature range from -65° to +180° the Y-axis must span from 0 to 90,000 psi. This reduces the visibility at the low end of the curve. The master stress/strain curves are shown in Figures 36 thru 43. The raw data are in Tables 11 thru 14.

C. Burning Rate:

Both outer and inner regressions at 500 psi initial pressure have a trend line with a flatter slope (approaching a zero slope line) than in previous reports due to the accumulation of more data. The regression slope for outer propellant is statistically significant and the inner is not significant (Figures 44 and 45). Raw data is in Table 15.

D. TCLE (Thermal Coefficient of Linear Expansion):

The regressions below the glass point have a flatter slope than the previous test period for both inner and outer propellant. The regression showed a statistically significant decrease at the last test period while a non-significant trend is shown here.

The regressions above the glass point have a flatter slope than the previous test period for both inner and outer propellant. Both are statistically significant. See Figures 46 thru 49. Raw data for this test period are in Tables 16 and 17.

The TCLE is defined as the change in length per unit of length in turn divided by the change in temperature. The TCLE varies with temperature, thus the temperature range for the TCLE must be known. Equations of the TCLE curves are given to simplify determining the TCLE over shorter

temperature ranges within the ranges used in the testing.

E. Hardness:

The outer hardness has a statistically significant decreasing trend and the inner hardness a statistically significant increasing trend. See Figures 50 and 51. Raw data is in Table 18.

F. Additional Testing:

Additional raw data on propellant and case bond material is included where data were not available for regression analysis. This data is in Table 19. No abnormalities were observed during this test period.

G. Bulk Modulus:

During the 1978 test period it was discovered the bulk modulus calculated from 0 to 200 psi was comparatively low and when calculated from 200 to 400 psi, 200 to 600 psi, etc. was higher and virtually constant. This method of calculation gives a more realistic presentation than previously wherein the calculations were from 0 to 200 psi, 0 to 400 psi etc., and the bulk modulus continuously increased. Accordingly, the bulk modulus from the 1977 report (MANCP Nr 384(77)) was recalculated to correspond to the improved presentation.

An example from the 1977 data is given in Table 20, "Bulk Modulus, Motor 0022788 Inner, Specimen Nr 2", under the heading, "1977 Data as Originally Reported". The same data recalculated in 200 psi intervals, 0 to 200 psi, 200 to 400 psi etc., to 2000 psi is shown in the same table

under the heading, "1977 Data Recalculated". The two answers, 8.33×10^{-5} and 11.11×10^{5} are caused by a 1 millivolt difference in test equipment readings, the limit of accuracy at the time. This was improved to 0.5 millivolt by the time the 1978 testing was done.

Because the bulk modulus is nearly constant above 200 psi, the 1977 data was recalculated for the ranges 0 to 200, 200 to 1400, and 200 to 2000 psi. The results are in Table 21, "Bulk Modulus, 1977 Data Recalculated". The range 200 to 1400 psi was included because in 1978 this was the maximum pressure used. The one number, bulk modulus 200 to 1400 psi can, with little error, be used over the range 200 to 2000 psi.

A side by side comparison of 1977 data recalculated and 1978 data is given in Table 22, "Bulk Modulus Summary". The percent change in volume and bulk modulus for inner and outer propellant from Motors 0022135 and 0027788 are given in this table.

The bulk modulus data for 1978 is given in Table 23, "Bulk Modulus 1978 Data".

H. SOL GEL:

Linear regressions for Sol Gel data are presented for the first time. Four test periods are included for Motors S/N 0022135 and S/N 0022788. Only three test periods are included for motor S/N 0022583 because the last available propellant was tested the previous test period.

For regressions see Figures 52 thru 61, and for raw data for this test period see Table 24.

CONCLUSIONS

As stated in greater detail in "Test Results", three propellant regressions show decreasing trends. However, only three test periods are involved and probably the trends will level off considerably as additional testing is performed. Based on these analyses, none of the other trends show cause for appreciable concern at this time.

RECOMMENDATIONS

It is recommended that:

1. The motor scheduled for dissection be dissected immediately so it can be tested with the remaining two motors.

2. The amount of Garlock and Genguard insulation materials in a motor is rather limited. Because of this, recommend existing data and the testing program for these materials be examined to see if it is feasible to materially lengthen the time period over which they could be tested.

3. It is further recommended, testing continue to accumulate sufficient data to establish realistic trends.

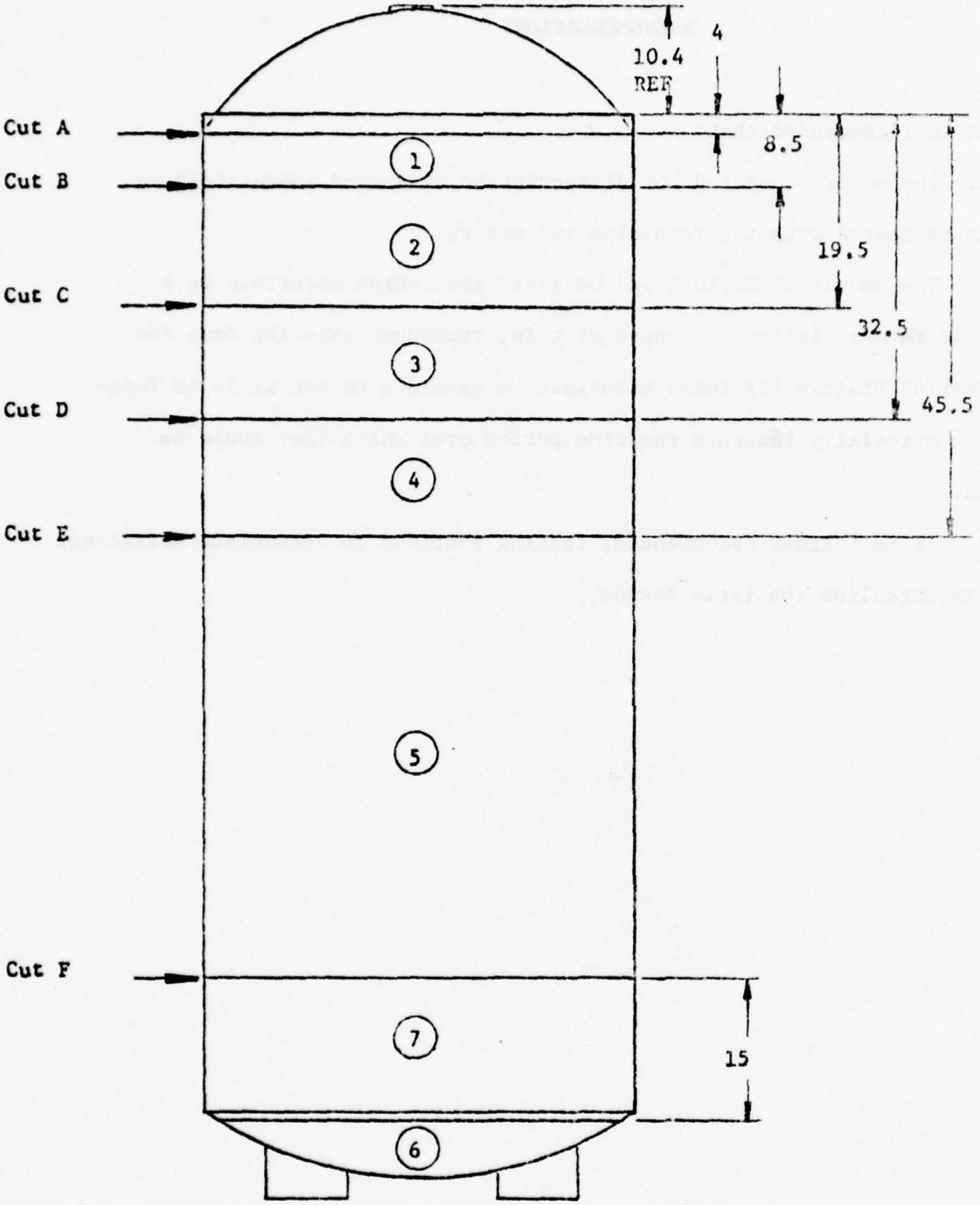


Figure 1 Dissection layout of Cuts, Locations and Section Numbers

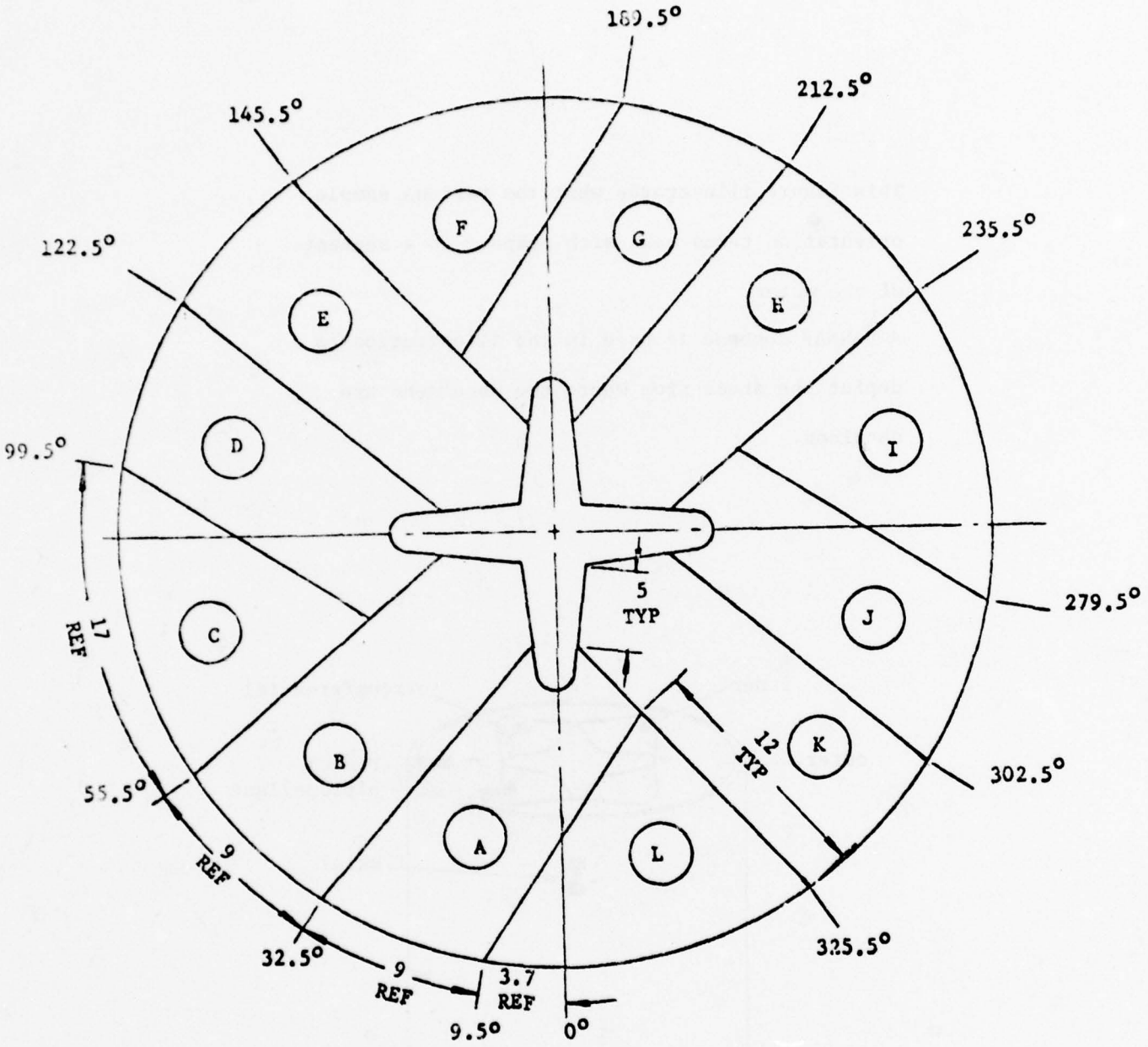


Figure 2 Section 3 and 4 Segment Layout and Letter Identification

This figure illustrates what the various sample orientation terms mean with respect to a segment of the motor.

A JANNAF dogbone is used in the illustration to depict the areas from where the specimens are obtained.

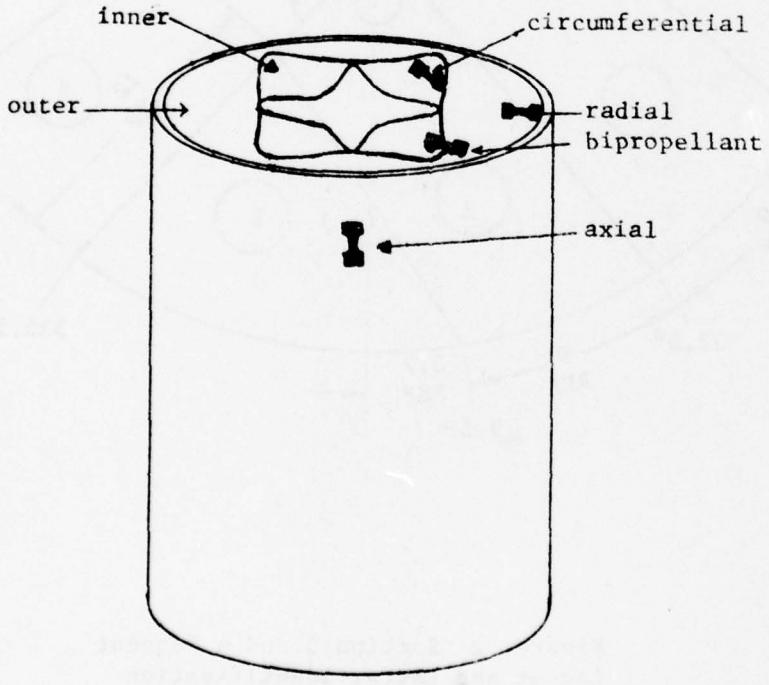


FIGURE 3

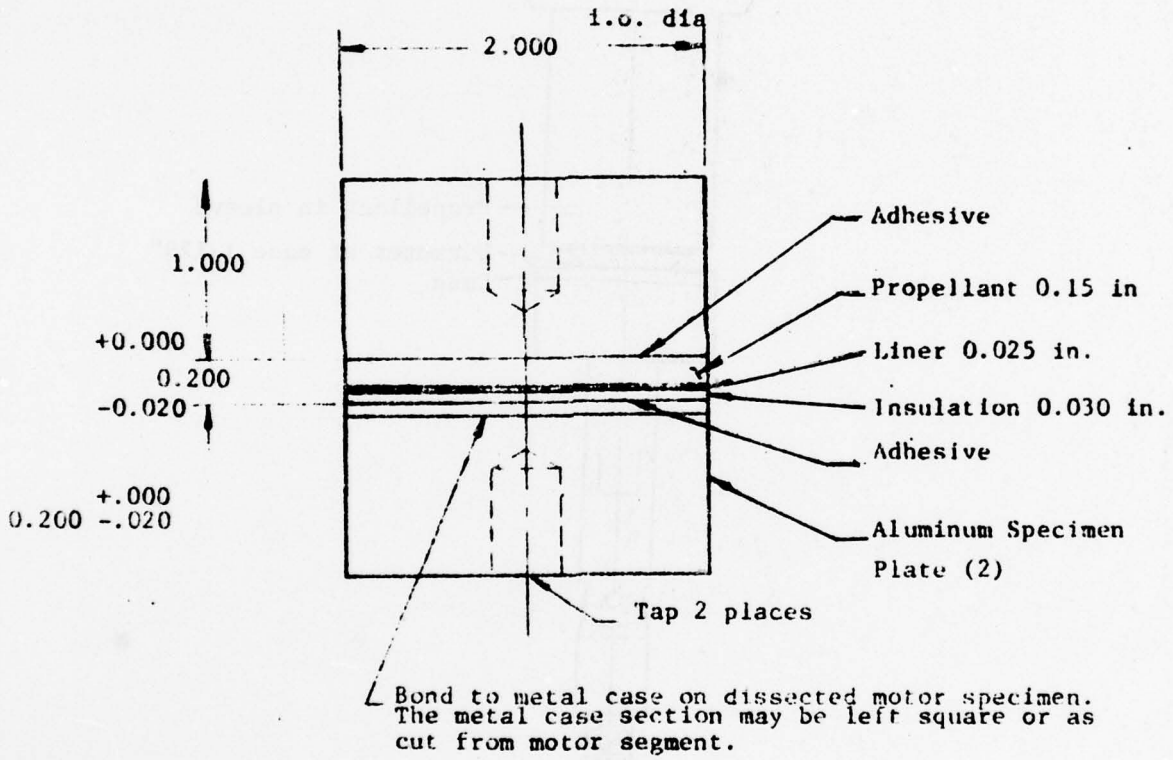


Figure 4 Bond Shear Specimen
(Propellant/Liner/Insulation)

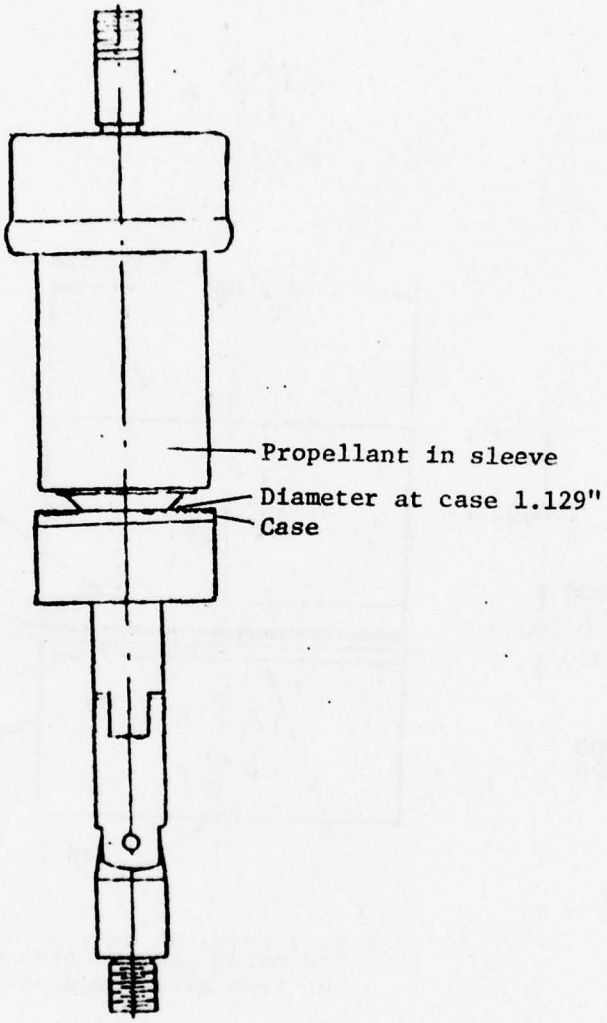


Figure 5 Sleeved Bond Specimen (for Bond Tensile Test)
(Propellant/Liner/Insulation/Case)

NOTE: Case may be left as cut from motor

TABLE 1

LOW AND VERY LOW RATE
DISSECTED MOTOR TENSILE
(AXIAL POSITION)

(OUTER)

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	0.0002	+077	78097	178	39.57	0.2156	360.0
					39.25	0.2236	334.0
					43.02	0.1836	407.0
	0.0002	+120	78086	177	38.77	0.2036	294.0
					37.97	0.2122	287.0
					40.88	0.1703	315.0
	0.0002	+160	78122	179	35.09	0.2559	186.0
					38.77	0.2709	197.0
					38.93	0.2559	199.0
	0.002	+077	78081	177	51.38	0.2889	449.0
					44.01	0.3289	357.0
					43.61	0.3275	338.0
	0.002	+120	78083	177	36.91	0.2223	306.0
					35.50	0.2642	270.0
					36.67	0.2555	280.0
	0.02	+077	78080	177	65.89	0.3469	546.0
					66.70	0.3092	582.0
					67.93	0.3219	585.0
	0.02	+120	78082	177	47.01	0.2676	364.0
					47.77	0.2745	420.0
					48.63	0.3016	425.0
	0.2	+020	78081	177	209.16	0.4168	2507.0
					210.02	0.4219	2485.0
					209.73	0.3903	2497.0
	2.0	+020	78081	177	291.56	0.3199	4676.0
					291.13	0.3388	4523.0
					290.27	0.3115	4590.0

TABLE 1 (cont)

LOW AND VERY LOW RATE
DISSECTED MOTOR TENSILE
(AXIAL POSITION)

(OUTER)

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	2.0	+077	78074	177	118.89	0.4702	1250.0
					117.48	0.4423	1218.0
	20.0	+020	78081	177	427.23	0.3523	10135.0
					409.14	0.3378	9399.0
					412.30	0.3079	10044.0
0022788	0.0002	+077	78097	165	36.63	0.2756	215.0
					42.18	0.2716	262.0
					40.19	0.2796	236.0
	0.0002	+120	78128	166	54.03	0.3818	198.0
					53.84	0.4004	192.0
					46.77	0.3658	205.0
	0.0002	+160	78128	166	36.71	0.3469	147.0
					35.56	0.3349	145.0
					31.86	0.3309	124.0
	0.002	+077	78109	165	49.84	0.3159	376.0
					49.98	0.2695	377.0
					49.42	0.2943	382.0
	0.002	+120	78103	165	47.47	0.2999	292.0
					47.41	0.2599	271.0
					45.69	0.2666	305.0
	0.02	+077	78094	165	64.07	0.3366	491.0
					55.81	0.3766	365.0
					64.92	0.3482	531.0
	0.02	+120	78088	165	50.82	0.2692	386.0
					49.27	0.2863	379.0
					52.71	0.2474	432.0

TABLE 1 (cont)

LOW AND VERY LOW RATE
DISSECTED MOTOR TENSILE
(AXIAL POSITION)

(OUTER)

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
	0.2	+020	78094	165	199.73	0.4470	2376.0
					184.58	0.4689	2242.0
					184.86	0.4107	2454.0
	0.2	+077	78094	165	88.94	0.4947	358.0
					69.30	0.5550	456.0
					73.37	0.5279	499.0
	2.0	+020	78093	165	251.72	0.4353	3601.0
					245.83	0.5272	3176.0
					252.73	0.5367	3736.0
	2.0	+077	78094	165	120.31	0.5183	1087.0
					108.48	0.5530	834.0
					121.60	0.5103	1101.0
	20.0	+020	78093	165	373.64	0.4697	7666.0
					372.78	0.3529	7729.0
					378.23	0.3629	6969.0

TABLE 2

LOW AND VERY LOW RATE
DISSECTED MOTOR TENSILE
(AXIAL POSITION)

(INNER)

MSN	X-HD SPEED (IN/MIN)	TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	0.0002	+077	78097	178	54.64	0.3166	243.0
					53.28	0.2796	296.0
					59.98	0.2946	360.0
					59.14	0.3146	309.0
					50.25	0.3046	305.0
	0.0002	+120	78086	178	46.51	0.2686	245.0
					46.90	0.2599	256.0
	0.002	+077	78081	177	76.07	0.3470	442.0
					74.96	0.3089	521.0
					68.76	0.3541	441.0
	0.002	+120	78083	178	55.85	0.2541	371.0
					48.77	0.2728	328.0
					47.16	0.2006	332.0
	0.02	+077	78080	177	91.23	0.4118	603.0
					93.53	0.4139	483.0
					90.19	0.4219	600.0
	0.02	+120	78082	178	64.43	0.3349	454.0
					64.22	0.3301	454.0
					63.62	0.3482	436.0
	0.2	+020	78081	177	240.17	0.4720	2089.0
					245.77	0.4897	2091.0
					242.61	0.4917	2154.0
	2.0	+020	78093	178	271.97	0.4603	3377.0
					247.70	0.5954	2407.0
					264.50	0.5639	3039.0
	20.0	+020	78093	178	374.64	0.4969	5983.0
					377.66	0.4049	7143.0
					377.23	0.4569	6656.0

TABLE 2(cont)

LOW AND VERY LOW RATE
DISSECTED MOTOR TENSILE
(AXIAL POSITION)

(INNER)

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022788	0.0002	+077	78097	165	44.80	0.2716	201.0
					45.43	0.2906	181.0
					45.01	0.3546	190.0
					44.69	0.3606	174.0
					42.18	0.3706	202.0
	0.0002	+120	78086	164	47.19	0.3479	158.0
					46.86	0.3679	201.0
	0.0002	+120	78086	164	46.86	0.3859	211.0
					47.30	0.3819	174.0
					47.86	0.3479	196.0
	0.0002	+160	78122	166	47.58	0.4089	166.0
					46.17	0.4549	157.0
					43.60	0.4369	136.0
	0.002	+077	78081	164	51.27	0.4306	232.0
					52.40	0.3950	244.0
					53.31	0.4341	252.0
	0.002	+120	78083	164	45.82	0.2844	234.0
					45.62	0.3595	215.0
					44.80	0.3162	212.0
	0.02	+077	78080	164	73.65	0.4649	337.0
					75.31	0.4310	349.0
	0.02	+120	78082	164	50.31	0.3659	232.0
					49.10	0.4733	228.0
					48.26	0.4416	224.0
	0.2	+020	78081	164	217.20	0.6072	1734.0
					218.92	0.4004	1761.0

TABLE 2 (cont)

LOW AND VERY LOW RATE
DISSECTED MOTOR TENSILE
(AXIAL POSITION)

(INNER)

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022788	0.2	+020	78081	164	217.63	0.5734	1644.0
	2.0	+020	78080	164	280.78	0.6739	2887.0
					282.37	0.6179	3150.0
					286.98	0.6099	3194.0
	2.0	+077	78082	164	114.07	0.6921	526.0
					117.59	0.7163	562.0
					107.11	0.5164	1090.0
	20.0	+020	78080	164	417.43	0.3079	7335.0
					429.83	0.3521	10847.0
					427.09	0.3873	10563.0
					410.51	0.4074	8360.0
					424.06	0.4552	8382.0

TABLE 3

LOW AND VERY LOW RATE TENSILE
GROUPED
(AXIAL POSITION)

(INNER)

MOTOR S/N	X-HEAD SPEED IN/MIN	TEST TEMP °F	AGE AT TEST MO	NO	MAXIMUM STRESS MEAN	MAXIMUM STRESS S.D.	STRAIN AT RUPTURE MEAN	STRAIN AT RUPTURE S.D.	MODULUS MEAN	MODULUS S.D.
0022135	0.0002	+077	178	5	55.5	4.08	0.3021	0.015291	302.6	41.6
		+120	178	2	46.7	0.28	0.2643	0.006152	250.5	7.8
	0.002	+077	177	3	73.3	3.94	0.3368	0.024307	468.0	45.9
		+120	178	3	50.6	4.62	0.2426	0.037472	343.7	23.8
	0.02	+077	177	3	91.7	1.71	0.4160	0.005329	562.0	68.4
		+120	178	3	64.1	0.42	0.3378	0.003768	447.7	10.1
	0.2	+020	177	3	242.9	2.81	0.4846	0.010843	2111.3	37.0
	2.0	+020	178	3	261.4	12.43	0.5400	0.070684	2941.0	492.4
	20.0	+020	178	3	376.3	2.00	0.4529	0.046130	6594.0	582.5
0022788	0.0002	+077	165	5	44.4	1.3	0.3297	0.045144	189.6	12.3
		+120	164	5	47.2	0.4	0.3664	0.018078	188.0	21.6
		+160	166	3	45.8	2.0	0.4337	0.023180	153.0	15.4
	0.002	+077	164	3	52.3	1.0	0.4200	0.021635	242.7	10.1
		+120	164	3	45.4	0.5	0.3201	0.037697	220.3	11.9
	0.02	+077	164	2	74.5	1.2	0.4480	0.023971	343.0	8.5
		+120	164	3	49.2	1.0	0.4270	0.055182	228.0	4.0
	0.2	+020	164	3	217.9	0.9	0.5271	0.110933	1713.0	61.3

TABLE 3 (cont)

LOW AND VERY LOW RATE TENSILE
GROUPED
(AXIAL POSITION)

MOTOR S/N	X-HEAD SPEED IN/MIN	TEST TEMP °F	AGE AT TEST MO	NO	MAXIMUM STRESS MEAN	MAXIMUM STRESS S.D.	STRAIN AT RUPTURE MEAN	STRAIN AT RUPTURE S.D.	MODULUS MEAN	MODULUS S.D.
(INNER)										
0022788	2.0	+020	164	3	283.4	3.2	0.6340	0.034871	3077.0	166.0
		+077	164	3	112.9	5.3	0.6417	0.109099	726.3	316.3
	20.0	+020	164	5	421.8	7.8	0.3821	0.055714	9097.4	1530.6
(OUTER)										
0022135	0.0002	+077	178	3	40.6	2.09	0.2077	0.021167	367.0	37.0
		+120	177	3	39.2	1.50	0.1955	0.022130	298.7	14.6
		+160	179	3	37.6	2.17	0.2610	0.008660	194.0	7.0
	0.002	+077	177	3	46.3	4.38	0.3152	0.02270	381.3	59.4
		+120	177	3	36.4	0.75	0.2474	0.022112	285.3	18.6
	0.02	+077	177	3	66.8	1.03	0.3261	0.019182	571.0	21.7
		+120	177	3	47.8	0.81	0.2813	0.017972	403.0	33.9
	0.2	+020	177	3	209.6	0.44	0.4098	0.016965	2496.3	11.0
	2.0	+020	177	3	291.0	0.66	0.3235	0.013982	4596.3	76.7
		+077	177	2	118.2	1.00	0.4563	0.019728	1234.0	22.6
	20.0	+020	177	3	416.2	9.66	0.3328	0.022641	9859.3	401.2

TABLE 9 (cont)

LOW AND VERY LOW RATE TENSILE
GROUPED
(AXIAL POSITION)

(OUTER)

MOTOR S/N	X-HEAD SPEED IN/MIN	TEST TEMP. °F	AGE AT TEST MO	NO	MAXIMUM STRESS MEAN	MAXIMUM STRESS S.D.	STRAIN AT RUPTURE MEAN	STRAIN AT RUPTURE S.D.	MODULUS MEAN	MODULUS S.D.
0022788	0.0002	+077	3	165	39.7	2.81	0.2757	0.004000	237.7	23.5
		+120	3	166	51.6	4.14	0.3828	0.01732	198.3	6.5
		+160	3	166	34.7	2.53	0.3377	0.008327	138.7	12.7
	0.002	+077	3	165	49.8	0.29	0.2933	0.023218	378.3	3.2
		+120	3	165	46.9	1.01	0.2756	0.021423	289.3	17.2
	0.02	+077	3	165	61.6	5.03	0.3539	0.02058	462.3	86.6
		+120	3	165	50.9	1.73	0.2677	0.019497	399.0	28.8
	0.2	+020	3	165	189.7	8.70	0.4423	0.029395	2357.3	107.2
		+077	3	165	77.2	10.37	0.5260	0.030201	437.7	72.3
	2.0	+020	3	165	250.1	3.73	0.4998	0.056003	3504.3	292.2
		+077	3	165	116.8	7.23	0.5273	0.022699	1007.3	150.3
	20.0	+020	3	165	374.9	2.93	0.3953	0.064741	7454.7	421.8

TABLE 4

BI-PROPELLANT TENSILE
DISSECTED MOTORS
(NON-ORIENTED)
Specimen Configuration 1/2 in. JANNAF dogbone, EGL=3.00 in., CSA=0.1875 in^2.

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	0.0002	+077	78097	178	37.90	0.1837	289.0
					32.45	0.1637	289.0
				...Mean/S.D.=	35.18/3.85	0.1737/0.014	289.0/0.0
		+120	78086	178	40.02	0.2138	233.0
					38.28	0.2037	260.0
				...Mean/S.D.=	39.15/1.23	0.2088/0.007	246.5/19.09
	20.0	+020	78080	177	403.45	0.2230	10324.0
					396.82	0.2328	9714.0
				...Mean/S.D.=	400.14/4.69	0.2279/0.007	10019.0/431.3
0022788	0.0002	+077	78097	165	42.51	0.2077	374.0
					43.34	0.2197	360.0
				...Mean/S.D.=	42.93/0.59	0.2137/0.008	367.0/9.90
		+120	78086	164	39.10	0.2499	211.0
					48.99	0.3320	201.0
				...Mean/S.D.=	44.05/7.00	0.2910/0.06	206.0/7.07
	20.0	+120	78086	164	415.85	0.3420	11061.0
					396.39	0.4036	7552.0
				...Mean/S.D.=	406.12/13.76	0.3728/0.044	9306.5/2481.2

TABLE 4 (cont)

BI-PROPELLANT TENSILE
DISSECTED MOTORS
(NON-ORIENTED)
3/4 in. GL dogbone, EGL=3.00 in., CSA=0.1875 in^2

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	0.2	+077	78125	179	76.81	0.4817	519.0
					76.67	0.4615	536.0
					77.10	0.4669	527.0
				...Mean/S.D.=	76.86/0.22	0.4700/0.01	527.3/8.5
	2.0	+020	78125	179	258.42	0.3879	3249.0
					261.75	0.3490	5701.0
					262.83	0.3373	3433.0
				...Mean/S.D.=	261. /2.30	0.3981/0.03	4127.7/1365.6
	2.0	+077	78125	179	102.62	0.5519	777.0
					103.91	0.5608	721.0
					105.20	0.5784	758.0
				...Mean/S.D.=	103.9/1.29	0.5634/0.014	752/28.48
0022788	0.2	+077	78130	166	91.32	0.3696	482.0
					91.91	0.3689	474.0
					91.27	0.3697	474.0
				...Mean/S.D.=	91.5/0.36	0.3694/0.0004	476.7/4.62
	2.0	+020	78131	166	281.95	0.2820	3298.0
		+077	78130	166	118.67	0.4392	753.0
					118.51	0.4432	716.0
					119.69	0.4140	696.0
				...Mean/S.D.=	118.96/0.64	0.4321/0.016	721.7/28.9

TABLE 5

LOW RATE BIAXIAL
Dissected Motor Tensile
(Axial Position)

OUTER

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	ATT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	0.0002	+120	78109	178	47.74	0.1608	240.0
					52.63	0.1608	323.0
					45.95	0.1608	276.0
			...MEAN/S.D. =		48.77/3.46	0.1608/0.0	279.7/41.6
	0.002	+120	78103	178	42.53	0.2285	364.0
					42.13	0.2056	345.0
					40.92	0.1999	305.0
			...MEAN/S.D.=		41.87/0.83	0.2113/0.02	338.0/30.1
	0.2	+077	78101	178	89.79	0.3642	706.0
					93.57	0.3759	805.0
					92.25	0.3549	790.0
			...MEAN/S.D. =		91.88/1.92	0.3650/0.01	767.0/53.4
	2.0	+020	78101	178	312.22	0.3252	4191.0
					320.19	0.3317	4309.0
					289.40	0.3639	3682.0
			...MEAN/S.D. =		307.28/15.98	0.3403/0.02	4060.7/333.2
	2.0	+077	78101	178	118.22	0.4509	878.0
					123.28	0.3789	1169.0
					120.09	0.3989	1131.0
			...MEAN/S.D.=		120.54/2.56	0.4096/0.04	1059.3/158.2

TABLE 5 (cont)

LOW RATE BIAXIAL
Dissected Motor Tensile
(Axial Position)

OUTER

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	ATT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022788	0.0002	+120	78109	165	46.58	0.2803	275.0
					53.00	0.2872	300.0
					53.16	0.2855	295.0
			...MEAN/S.D. =		50.91/3.75	0.2843/0.004	290.0/13.23
	0.002	+120	78103	165	51.01	0.2628	331.0
					50.56	0.2323	326.0
					48.53	0.2285	330.0
			...MEAN/S.D. =		50.03/1.32	0.2412/0.02	329.0/2.65
	0.2	+077	78101	165	94.78	0.3725	690.0
					97.85	0.3680	762.0
					90.80	0.4130	641.0
			...MEAN/S.D. =		94.48/3.53	0.3845/0.02	697.7/60.86
	2.0	+020	78101	165	303.26	0.3329	3028.0
					310.48	0.3421	3261.0
					274.70	0.3820	3196.0
			...MEAN/S.D.=		296.15/18.92	0.3523/0.03	3161.67/120.23
	2.0	+077	78101	165	132.53	0.4449	1098.0
					130.25	0.4519	974.0
					129.01	0.4929	877.0
			...MEAN/S.D. =		130.60/1.79	0.4632/0.03	983.0/110.77

TABLE 6

LOW RATE BIAXIAL
Dissected Motor Tensile
(Axial Position)

INNER

MSN	x-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	ATT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	0.0002	+120	78109	178	52.22	0.1615	321.0
					49.44	0.1615	288.0
					53.29	0.1607	333.0
			...MEAN/S.D. =		51.65/1.99	0.1612/0.0005	314.0/23.30
	0.002	+120	78103	178	58.15	0.3124	379.0
					57.00	0.2629	390.0
					56.89	0.3660	297.0
			...MEAN/S.D. =		57.35/0.70	0.3138/0.05	355.3/50.82
	0.2	+077	78101	178	101.95	0.4240	672.0
					110.33	0.3850	689.0
					126.64	0.3920	843.0
			...MEAN/S.D. =		112.97/12.56	0.4003/0.02	734.7/94.2
	2.0	+020	78101	178	309.09	0.4260	3642.0
					336.69	0.4030	3635.0
					324.79	0.3830	3505.0
			...MEAN/S.D. =		323.5/13.8	0.4040/0.02	3594.0/77.16
	2.0	+077	78101	178	166.44	0.4557	1174.0
					151.46	0.3761	1213.0
					148.84	0.4494	1116.0
			...MEAN/S.D. =		155.58/9.50	0.4271/0.04	1167.67/48.81

TABLE 6 (cont)

LOW RATE BIAXIAL
Dissected Motor Tensile
(Axial Position)

INNER

MSN	X-HD SPEED (IN/MIN)	TEST TEMP. (°F)	TEST DATE	ATT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022788	0.0002	+120	78167	167	41.37	0.3260	165.0
			78170		44.24	0.3285	183.0
			78174		48.90	0.3780	197.0
			...MEAN/S.D. =		44.84/3.80	0.3442/0.03	181.67/16.04
	0.002	+120	78166	167	49.67	0.3650	268.0
			78167		47.98	0.3249	231.0
			78170		48.92	0.3369	226.0
			...MEAN/S.D. =		48.86/0.85	0.3422/0.02	241.67/22.94
	0.2	+077	78165	167	97.78	0.4689	461.0
					83.50	0.4824	369.0
					97.72	0.4397	428.0
					96.00	0.4310	460.0
					103.39	0.4239	420.0
					94.96	0.4499	488.0
			...MEAN/S.D.=		95.56/6.59	0.4493/0.023	437.67/41.71
	2.0	+020	78170	167	312.61	0.3979	3097.0
					320.00	0.3669	3638.0
					257.28	0.1069	2974.0
			...MEAN/S.D. =		296.63/34.28	0.2906/0.16	3236.3/353.2

TABLE 7

LOW RATE PRESSURIZED TENSILE
500 PSI Test Pressure
+20°F Test Temp.

OUTER

MSN	X-HD SPEED (IN/MIN)	AAT (MO)	TEST DATE	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	2.0	177	78079	398.69	0.3587	3015.0
				422.65	0.3568	3488.0
				363.27	0.3669	2660.0
		...MEAN/S.D.=		394.87/29.87	0.3608/0.005	3054.3/415.4
	20.0	177	78079	582.29	0.2809	6457.0
				534.89	0.3769	5377.0
				508.06	0.3017	4916.0
		...MEAN/S.D.=		541.75/37.59	0.3198/0.05	5583.3/790.9
0022788	2.0	164	78079	432.28	0.3359	3605.0
				456.19	0.3159	4614.0
				446.34	0.3389	3855.0
		...MEAN/S.D.=		444.94/12.02	0.3302/0.013	4024.7/525.5
	20.0	164	78079	516.29	0.3919	4729.0
				530.72	0.3299	4775.0
				512.50	0.4269	4458.0
		...MEAN/S.D.=		519.84/9.61	0.3829/0.05	4654.0/171.3

TABLE 8

LOW RATE PRESSURIZED TENSILE
500 PSI Test Pressure
+20°F Test Temp

INNER

MSN	X-HD SPEED (IN/MIN)	ATT (MO)	TEST DATE	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	2.0	177	78079	492.18	0.2239	4687.0
	2.0	177	78079	490.88	0.2269	5466.0
		...MEAN/S.D.=		491.53/0.919	0.2254/0.002	5076.5/550.8
	20.0	177	78079	552.07	0.4579	4729.0
				535.67	0.3299	4149.0
				564.57	0.4269	5176.0
		... MEAN/S.D. =		550.77/14.49	0.4049/0.067	4684.7/514.9
0022788	2.0	164	78079	489.05	0.2309	4775.0
				500.00	0.2349	5642.0
				466.40	0.2679	4763.0
		...MEAN/S.D. =		485.15/17.14	0.2446/0.020	5060.0/504.1
	20.0	164	78079	500.19	0.5999	3754.0
				511.45	0.5809	3468.0
				563.69	0.4809	5535.0
		...MEAN/S.D. =		525.11/33.88	0.5539/0.064	4252.3/1119.99

TABLE 9

HIGH RATE TRIAXIAL TENSILE
Test Pressure = 500 psi Test temp = +077°F
Dissected Only (3/4" GL Rail)

MSN	X-HD SPEED (IN/MIN)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
OUTER						
0022135	1750	78137	179	624.69	0.3249	4902.0
				618.22	0.3429	4755.0
				622.98	0.3739	5192.0
		...MEAN/S.D. =		621.96/3.35	0.3472/0.025	4949.7/222.4
0022788	1750	78137	166	618.69	0.3829	4731.0
				589.69	0.4059	4714.0
				614.80	0.3965	4417.0
		...MEAN/S.D.=		607.73/15.74	0.3951/0.012	4620.7/176.6
INNER						
0022135	1750	78137	179	634.48	0.4549	5064.0
				635.50	0.4259	5275.0
				651.07	0.4849	4277.0
		...MEAN/S.D. =		640.35/9.30	0.4552/0.03	4872.0/526.0
0022788	1750	78137	166	636.63	0.4849	4246.0
				628.00	0.4499	3746.0
				626.29	0.4029	4465.0
		...MEAN/S.D.=		630.31/5.54	0.4459/0.04	4152.3/368.5

TABLE 10

HIGH RATE HYDROSTATIC TENSILE
Test Pressure = 500 psi Test Temp = +077°F
Dissected Only (3/4" GL Dogbone)

OUTER

MSN	X-HD SPEED (IN/MIN)	TEST DATE	AAT (MO)	MAXIMUM STRESS (PSI)	STRAIN AT RUPTURE (IN/IN)	MODULUS (PSI)
0022135	1750	78199	181	535.78	0.4748	5524.0
				532.95	0.4815	5280.0
				530.61	0.4924	5414.0
		...MEAN/S.D.=		533.11/2.59	0.4829/0.009	5406.0/122.2
0022788	1750	78199	168	530.72	0.4675	4902.0
				539.20	0.4642	4865.0
				540.28	0.4581	5574.0
		...MEAN/S.D. =		536.73/5.24	0.4633/0.005	5113.7/399.1

INNER

0022135	1750	78199	181	578.19	0.4992	6821.0
				590.80	0.5149	6221.0
				594.89	0.5580	5210.0
		...MEAN/S.D. =		587.96/8.70	0.5240/0.03	6084.0/814.2
0022788	1750	78199	168	517.21	0.6283	4710.0
				510.11	0.6511	4402.0
				518.78	0.6224	5954.0
		...MEAN/S.D.=		515.34/4.62	0.6339/0.015	5022.0/821.7

TABLE 11
STRESS RELAXATION
0.5% Strain
(Data Compiled)

MSN	TEST TEMP (°F)	NR.	10 Sec MEAN	10 Sec S.D.	50 Sec MEAN	50 Sec S.D.	100 Sec MEAN	100 Sec S.D.	1000 Sec MEAN	1000 Sec S.D.
OUTER										
0022135	-065	2	68400	16094	61170	13873	57350	12883	41330	7170
	-040	3	27473	2715	18227	2281	15247	1866	7207	1402
	+020	6	1781	274	1192	162	1024	146	649	99
	+077	5	431	34	321	20	293	25	222	17
	+100	6	536	71	443	57	412	58	333	63
	+140	6	344	63	291	53	272	55	227	45
	+180	6	313	67	271	51	250	54	208	39
0022788	-065	2	81180	8683	74860	6986	71670	6208	57910	4738
	-040	3	29280	771	19300	798	15780	1005	7093	824
	+020	6	1391	170	899	120	757	99	492	65
	+077	6	469	24	356	23	325	18	242	18
	+100	6	423	49	344	38	324	37	265	36
	+140	6	293	29	248	25	233	26	189	27
	+180	6	195	18	162	23	148	28	107	27
INNER										
0022135	-065	3	65913	11300	57937	8732	53213	6989	37193	1359
	-040	4	24791	4647	17054	3981	14318	3489	7392	1763
	+020	6	1899	586	1342	289	1131	221	646	50
	+077	6	703	107	539	55	493	45	367	49
	+100	6	552	35	444	23	402	18	330	18
	+140	6	456	52	386	41	360	37	296	29
	+180	6	314	87	261	70	241	70	187	50
0022788	-065	3	57227	3087	52093	2322	49280	1657	36887	392
	-040	3	34767	2725	24240	1342	20247	193	10073	570
	+020	6	1177	362	784	135	649	107	311	39
	+077	6	422	21	306	15	271	22	201	20
	+100	6	331	28	258	25	237	27	193	14
	+140	6	241	34	207	32	191	30	158	30
	+180	6	232	20	198	21	190	19	148	14

TABLE 11 (cont)

STRESS RELAXATION
0.5% Strain
(Axial Position)

OUTER

MSN	TEST TEMP (°F)	TEST DATE	AAT (MO)	10 SEC (PSI)	50 SEC (PSI)	100 SEC (PSI)	1000 SEC (PSI)
0022135	-065	78080	177	57020.0	51360.0	48240.0	36260.0
				79780.0	70980.0	66460.0	46400.0
	-40	78080	177	24860.0	15980.0	13300.0	5760.0
				30280.0	20540.0	17020.0	8560.0
				27280.0	18160.0	15420.0	7300.0
	+020	78079	177	1940.0	1260.0	1080.0	660.0
				2080.0	1360.0	1180.0	780.0
				2020.0	1340.0	1160.0	720.0
				1407.0	953.0	813.0	507.0
				1543.0	1053.0	879.0	570.0
				1697.0	1183.0	1013.0	657.0
	+077	78075	177	460.0	340.0	320.0	220.0
				380.0	300.0	260.0	200.0
				440.0	320.0	300.0	220.0
				460.0	343.0	310.0	247.0
				413.0	303.0	277.0	223.0
	+100	78075	177	460.0	380.0	340.0	240.0
				500.0	440.0	400.0	320.0
				520.0	440.0	420.0	340.0
				490.0	383.0	357.0	293.0
				643.0	523.0	490.0	410.0
				603.0	493.0	463.0	393.0

TABLE 11 (cont)

STRESS RELAXATION
0.5% Strain
(Axial Position)

OUTER

MSN	TEST TEMP (°F)	TEST DATE	AAT (MO)	10 SEC (PSI)	50 SEC (PSI)	100 SEC (PSI)	1000 SEC (PSI)
0022135	+140	78076	177	360.0	280.0	260.0	220.0
				420.0	360.0	340.0	280.0
				340.0	280.0	240.0	200.0
				313.0	277.0	263.0	220.0
				390.0	340.0	330.0	277.0
				240.0	210.0	197.0	163.0
	+180	78076	177	240.0	220.0	180.0	160.0
				400.0	340.0	320.0	240.0
				360.0	280.0	260.0	240.0
				233.0	207.0	197.0	157.0
				340.0	307.0	290.0	233.0
				303.0	270.0	253.0	220.0
0022788	-065	78080	164	87320.0	79800.0	76060.0	61260.0
				75040.0	69920.0	67280.0	54560.0
	-040	78080	164	28500.0	18800.0	15200.0	7320.0
				30040.0	20220.0	16940.0	7780.0
				29300.0	18880.0	15200.0	6180.0
	+020	78079	164	1100.0	680.0	580.0	460.0
				1580.0	1040.0	880.0	620.0
				1540.0	960.0	800.0	500.0
				1383.0	920.0	770.0	470.0
				1347.0	883.0	747.0	450.0
				1393.0	913.0	763.0	453.0

TABLE 11 (cont)

STRESS RELAXATION
0.5% Strain
(Axial Position)

OUTER

MSN	TEST TEMP (°F)	TEST DATE	AAT (MO)	10 SEC (PSI)	50 SEC (PSI)	100 SEC (PSI)	1000 SEC (PSI)
0022788	+077	78075	164	440.0	340.0	320.0	220.0
				500.0	400.0	360.0	260.0
				440.0	340.0	320.0	220.0
				487.0	357.0	323.0	257.0
				473.0	347.0	313.0	247.0
				473.0	350.0	313.0	250.0
	+100	78075	164	440.0	360.0	340.0	260.0
				440.0	360.0	340.0	280.0
				340.0	280.0	260.0	200.0
				460.0	370.0	347.0	293.0
				470.0	377.0	357.0	297.0
				390.0	317.0	297.0	257.0
	+140	78076	164	340.0	280.0	260.0	220.0
				280.0	240.0	220.0	160.0
				280.0	220.0	200.0	160.0
				317.0	277.0	267.0	220.0
				280.0	243.0	230.0	190.0
				263.0	277.0	223.0	183.0
	+180	78076	164	200.0	160.0	140.0	100.0
				160.0	120.0	100.0	60.0
				200.0	160.0	140.0	100.0
				200.0	173.0	167.0	130.0
				213.0	190.0	177.0	127.0
				197.0	170.0	163.0	127.0

TABLE 12

STRESS RELAXATION
0.5% Strain
(Axial Position)

INNER

MSN	TEST TEMP (°F)	TEST DATE	AAT (MO)	10 SEC (PSI)	50 SEC (PSI)	100 SEC (PSI)	1000 SEC (PSI)
0022135	-065	78080	177	78940.0	68000.0	61280.0	38160.0
				60040.0	53260.0	48960.0	35640.0
				58760.0	52520.0	49400.0	37780.0
	-040	78080	177	27420.0	18940.0	15700.0	7260.0
				28760.0	20420.0	17440.0	9460.0
				24680.0	17500.0	14780.0	7680.0
				18303.0	11357.0	9353.0	5167.0
	+020	78079	177	2560.0	1680.0	1380.0	720.0
				2260.0	1500.0	1240.0	680.0
				2460.0	1620.0	1360.0	660.0
				1410.0	1113.0	960.0	623.0
				1343.0	1057.0	910.0	587.0
				1363.0	1083.0	933.0	603.0
	+077	78075	177	700.0	540.0	480.0	300.0
				500.0	440.0	420.0	320.0
				780.0	580.0	540.0	380.0
				743.0	560.0	510.0	403.0
				700.0	520.0	473.0	370.0
				797.0	593.0	537.0	427.0
	+100	78075	177	540.0	440.0	400.0	320.0
				580.0	480.0	420.0	360.0
				500.0	440.0	380.0	320.0
				563.0	437.0	403.0	330.0
				597.0	457.0	423.0	340.0
				533.0	410.0	383.0	310.0

TABLE 12 (cont)

STRESS RELAXATION
0.5% Strain
(Axial Position)

INNER

MSN	TEST TEMP (°F)	TEST DATE	AAT (MO)	10 SEC (PSI)	50 SEC (PSI)	100 SEC (PSI)	1000 SEC (PSI)
0022135	+140	78076	177	540.0	440.0	400.0	320.0
				460.0	400.0	380.0	300.0
				420.0	340.0	320.0	260.0
				487.0	420.0	393.0	333.0
				430.0	377.0	353.0	297.0
				397.0	340.0	313.0	267.0
	+180	78076	177	300.0	240.0	220.0	180.0
				440.0	360.0	340.0	240.0
				300.0	240.0	200.0	140.0
				247.0	213.0	200.0	160.0
				390.0	333.0	317.0	257.0
				207.0	180.0	170.0	143.0
0022788	-065	78080	164	58240.0	52200.0	49100.0	36520.0
				53760.0	49720.0	47720.0	37300.0
				59680.0	54360.0	51020.0	36840.0
	-040	78080	164	33900.0	23620.0	19760.0	9640.0
				32580.0	23320.0	19680.0	9860.0
				37820.0	25780.0	21300.0	10720.0
	+020	78079	164	1380.0	840.0	720.0	240.0
				1680.0	1000.0	820.0	300.0
				1420.0	840.0	660.0	320.0
				867.0	690.0	577.0	350.0
				880.0	690.0	577.0	340.0
				833.0	643.0	537.0	313.0

TABLE 12 (cont)

STRESS RELAXATION
0.5% Strain
(Axial Position)

INNER

MSN	TEST TEMP (°F)	TEST DATE	AAT (MO)	10 SEC (PSI)	50 SEC (PSI)	100 SEC (PSI)	1000 SEC (PSI)
0022788	+077	78075	164	440.0	320.0	280.0	200.0
				440.0	320.0	300.0	180.0
				420.0	300.0	240.0	180.0
				410.0	300.0	273.0	220.0
				387.0	280.0	253.0	197.0
				437.0	313.0	283.0	227.0
	+100	78075	164	320.0	260.0	220.0	180.0
				340.0	280.0	260.0	200.0
				300.0	220.0	200.0	180.0
				333.0	257.0	240.0	190.0
				380.0	290.0	273.0	217.0
				310.0	243.0	230.0	190.0
	+140	78076	164	300.0	260.0	240.0	200.0
				220.0	180.0	160.0	120.0
				240.0	200.0	180.0	140.0
				257.0	227.0	213.0	187.0
				203.0	177.0	167.0	143.0
				227.0	197.0	183.0	160.0
	+180	78076	164	220.0	180.0	180.0	140.0
				240.0	200.0	180.0	140.0
				240.0	200.0	200.0	140.0
				200.0	170.0	163.0	137.0
				257.0	230.0	217.0	170.0
				237.0	207.0	197.0	163.0

TABLE 13
STRESS RELAXATION
At 3% Strain

(Outer)

MSN	Test Temp. (°F)	Test Date	AAT (MO)	10 Sec. (psi)	50 Sec (psi)	100 Sec (psi)	1000 Sec. (psi)
22135	+20	78079	177	1407	953	813	507
				1543	1053	897	570
				1697	1183	1013	657
			...Mean/S.D.=	1549/145	1063/115	908/100	578/75
22135	+77	78075	177	460	343	310	247
				413	303	277	223
			...Mean/S.D.=	436/33	323/28	294/23	235/17
22135	+100	78075	177	490	383	357	293
				643	523	490	410
				603	493	463	393
			...Mean/S.D.=	579/79	466/74	437/70	365/63
22135	+140	78076	177	313	277	263	220
				390	340	330	277
				240	210	197	163
			...Mean/S.D.=	314/75	276/65	263/66	220/57
22135	+180	78076	177	233	207	197	157
				340	307	290	233
				303	270	253	220
			...Mean/S.D.=	292/54	261/51	247/47	203/41
22788	+20	78079	164	1383	920	770	470
				1347	883	747	450
				1393	913	763	453
			...Mean/S.D.=	1374/24	905/20	760/12	458/11

TABLE 13 (cont)
STRESS RELAXATION
At 3% Strain

(Outer)

MSN	Test Temp (°F)	Test Date	AAT (MO)	10 Sec. (psi)	50 Sec (psi)	100 Sec. (psi)	1000 Sec. (psi)
22788	+77	78075	164	487	357	323	257
				473	347	313	247
				473	350	313	250
			...Mean/S.D.=	478/8	351/5	316/6	251/5
22788	+100	78075	164	460	370	347	293
				470	377	357	297
				390	317	297	257
			...Mean/S.D.=	440/44	355/33	334/32	282/22
22788	+140	78076	164	317	277	267	220
				280	243	230	190
				263	227	223	183
			...Mean/S.D.=	287/28	249/26	240/24	198/20
22788	+180	78076	164	200	173	167	130
				213	190	177	127
				197	170	163	127
			...Mean/S.D.=	203/8	178/11	169/7	128/2

(Inner)

22135	+20	78079	177	1410	1113	960	623
				1340	1057	910	587
				1360	1083	933	603
			...Mean/S.D.=	1370/36	1084/28	934/25	604/18
22135	+77	78075	177	743	560	510	403
				700	520	473	370
				797	593	537	427
			...Mean/S.D.=	747/49	558/37	507/32	400/29

TABLE 14
STRESS RELAXATION
At 3% Strain

(Inner)

MSN	Test Temp. (°F)	Test Date	AAT (MO)	10 Sec. (psi)	50 Sec. (psi)	100 Sec. (psi)	1000 Sec. (psi)
22135	+100	78075	177	563	437	403	330
				597	457	423	340
				533	410	383	310
			...Mean/S.D.=	564/32	435/24	403/20	327/15
22135	+140	78076	177	487	420	393	333
				430	377	353	297
				397	340	313	267
			...Mean/S.D.=	438/46	379/40	353/40	299/33
22135	+180	78076	177	247	213	200	160
				390	333	317	257
				207	180	170	143
			...Mean/S.D.=	281/96	242/81	229/78	187/62
22788	+20	78079	164	867	690	577	350
				880	690	577	340
				833	643	537	313
			...Mean/S.D.=	860/24	674/27	564/23	334/19
22788	+77	78075	164	410	300	273	220
				387	280	250	197
				437	313	283	227
			...Mean/S.D.=	411/25	298/17	269/17	215/16
22788	+100	78075	164	333	257	240	190
				380	290	273	217
				310	243	230	190
			...Mean/S.D.=	341/36	263/24	248/22	199/16

TABLE 14 (cont)
STRESS RELAXATION
At 3% Strain

(Inner)

MSN	Test Temp. (°F)	Test Date	AAT (MO)	10 Sec. (psi)	50 Sec. (psi)	100 Sec. (psi)	1000 Sec. (psi)
22788	+140	78076	164	257	227	213	187
				203	177	167	143
				227	197	183	160
			...Mean/S.D.=	229/27	200/25	188/23	163/22
22788	+180	78076	164	200	170	163	137
				257	230	217	170
				237	207	197	163
			...Mean/S.D.=	231/29	202/30	192/27	157/17

TABLE 15

BURN RATE
INITIAL PRESSURE = 350 PSI
(NON-ORIENTED)

	MSN	TEST DATE	AAT (MO)	BURN RATE (IN/SEC)
(OUTER)	0022135	78082	177	0.270
				0.270
				0.270
			...Mean/S.D. =	0.270/0.0
	0022788	78082	164	0.316
				0.316
				0.315
			...Mean/S.D. =	0.3157/0.00058
(INNER)	0022135	78082	177	0.319
				0.319
				0.318
			...Mean/S.D. =	0.3187/0.00058
	0022788	78082	164	0.271
				0.271
				0.272
			...Mean/S.D. =	0.2713/0.00058

BURN RATE
INITIAL PRESSURE = 500 PSI
(NON-ORIENTED)

(OUTER)	0022135	78082	177	0.275
				0.275
				0.275
			...Mean/S.D. =	0.275/0.0
	0022788	78082	164	0.336
				0.339
				0.335
			...Mean/S.D. =	0.3367/0.0021
(INNER)	0022135	78082	177	0.340
				0.340
				0.341
			...Mean/S.D. =	0.3403/0.00058
	0022788	78082	164	0.273
				0.273
				0.273
			...Mean/S.D. =	0.273/0.0

TABLE 16

THERMAL COEFFICIENT OF LINEAR EXPANSION
(NON-ORIENTED)
Temp -120° to 0°C

	MSN	TEST DATE	AAT (MO)	TCLE/ BELOW (IN/IN/°C)	GLASS POINT (°C)	TCLE/ ABOVE (IN/IN/°C)
Outer	0022788	78072	164	0.0000622	-60.0	0.0000950
				0.0000633	-59.0	0.0000950
				0.0000578	-55.0	0.0000982
	...Mean/S.D. =			0.0000611/0.0000029	-58/2.65	0.0000961/0.0000018
	0022135	78073	177	0.0000635	-59.0	0.0000918
				0.0000696	-63.0	0.0000849
				0.0000666	-60.0	0.0000900
	...Mean/S.D. =			0.0000666/0.0000031	-60.7/2.08	0.0000889/0.0000036
Inner	0022788	78072	164	0.0000633	-56.0	0.0001010
				0.0000691	-57.0	0.0001033
				0.0000683	-56.0	0.0001068
	...Mean/S.D. =			0.0000669/0.0000031	-56.3/0.58	0.0001037/0.0000029
	0022135	78073	177	0.0000608	-60.0	0.0000947
				0.0000661	-60.0	0.0000917
				0.0000612	-59.0	0.0000931
				0.0000702	-57.0	0.0000976
	...Mean/S.D. =			0.0000646/0.0000045	-59.0/1.41	0.0000943/0.0000025

TABLE 17

TCLE EQUATIONS OF CURVES

Below Tg

Motor Nr	Propellant	TCLE x 10^5(1)	Equation of Curve (1)	L, inches
0022135	Inner	6.46	Y = -2.9297A+1.2500B+1.4796C+0.0015450	0.19925
0022135	Outer	6.66	Y = -6.0417A+0.78750B+1.5162C+0.0016016	0.20033
0022788	Inner	6.69	Y = -6.1458A+0.81880B+1.5256C+0.0016066	0.20000
0022788	Outer	6.11	Y = -7.8177A+0.36380B+1.3770C+0.0014649	0.19967

Above Tg

0022135	Inner	9.43	Y = -0.65104A+2.5000B+2.1886C+0.0022551	0.19925
0022135	Outer	8.89	Y = -9.5703A+0.72500B+2.0068C+0.0021384	0.20033
0022788	Inner	10.37	Y = -3.8672A+2.3000B+2.4066C+0.0024900	0.20000
0022788	Outer	9.61	Y = -8.6590A+1.0453B+2.1682C+0.0023017	0.19967

(1) -120 to 0°C. The TCLE trace below Tg was extrapolated to 0°C and the trace above Tg was extrapolated to -120°C.

NOTE: $A = 10^{-11} X^3$

$B = 10^{-8} X^2$

$C = 10^{-5} X$

TABLE 18

HARDNESS
DISSECTED MOTORS
(NON-ORIENTED)

	MSN	TEST DATE	AAT (MO)	SHORE-A 10 SEC.
Outer	0022135	78080	177	67.0
				67.0
				68.0
				68.0
				66.0
				67.0
				70.0
				68.0
			...Mean/S.D.=	67.6/1.19
	0022788	78090	164	66.0
				65.0
				65.0
				63.0
				64.0
				63.0
				63.0
				67.0
			...Mean/S.D.=	64.5/1.51
Inner	0022135	78080	177	68.0
				67.0
				68.0
				69.0
				69.0
				69.0
				69.0
				70.0
			...Mean/S.D.=	68.6/0.92
	0022788	78080	164	59.0
				57.0
				60.0
				60.0
				60.0
				59.0
				60.0
				58.0
			...Mean/S.D.=	59.1/1.13

TABLE 19
CASE BOND

1. Bond Shear, Constant Load
Case/Liner/Propellant "Poker Chip"

A. TEST TEMP: 77°F

MSN	Test Date	AAT (mo)	Regression Equation (1)	Predicted Load PSI, To Fail At 1 min	10 min
0022135	78207	181	Y = -0.07647X+1.554	35.8	30.0
0022788	78206	162	Y = -0.1119X+1.619	41.6	32.1

B. TEST TEMP: 120°F

0022788	78206	168	Y = -0.2283X+1.485	30.5	18.0

2. Bond Tensile, Constant Load
Case/Liner/Propellant "Sleeved Bond Specimen"

TEST TEMP: 77°F

MSN	Test Date	AAT (mo)	Regression Equation (1)	Predicted Load PSI, To Fail At 1 min	10 min
0022135	78205	181	Y = -0.03695X+1.550	35.5	32.6
0022788	78204	168	Y = -0.03169X+1.539	34.6	32.2

(1) Obtained from log, log plots, therefore, logs of times must be used in evaluations.

TABLE 20
BULK MODULUS, MOTOR 0022788 INNER, SPECIMEN NR. 2

1977 Data as Originally Reported				1977 Data Recalculated			
Applied Pressure PSI From	To	% Change In Volume	K/Bulk Modulus PSI/x10^{-5}	Applied Pressure PSI From	To	% Change In Volume	K/Bulk Modulus PSI/x10^{-5}
0	200	0.060	3.33	0	200	0.060	3.33
0	400	0.084	4.76	200	400	0.024	8.33
0	600	0.102	5.88	400	600	0.018	11.11
0	800	0.126	6.35	600	800	0.024	8.33
0	1000	0.144	6.94	800	1000	0.018	11.11
0	1200	0.168	7.14	1000	1200	0.024	8.33
0	1400	0.186	7.53	1200	1400	0.018	11.11
0	1600	0.204	7.84	1400	1600	0.018	11.11
0	1800	0.228	7.90	1600	1800	0.024	8.33
0	2000	0.246	8.13	1800	2000	0.018	11.11

TABLE 21
BULK MODULUS, 1977 DATA RECALCULATED

Motor 0022135 Inner, Age at Test 172 Months

Applied Pressure PSI		Specimen Nr. 1		Specimen Nr. 2		Specimen Nr. 3			
From	To	% Change In Volume	K/Bulk Modulus PSI/x10^{-5}	% Change In Volume	K/Bulk Modulus PSI/x10^{-5}	% Change In Volume	K/Bulk Modulus PSI/x10^{-5}	% Change In Volume Mean/S.D.	K/ Mean S.D.x10^{-5}
0	200	0.054	3.70	0.048	4.17	0.072	2.78	0.058/0.0125	3.55/0.707
200	1400	0.132	9.09	0.150	8.00	0.150	8.00	0.144/0.0104	8.36/0.629
200	2000	0.198	9.09	0.216	8.33	0.210	8.57	0.208/0.00916	8.66/0.388
Motor 0022788 Inner, Age at Test 158 Months									
0	200	0.042	4.76	0.060	3.33	0.018	11.11	0.040/0.0211	6.40/4.17
200	1400	0.150	8.00	0.126	9.52	0.126	9.52	0.134/0.0138	9.01/0.878
200	2000	0.228	7.89	0.186	9.68	0.192	9.37	0.202/0.0227	8.98/0.957
Motor 0022788 Outer, Age at Test 158 Months									
0	200	0.070	2.56	0.072	2.78	0.042	4.76	0.0613/0.0168	3.37/1.21
200	1400	0.108	11.11	0.168	7.14	0.138	8.70	0.138/0.0300	8.98/2.00
200	2000	0.156	11.54	0.240	7.50	0.204	8.82	0.200/0.0421	9.29/2.06

TABLE 22
BULK MODULUS SUMMARY

Applied Pressure PSI From	To	Motor Nr. & Propellant	1977 Data Recalculated % Change In Volume Mean/S	1977 Data Recalculated $Kx10^{-5}$ Mean/S	1978 Data % Change In Volume Mean/S	1978 Data $Kx10^{-5}$ Mean/S
200	1400	0022135 Inner	0.144/0.0104	8.36/0.629	0.165/0.0134	7.31/0.611
200	1400	0022135 Outer	No date		0.122/0.0409	10.42/3.51
200	1400	0022788 Inner	0.134/0.0138	9.01/0.878	0.173/0.0226	7.00/0.0912
200	1400	0022788 Outer	0.138/0.0300	8.98/2.00	0.154/0.0143	8.22/1.38

TABLE 23
BULK MODULUS 1978

Motor 0022135 Inner, Age at Test 178 Months

Applied Pressure PSI From	To	Specimen Nr. 1 % Change In Volume	K/Bulk Modulus PSI/x10^{-5}	Specimen Nr. 2 % Change In Volume	K/Bulk Modulus PSI/x10^{-5}	Specimen Nr. 3 % Change In Volume	K/Bulk Modulus PSI/x10^{-5}	% Change In Volume Mean/S.D.	K/ Mean S.D.x10^{-5}
0	200	0.096	2.08	0.0785	2.55	0.0349	5.73		
200	1400	0.160	7.50	0.148	8.09	0.174	6.88		
		Specimen Nr. 4							
0	200	0.113	1.76					0.0806/0.0336	3.03/1.83
200	1400	0.177	6.77					0.165/0.0134	7.31/0.611

Motor 0022135 Outer, Age at Test 178 Months

0	200	0.0320	6.26	0.0872	2.29			0.0596/0.039?	4.28/2.81
200	1400	0.0931	12.90	0.151	7.94			0.122/0.0409	10.42/3.51

Motor 0022788 Inner, Age at Test 165 Months

0	200	0.0523	3.82	0.0465	4.30			0.0494/0.00410	4.06/0.339
200	1200	0.174	6.88	0.140	8.60			0.157/0.0240	7.74/1.22
		Specimen Nr. 3		Specimen Nr. 4					
0	200	0.0640	3.13	0.0465	4.30			0.0552/0.0124	3.72/0.827
200	1400	0.157	7.64	0.189	6.35			0.173/0.0226	7.00/0.0912

Motor 0022788 Outer, Age at Test 165 Months

0	200	0.0407	4.91	0.0349	5.73	0.0523	3.82		
200	1400	0.145	8.62	0.134	10.47	0.160	7.51		
		Specimen Nr. 4		Speciemn Nr. 5					
0	200	0.0407	4.91	0.0465	4.30			0.0430/0.00661	4.73/0.721
200	1400	0.169	7.12	0.163	7.37			0.154/0.0143	8.22/1.38

TABLE 24

SOL GEL
Test Temp. 77°F (Non Oriented)

	MSN	Test Date	AAT (MO)	Gel Swell Ratio	Weight Swell Ratio	Mass Density (gm/cc)	Cross Link Density (1)	% Extract-able
OUTER	0022135	78075	177	11.4208	3.5994	1.7516	0.0322	7.9042
				11.6652	4.0101	1.7510	0.0316	7.4416
				11.0241	3.7085	1.7520	0.0316	7.4970
				10.9464	3.7316	1.7518	0.0303	7.4127
	...Mean			11.2641	3.7624	1.7516	0.0314	7.5639
	...S.D.			0.3386	0.1749	0.0004	0.0008	0.2296
	0022788	78075	164	9.6914	3.2720	1.7520	0.0430	7.3169
				9.5903	3.3199	1.7511	0.0430	7.1628
				9.8586	3.2954	1.7430	0.0418	7.4652
				9.4410	3.3309	1.7532	0.0469	7.0115
	...Mean			9.6453	3.3046	1.7498	0.0437	7.2391
	...S.D.			0.1755	0.0263	0.0046	0.0022	0.1956
INNER	0022135	78075	177	9.2145	2.9013	1.7572	0.0499	7.6030
				8.4544	2.9200	1.7572	0.0673	6.9511
				9.2396	2.9112	1.7583	0.0573	7.5947
				8.8291	3.8336	1.7557	0.0600	5.4921
	...Mean			8.9344	3.1415	1.7571	0.0586	6.9102
	...S.D.			0.3710	0.4614	0.0011	0.0072	0.9935
	0022788	78075	164	8.3647	3.3202	1.7566	0.0407	6.0468
				8.3893	3.3303	1.7570	0.0397	6.0482
				8.7929	3.2844	1.7569	0.0516	6.5250
				8.8604	3.2233	1.7572	0.0516	6.7024
	...Mean			8.6018	3.2896	1.7569	0.0459	6.3306
	...S.D.			0.2613	0.0484	0.0002	0.0066	0.3348

(1) Units are milliequivalents per cubic centimeter

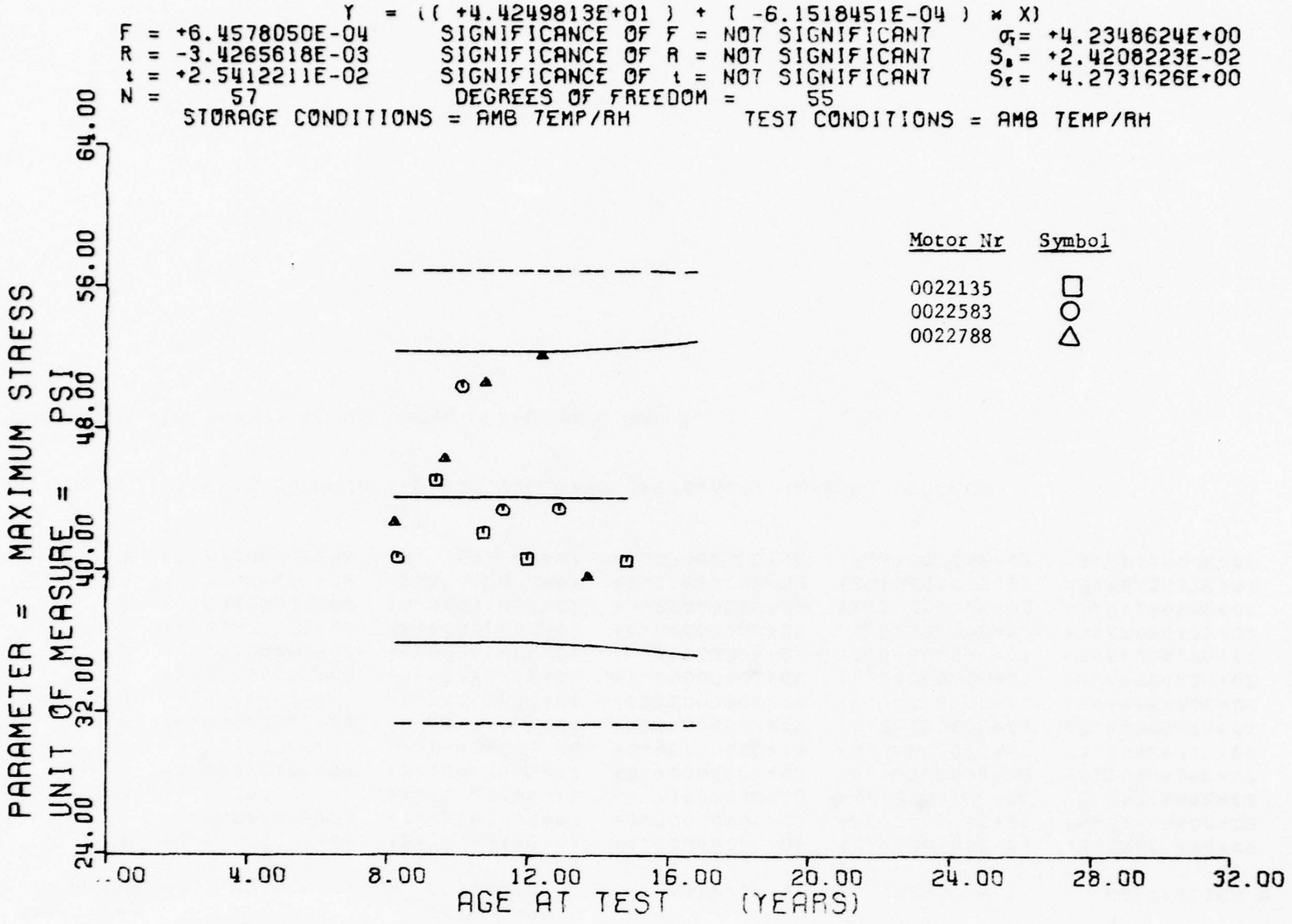
**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
99.0	8	+3.5050000E+02	+5.3092910E+01	+4.4000000E+02	+2.8400000E+02	+3.7260961E+02
100.0	8	+2.9462500E+02	+1.7880073E+01	+3.2000000E+02	+2.7200000E+02	+3.7251440E+02
113.0	8	+4.4325000E+02	+1.8273712E+01	+4.7100000E+02	+4.1900000E+02	+3.7127954E+02
116.0	4	+3.6550000E+02	+2.1548395E+01	+3.9000000E+02	+3.3800000E+02	+3.7059438E+02
122.0	4	+3.8525000E+02	+7.8049129E+00	+3.9500000E+02	+3.7800000E+02	+3.7042431E+02
129.0	4	+4.4500000E+02	+9.8319208E+00	+4.5400000E+02	+4.3600000E+02	+3.6975927E+02
130.0	3	+4.6466650E+02	+2.7024680E+01	+4.8500000E+02	+4.3400000E+02	+3.6966430E+02
136.0	3	+3.3166650E+02	+4.9328828E+00	+3.3500000E+02	+3.2600000E+02	+3.6909423E+02
144.0	3	+4.1033325E+02	+4.0278199E+01	+4.3700000E+02	+3.6400000E+02	+3.6833422E+02
149.0	3	+4.2133325E+02	+6.6063101E+01	+4.8900000E+02	+3.5700000E+02	+3.6785913E+02
155.0	3	+3.0300000E+02	+3.0643106E+01	+3.2500000E+02	+2.6800000E+02	+3.6728906E+02
165.0	3	+2.3766665E+02	+2.3544284E+01	+2.6200000E+02	+2.1500000E+02	+3.6633911E+02
178.0	3	+3.6700000E+02	+3.6999999E+01	+4.0700000E+02	+3.3400000E+02	+3.6510400E+02

II STAGE DSCT MTRS,OUTER,AXIAL FCS,V.L.RATE CHS=0.0002 IN/MIN, MODULUS

This sample size summary is applicable to figures 6 thru 8.



II STAGE DSCT MTRS, OUTER, AXIAL POS, V.L. RATE CHS=0.0002 IN/MIN, MAXIMUM STRESS

Figure 6

Y = ((+2.3631693E-01) + (-2.1214654E-04) × X)

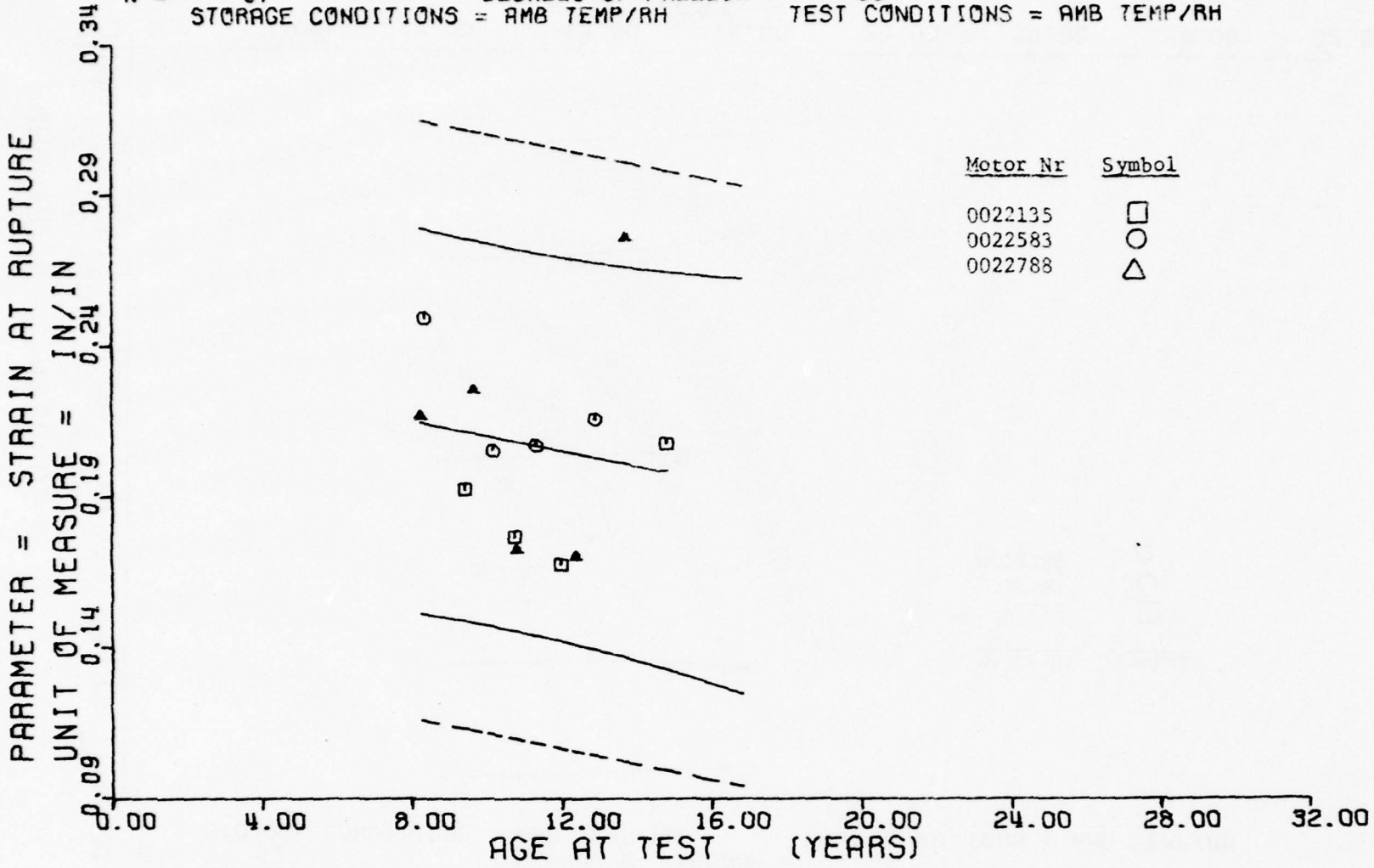
F = +1.2689540E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_1 = +3.3322679E-02

R = -1.5017184E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_b = +1.8832718E-04

t = +1.1264785E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_ε = +3.3242946E-02

N = 57 DEGREES OF FREEDOM = 55

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



II STAGE DSCT MTRS,OUTER,AXIAL POS,V.L.RATE CHS=0.0002 IN/MIN,STRAIN/RUPTURE

Figure 7

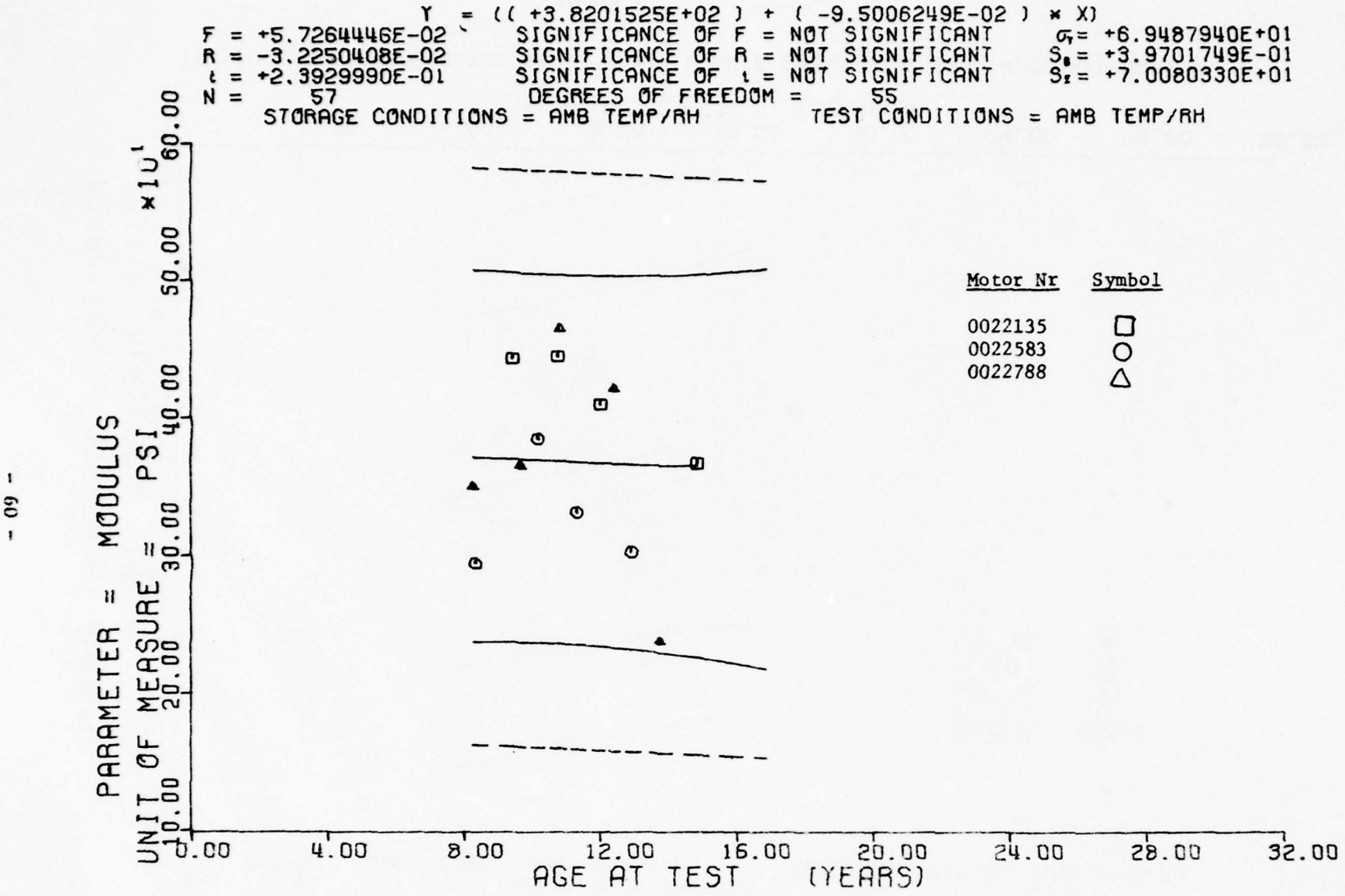

Y = ((+3.8201525E+02) + (-9.5006249E-02) * X)
F = +5.7264446E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT σY = +6.9487940E+01
R = -3.2250408E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT Sb = +3.9701749E-01
t = +2.3929990E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT Sr = +7.0080330E+01
N = 57 DEGREES OF FREEDOM = 55
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI
*10^1
60.00
50.00
40.00
30.00
20.00
10.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS,OUTER,AXIAL POS,V.L.RATE CHS=0.0002 IN/MIN, MODULUS

Figure 8

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
99.0	8	+1.8987500E+02	+1.1861552E+01	+2.1300000E+02	+1.820C000E+02	+2.2239317E+02
100.0	8	+1.7562500E+02	+1.0013383E+01	+1.9500000E+02	+1.650CCC0E+02	+2.2344938E+02
113.0	8	+3.1900000E+02	+1.5638779E+01	+3.5100000E+02	+2.980CC00E+02	+2.3718CC0E+02
116.0	4	+2.4200000E+02	+8.3666002E+00	+2.4900000E+02	+2.3100000E+02	+2.4034860E+02
122.0	4	+1.7700000E+02	+2.1502468E+00	+1.800CC00E+02	+1.750CC00E+02	+2.4668582E+02
129.0	4	+4.2100000E+02	+3.1187604E+01	+4.4800000E+02	+3.760CC00E+02	+2.54C7922E+02
130.0	3	+2.2900000E+02	+5.1961524E+00	+2.3200000E+02	+2.230C000E+02	+2.5513542E+02
136.0	3	+1.9133332E+02	+1.9731531E+01	+2.140C000E+02	+1.780CC00E+02	+2.6147241E+02
144.0	3	+4.0000000E+02	+2.5980762E+01	+4.3000000E+02	+3.850CC00E+02	+2.6952211E+02
149.0	3	+2.2066665E+02	+8.1445278E+00	+2.3000000E+02	+2.150CC00E+02	+2.7520312E+02
155.0	3	+2.7700000E+02	+8.8881944E+01	+3.7700000E+02	+2.070CC00E+02	+2.8154028E+02
162.0	4	+2.6950000E+02	+2.4255583E+01	+2.940C000E+02	+2.360CCC0E+02	+2.8853383E+02
165.0	3	+1.8866665E+02	+1.4047538E+01	+2.0200000E+02	+1.740CC00E+02	+2.9210229E+02
178.0	3	+3.2466650E+02	+3.0664855E+01	+3.6000000E+02	+3.050C000E+02	+3.0583300E+02

II STAGE DSCT MTRS,INNER,AXIAL POS,V.L.RATE CHS=0.C002 IN/MIN, MODULUS

This sample size summary is applicable to figures 9 thru 11.

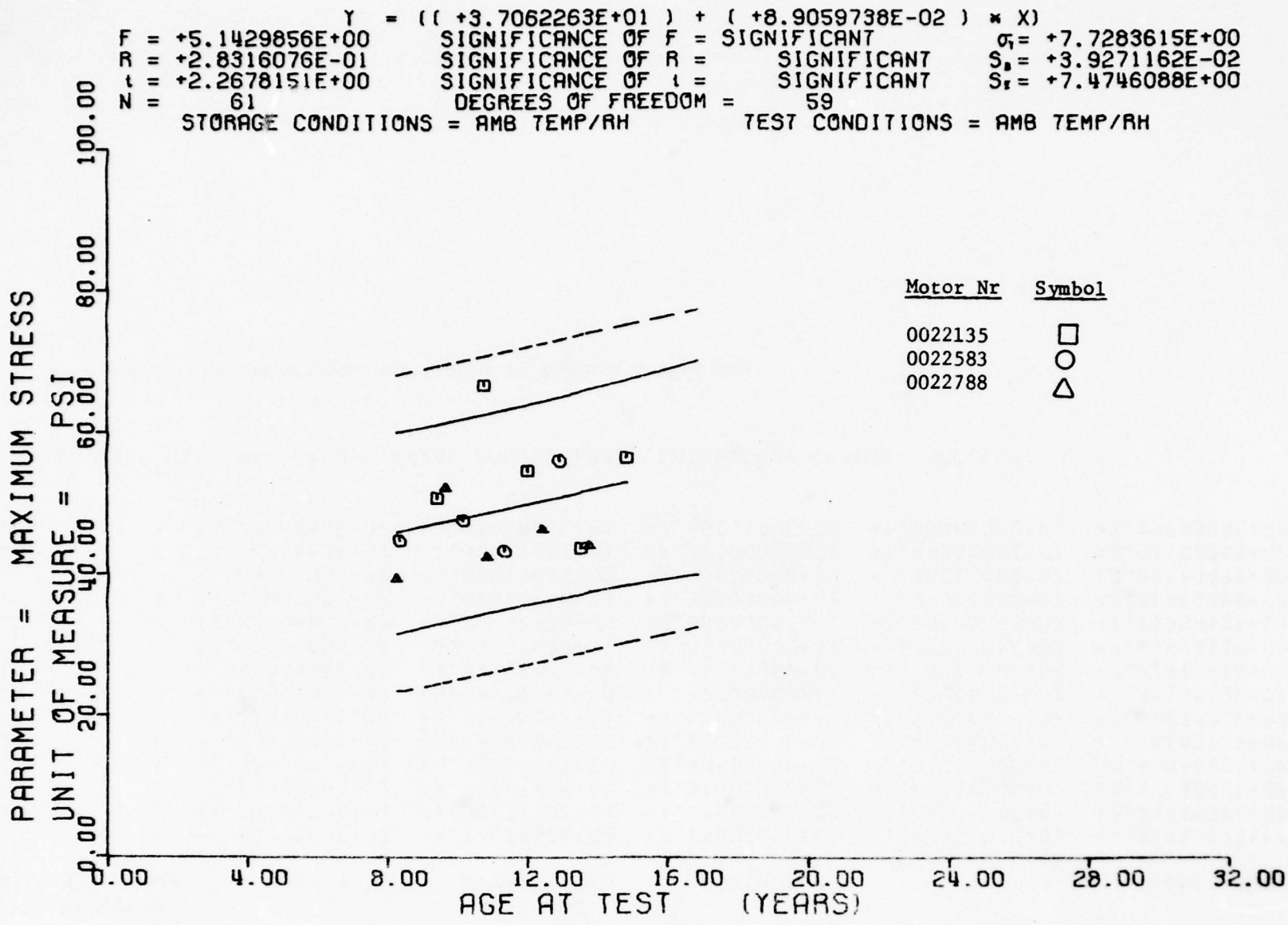

Y = ((+3.7062263E+01) + (+8.9059738E-02) * X)
F = +5.1429856E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +7.7283615E+00
R = +2.8316076E-01 SIGNIFICANCE OF R = SIGNIFICANT S = +3.9271162E-02
t = +2.2678151E+00 SIGNIFICANCE OF t = SIGNIFICANT S = +7.4746088E+00
N = 61 DEGREES OF FREEDOM = 59
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
0.00
20.00
40.00
60.00
80.00
100.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS, INNER, AXIAL POS, V.L. RATE CHS=0.0002 IN/MIN, MAXIMUM STRESS

Figure 9

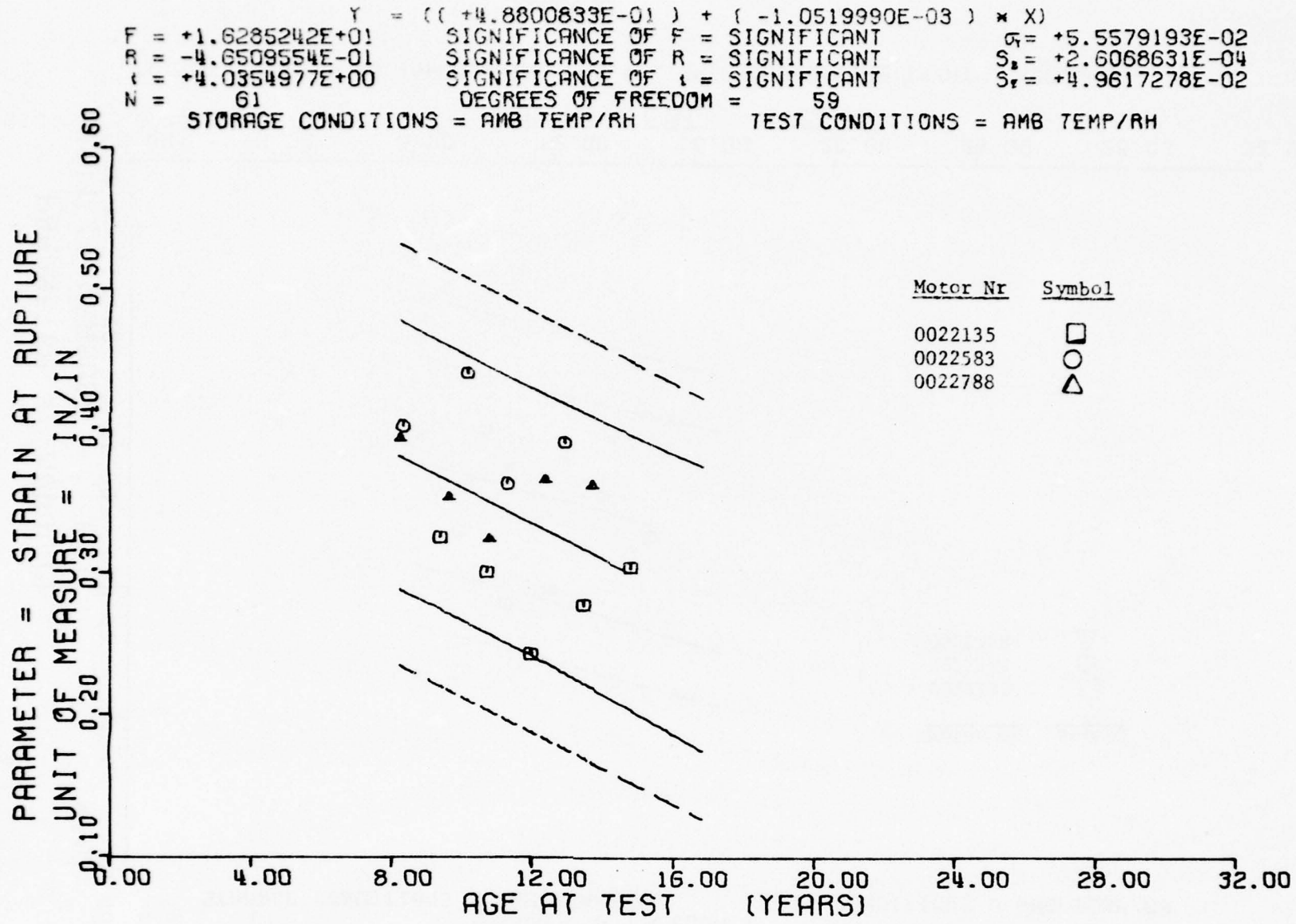

Y = ((+4.8800833E-01) + (-1.0519990E-03) * X)
F = +1.6285242E+01 SIGNIFICANCE OF F = SIGNIFICANT σr = +5.5579193E-02
R = -4.6508554E-01 SIGNIFICANCE OF R = SIGNIFICANT Sb = +2.6068631E-04
t = +4.0354977E+00 SIGNIFICANCE OF t = SIGNIFICANT Sr = +4.9617278E-02
N = 61 DEGREES OF FREEDOM = 59
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.10
0.20
0.30
0.40
0.50
0.60
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS, INNER, AXIAL POS, V.L.RATE CHS=0.0002 IN/MIN, STRAIN/RUPTURE

Figure 10

Y = ((+1.1782923E+02) + (+1.0562015E+00) * X)

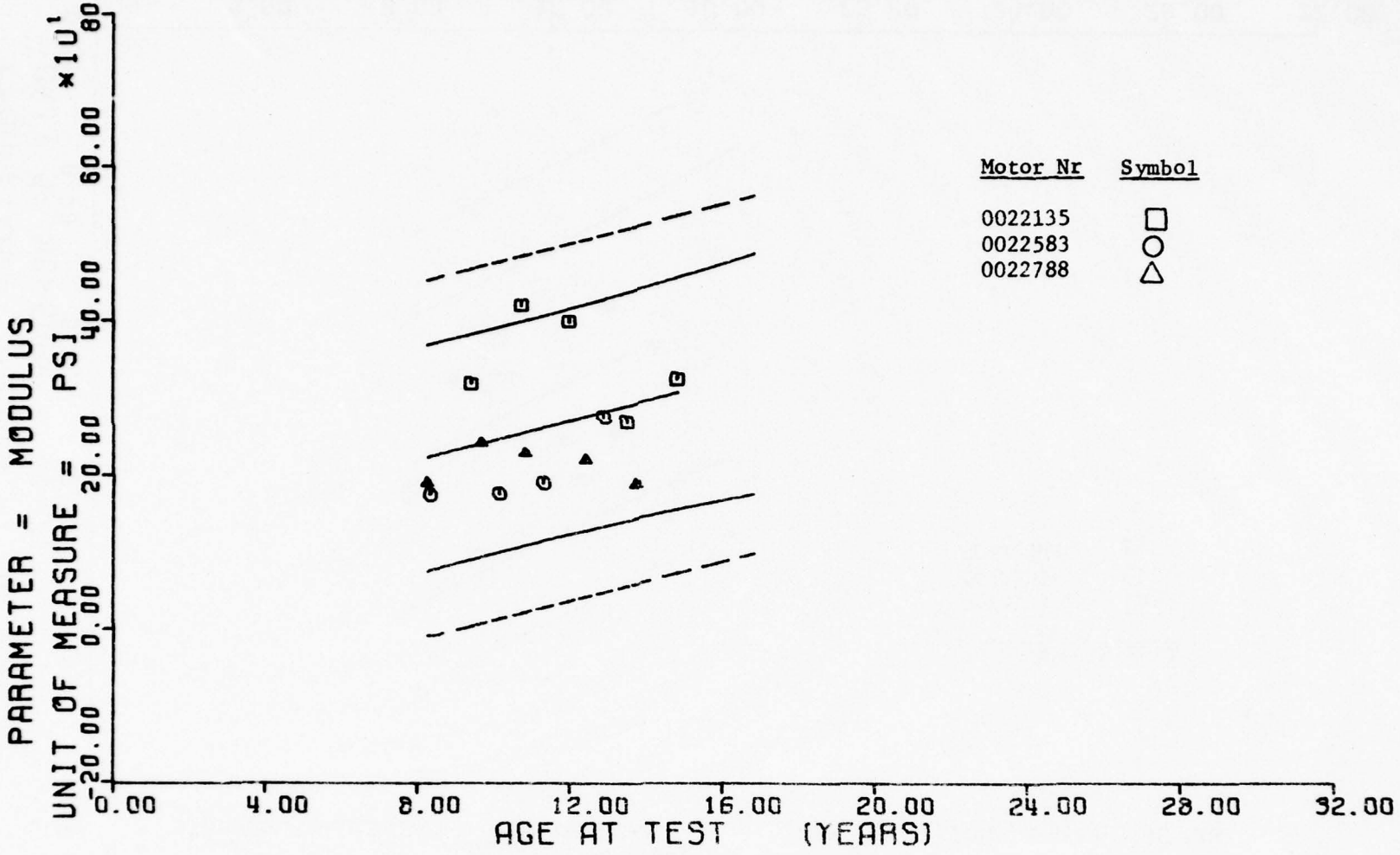
F = +6.7907853E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +8.0780851E+01

R = +3.2127539E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +4.0530951E-01

t = +2.6059135E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +7.7143886E+01

N = 61 DEGREES OF FREEDOM = 59

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



II STAGE DSCT MTRS, INNER, AXIAL POS, V.L. RATE CHS=0.0002 IN/MIN, MODULUS

Figure 11

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
100.0	16	+9.5937500E+01	+1.4172596E+01	+1.1500000E+02	+8.0000000E+01	+1.0876467E+02
113.0	8	+1.2962500E+02	+3.9256482E+00	+1.3500000E+02	+1.2300000E+02	+1.1231688E+02
115.0	4	+1.2783996E+02	+1.2918885E+00	+1.2962998E+02	+1.2666999E+02	+1.1276507E+02
122.0	4	+1.2726489E+02	+1.2461648E+00	+1.2857998E+02	+1.2614999E+02	+1.1463192E+02
129.0	4	+1.2971240E+02	+8.4571722E-01	+1.3075000E+02	+1.2903999E+02	+1.1649877E+02
131.0	3	+1.2301992E+02	+7.1236251E-01	+1.2377999E+02	+1.2240998E+02	+1.1703216E+02
137.0	3	+1.0322329E+02	+2.1504902E+00	+1.0519999E+02	+1.0086999E+02	+1.1863232E+02
143.0	4	+1.0432495E+02	+9.7243835E+00	+1.1617999E+02	+9.4009994E+01	+1.2023248E+02
148.0	3	+1.2969985E+02	+2.6765109E+00	+1.3144999E+02	+1.2662998E+02	+1.2186594E+02
155.0	3	+1.4210993E+02	+8.1255019E+00	+1.5122999E+02	+1.3562998E+02	+1.2343280E+02
161.0	3	+1.1301660E+02	+1.7623937E+00	+1.1472999E+02	+1.1121998E+02	+1.2503295E+02
165.0	3	+1.1660664E+02	+7.2316964E+00	+1.2160998E+02	+1.0848999E+02	+1.2609573E+02
177.0	2	+1.1819499E+02	+9.9657917E-01	+1.1889999E+02	+1.1748999E+02	+1.2930004E+02

1
65
1

II STAGE DSCT MTRS ONLY, OUTER,AXIAL PCS,LOW RATE CRS=2.0 IN/MIN,MAX STRESS

This sample size summary is applicable to figures 12 thru 14.

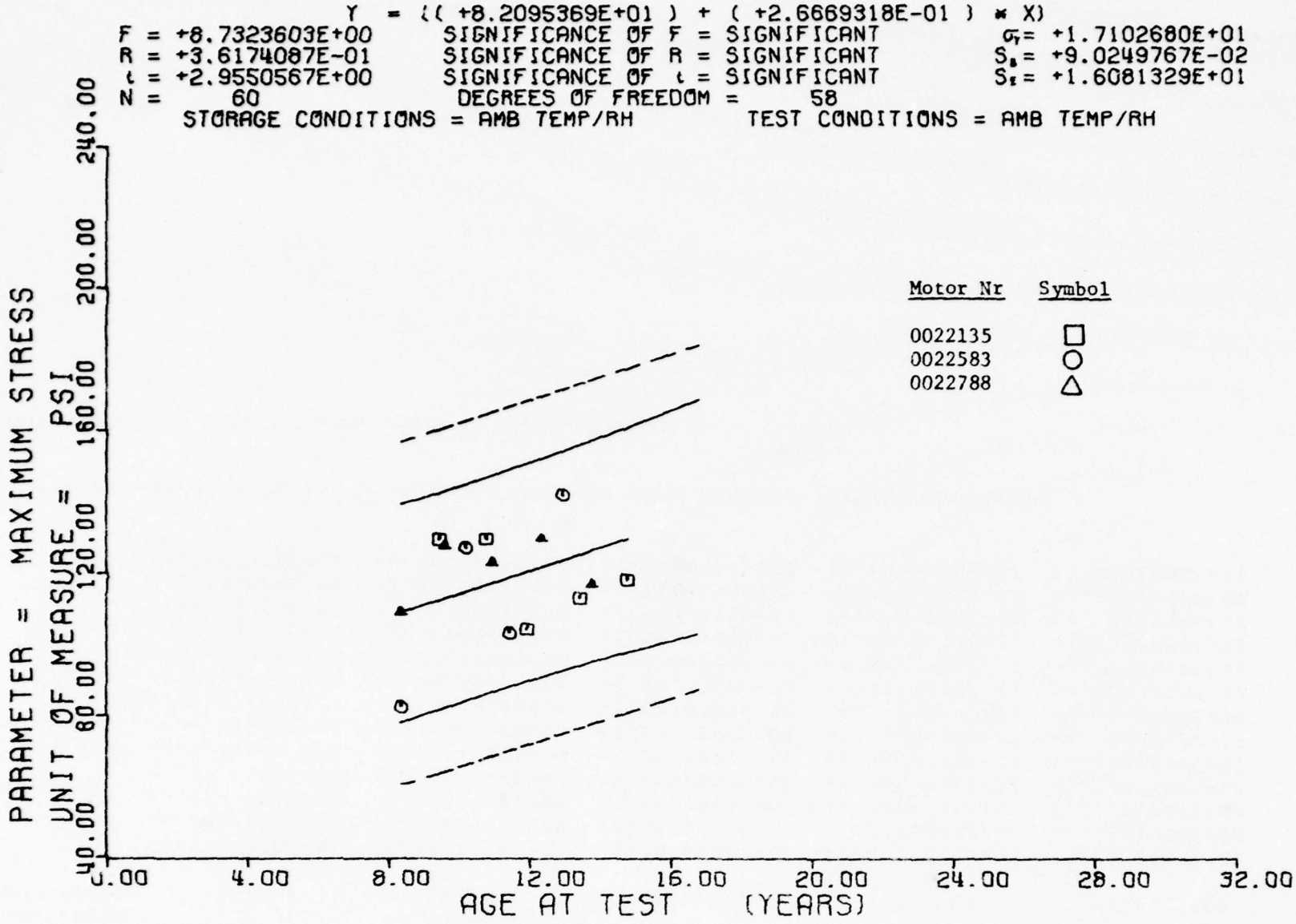

Y = ((+8.2095369E+01) + (+2.6669318E-01) * X)
F = +8.7323603E+00 SIGNIFICANCE OF F = SIGNIFICANT σY = +1.7102680E+01
R = +3.6174087E-01 SIGNIFICANCE OF R = SIGNIFICANT Sb = +9.0249767E-02
t = +2.9550567E+00 SIGNIFICANCE OF t = SIGNIFICANT Se = +1.6081329E+01
N = 60 DEGREES OF FREEDOM = 58
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
40.00
80.00
120.00
160.00
200.00
240.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS ONLY, OUTER,AXIAL POS.LOW RATE CHS=2.0 IN/MIN,MAX STRESS

Figure 12

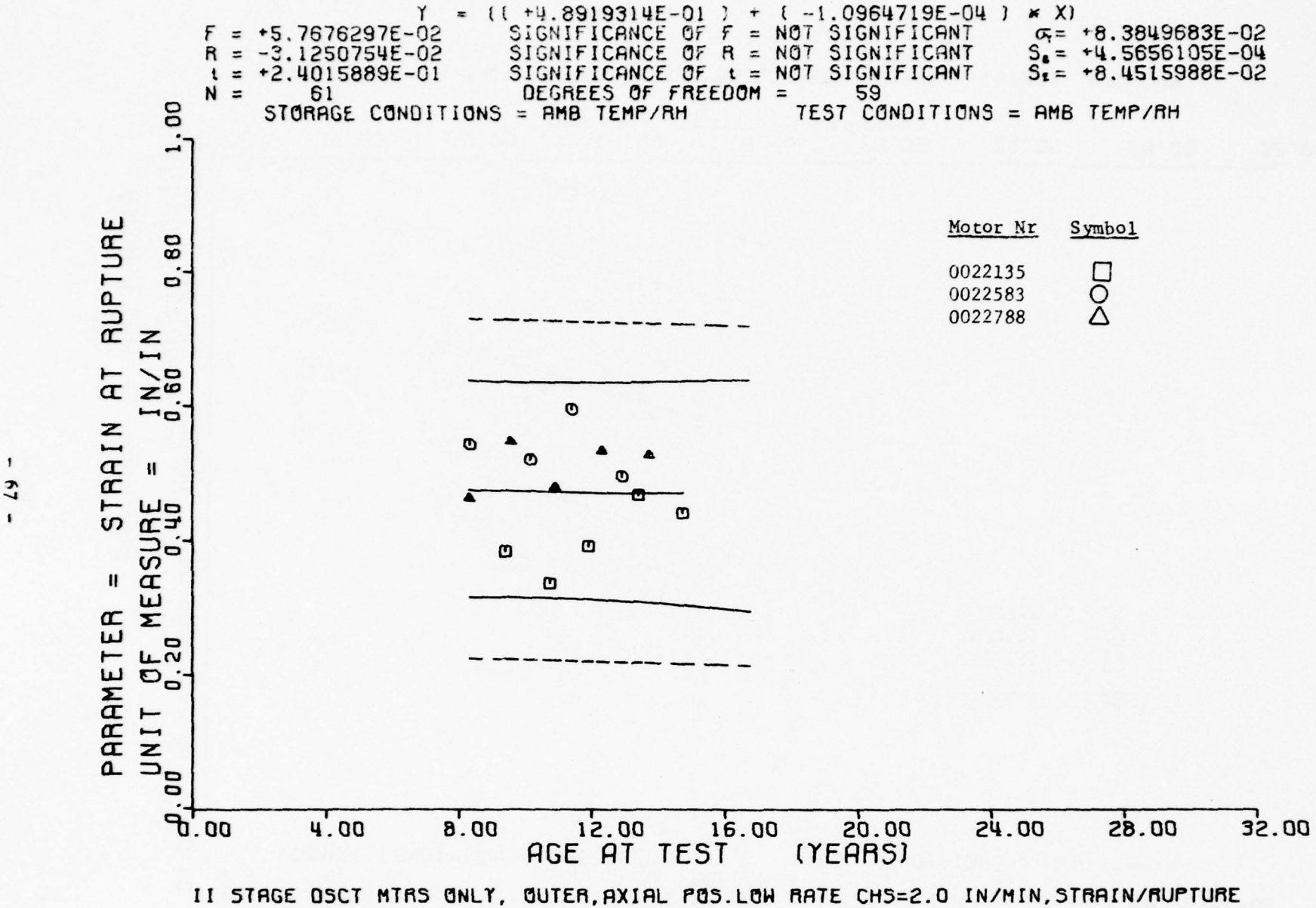

Y = (+4.8919314E-01) + (-1.0964719E-04) * X)
F = +5.7676297E-02 SIGNIFICANCE OF F = NOT SIGNIFICANT
R = -3.1250754E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT
t = +2.4015889E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT
N = 61 DEGREES OF FREEDOM = 59
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = AMB TEMP/RH
Motor Nr
Symbol
0022135
0022583
0022788
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.00
0.20
0.40
0.60
0.80
1.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
II STAGE OSCT MTRS ONLY, OUTER,AXIAL POS.LOW RATE CHS=2.0 IN/MIN,STRAIN/RUPTURE

Figure 13

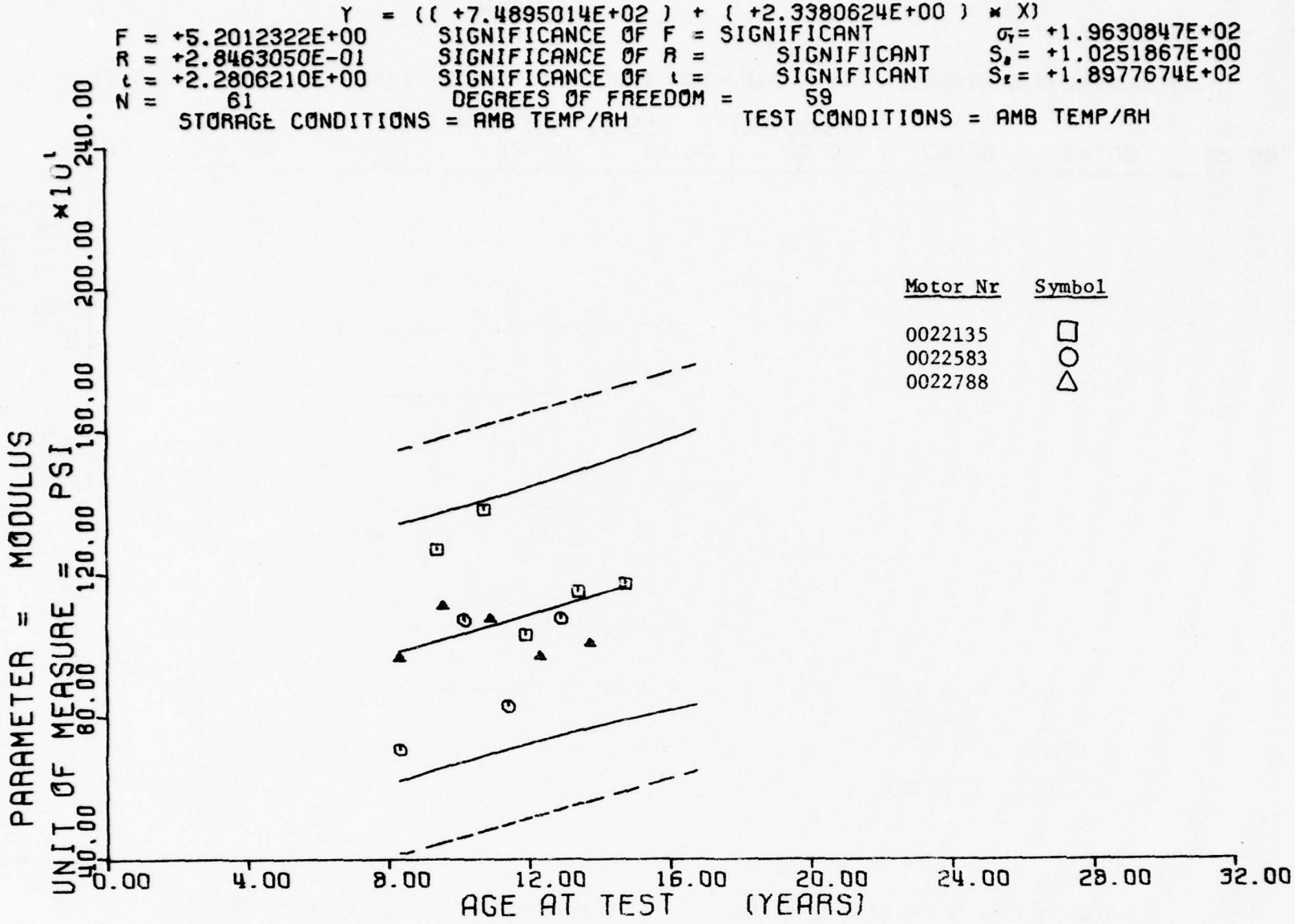

Y = ((+7.4895014E+02) + (+2.3380624E+00) * X)
F = +5.2012322E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_Y = +1.9630847E+02
R = +2.8463050E-01 SIGNIFICANCE OF R = SIGNIFICANT S_e = +1.0251867E+00
t = +2.2806210E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +1.8977674E+02
N = 61 DEGREES OF FREEDOM = 59
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10^1
40.00
80.00
120.00
160.00
200.00
240.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS ONLY, OUTER,AXIAL POS.LOW RATE CHS=2.0 IN/MIN, MODULUS

Figure 14

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
100.0	12	+9.6083328E+01	+8.6598166E+00	+1.1100000E+02	+8.6000000E+01	+1.1574629E+02
113.0	8	+1.5362500E+02	+3.6620642E+00	+1.5900000E+02	+1.5000000E+02	+1.2131475E+02
115.0	4	+1.2376245E+02	+1.8403804E+00	+1.2607998E+02	+1.2173999E+02	+1.2217144E+02
122.0	4	+1.2032745E+02	+1.2474978E+00	+1.2186999E+02	+1.1891999E+02	+1.2516986E+02
129.0	4	+1.6060485E+02	+1.6142939E+00	+1.6275999E+02	+1.5900999E+02	+1.2816825E+02
131.0	3	+1.1671997E+02	+2.2014737E+00	+1.1891999E+02	+1.1451998E+02	+1.2902494E+02
137.0	3	+1.2369995E+02	+1.3552253E+00	+1.2475999E+02	+1.2217999E+02	+1.3159501E+02
144.0	3	+1.4483657E+02	+1.7027619E+00	+1.4675999E+02	+1.4356999E+02	+1.3459342E+02
148.0	3	+1.1721328E+02	+4.1233268E+00	+1.2109999E+02	+1.1288999E+02	+1.3630679E+02
154.0	3	+1.3520996E+02	+3.8992797E+00	+1.3795999E+02	+1.3075000E+02	+1.3887686E+02
161.0	3	+1.5639656E+02	+6.1652806E+00	+1.6356999E+02	+1.5157998E+02	+1.4187527E+02
164.0	3	+1.1293325E+02	+5.3350770E+00	+1.1759999E+02	+1.0711999E+02	+1.4316030E+02

69

II STAGE,DSCT MTRS,ONLY, INNER,AXIAL POS,LOW RATE CHS=2.0 IN/MIN,MAX STRESS

This sample size summary is applicable to figures 15 thru 17.

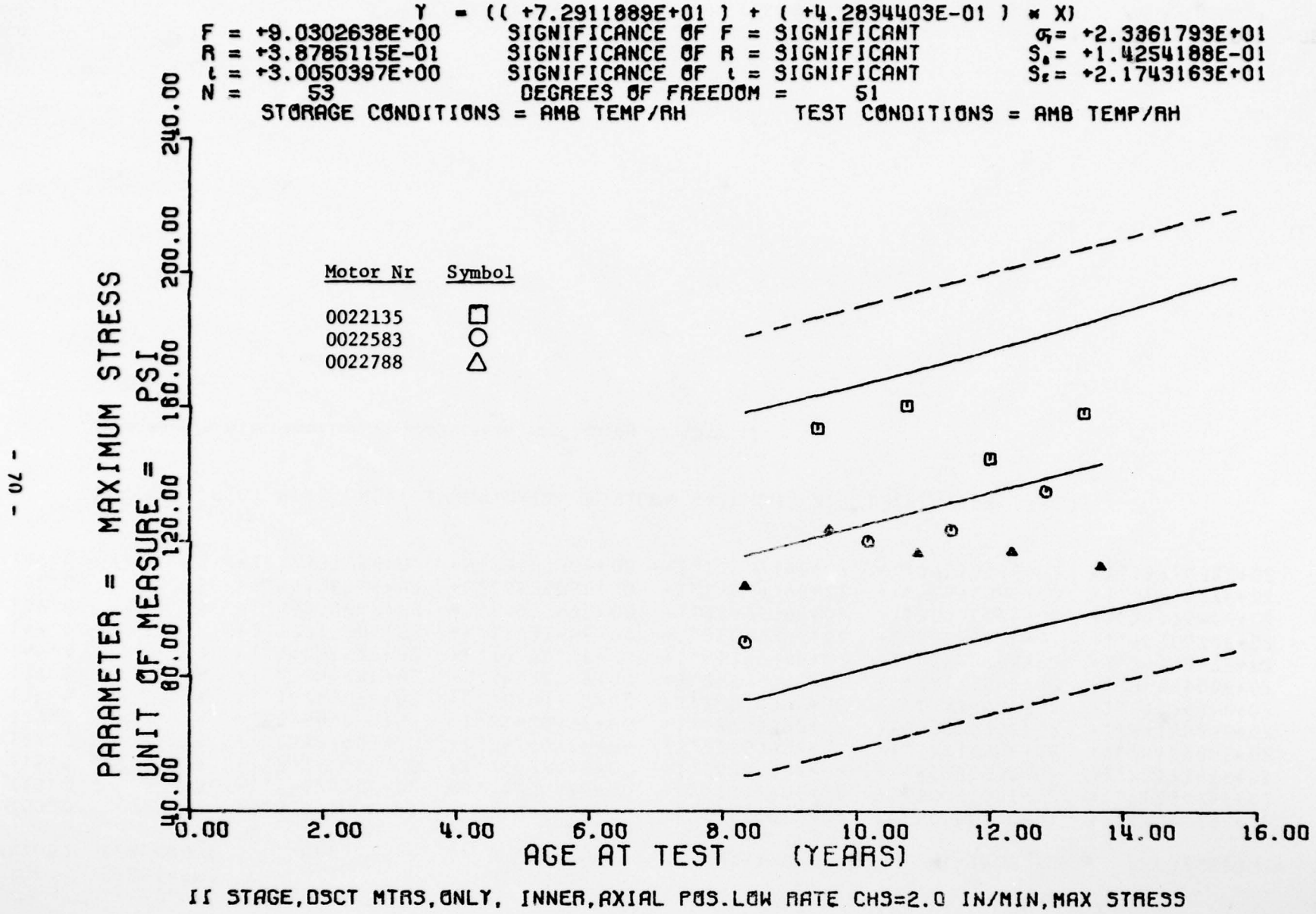

Y = ((+7.2911889E+01) + (+4.2834403E-01) * X)
F = +9.0302638E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +2.3361793E+01
R = +3.8785115E-01 SIGNIFICANCE OF R = SIGNIFICANT S = +1.4254188E-01
t = +3.0050397E+00 SIGNIFICANCE OF t = SIGNIFICANT S = +2.1743163E+01
N = 53 DEGREES OF FREEDOM = 51
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
Motor Nr Symbol
0022135
0022583
0022788
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
240.00
200.00
160.00
120.00
80.00
40.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
II STAGE,OSCT MTRS,ONLY, INNER,AXIAL POS.LOW RATE CHS=2.0 IN/MIN,MAX STRESS

Figure 15

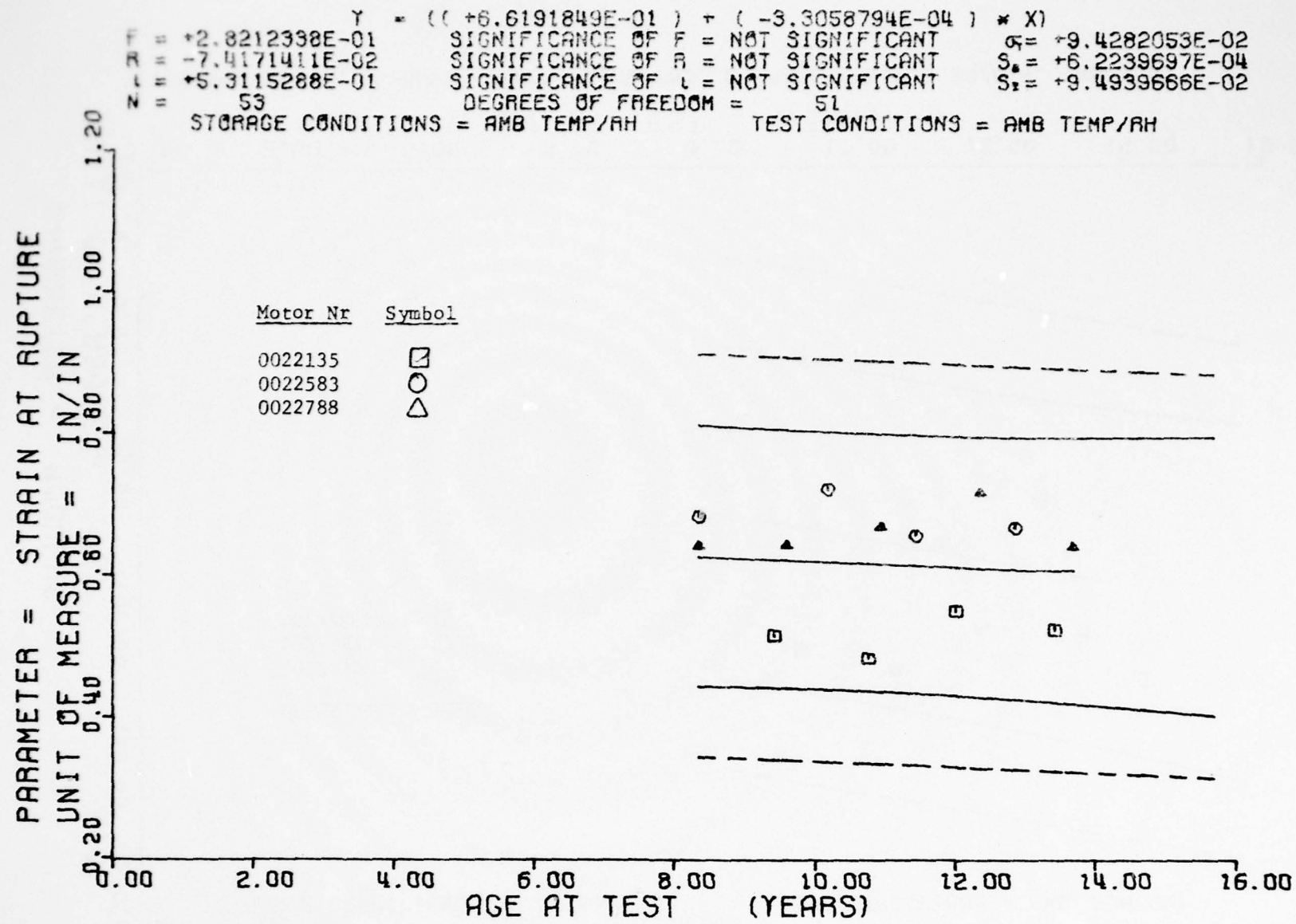

Y = ((+6.6191849E-01) + (-3.3058794E-04) * X)
F = +2.8212338E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ = +9.4282053E-02
R = -7.4171411E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT Sa = +6.2239697E-04
ι = +5.3115288E-01 SIGNIFICANCE OF ι = NOT SIGNIFICANT Sr = +9.4939666E-02
N = 53 DEGREES OF FREEDOM = 51
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
Motor Nr Symbol
0022135
0022583
0022788
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
II STAGE,DSCT MTRS,ONLY, INNER,AXIAL PDS.LOW RATE CHS=2.0 IN/MIN,STRAIN/RUPTURE

Figure 16

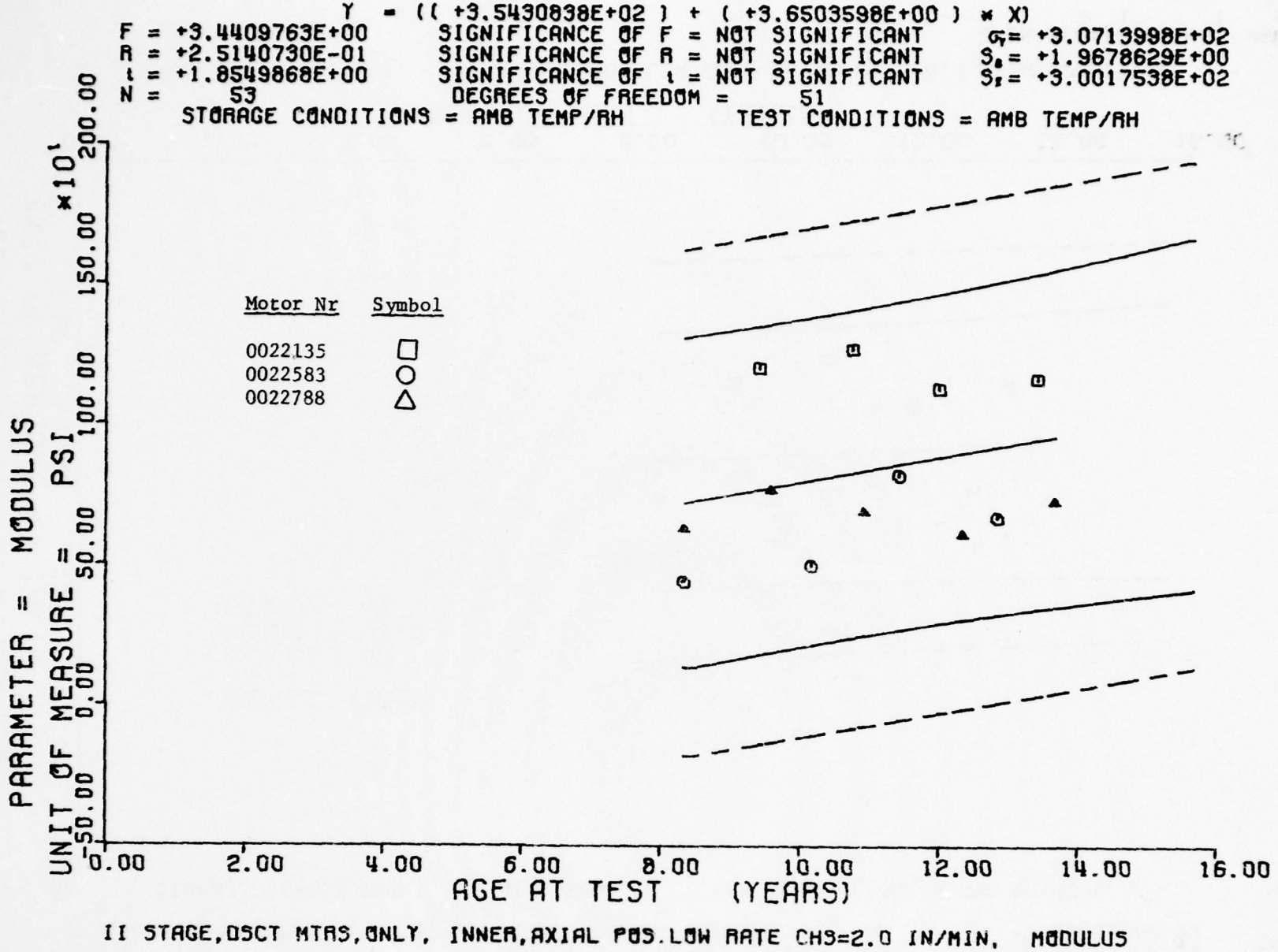

Y = ((+3.5430838E+02) + (+3.6503598E+00) * X)
F = +3.4409763E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT
R = +2.5140730E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT
t = +1.8549868E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT
N = 53 DEGREES OF FREEDOM = 51
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = AMB TEMP/RH
Motor Nr
Symbol
0022135
0022583
0022788
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10¹
200.00
150.00
100.00
50.00
0.00
-50.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
AGE AT TEST (YEARS)
II STAGE,OSCT MTRS,ONLY, INNER,AXIAL POS.LOW RATE CHS=2.0 IN/MIN, MODULUS

Figure 17

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
130.0	3	+1.1383662E+02	+9.7965671E-01	+1.1476999E+02	+1.1283999E+02	+1.0467709E+02
136.0	3	+9.5599929E+01	+3.1650804E+00	+9.9169998E+01	+9.3149993E+01	+1.0276249E+02
145.0	3	+9.3756591E+01	+2.5700148E+00	+9.6269989E+01	+9.1139999E+01	+9.9690625E+01
148.0	2	+1.0618499E+02	+4.8854464E+00	+1.0963999E+02	+1.0272999E+02	+9.8933319E+01
155.0	3	+9.3619970E+01	+4.9267017E+00	+9.6449996E+01	+8.7549987E+01	+9.6699645E+01
161.0	3	+9.3129959E+01	+7.7975986E+00	+1.0102999E+02	+8.5439987E+01	+9.4785049E+01
165.0	2	+9.6314987E+01	+2.1704230E+00	+9.7849990E+01	+9.4779998E+01	+9.3508651E+01
178.0	3	+9.1876617E+01	+1.9139357E+00	+9.3579986E+01	+8.9799987E+01	+8.9360382E+01

II STAGE DSCT MTRS ONLY,OUTER,AXIAL PCS.BIAXIAL CHS=0.2 IN/MIN,MAXIMUM STRESS

This sample size summary is applicable to figures 18 thru 20.

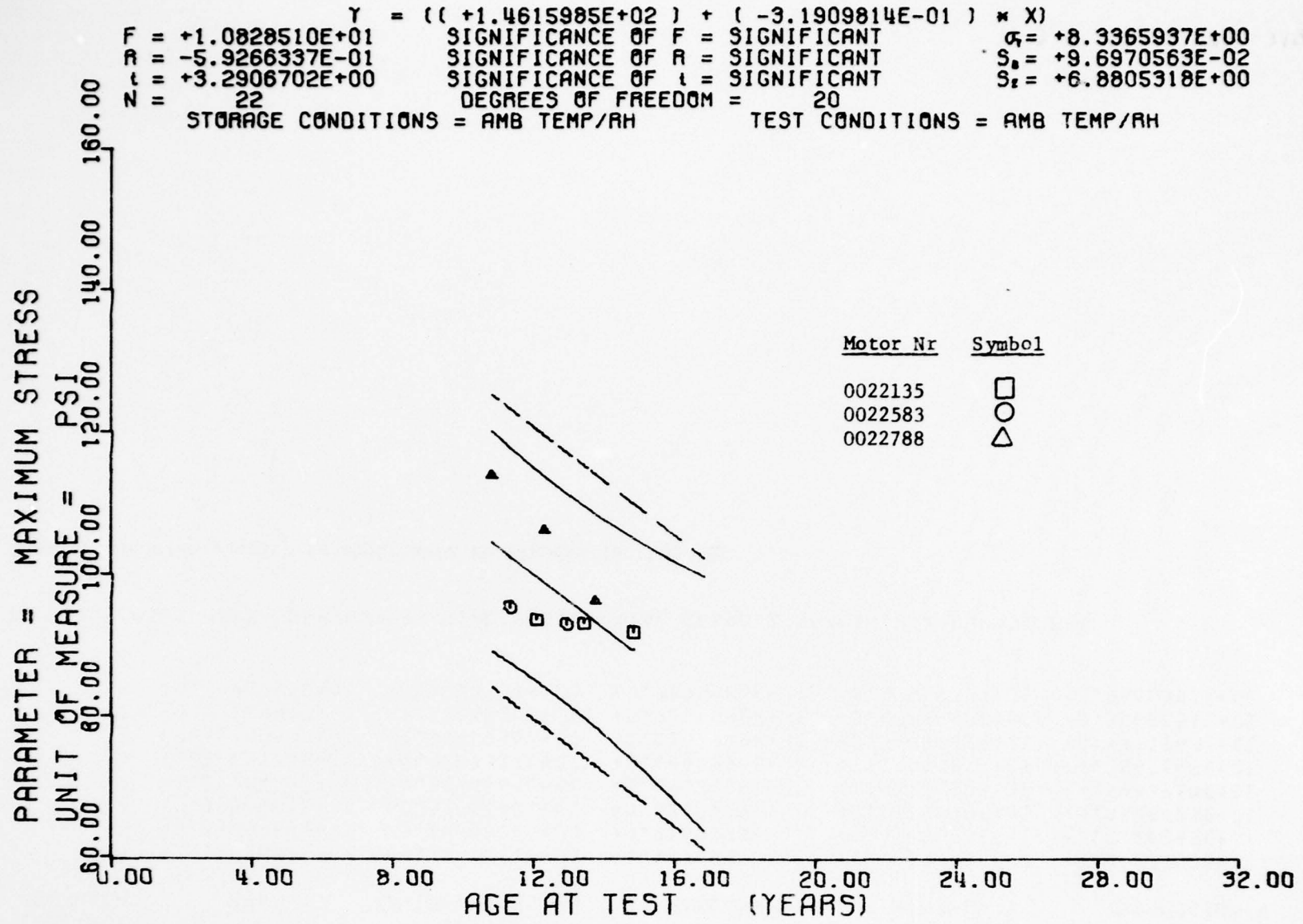

Y = ((+1.4615985E+02) + (-3.1909814E-01) * X)
F = +1.0828510E+01 SIGNIFICANCE OF F = SIGNIFICANT σ = +8.3365937E+00
R = -5.9266337E-01 SIGNIFICANCE OF R = SIGNIFICANT S_B = +9.6970563E-02
t = +3.2906702E+00 SIGNIFICANCE OF t = SIGNIFICANT S_Z = +6.8805318E+00
N = 22 DEGREES OF FREEDOM = 20
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
160.00
140.00
120.00
100.00
80.00
60.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS ONLY,OUTER,AXIAL POS.BIAXIAL CHS=0.2 IN/MIN,MAXIMUM STRESS

Figure 18

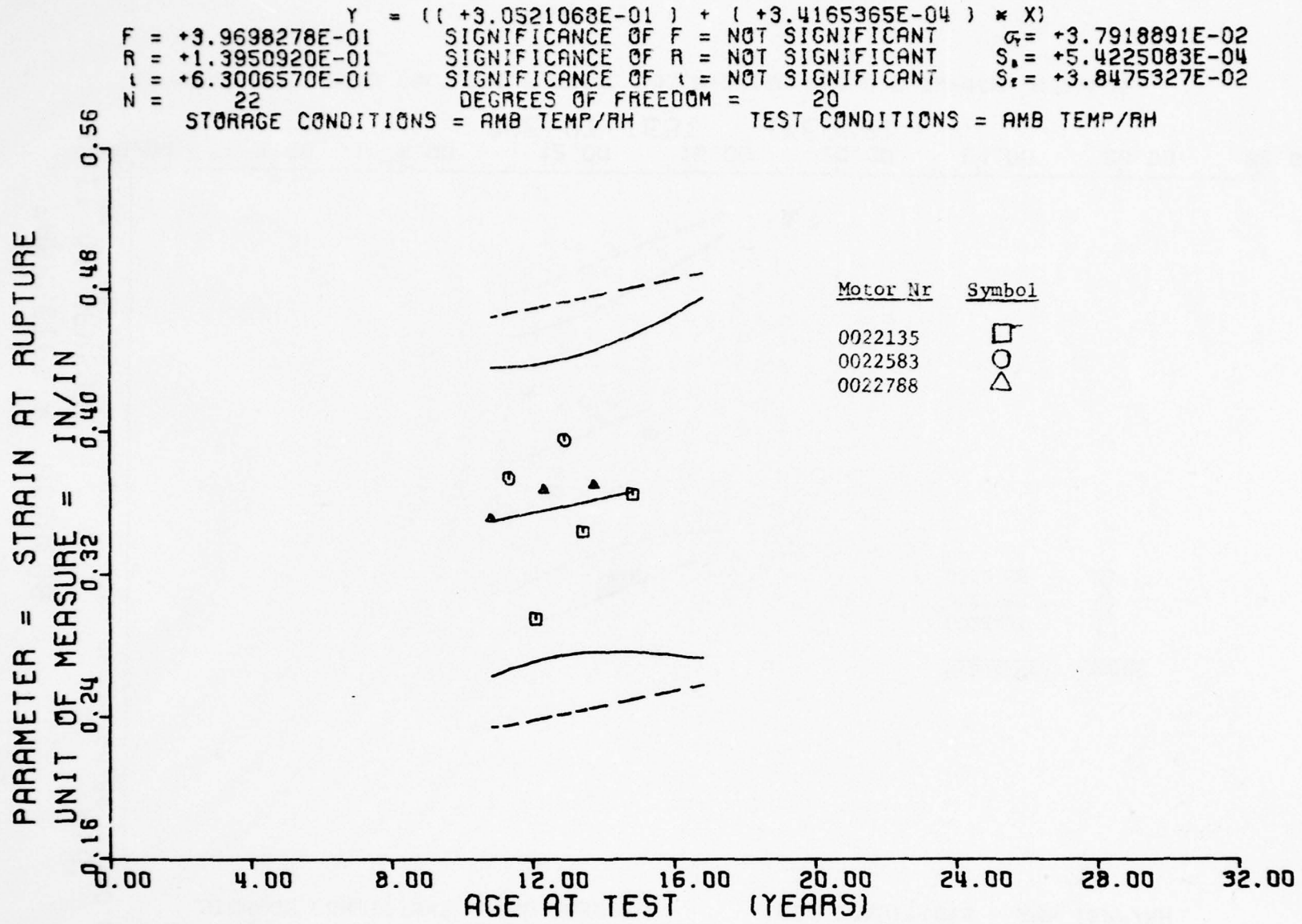

Y = ((+3.0521068E-01) + (+3.4165365E-04) * X)
F = +3.9698278E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σr = +3.7918891E-02
R = +1.3950920E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT Sb = +5.4225083E-04
t = +6.3006570E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT Sr = +3.8475327E-02
N = 22 DEGREES OF FREEDOM = 20
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.56
0.48
0.40
0.32
0.24
0.16
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS ONLY,OUTER,AXIAL POS.BIAXIAL CHS=0.2 IN/MIN,STRAIN/RUPTURE

Figure 19

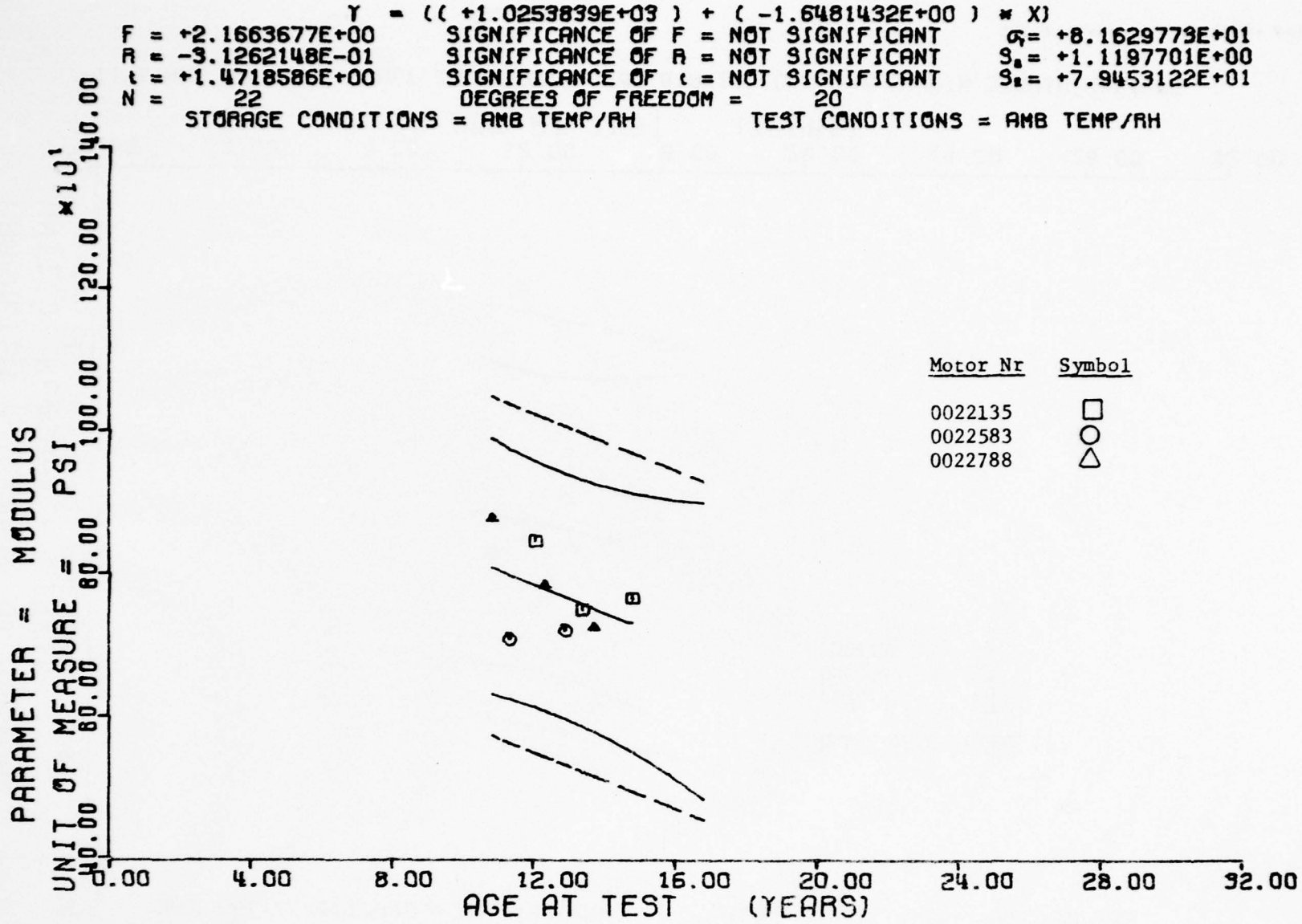

Y = ((+1.0253839E+03) + (-1.6481432E+00) * X)
F = +2.1663677E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ = +8.1629773E+01
R = -3.1262148E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S = +1.1197701E+00
t = +1.4718586E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S = +7.9453122E+01
N = 22 DEGREES OF FREEDOM = 20
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10^1
140.00
120.00
100.00
80.00
60.00
40.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS ONLY,OUTER,AXIAL POS.BIAXIAL CHS=0.2 IN/MIN, MODULUS

Figure 20

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
116.0	8	+1.0881115E+02	+2.0351905E+00	+1.1076998E+02	+1.0468998E+02	+1.1310993E+02
122.0	8	+1.0042492E+02	+4.9396021E+00	+1.0588699E+02	+9.4229995E+01	+1.1258692E+02
129.0	8	+1.2839617E+02	+5.4988664E+00	+1.3267999E+02	+1.1665998E+02	+1.1157673E+02
136.0	3	+1.1561994E+02	+5.4480952E+00	+1.2177999E+02	+1.1143998E+02	+1.1136654E+02
143.0	3	+1.3641992E+02	+6.9937421E-01	+1.3717999E+02	+1.3589999E+02	+1.1075634E+02
145.0	3	+1.0451325E+02	+1.5647966E+00	+1.0629998E+02	+1.0342999E+02	+1.1058201E+02
148.0	3	+1.0155329E+02	+1.2789654E+00	+1.0289999E+02	+1.0035998E+02	+1.1032049E+02
155.0	3	+1.0219326E+02	+1.9096078E+00	+1.0406999E+02	+1.0025999E+02	+1.0971031E+02
161.0	3	+1.2264997E+02	+8.5328667E-01	+1.2347999E+02	+1.2177999E+02	+1.0918728E+02
167.0	6	+9.5566558E+01	+6.5916284E+00	+1.0339999E+02	+8.3500000E+01	+1.0866426E+02
178.0	3	+1.1298330E+02	+1.2555533E+01	+1.2664999E+02	+1.0195999E+02	+1.0770539E+02

STAGE II DISSECTED MTRS.INNER,AXIAL PCS. BIAXIAL CPS=0.2 IN/MIN.MAX STRESS

This sample size summary is applicable to figures 21 thru 23.

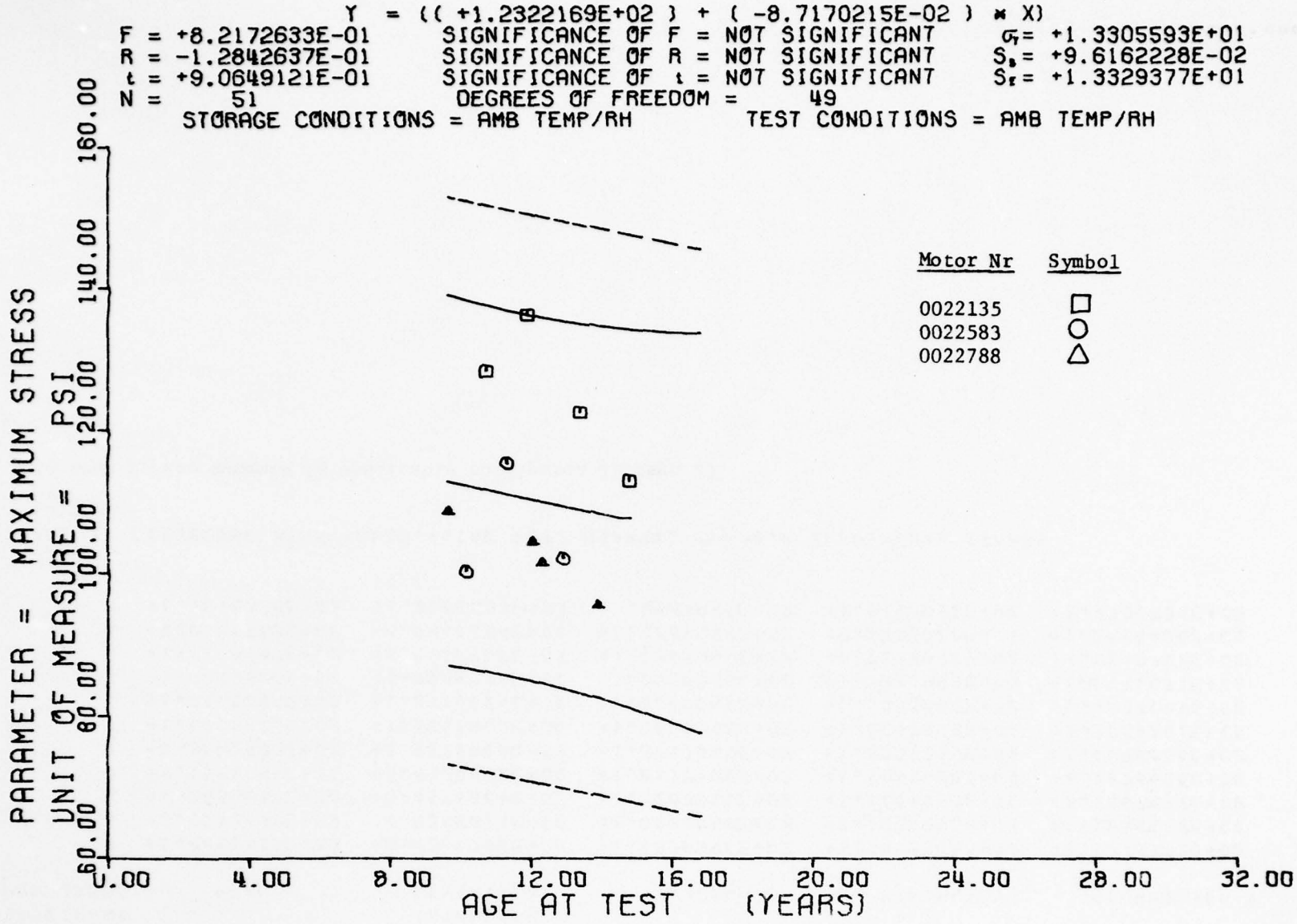

Y = ((+1.2322169E+02) + (-8.7170215E-02) * X)
F = +8.2172633E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σr= +1.3305593E+01
R = -1.2842637E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT Sb= +9.6162228E-02
t = +9.0649121E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT Sr= +1.3329377E+01
N = 51 DEGREES OF FREEDOM = 49
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
160.00
140.00
120.00
100.00
80.00
60.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II DISSECTED MTRS, INNER, AXIAL POS. BIAXIAL CHS=0.2 IN/MIN, MAX STRESS

Figure 21

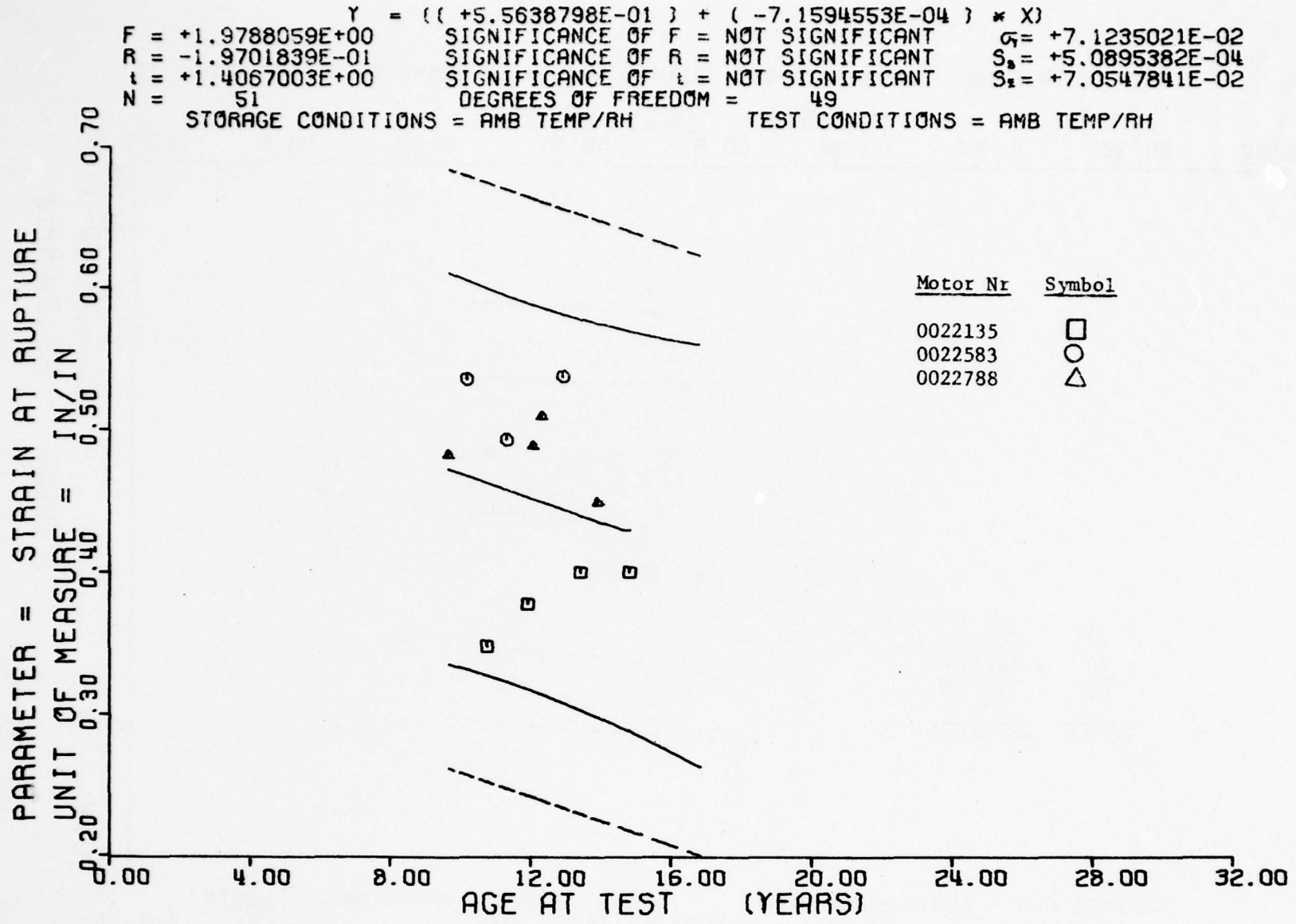

Y = ((+5.5638798E-01) + (-7.1594553E-04) * X)
F = +1.9788059E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ = +7.1235021E-02
R = -1.9701839E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT Sb = +5.0895382E-04
t = +1.4067003E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT St = +7.0547841E-02
N = 51 DEGREES OF FREEDOM = 49
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.70
0.60
0.50
0.40
0.30
0.20
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS, INNER, AXIAL POS, BIAXIAL CHS=0.2 IN/MIN, STRAIN AT RUPURE

Figure 22

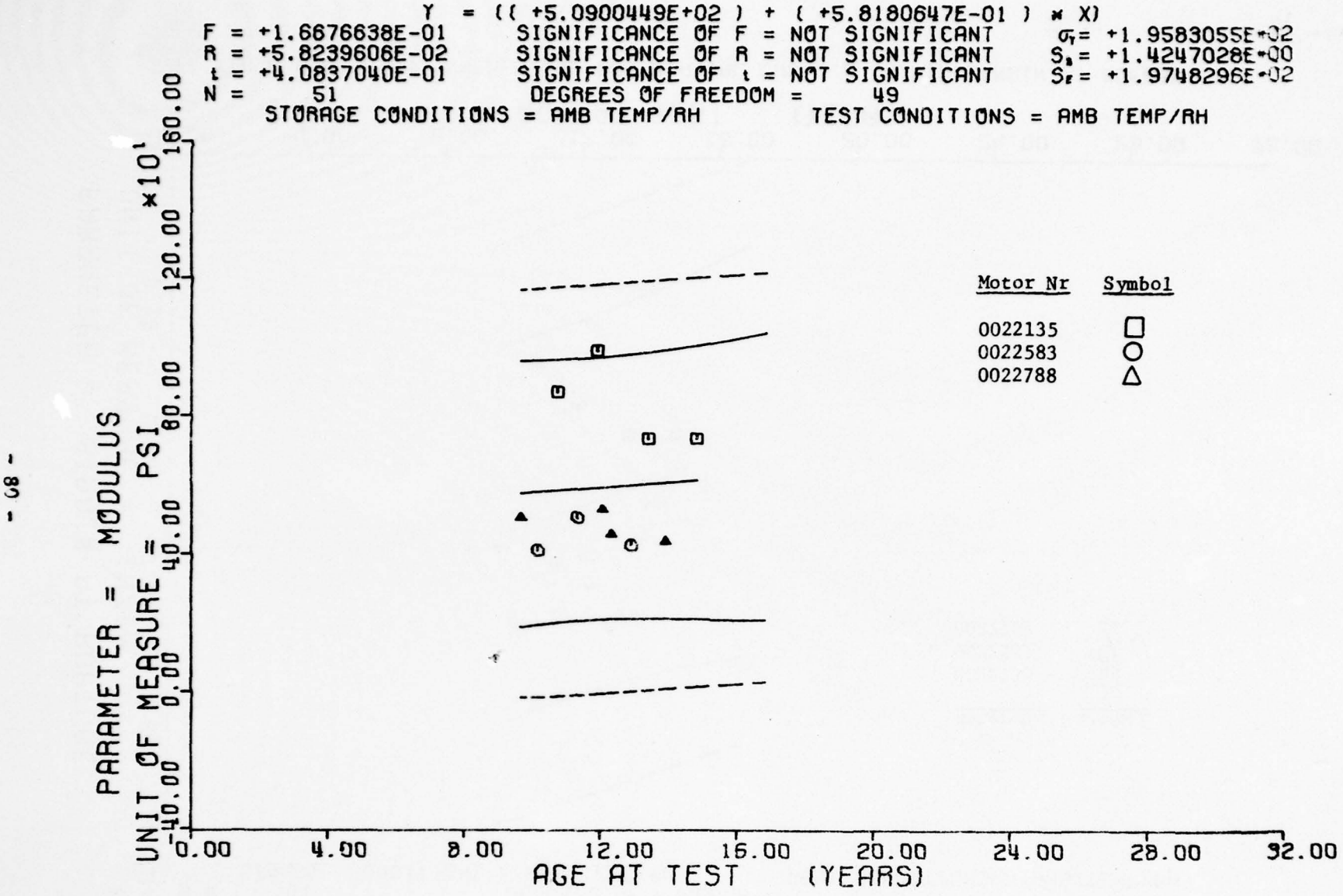

Y = ((+5.0900449E+02) + (+5.8180647E-01) * X)
F = +1.6676638E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ1 = +1.9583055E+02
R = +5.8239606E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT Sa = +1.4247028E+00
t = +4.0837040E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT Sε = +1.9748296E+02
N = 51 DEGREES OF FREEDOM = 49
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10¹
160.00
120.00
80.00
40.00
0.00
-40.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS, INNER, AXIAL POS, BIAXIAL CHS=0.2 IN/MIN, MODULUS

Figure 23

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
116.0	8	+6.2769580E+02	+1.3668804E+01	+6.4366992E+02	+6.0285986E+02	+6.2425585E+02
122.0	8	+6.0893212E+02	+9.2450688E+00	+6.1859985E+02	+5.9466992E+02	+6.2387695E+02
129.0	8	+6.3754589E+02	+1.4666867E+01	+6.5463989E+02	+6.135CC00E+02	+6.2343505E+02
148.0	3	+6.0643652E+02	+2.3380559E+00	+6.0872998E+02	+6.0393994E+02	+6.2223535E+02
155.0	3	+6.3951660E+02	+6.4245224E+00	+6.4642993E+02	+6.3372998E+02	+6.2179345E+02
161.0	3	+6.2420654E+02	+8.2544035E+00	+6.3342993E+02	+6.175CC00E+02	+6.2141479E+02
166.0	3	+6.0773657E+02	+1.5744462E+01	+6.1869995E+02	+5.8969995E+02	+6.21C9887E+02
179.0	3	+6.2197314E+02	+3.2874800E+00	+6.2469995E+02	+6.1822998E+02	+6.2027832E+02

II STAGE DSCT MTRS,OUTER,AXIAL,H.R.TRIAX.CHS=1750 AT 500 PSI,MAXIMUM STRESS

This sample size summary is applicable to figures 24 thru 26.

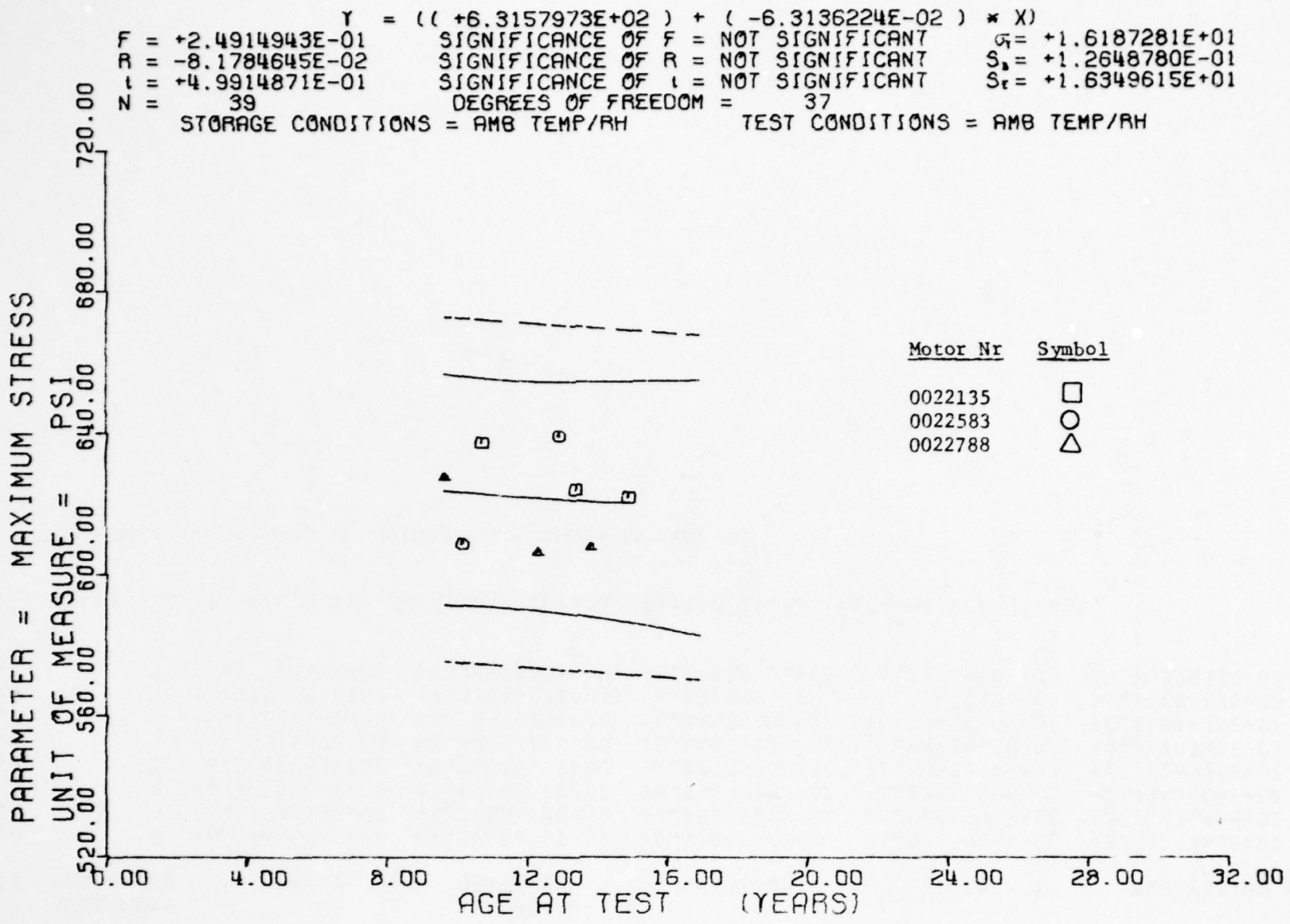

Y = ((+6.3157973E+02) + (-6.3136224E-02) * X)
F = +2.4914943E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σT= +1.6187281E+01
R = -8.1784645E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT Sa= +1.2648780E-01
t = +4.9914871E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT Sr= +1.6349615E+01
N = 39 DEGREES OF FREEDOM = 37
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
720.00
680.00
640.00
600.00
560.00
520.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS,OUTER,AXIAL,H.R.TRIAX.CHS=1750 AT 500 PSI,MAXIMUM STRESS

Figure 24

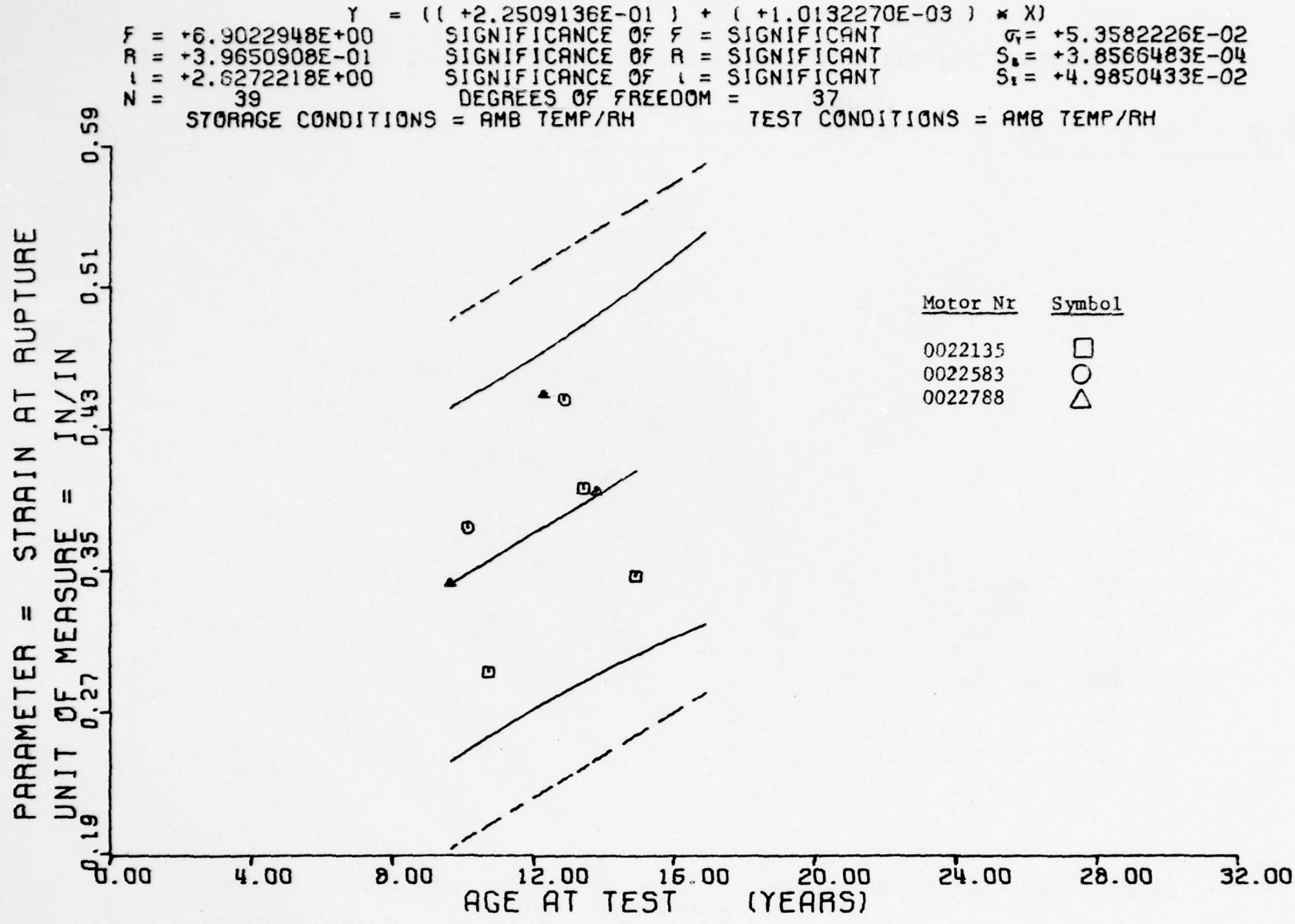

Y = ((+2.2509136E-01) + (+1.0132270E-03) * X)
F = +6.9022948E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +5.3582226E-02
R = +3.9650908E-01 SIGNIFICANCE OF R = SIGNIFICANT Sb = +3.8566483E-04
i = +2.8272218E+00 SIGNIFICANCE OF i = SIGNIFICANT Sr = +4.9850433E-02
N = 39 DEGREES OF FREEDOM = 37
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.19
0.27
0.35
0.43
0.51
0.59
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS,OUTER,AXIAL,H.R.TRIAX.CHS=1750 AT 500 PSI,STRAIN/RUPTURE

Figure 25

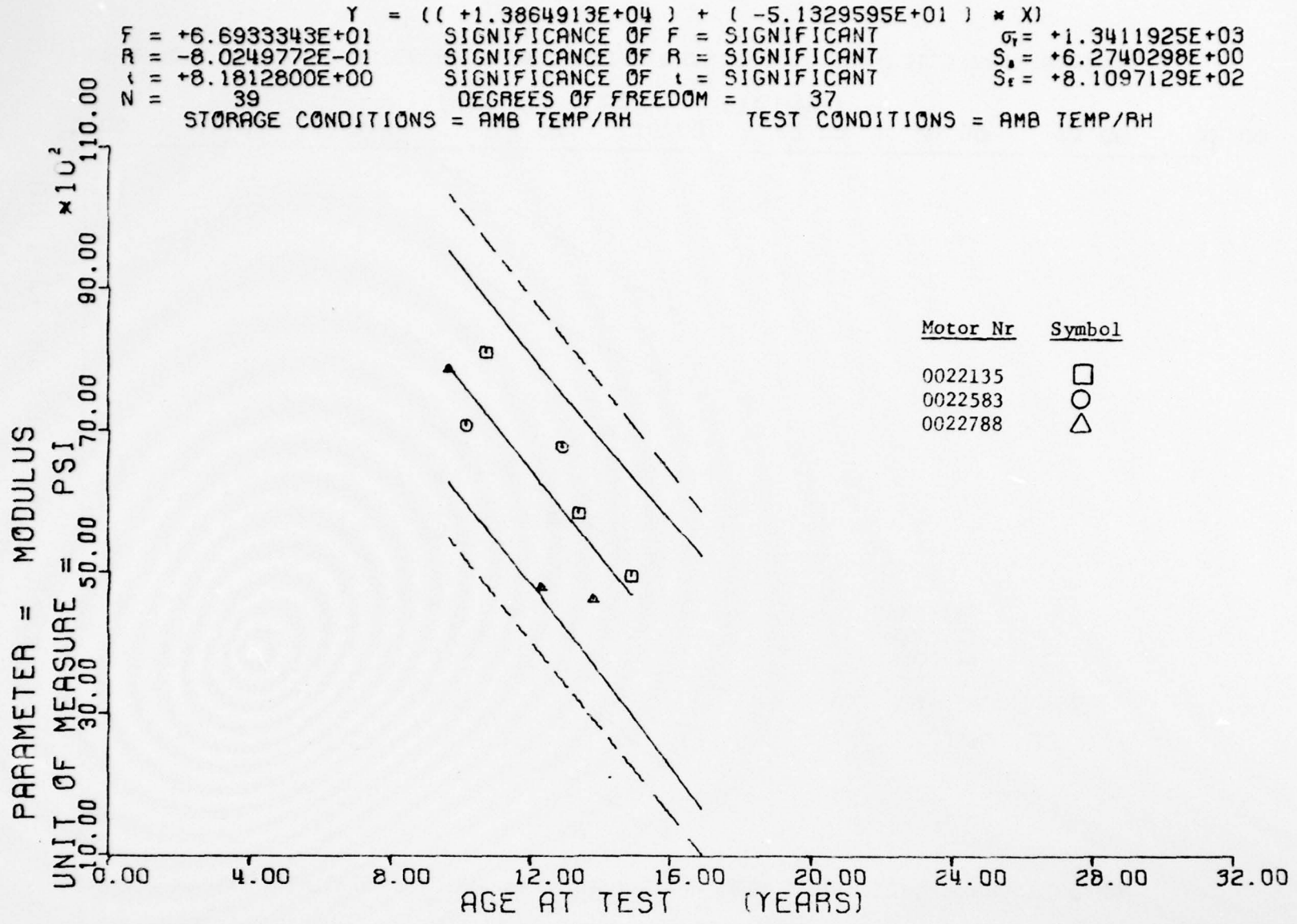
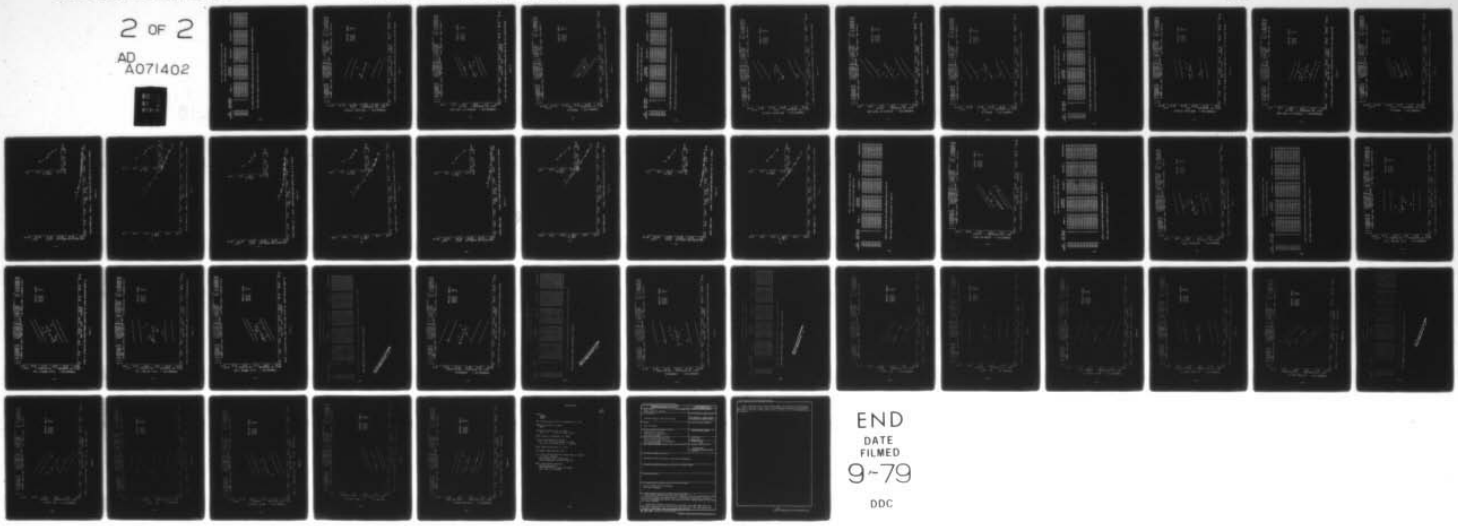

Y = ((+1.3864913E+04) + (-5.1329595E+01) * X)
F = +6.6933343E+01 SIGNIFICANCE OF F = SIGNIFICANT
R = -8.0249772E-01 SIGNIFICANCE OF R = SIGNIFICANT
t = +8.1812800E+00 SIGNIFICANCE OF t = SIGNIFICANT
N = 39 DEGREES OF FREEDOM = 37
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10^2
10.00
30.00
50.00
70.00
90.00
110.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS,OUTER,AXIAL,H.R.TRIAX.CHS=1750 AT 500 PSI, MODULUS

Figure 26

AD-A071 402 OGDEN AIR LOGISTICS CENTER HILL AFB UTAH PROPELLANT L--ETC F/G 21/8.2
LGM-30B, STAGE II DISSECTED MOTORS.(U)
MAR 79 N M HANSEN

UNCLASSIFIED MANCP-414(79). NL

2 OF 2
AD A071402



END
DATE FILMED
9-79
DDC

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
116.0	8	+6.5638085E+02	+2.2788905E+01	+6.7690991E+02	+6.0677978E+02	+6.5879272E+02
122.0	7	+6.5665502E+02	+1.9959315E+01	+6.8095996E+02	+6.3355981E+02	+6.5685620E+02
129.0	8	+6.6325048E+02	+1.2324878E+01	+6.8808984E+02	+6.5091592E+02	+6.5459692E+02
148.0	3	+6.1255322E+02	+6.7323190E+00	+6.1765991E+02	+6.0485990E+02	+6.4846484E+02
155.0	3	+6.4761303E+02	+4.5513768E+00	+6.5038989E+02	+6.4233984E+02	+6.4620556E+02
161.0	3	+6.7303637E+02	+3.3502709E+00	+6.7514990E+02	+6.6919995E+02	+6.4426928E+02
166.0	3	+6.3031640E+02	+5.5396870E+00	+6.3663989E+02	+6.2629980E+02	+6.4265551E+02
179.0	3	+6.4035644E+02	+9.2801802E+00	+6.5107983E+02	+6.3448999E+02	+6.3845971E+02

II STAGE DSCT MTRS,INNER,AXIAL,H.R.TRIAX.CHS=1750 AT 500 PSI,MAXIMUM STRESS

This sample size summary is applicable to figures 27 thru 29.

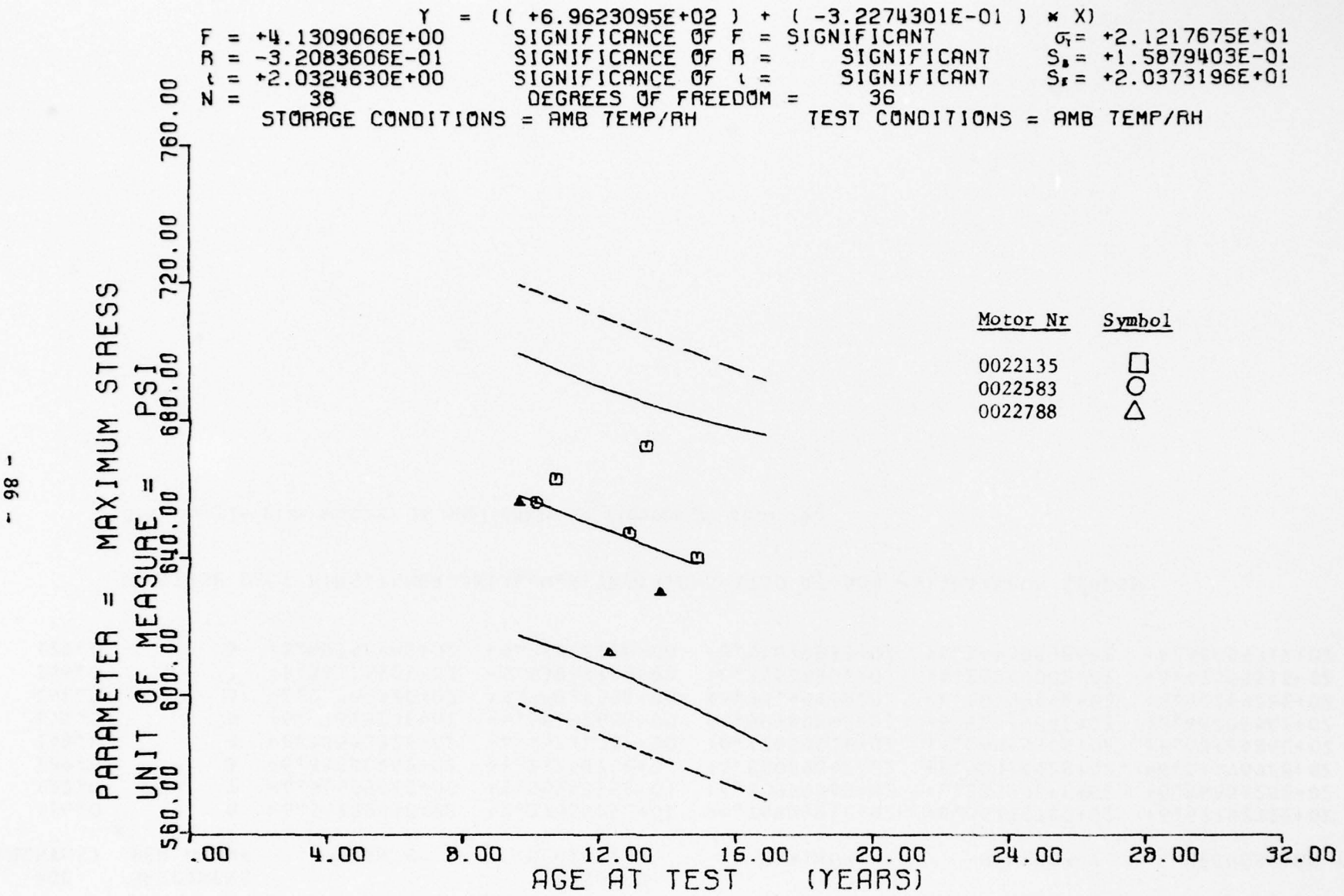

Y = ((+6.9623095E+02) + (-3.2274301E-01) * X)
F = +4.1309060E+00 SIGNIFICANCE OF F = SIGNIFICANT σT = +2.1217675E+01
R = -3.2083606E-01 SIGNIFICANCE OF R = SIGNIFICANT Sa = +1.5879403E-01
t = +2.0324630E+00 SIGNIFICANCE OF t = SIGNIFICANT Sr = +2.0373196E+01
N = 38 DEGREES OF FREEDOM = 36
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI
760.00
720.00
680.00
640.00
600.00
560.00
.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS, INNER, AXIAL, H.R. TRIAX. CHS=1750 AT 500 PSI, MAXIMUM STRESS

Figure 27

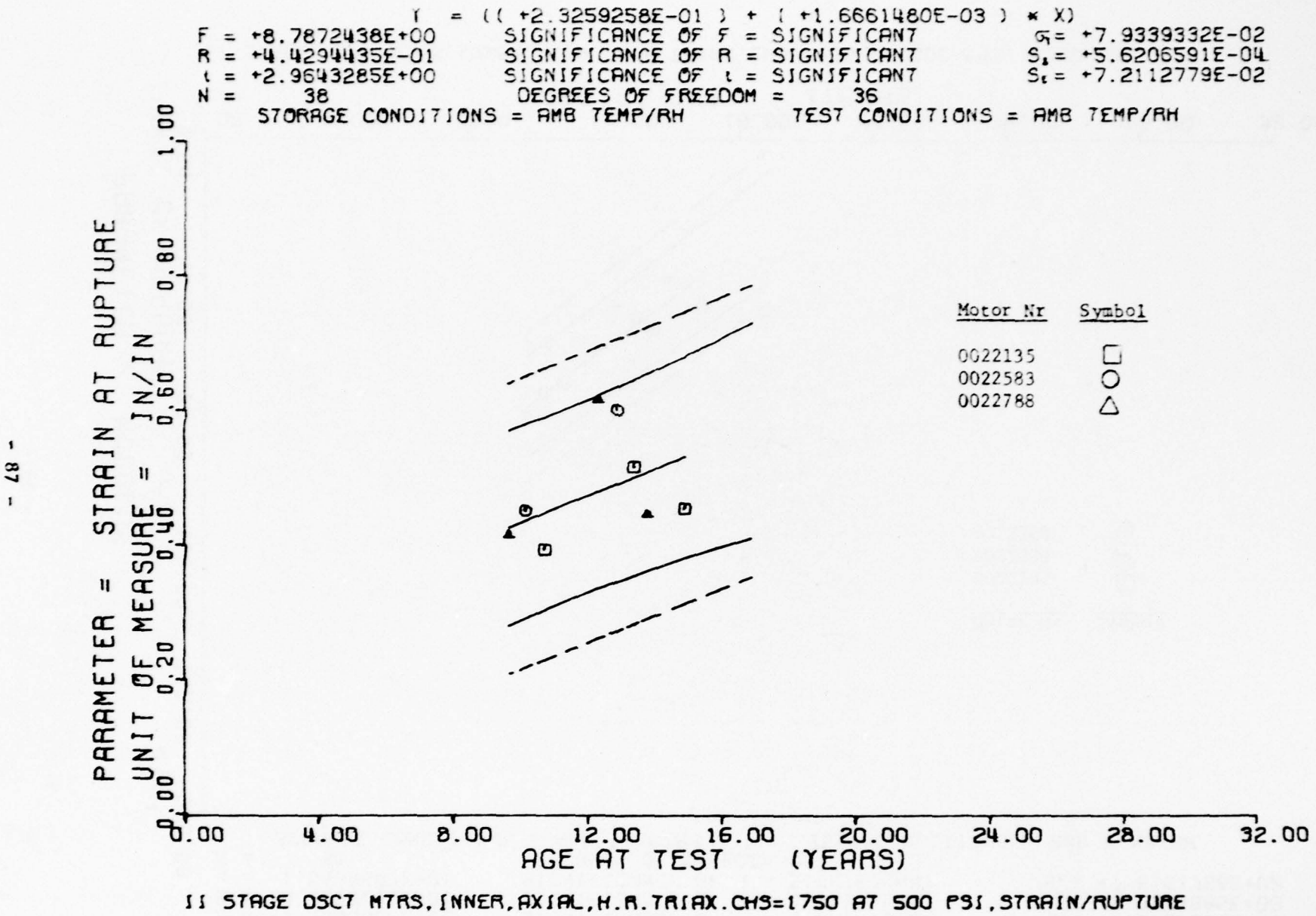

Y = ((+2.3259258E-01) + (+1.6661480E-03) * X)
F = +8.7872438E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +7.9339332E-02
R = +4.4294435E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +5.6206591E-04
t = +2.9643285E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +7.2112779E-02
N = 38 DEGREES OF FREEDOM = 36
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.00
0.20
0.40
0.60
0.80
1.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS, INNER, AXIAL, H.R. TRIAX. CHS=1750 AT 500 PSI, STRAIN/RUPTURE

Figure 28

Y = ((+1.5181569E+04) + (-6.2260378E+01) * X)

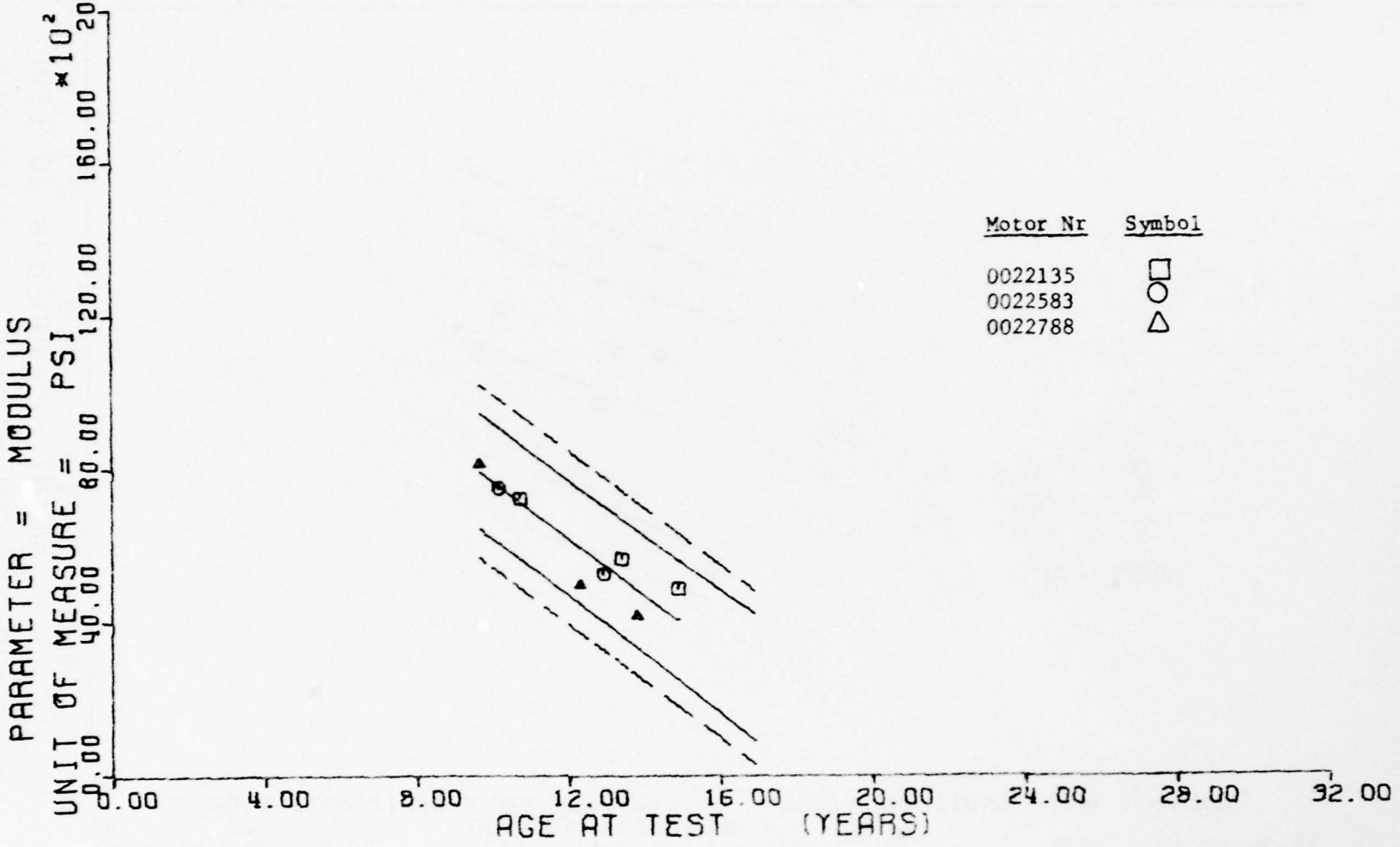
F = +1.1003060E+02 SIGNIFICANCE OF F = SIGNIFICANT σ_r = +1.5128681E+03

R = -8.6803014E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +5.9354685E+00

t = +1.0489547E+01 SIGNIFICANCE OF t = SIGNIFICANT S_t = +7.6151768E+02

N = 38 DEGREES OF FREEDOM = 36

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



II STAGE DSCT MTRS, INNER, AXIAL, H.R. TRIAX. CHS=1750 AT 500 PSI, MODULUS

Figure 29

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
117.0	10	+5.0579980E+02	+1.8140194E+01	+5.3400000E+02	+4.8500000E+02	+4.5680273E+02
124.0	8	+4.7163989E+02	+3.2672605E+01	+5.1744995E+02	+4.2952978E+02	+4.6473974E+02
131.0	11	+4.2857934E+02	+6.9663695E+01	+5.0742993E+02	+3.0756982E+02	+4.7267700E+02
137.0	3	+3.3146972E+02	+1.1748934E+01	+3.4443994E+02	+3.2154980E+02	+4.7948022E+02
148.0	3	+5.4205981E+02	+2.1834794E+00	+5.4407983E+02	+5.3983984E+02	+4.9155288E+02
155.0	3	+5.1894311E+02	+6.1236293E+00	+5.2518994E+02	+5.1295996E+02	+4.9988989E+02
161.0	3	+5.3964306E+02	+2.1730326E+00	+5.4207983E+02	+5.3830981E+02	+5.0669311E+02
168.0	3	+5.3674316E+02	+5.2441832E+00	+5.4028979E+02	+5.3072998E+02	+5.1463037E+02
181.0	3	+5.3312304E+02	+2.6153435E+00	+5.3578979E+02	+5.3061987E+02	+5.2937060E+02

II STAGE DSCT MTRS,OUTER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI,MAXIMUM STRESS

This sample size summary is applicable to figures 30 thru 32

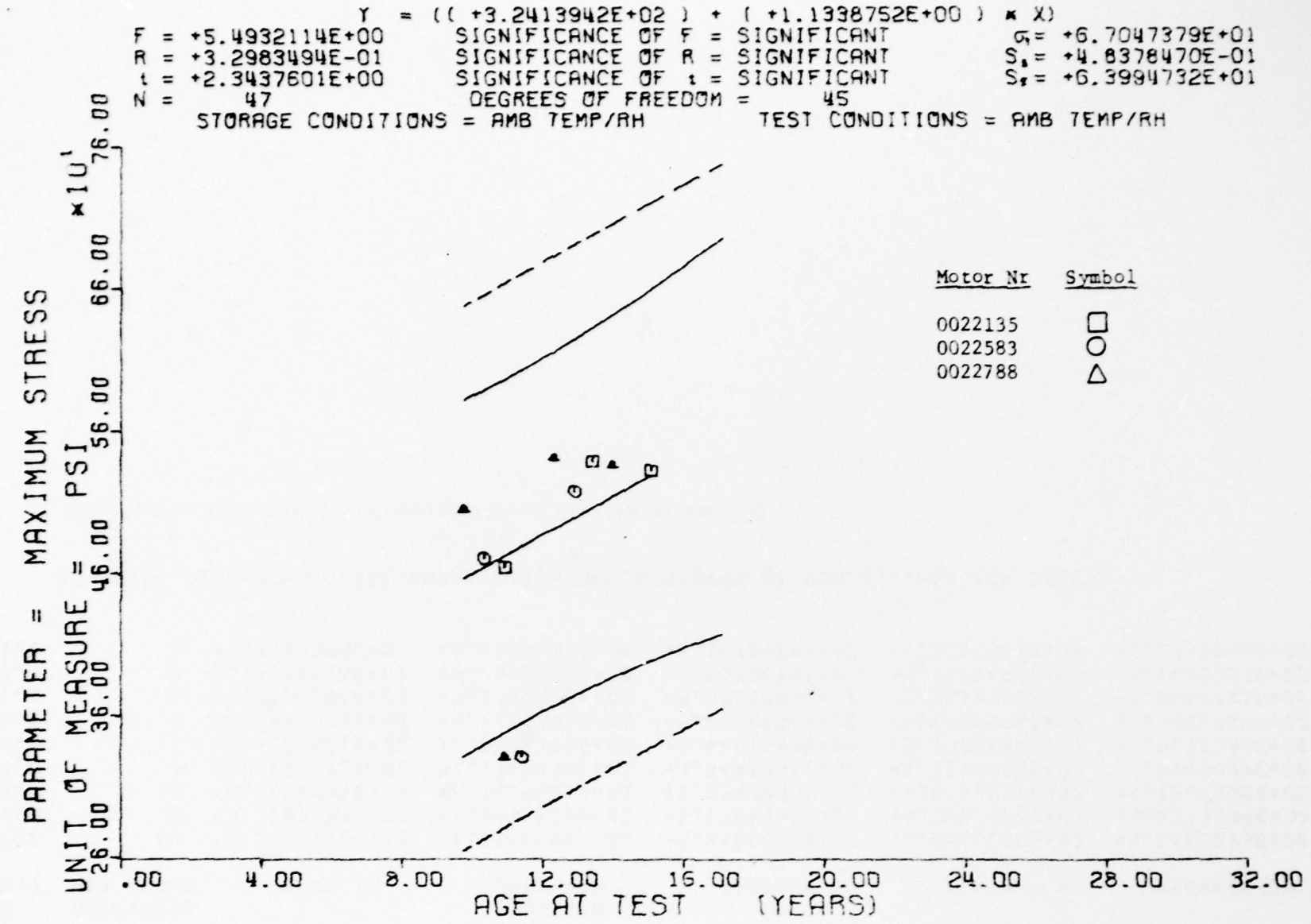

Y = ((+3.2413942E+02) + (+1.1338752E+00) * X)
F = +5.4932114E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +6.7047379E+01
R = +3.2983494E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +4.8378470E-01
t = +2.3437601E+00 SIGNIFICANCE OF t = SIGNIFICANT S_r = +6.3994732E+01
N = 47 DEGREES OF FREEDOM = 45
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI *10^1
26.00
36.00
46.00
56.00
66.00
76.00
.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS, OUTER, AXIAL, H.R. HYDRO. CHS=1750 AT 500 PSI, MAXIMUM STRESS

Figure 30

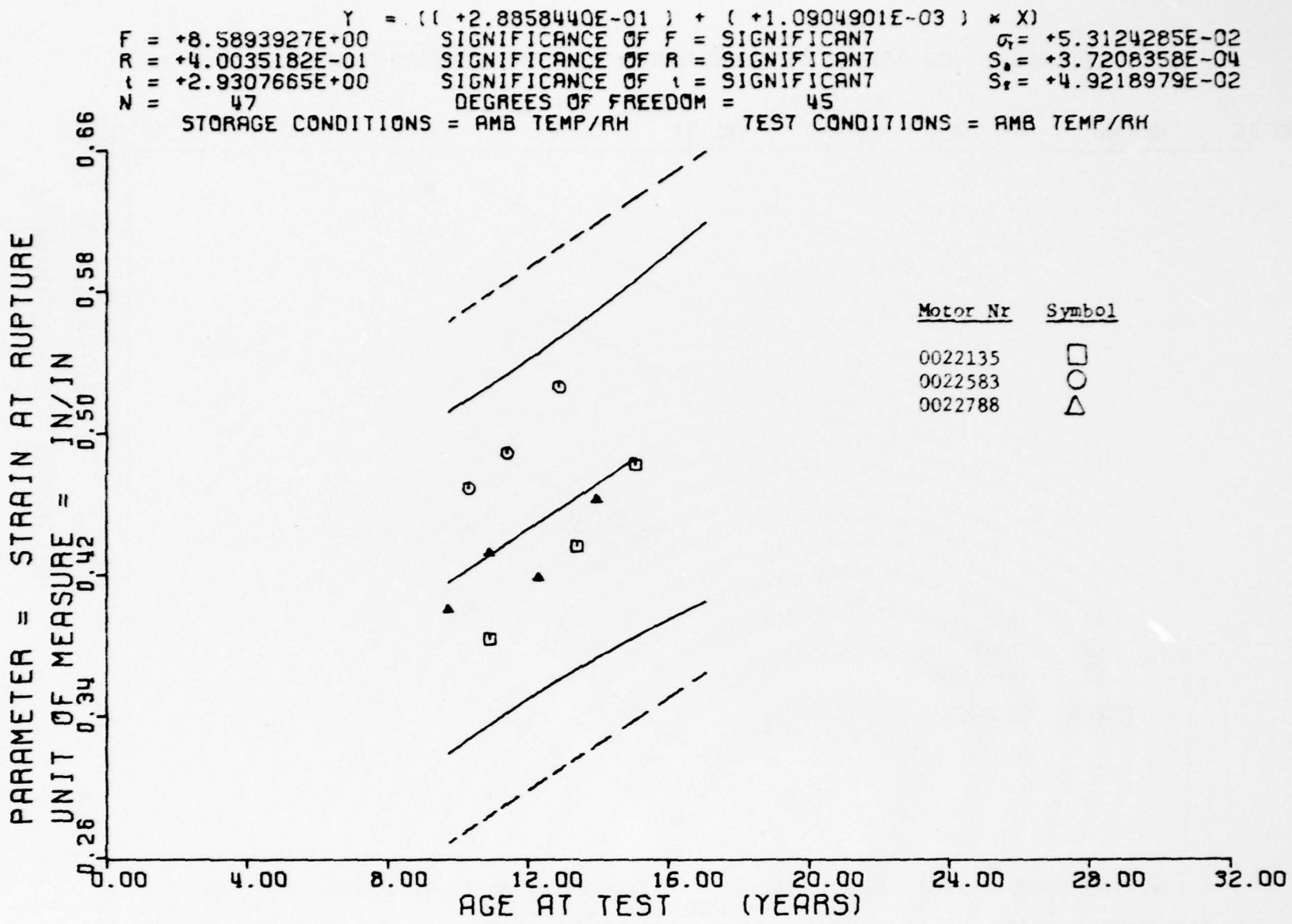

Y = (+2.8858440E-01) + (+1.0904901E-03) * X)
F = +8.5893927E+00 SIGNIFICANCE OF F = SIGNIFICANT
R = +4.0035182E-01 SIGNIFICANCE OF R = SIGNIFICANT
t = +2.9307665E+00 SIGNIFICANCE OF t = SIGNIFICANT
N = 47 DEGREES OF FREEDOM = 45
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = AMB TEMP/RH
σt = +5.3124285E-02
Sb = +3.7208358E-04
Sr = +4.9218979E-02
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.26
0.34
0.42
0.50
0.58
0.66
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS,OUTER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI,STRAIN/RUPTURE

Figure 31

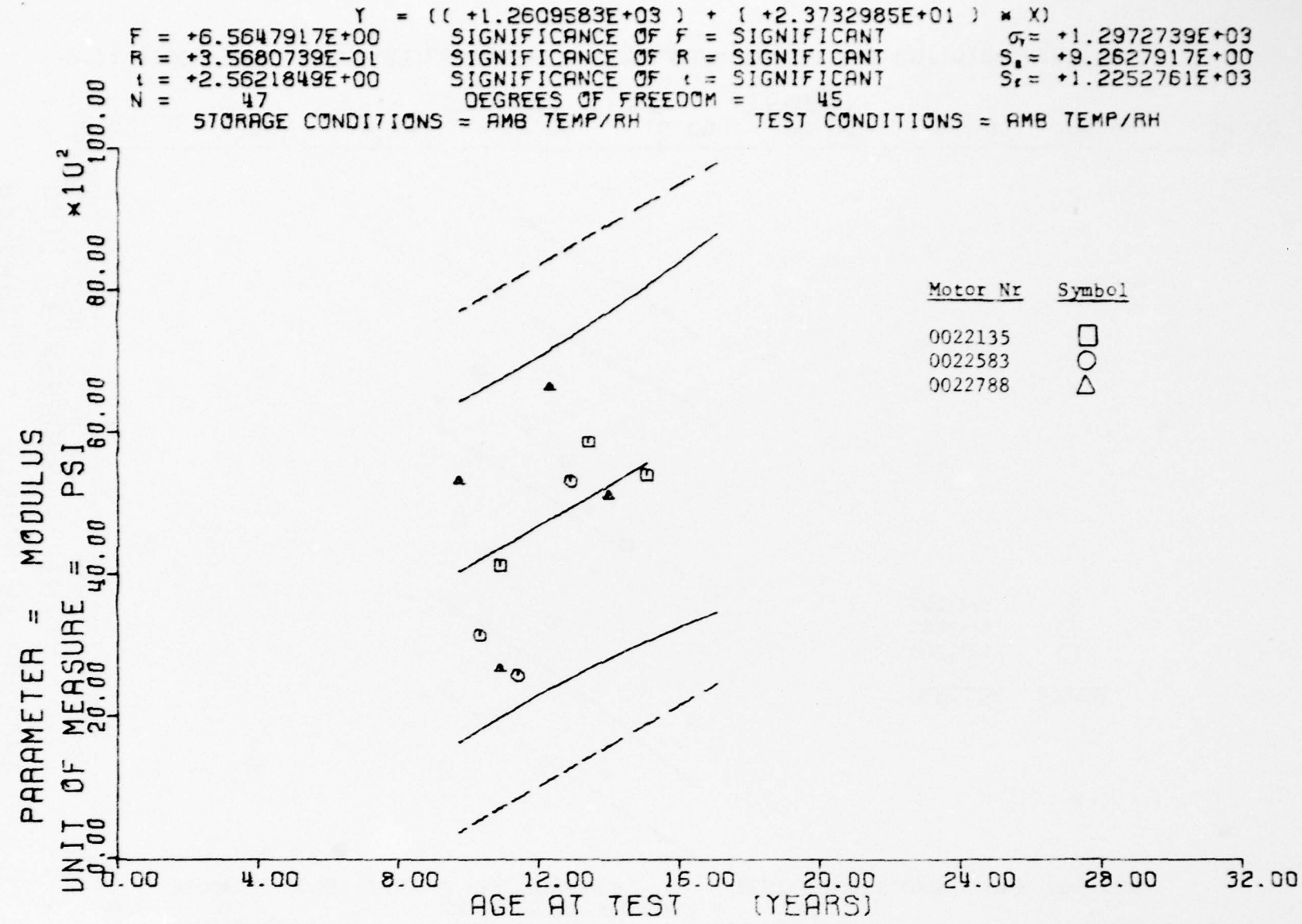

Y = ((+1.2609583E+03) + (+2.3732985E+01) * X)
F = +6.5647917E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +1.2972739E+03
R = +3.5680739E-01 SIGNIFICANCE OF R = SIGNIFICANT S = +9.2627917E+00
t = +2.5621849E+00 SIGNIFICANCE OF t = SIGNIFICANT S = +1.2252761E+03
N = 47 DEGREES OF FREEDOM = 45
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10²
0.00
20.00
40.00
60.00
80.00
100.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr Symbol
0022135
0022583
0022788
II STAGE DSC7 MTRS,OUTER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI, MODULUS

Figure 32

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
117.0	8	+5.1012500E+02	+7.4342354E+00	+5.1900000E+02	+5.0100000E+02	+4.6900073E+02
124.0	8	+5.2212500E+02	+1.0329396E+01	+5.3700000E+02	+5.0800000E+02	+4.7372534E+02
131.0	11	+4.7591796E+02	+9.3815221E+01	+5.5189990E+02	+3.0765991E+02	+4.7844995E+02
137.0	2	+3.5090478E+02	+6.7308742E+00	+3.5565991E+02	+3.4614990E+02	+4.8249951E+02
144.0	6	+3.0096630E+02	+3.7589597E+01	+3.6158984E+02	+2.4850999E+02	+4.8722412E+02
148.0	3	+5.3238647E+02	+4.3107426E+00	+5.3495996E+02	+5.2742993E+02	+4.8952382E+02
155.0	3	+5.2184326E+02	+2.3827694E+01	+5.4444995E+02	+4.9695996E+02	+4.9464843E+02
161.0	3	+5.7210986E+02	+1.1130109E+01	+5.8347998E+02	+5.6123999E+02	+4.9869824E+02
168.0	3	+5.1537646E+02	+4.6359630E+00	+5.1878979E+02	+5.1011987E+02	+5.0342260E+02
181.0	3	+5.8796972E+02	+8.7135741E+00	+5.9489990E+02	+5.7819995E+02	+5.1219677E+02

II STAGE DSCT MTRS,INNER,AXIAL,H.R.HYDRO.CHS=1750 AT 500 PSI,MAXIMUM STRESS

This sample size summary is applicable to figures 33 thru 35.

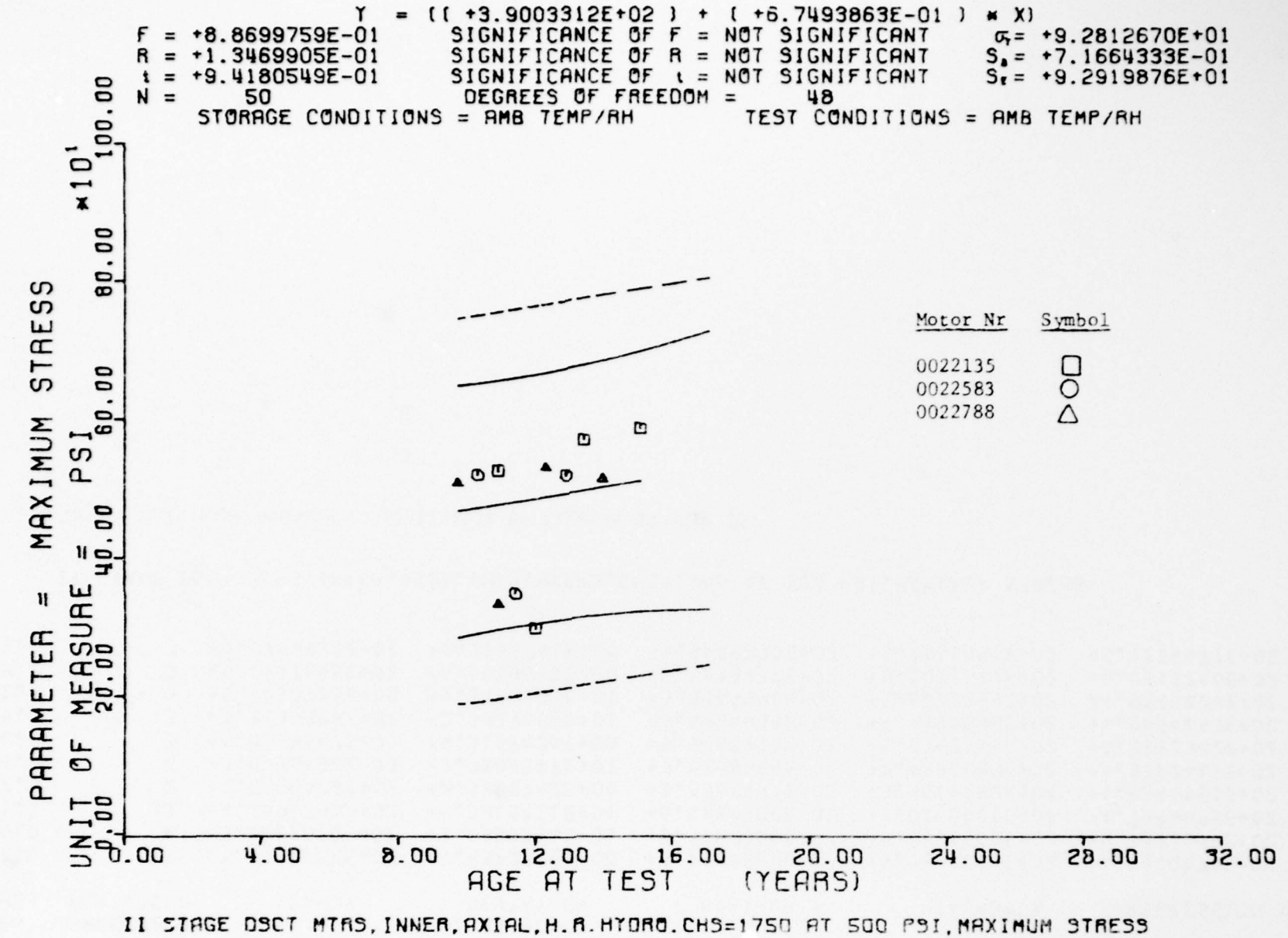

Y = ((+3.9003312E+02) + (+6.7493863E-01) * X)
F = +8.8699759E-01 SIGNIFICANCE OF F = NOT SIGNIFICANT σ = +9.2812670E+01
R = +1.3469905E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S = +7.1664333E-01
t = +9.4180549E-01 SIGNIFICANCE OF t = NOT SIGNIFICANT S = +9.2919876E+01
N = 50 DEGREES OF FREEDOM = 48
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MAXIMUM STRESS
UNIT OF MEASURE = PSI *10¹
100.00
80.00
60.00
40.00
20.00
0.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS, INNER, AXIAL, H.R. HYDRO. CHS=1750 AT 500 PSI, MAXIMUM STRESS

Figure 33

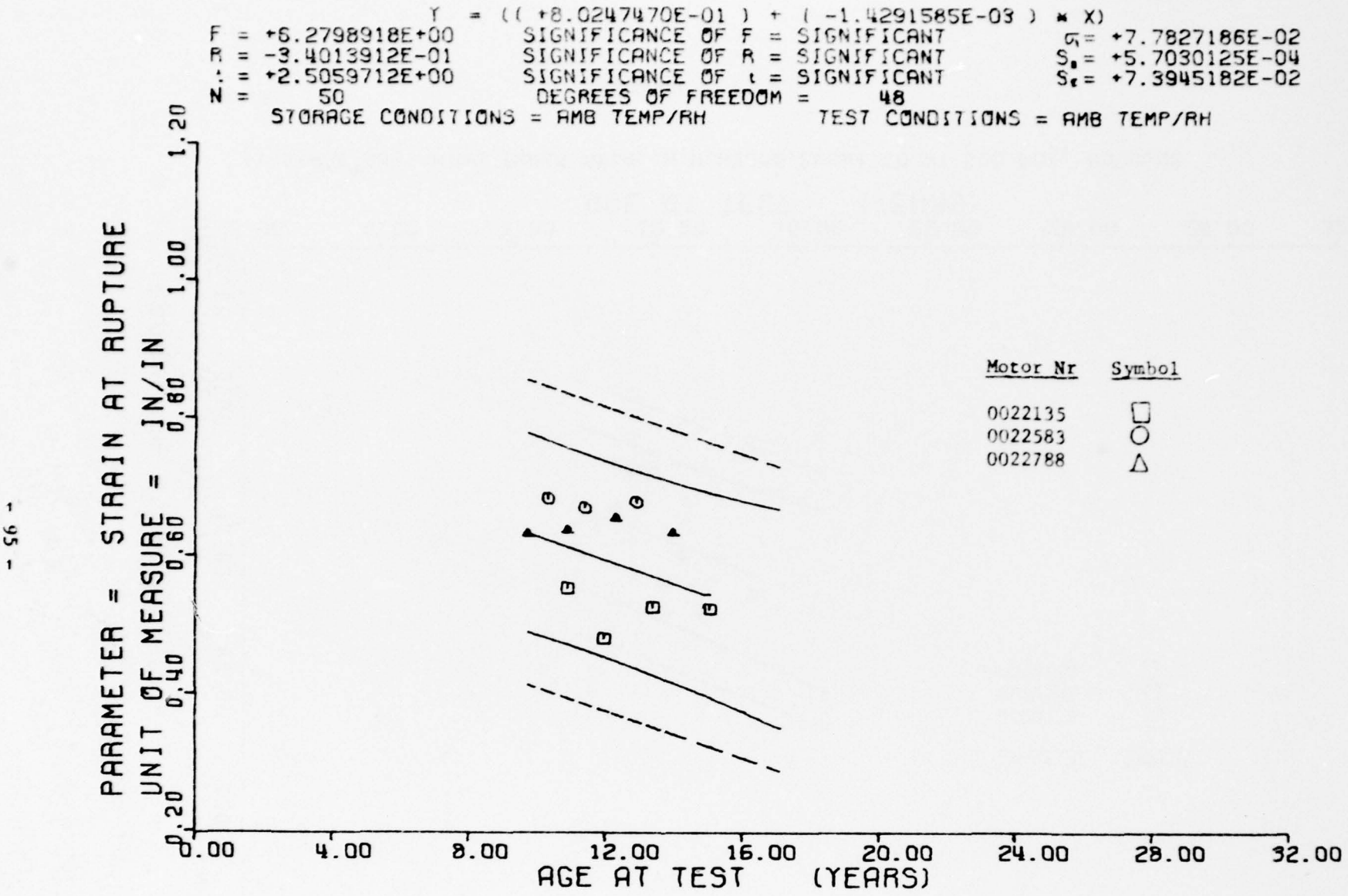

Y = ((+8.0247470E-01) + (-1.4291585E-03) * X)
F = +6.2798918E+00 SIGNIFICANCE OF F = SIGNIFICANT σ = +7.7827186E-02
R = -3.4013912E-01 SIGNIFICANCE OF R = SIGNIFICANT S = +5.7030125E-04
t = +2.5059712E+00 SIGNIFICANCE OF t = SIGNIFICANT S = +7.3945182E-02
N = 50 DEGREES OF FREEDOM = 48
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = STRAIN AT RUPTURE
UNIT OF MEASURE = IN/IN
0.20
0.40
0.60
0.80
1.00
1.20
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE DSCT MTRS, INNER, AXIAL, H.R. HYDRO. CHS=1750 AT 500 PSI, STRAIN/RUPTURE

Figure 34

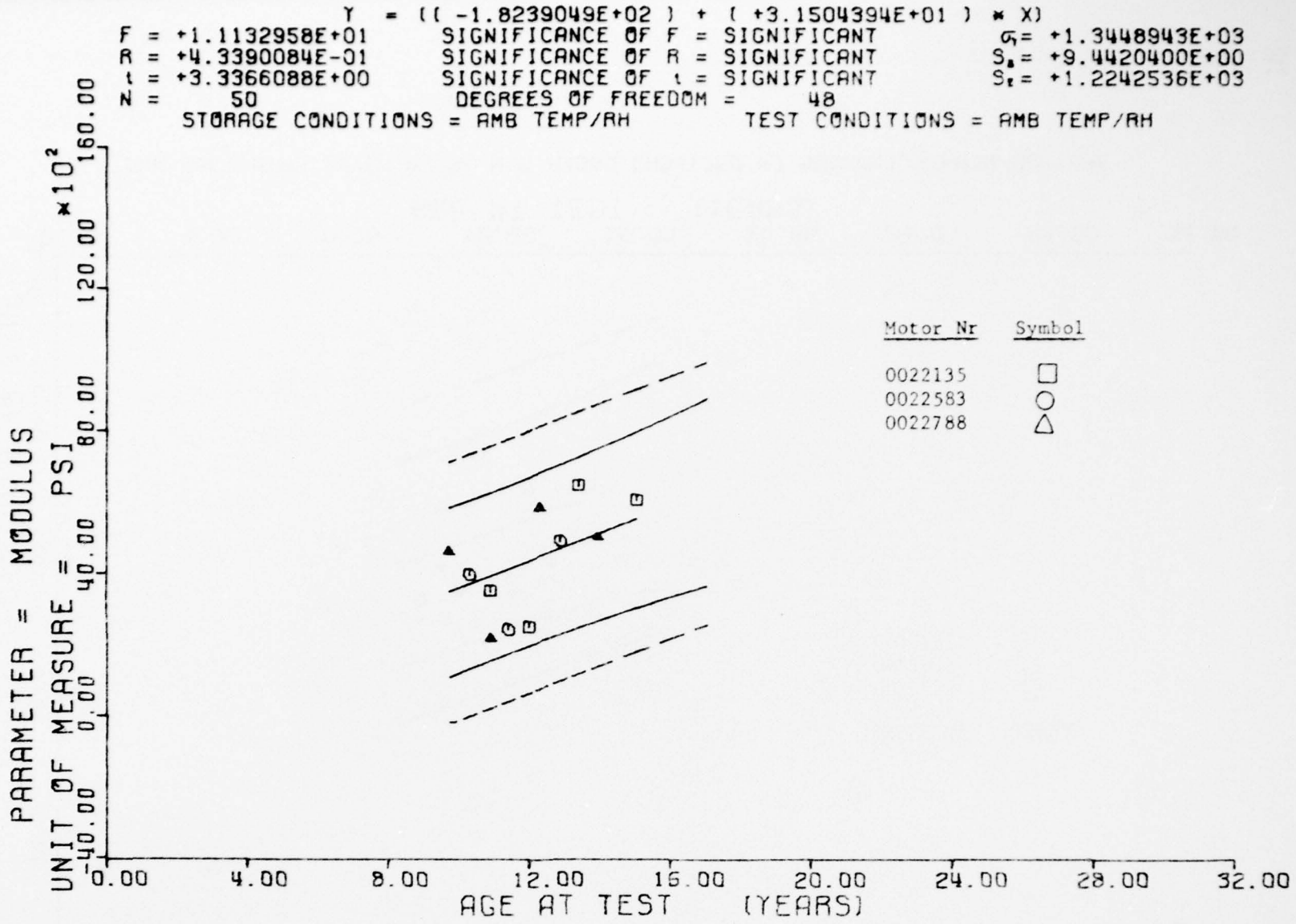
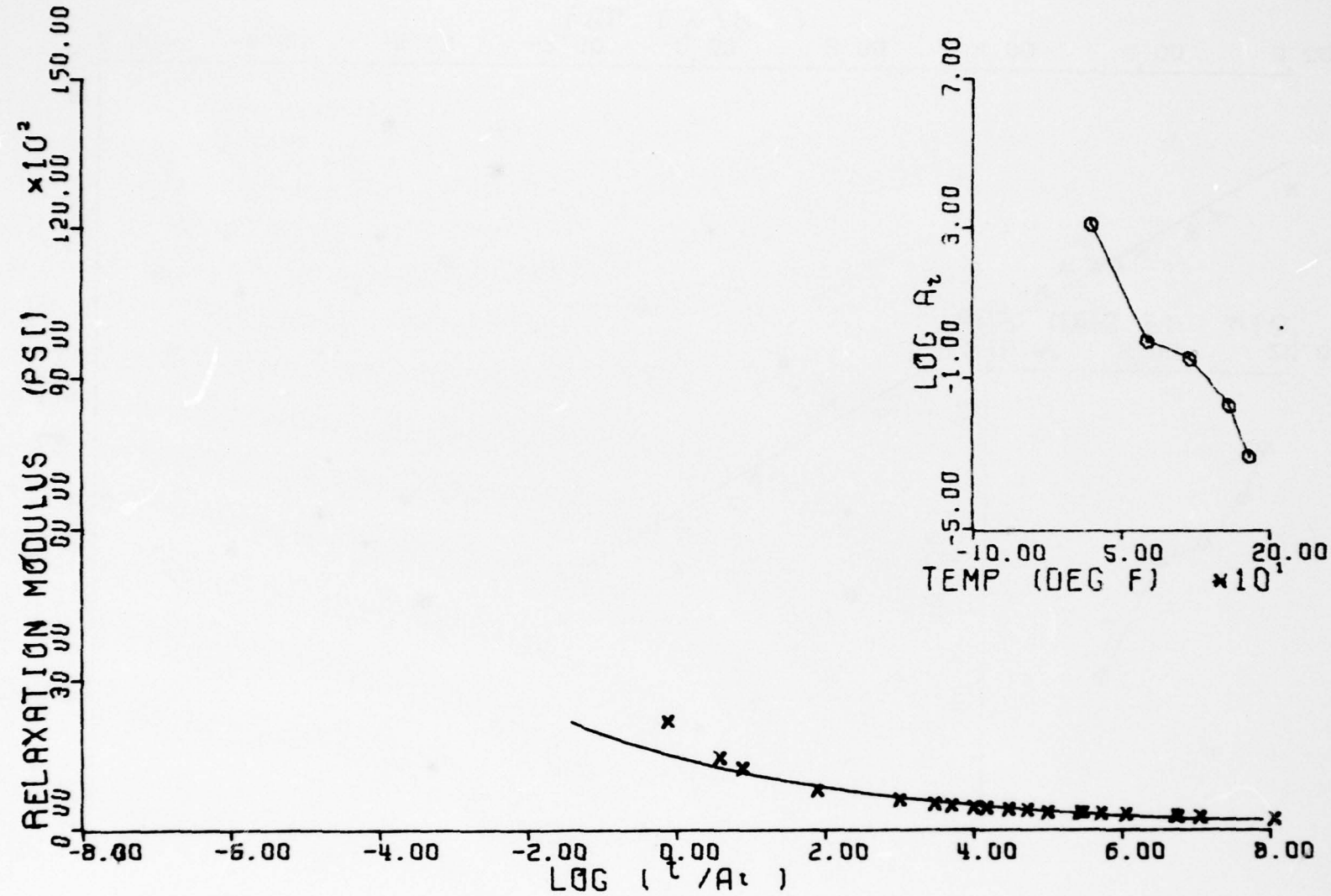
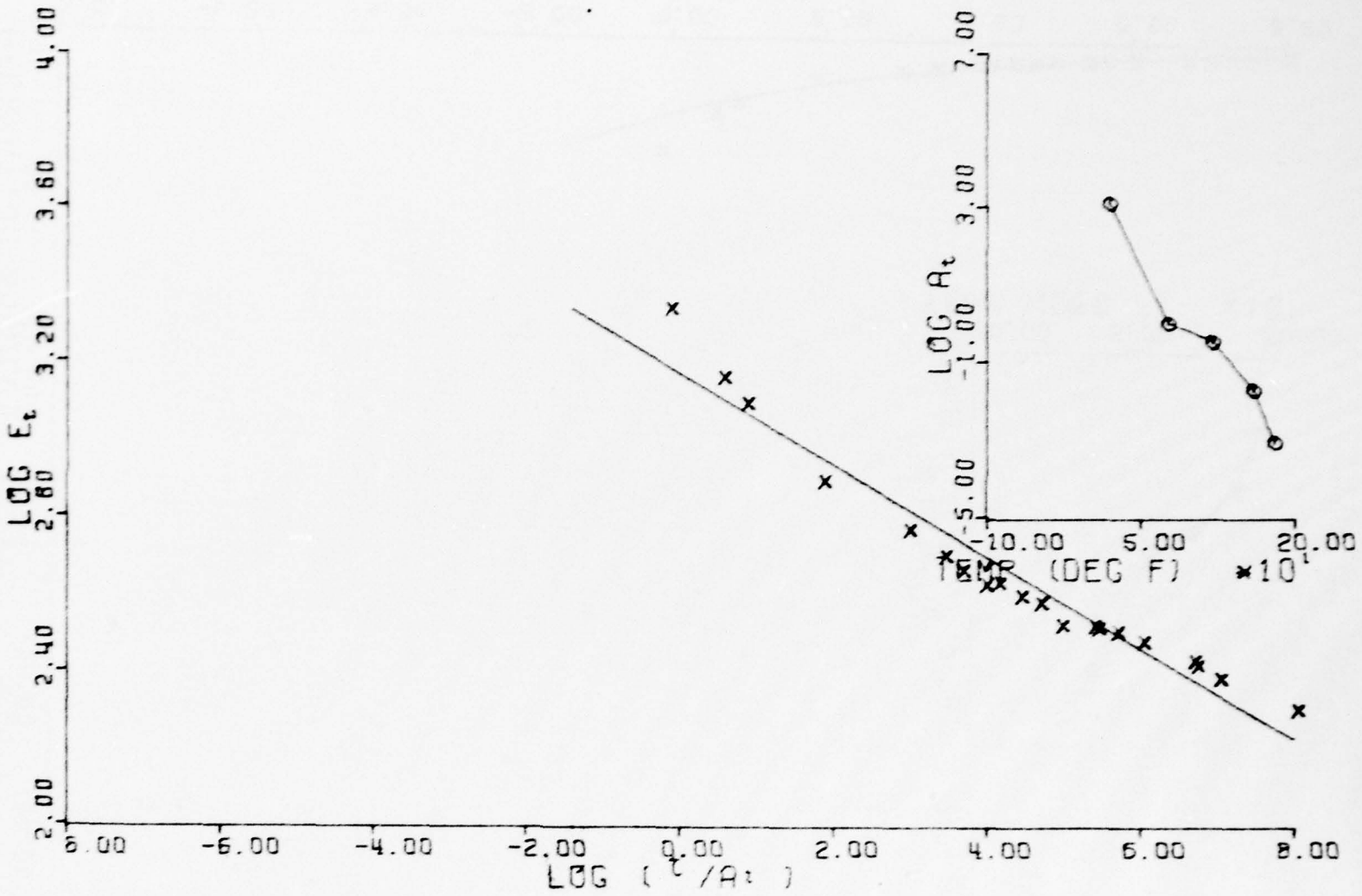

Y = ((-1.8239049E+02) + (+3.1504394E+01) * X)
F = +1.1132958E+01 SIGNIFICANCE OF F = SIGNIFICANT σ = +1.3448943E+03
R = +4.3390084E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +9.4420400E+00
t = +3.3366088E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +1.2242536E+03
N = 50 DEGREES OF FREEDOM = 48
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MODULUS
UNIT OF MEASURE = PSI *10²
160.00
120.00
80.00
40.00
0.00
-40.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS, INNER, AXIAL, H.R.HYDRO. CHS=1750 AT 500 PSI, MODULUS

Figure 35



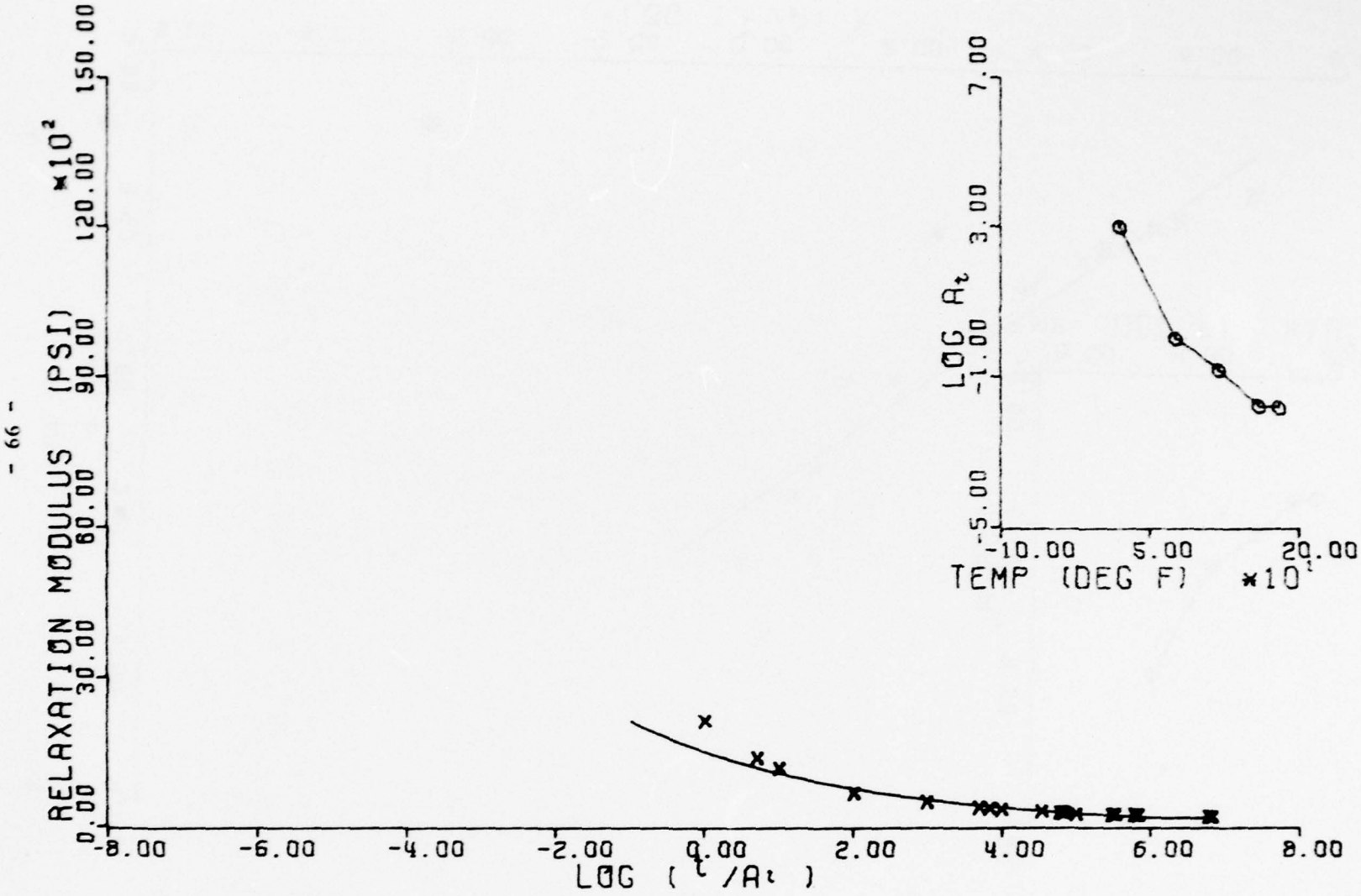
OUTER PROPELLANT STAGE II, STRESS RELAXATION MASTER PLOT AT 0.5% STRAIN

Figure 36



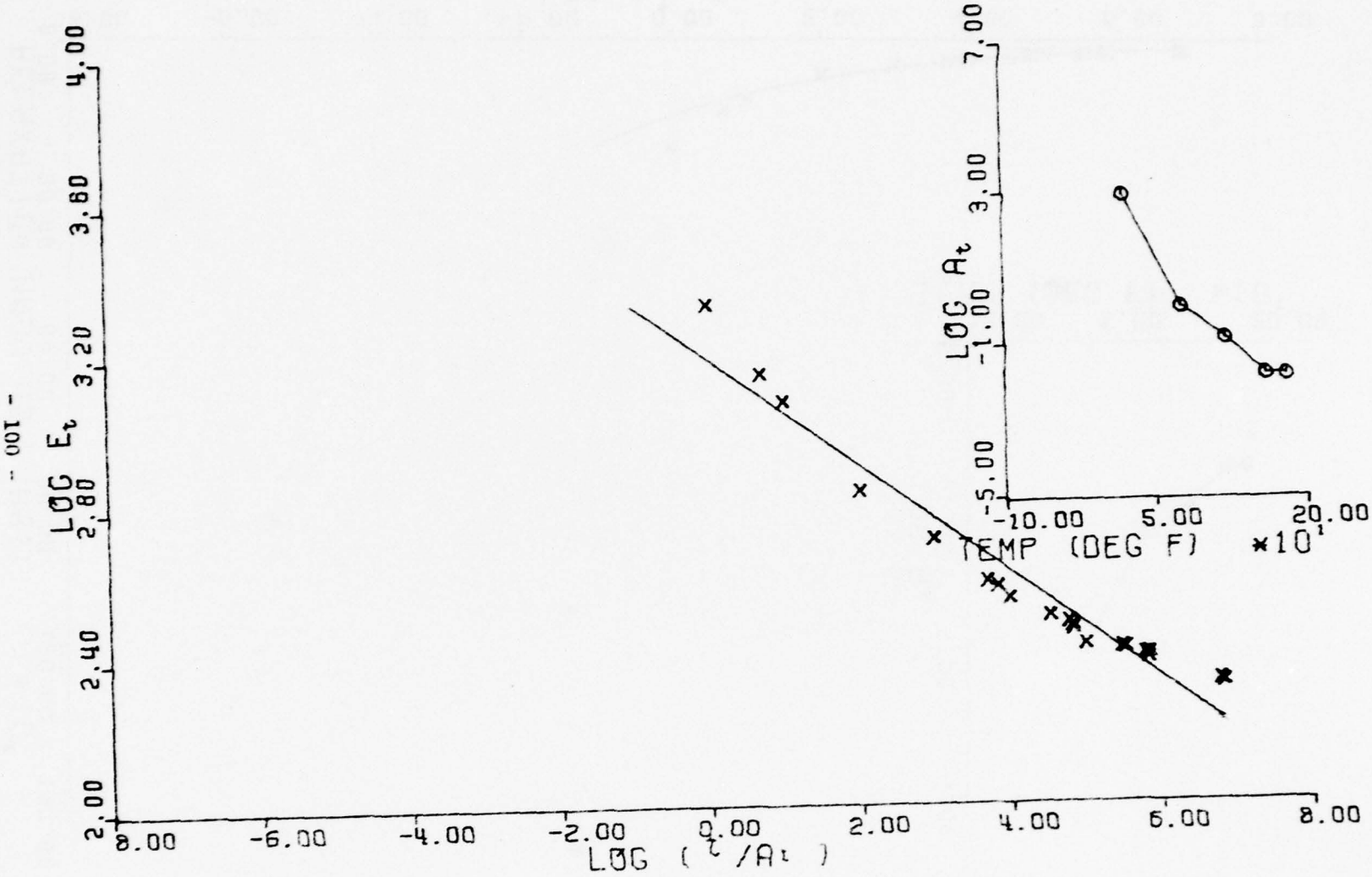
OUTER PROPELLANT STAGE II. STRESS RELAXATION MASTER PLOT AT 0.5% STRAIN

Figure 37



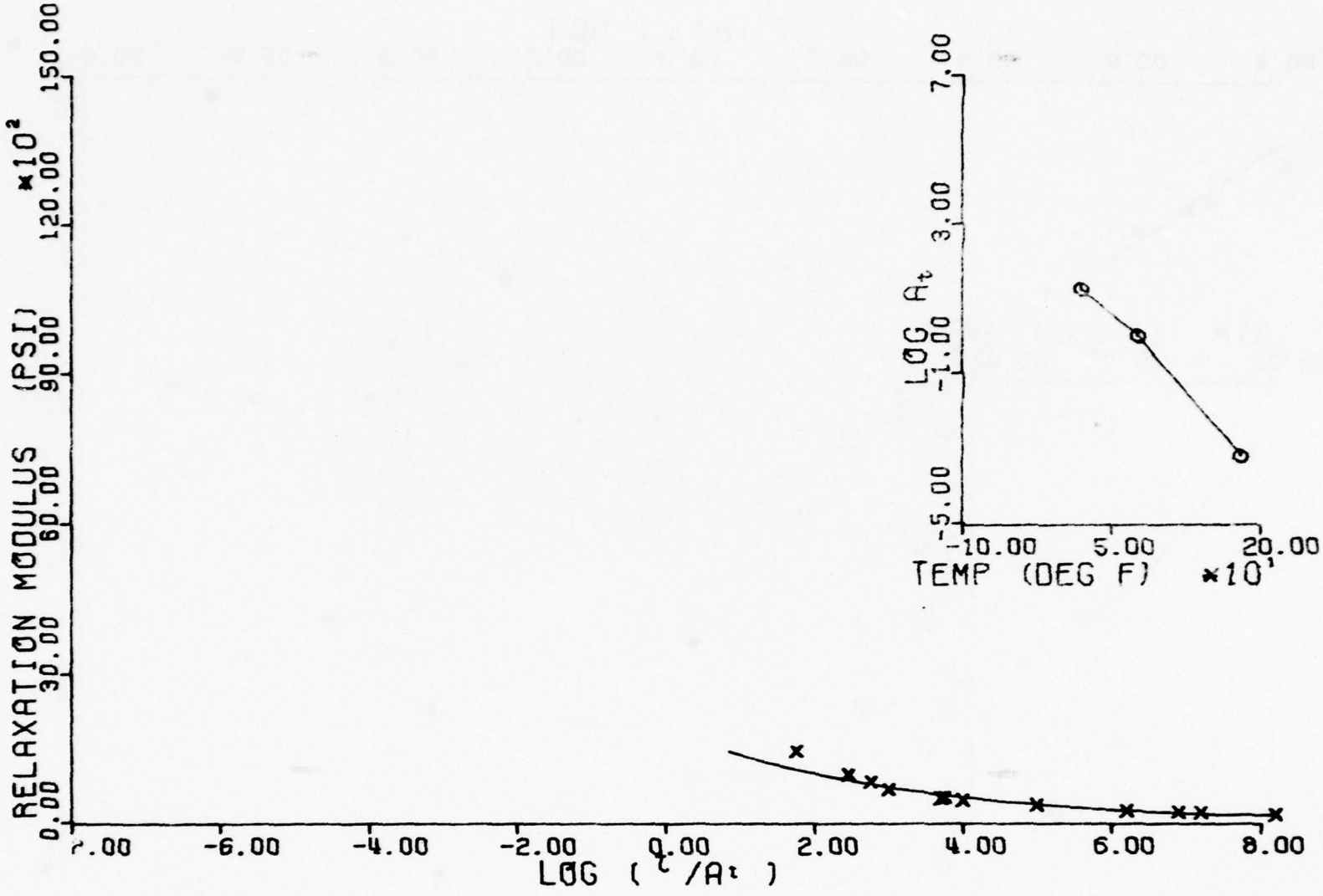
INNER PROPELLANT II STAGE, STRESS RELAXATION MASTER PLOT AT 0.5% STRAIN

Figure 38



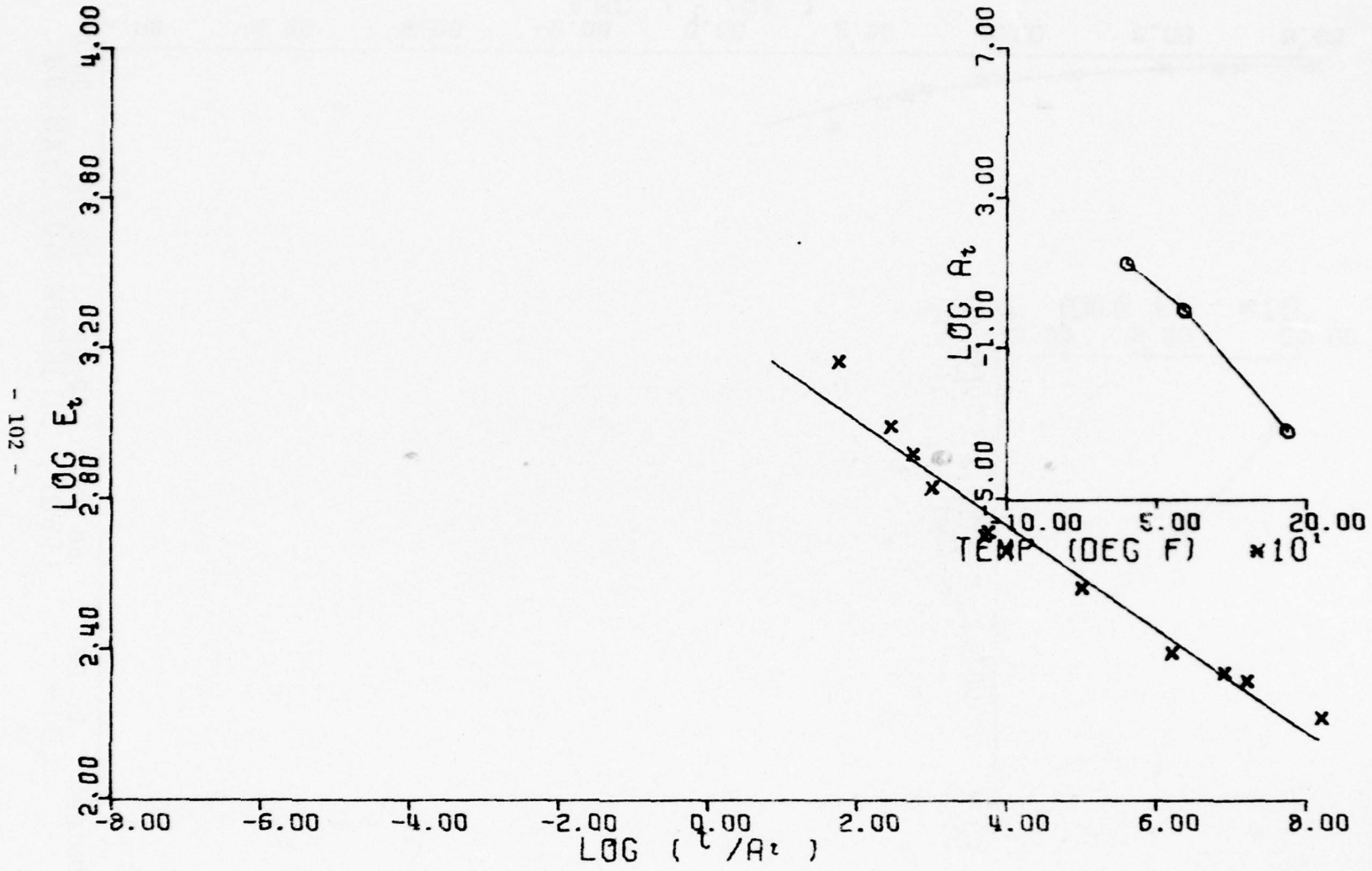
INNER PROPELLANT II STAGE, STRESS RELAXATION MASTER PLOT AT 0.5% STRAIN

Figure 39



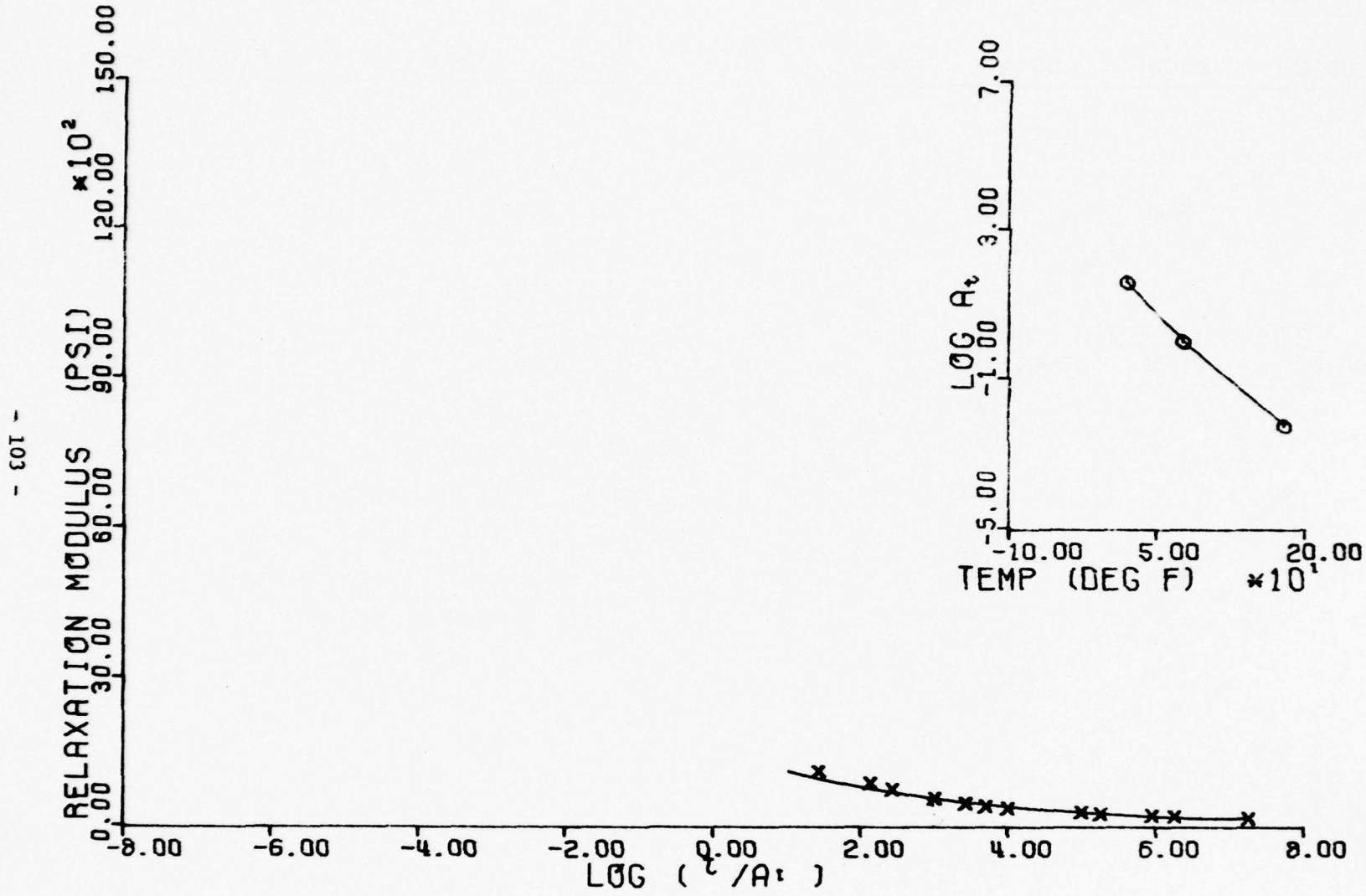
OUTER PROPELLANT STAGE II STRESS RELAXATION MASTER PLOT AT 3.0% STRAIN

Figure 40



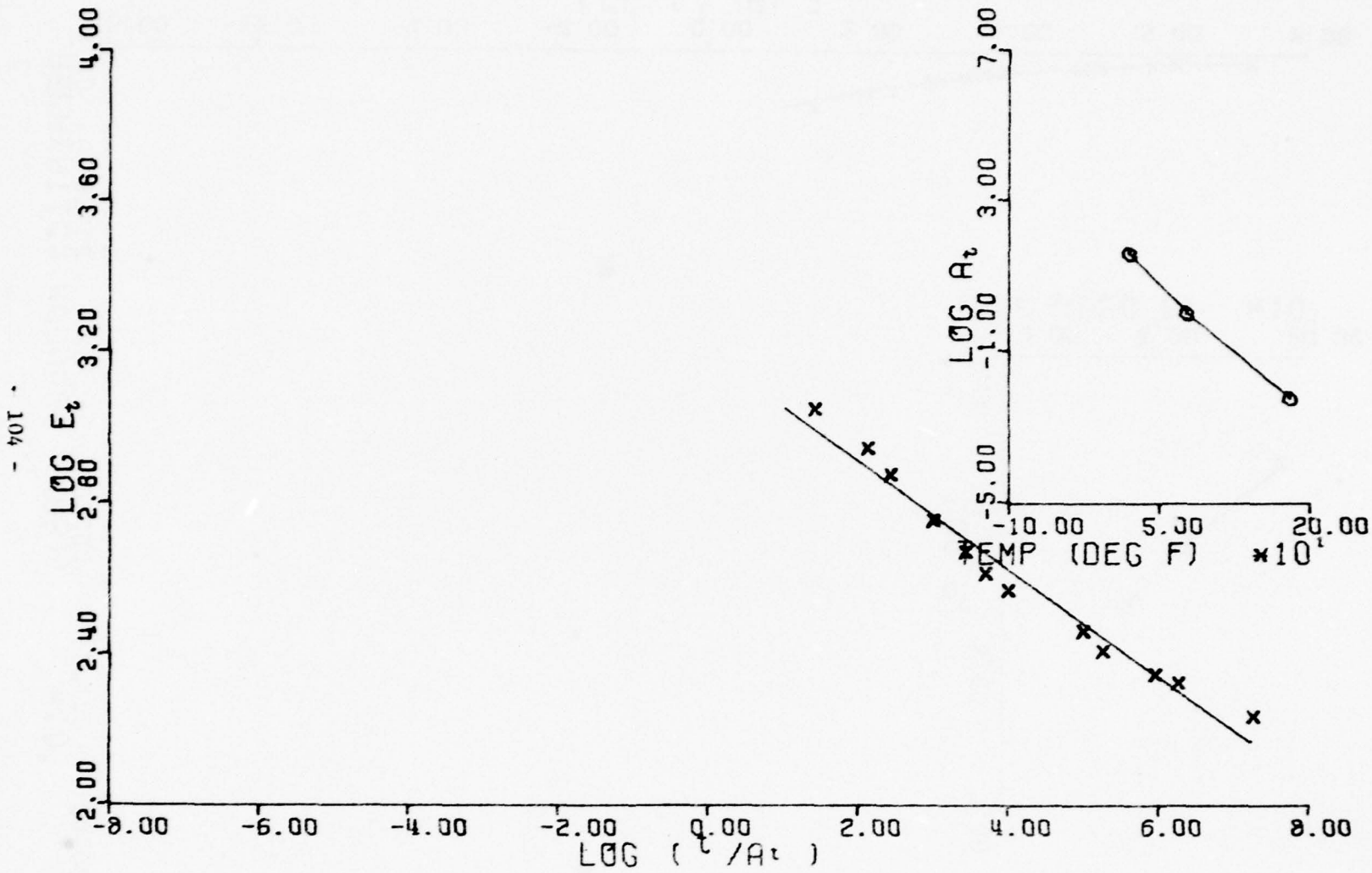
OUTER PROPELLANT STAGE II STRESS RELAXATION MASTER PLOT AT 3.0% STRAIN

Figure 41



INNER PROPELLANT STAGE II, STRESS RELAXATION MASTER PLOT AT 3.0% STRAIN

Figure 42



INNER PROPELLANT STAGE II, STRESS RELAXATION MASTER PLOT AT 3.0% STRAIN

Figure 43

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
99.0	8	+2.4124979E-01	+7.3303108E-03	+2.5000000E-01	+2.2599995E-01	+2.5111079E-01
101.0	8	+2.4637472E-01	+5.1938044E-03	+2.5099998E-01	+2.3699998E-01	+2.5336009E-01
112.0	8	+2.5474977E-01	+6.5268895E-03	+2.6599997E-01	+2.4599999E-01	+2.6573139E-01
116.0	6	+2.8466653E-01	+1.2912239E-02	+3.0499994E-01	+2.7099996E-01	+2.7023005E-01
122.0	6	+2.6649963E-01	+2.3808063E-03	+2.6899999E-01	+2.6299995E-01	+2.7697801E-01
129.0	6	+2.8199988E-01	+7.9519349E-03	+2.9699999E-01	+2.7399998E-01	+2.8485065E-01
130.0	3	+3.2133328E-01	+8.3845155E-03	+3.3099997E-01	+3.1599998E-01	+2.8597527E-01
136.0	3	+3.2399994E-01	+1.8357310E-02	+3.4499996E-01	+3.1099998E-01	+2.9272329E-01
143.0	3	+3.5733318E-01	+7.5123672E-03	+3.6499994E-01	+3.4999996E-01	+3.0059587E-01
164.0	3	+3.3666640E-01	+2.1319166E-03	+3.3899998E-01	+3.3499997E-01	+3.2421380E-01
177.0	3	+2.7499997E-01	+2.5721811E-04	+2.7499997E-01	+2.7499997E-01	+3.3883440E-01

STAGE II DISSECTED MTRS,OUTER,BURNING RATE AT 500 PSI

This sample size summary is applicable to figure 44 .

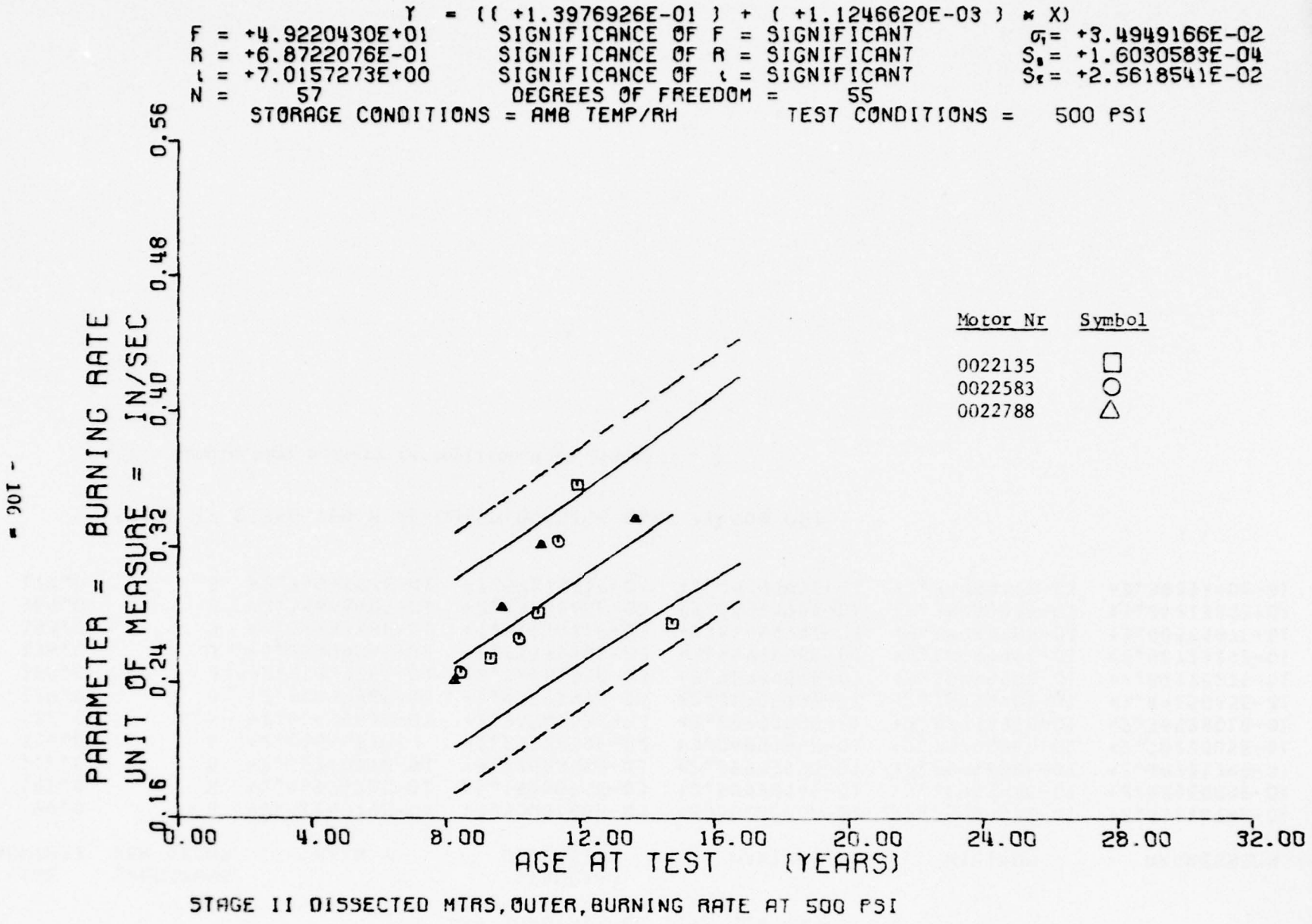

Y = ((+1.3976926E-01) + (+1.1246620E-03) * X)
F = +4.9220430E+01 SIGNIFICANCE OF F = SIGNIFICANT σ1 = +3.4949166E-02
R = +6.8722076E-01 SIGNIFICANCE OF R = SIGNIFICANT Sb = +1.6030583E-04
t = +7.0157273E+00 SIGNIFICANCE OF t = SIGNIFICANT Sr = +2.5618541E-02
N = 57 DEGREES OF FREEDOM = 55
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 500 PSI
PARAMETER = BURNING RATE
UNIT OF MEASURE = IN/SEC
0.16
0.24
0.32
0.40
0.48
0.56
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II DISSECTED MTRS, OUTER, BURNING RATE AT 500 PSI

Figure 44

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
99.0	8	+3.3949971E-01	+8.7289668E-03	+3.4999996E-01	+3.2299995E-01	+3.5493665E-01
101.0	8	+3.4537458E-01	+7.7998263E-03	+3.5499995E-01	+3.3099997E-01	+3.5563904E-01
112.0	8	+3.3537447E-01	+5.4830428E-03	+3.4299999E-01	+3.2699996E-01	+3.5950219E-01
116.0	6	+3.6566621E-01	+1.1091773E-02	+3.8299995E-01	+3.5299998E-01	+3.6090701E-01
122.0	6	+3.7566626E-01	+2.6392265E-03	+3.7899994E-01	+3.7199997E-01	+3.6301416E-01
129.0	6	+3.5466635E-01	+1.0976121E-02	+3.6899995E-01	+3.3899998E-01	+3.6547255E-01
130.0	3	+4.2899990E-01	+1.0423056E-03	+4.2999994E-01	+4.2799997E-01	+3.6582374E-01
136.0	3	+4.3999987E-01	+8.8926405E-03	+4.4699996E-01	+4.2999994E-01	+3.6793088E-01
143.0	3	+4.0999984E-01	+1.5625256E-02	+4.1999995E-01	+3.9199995E-01	+3.7038928E-01
148.0	3	+3.7133312E-01	+7.5826026E-03	+3.7999999E-01	+3.6599999E-01	+3.7214523E-01
149.0	6	+3.9766645E-01	+8.2492111E-03	+4.0899997E-01	+3.8599997E-01	+3.7249642E-01
154.0	3	+3.7966662E-01	+3.5078943E-03	+3.8299995E-01	+3.7599998E-01	+3.7425243E-01
155.0	6	+4.2283308E-01	+5.1693175E-03	+4.2999994E-01	+4.1399997E-01	+3.7460362E-01
161.0	3	+2.7066659E-01	+1.1371360E-02	+2.7999997E-01	+2.5799995E-01	+3.7671077E-01
162.0	6	+4.0016633E-01	+1.0393267E-02	+4.0899997E-01	+3.8199996E-01	+3.7706196E-01
164.0	3	+2.7299994E-01	+1.8846263E-04	+2.7299994E-01	+2.7299994E-01	+3.7776434E-01
177.0	3	+3.4033328E-01	+5.8383356E-04	+3.4099996E-01	+3.3999997E-01	+3.8232988E-01

STAGE II DISSECTED MTRS, INNER, BURNING RATE AT 500 PSI

This sample size summary is applicable to figure 45 .

Y = ((+3.2016837E-01) + (+3.5119526E-04) * X)

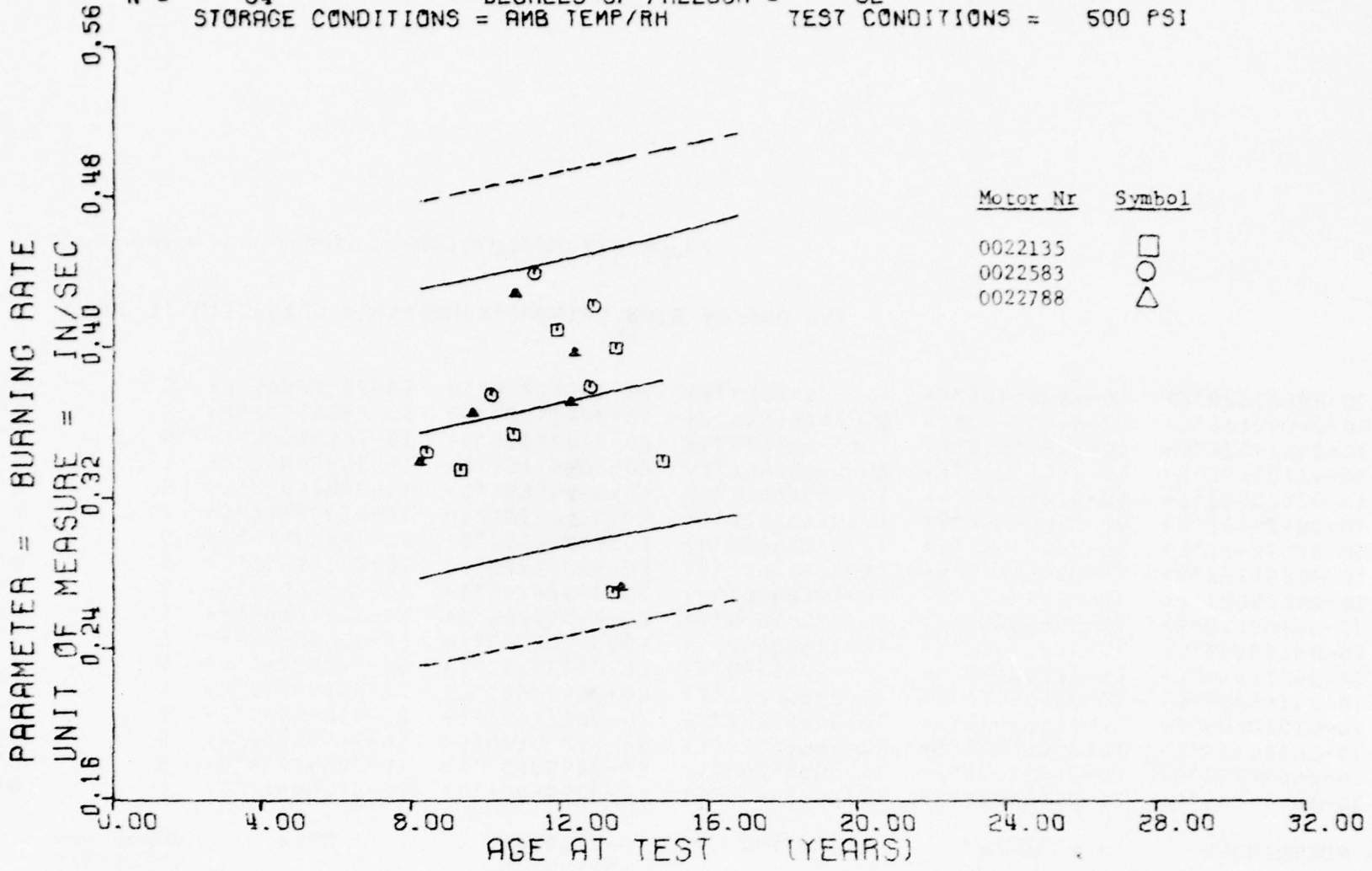
F = +3.3765994E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT σ_1 = +4.1748117E-02

R = +1.9887049E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT S_a = +1.9112120E-04

t = +1.8375525E+00 SIGNIFICANCE OF t = NOT SIGNIFICANT S_t = +4.1162952E-02

N = 84 DEGREES OF FREEDOM = 82

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 500 PSI



STAGE II DISSECTED MTRS, INNER, BURNING RATE AT 500 PSI

Figure 45

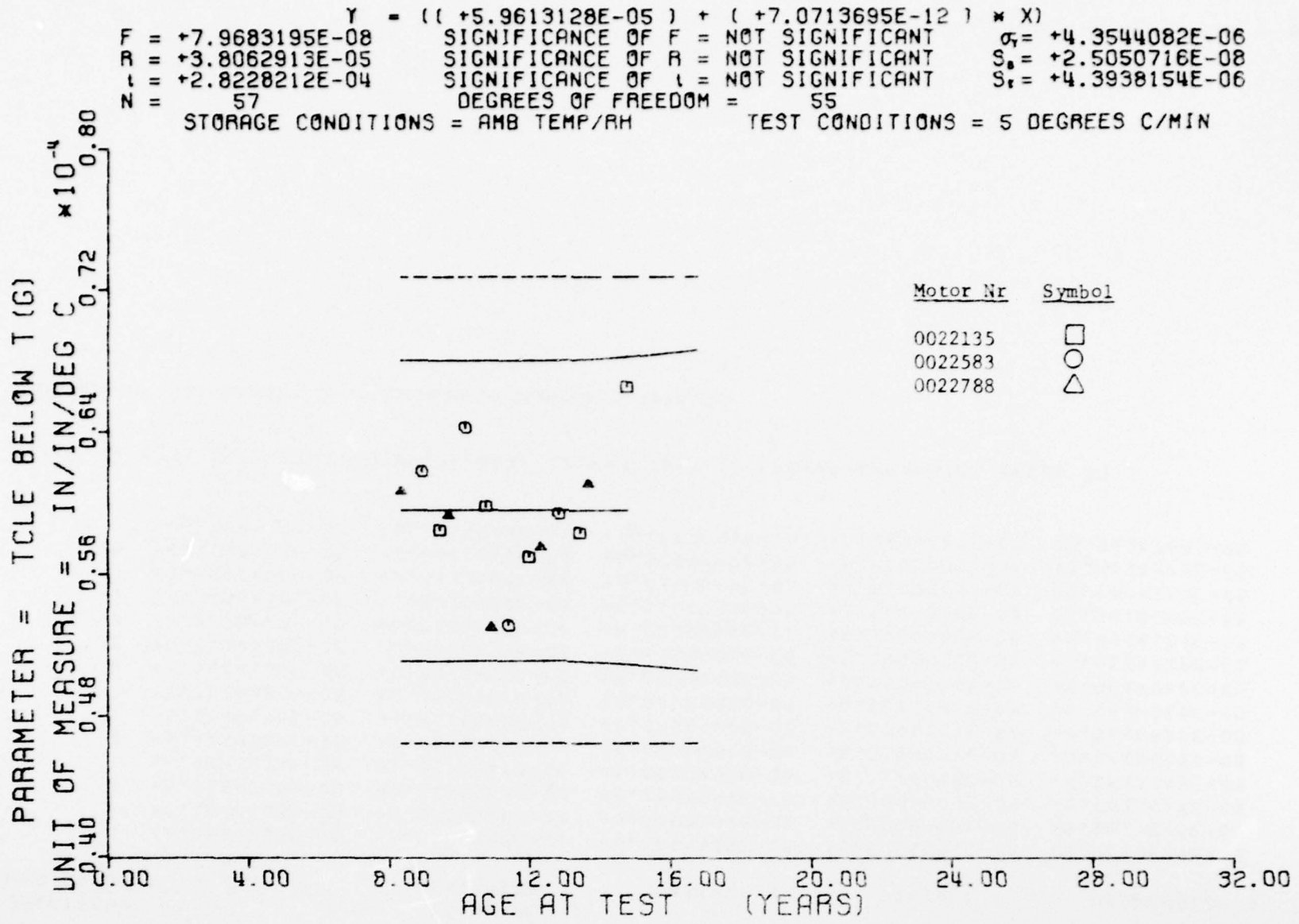
**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
100.0	8	+6.0699938E-05	+3.6064478E-06	+6.4859959E-05	+5.5299959E-05	+5.9613827E-05
107.0	8	+6.1862403E-05	+2.0799505E-06	+6.5499989E-05	+5.8999998E-05	+5.9613870E-05
113.0	8	+5.8524950E-05	+2.8026965E-06	+6.2659997E-05	+5.5399999E-05	+5.9613914E-05
116.0	3	+5.9333324E-05	+1.8579846E-06	+6.0599995E-05	+5.7199998E-05	+5.9613943E-05
122.0	3	+6.4299980E-05	+2.3514228E-06	+6.6999986E-05	+6.2699997E-05	+5.9613987E-05
129.0	3	+5.9899990E-05	+4.8508042E-06	+6.5499989E-05	+5.6999997E-05	+5.9614030E-05
131.0	3	+5.3033320E-05	+5.9510167E-06	+5.9699988E-05	+4.8099987E-05	+5.9614045E-05
137.0	3	+5.3166659E-05	+3.5014814E-06	+5.6599994E-05	+4.9599999E-05	+5.9614088E-05
144.0	3	+5.6999982E-05	+5.3328859E-06	+6.1199985E-05	+5.0999995E-05	+5.9614132E-05
148.0	3	+5.7533325E-05	+4.7088606E-06	+6.2399994E-05	+5.2999996E-05	+5.9614161E-05
154.0	3	+5.9466648E-05	+1.8230929E-06	+6.1099959E-05	+5.7499986E-05	+5.9614205E-05
161.0	3	+5.8366655E-05	+2.3113455E-06	+6.0799997E-05	+5.6199991E-05	+5.9614263E-05
164.0	3	+6.1099985E-05	+2.9101019E-06	+6.3299987E-05	+5.7799989E-05	+5.9614278E-05
177.0	3	+6.6566659E-05	+3.0499544E-06	+6.9999991E-05	+6.3499988E-05	+5.9614365E-05

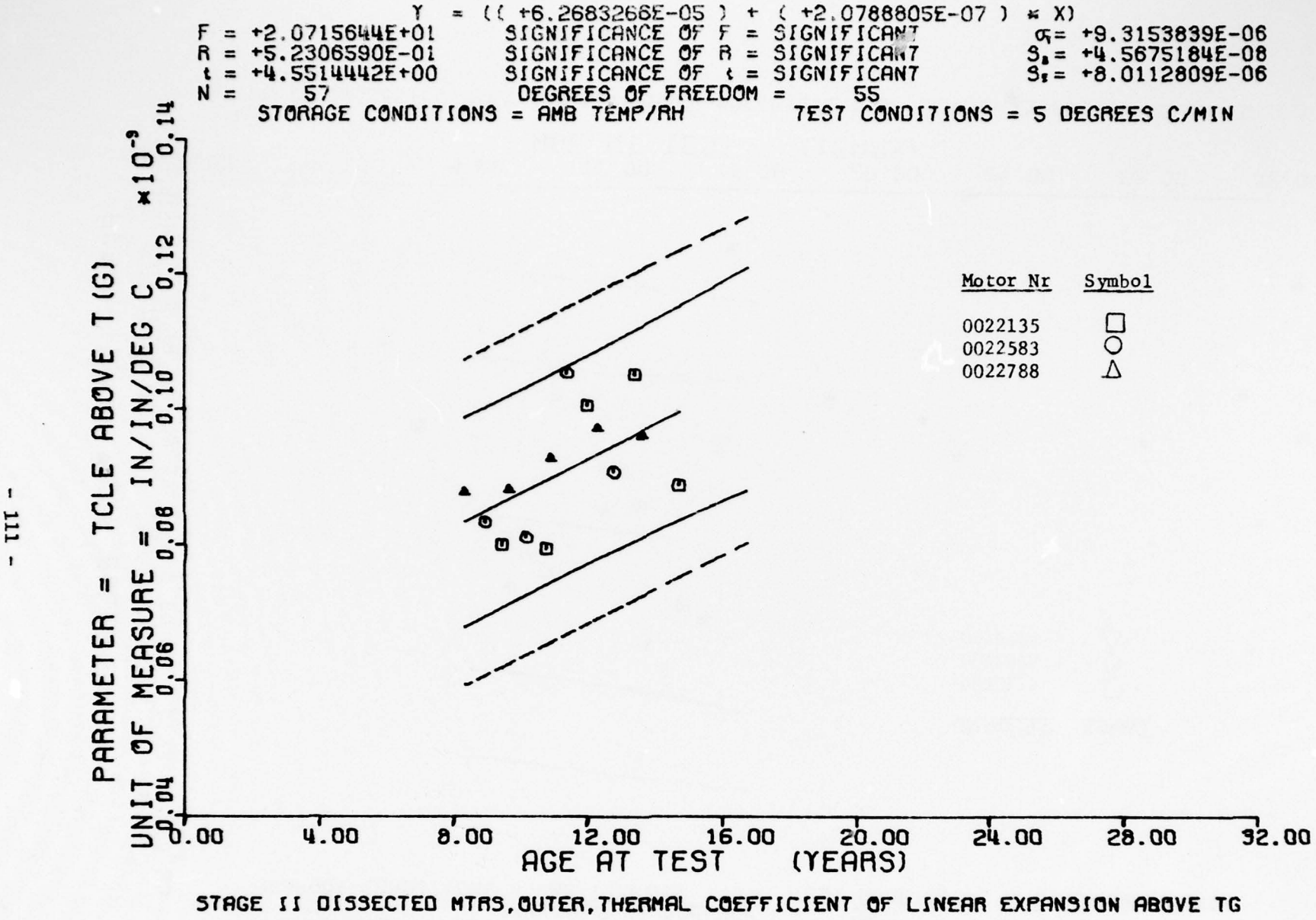
STAGE II DISSECTED MTRS,OUTER,THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TG

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



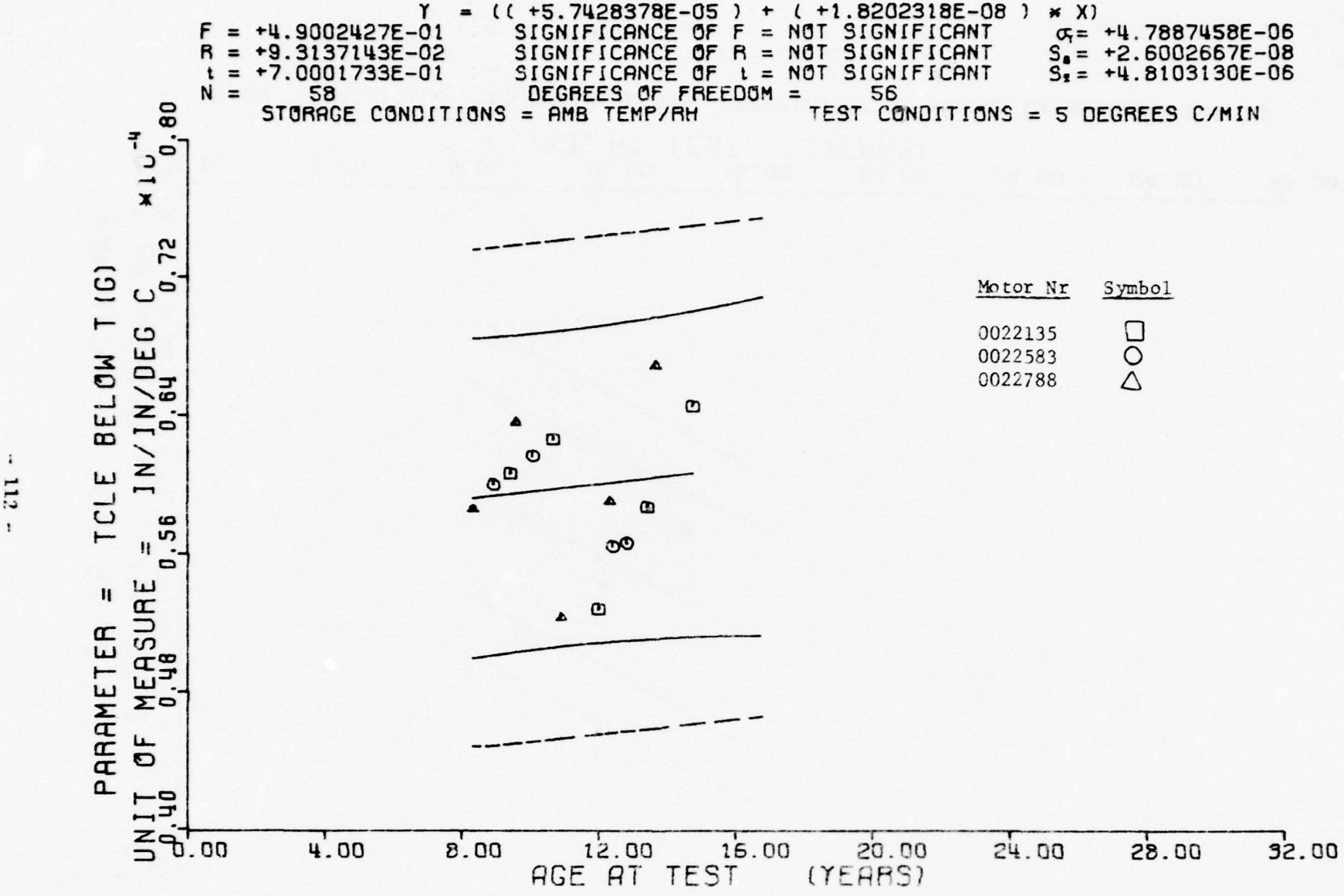
STAGE II DISSECTED MTRS,OUTER,THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TG

Figure 46



STAGE II DISSECTED MTRS,OUTER,THERMAL COEFFICIENT OF LINEAR EXPANSION ABOVE TG

Figure 47



STAGE II DISSECTED MTRS, INNER, THERMAL COEFFICIENT OF LINEAR EXPANSION BELOW TG

Figure 48

Y = ((+6.4104109E-05) + (+2.1138847E-07) * X)

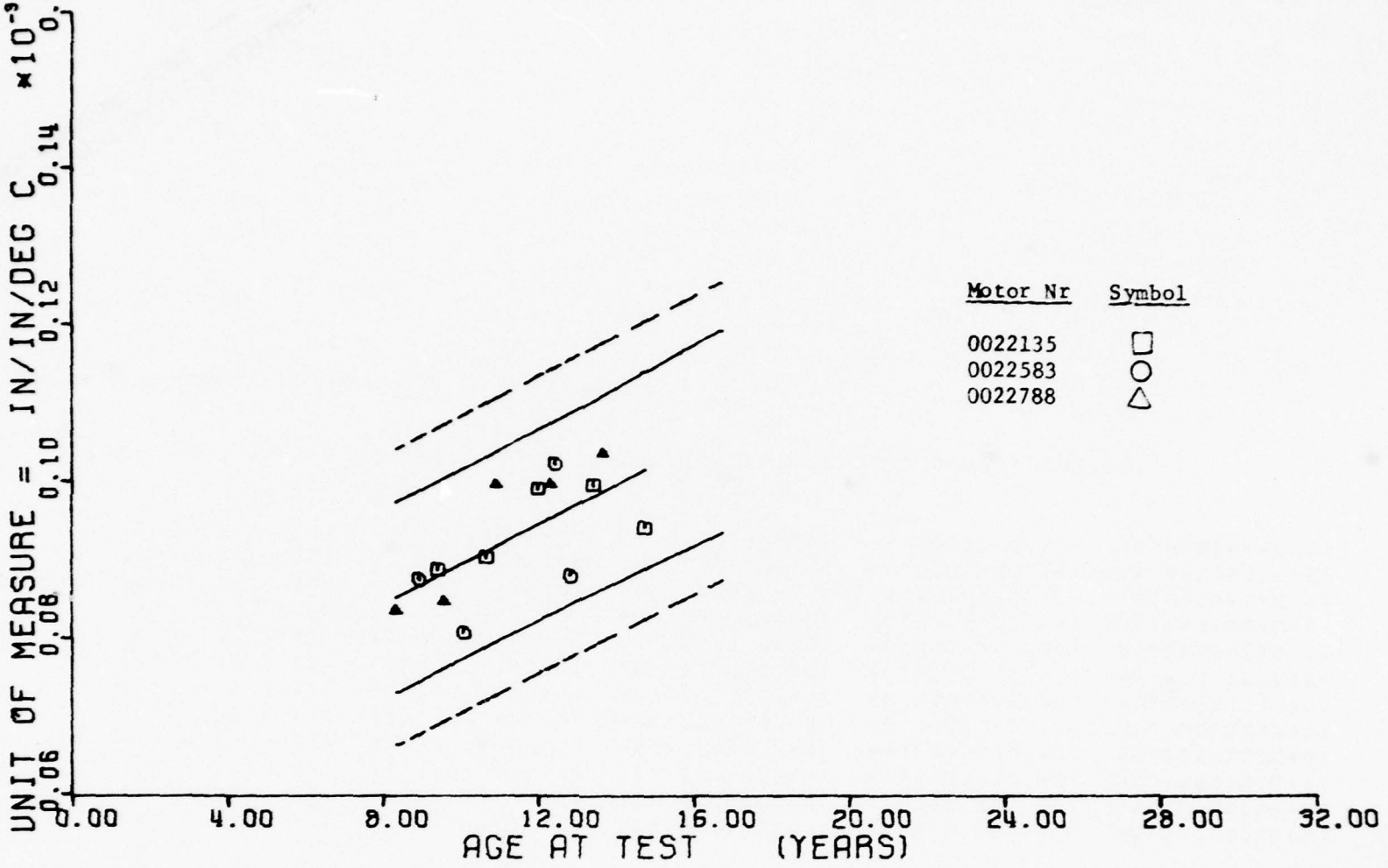
F = +3.8598935E+01 SIGNIFICANCE OF F = SIGNIFICANT σ_1 = +8.1087660E-06

R = +6.3877004E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +3.4024648E-08

t = +6.2128041E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +6.2943237E-06

N = 58 DEGREES OF FREEDOM = 56

STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 5 DEGREES C/MIN



STAGE II DISSECTED MTRS, INNER, THERMAL COEFFICIENT OF LINEAR EXPANSION ABOVE TG

Figure 49

*** LINEAR REGRESSION ANALYSIS ***

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
99.0	26	+6.76384428E+01	+1.49938038E+00	+7.00000000E+01	+6.50000000E+01	+6.80281066E+01
113.0	19	+7.16333329E+01	+2.23548614E-01	+7.30000000E+01	+7.00000000E+01	+6.75866518E+01
115.0	15	+6.68126075E+01	+1.16726175E+00	+6.90000000E+01	+6.50000000E+01	+6.74891516E+01
121.0	10	+6.36750000E+01	+1.35014705E+00	+6.60000000E+01	+6.10000000E+01	+6.72870338E+01
129.0	16	+6.81875000E+01	+2.07268352E+00	+7.10000000E+01	+6.50000000E+01	+6.70512395E+01
130.0	8	+6.67500000E+01	+1.03440983E+00	+6.80000000E+01	+6.50000000E+01	+6.69835716E+01
136.0	8	+6.51250000E+01	+6.40996994E-01	+6.60000000E+01	+6.40000000E+01	+6.67817538E+01
143.0	8	+6.53750000E+01	+1.28340995E+00	+6.80000000E+01	+6.30000000E+01	+6.65459595E+01
147.0	8	+6.52500000E+01	+1.16436475E+00	+6.70000000E+01	+6.40000000E+01	+6.64112245E+01
161.0	16	+6.62500000E+01	+1.29099445E+00	+6.80000000E+01	+6.40000000E+01	+6.59396365E+01
164.0	8	+6.48000000E+01	+1.51185788E+00	+6.70000000E+01	+6.30000000E+01	+6.58385775E+01
177.0	8	+6.76250000E+01	+1.16773495E+00	+7.00000000E+01	+6.60000000E+01	+6.54006655E+01

II STAGE DEGT MTHS ONLY,OUTER,HARDNESS,NON-CRNTL,VSN=.0022135,.0022593,.0022789

This sample size summary is applicable to figure 50 .

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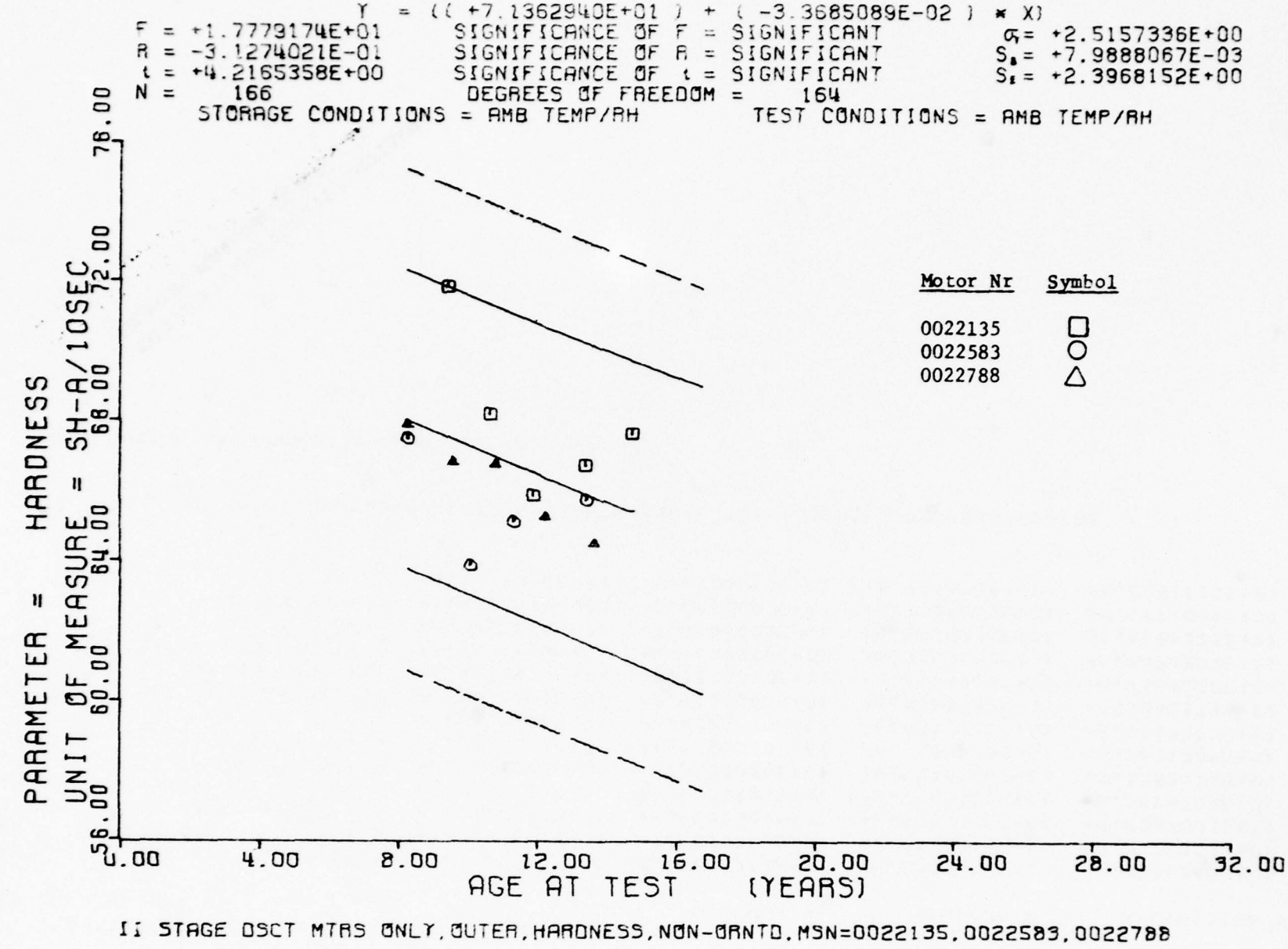

Y = ((+7.1362940E+01) + (-3.3685089E-02) * X)
F = +1.7773174E+01 SIGNIFICANCE OF F = SIGNIFICANT σ = +2.5157336E+00
R = -3.1274021E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +7.9888067E-03
t = +4.2165358E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +2.3968152E+00
N = 166 DEGREES OF FREEDOM = 164
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = HARDNESS
UNIT OF MEASURE = SH-A/10SEC
56.00
60.00
64.00
68.00
72.00
76.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
I: STAGE OSCT MTRS ONLY, OUTER, HARDNESS, NON-ORNTD, MSN=0022135, 0022583, 0022788

Figure 50

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
99.0	36	+6.2[illegible]E+01	+1.3783[illegible]E+00	+6.8000000E+01	+6.0000000E+01	+6.2204345E+01
113.	16	+7.2[illegible]E+01	+7.6615498E-01	+7.4000000E+01	+7.2000000E+01	+6.2758465E+01
116.0	16	+6.6[illegible]E+01	+1.0144785E+00	+6.8000000E+01	+6.5000000E+01	+6.2837631E+01
121.0	16	+6.5[illegible]E+01	+3.1191612E+00	+6.9000000E+01	+6.1000000E+01	+6.3075103E+01
128.0	16	+6.6[illegible]E+01	+6.7321245E-01	+6.8000000E+01	+6.5000000E+01	+6.3352172E+01
130.0	8	+6.2126000E+01	+1.2464234E+00	+6.5000000E+01	+6.1000000E+01	+6.3431335E+01
136.0	8	+6.3[illegible]E+01	+7.5592894E-01	+6.4000000E+01	+6.2000000E+01	+6.3668823E+01
148.0	8	+6.7[illegible]E+01	+7.4412380E-01	+6.9000000E+01	+6.7000000E+01	+6.3945677E+01
147.0	8	+6.1[illegible]E+01	+6.4086994E-01	+6.3000000E+01	+6.1000000E+01	+6.4104202E+01
156.0	16	+6.3312500E+01	+2.7454999E+00	+6.8000000E+01	+6.0000000E+01	+6.4420837E+01
161.0	8	+6.9000000E+01	+5.3452248E-01	+7.0000000E+01	+6.8000000E+01	+6.4658325E+01
164.0	8	+6.9125000E+01	+1.1259916E+00	+6.0000000E+01	+5.7000000E+01	+6.4777069E+01
177.0	8	+6.8625000E+01	+9.1612538E-01	+7.0000000E+01	+6.7000000E+01	+6.5291610E+01

II STAGE DSCT MTRS ONLY,INNER,HARDNESS,NON-CRNTD,MSN=0022135,0022583,0022788

This sample size summary is applicable to figure 51.

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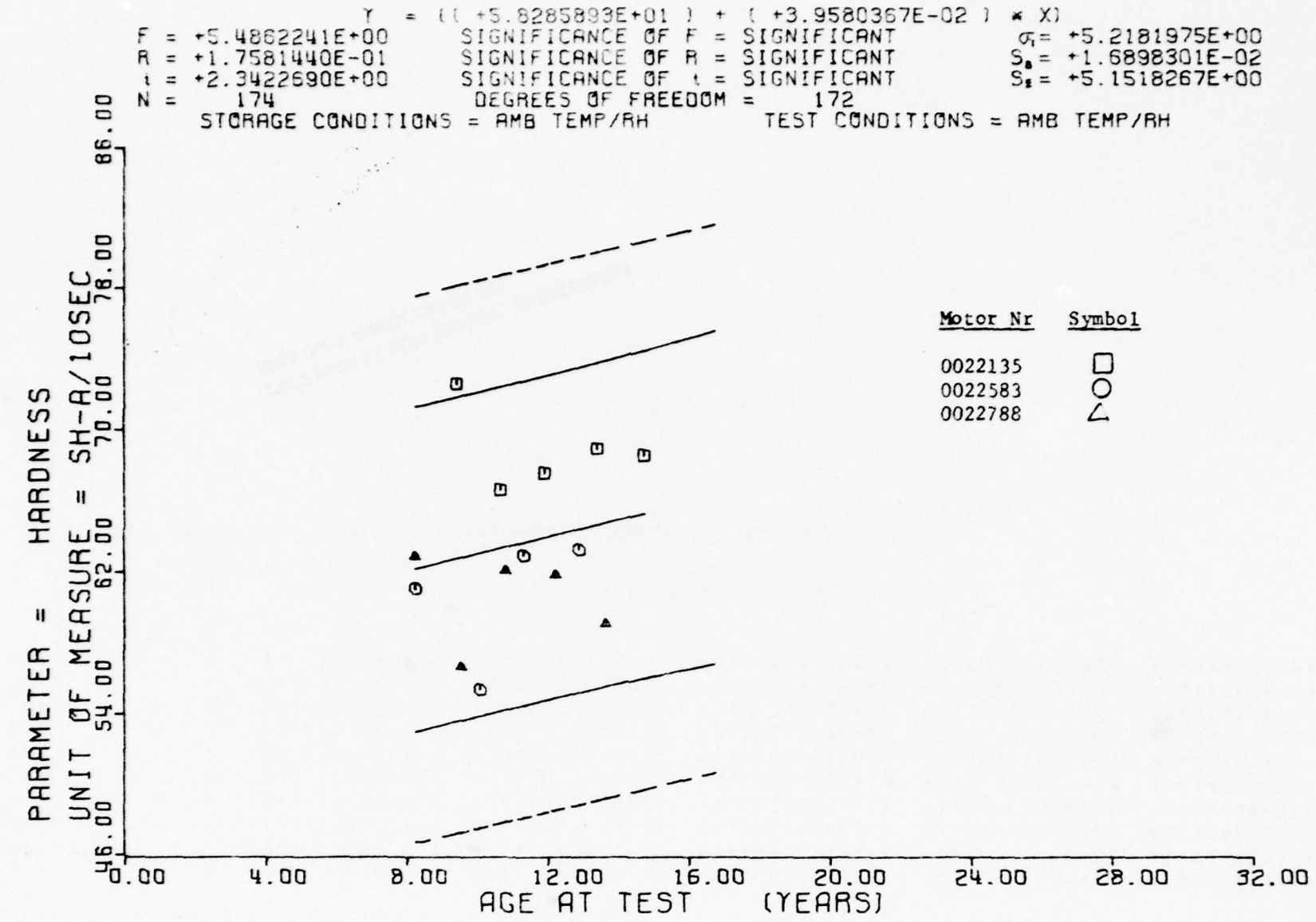

Y = ((+5.8285893E+01) + (+3.9580367E-02) * X)
F = +5.4862241E+00 SIGNIFICANCE OF F = SIGNIFICANT σ_i = +5.2181975E+00
R = +1.7581440E-01 SIGNIFICANCE OF R = SIGNIFICANT S_e = +1.6898301E-02
t = +2.3422690E+00 SIGNIFICANCE OF t = SIGNIFICANT S_z = +5.1518267E+00
N = 174 DEGREES OF FREEDOM = 172
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = HARDNESS
UNIT OF MEASURE = SH-A/10SEC
86.00
78.00
70.00
62.00
54.00
46.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
II STAGE OSCT MTRS ONLY, INNER, HARDNESS, NON-ORNTD, MSN=0022135, 0022583, 0022788

Figure 51

**** LINEAR REGRESSION ANALYSIS ****

*** ANALYSIS OF TIME SERIES ***

AGE (MONTHS)	SPECIMENS PER GROUP	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
103.0	6	+1.202482E+01	+3.666187E-01	+1.2[illegible]E+01	+1.19841[illegible]E+01	+1.2012111E+01
114.0	5	+1.1[illegible]E+01	+1.45[illegible]E-01	+1.17[illegible]E+01	+1.14238[illegible]E+01	+1.2031327E+01
116.0	6	+1.275[illegible]E+01	+2.629[illegible]E-01	+1.30[illegible]E+01	+1.23[illegible]E+01	+1.194[illegible]E+01
128.0	5	+1.142[illegible]E+01	+3.154[illegible]E-01	+1.20[illegible]E+01	+1.11[illegible]E+01	+1.1[illegible]E+01
127.0	5	+1.3[illegible]E+01	+1.[illegible]E-01	+1.3[illegible]E+01	+1.3[illegible]E+01	+1.140[illegible]E+01
148.0	3	+[illegible]E+00	+1.[illegible]E-01	+[illegible]E+00	+[illegible]E+00	+1.[illegible]E+01
154.0	3	+7.[illegible]E+00	+9.[illegible]E-02	+7.[illegible]E+00	+7.[illegible]E+00	+1.[illegible]E+01
161.0	3	+9.[illegible]E+00	+1.042[illegible]E-01	+9.[illegible]E+00	+9.[illegible]E+00	+1.[illegible]E+01
164.0	4	+9.[illegible]E+00	+1.75[illegible]E-01	+9.[illegible]E+00	+9.[illegible]E+00	+9.[illegible]E+00
177.0	4	+1.[illegible]E+01	+3.[illegible]E-01	+1.[illegible]E+01	+1.[illegible]E+01	+9.417[illegible]E+00

STAGE II, DISSECTED MTRS, OUTER, SOL GEL, GEL SMELL RATIO

This sample size summary is applicable to figures 52 thru 56.

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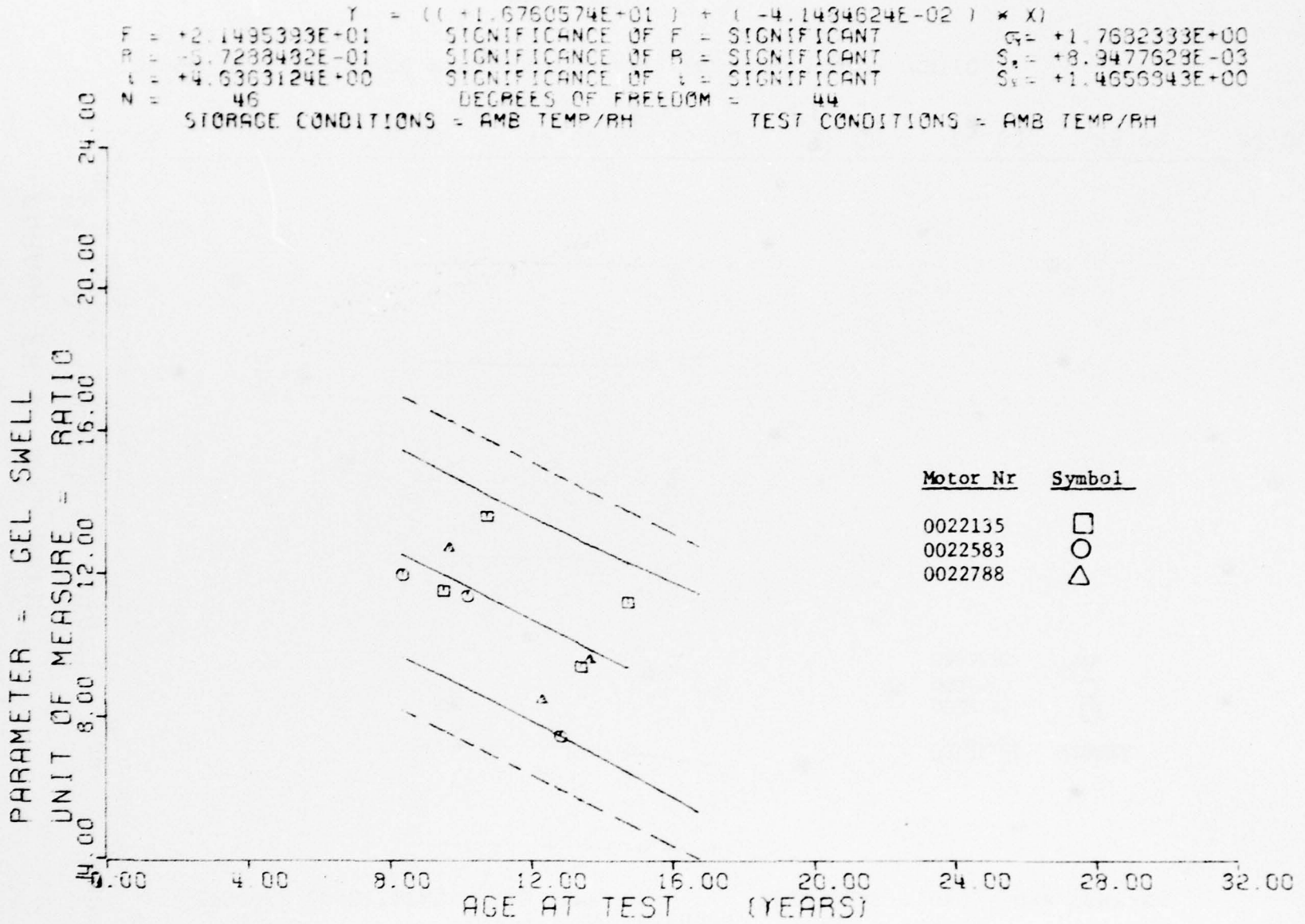

Y = (+1.6760574E+01) + (-4.1434624E-02) * X)
F = +2.1495393E+01 SIGNIFICANCE OF F = SIGNIFICANT σ = +1.7682333E+00
R = -5.7238432E-01 SIGNIFICANCE OF R = SIGNIFICANT S = +8.3477628E-03
t = +4.6303124E+00 SIGNIFICANCE OF t = SIGNIFICANT S = +1.4656843E+00
N = 46 DEGREES OF FREEDOM = 44
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = GEL SWELL
UNIT OF MEASURE = RATIO
24.00
20.00
16.00
12.00
8.00
4.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II, DISSECTED MTRS, OUTER, SOL GEL, GEL SWELL RATIO

Figure 52

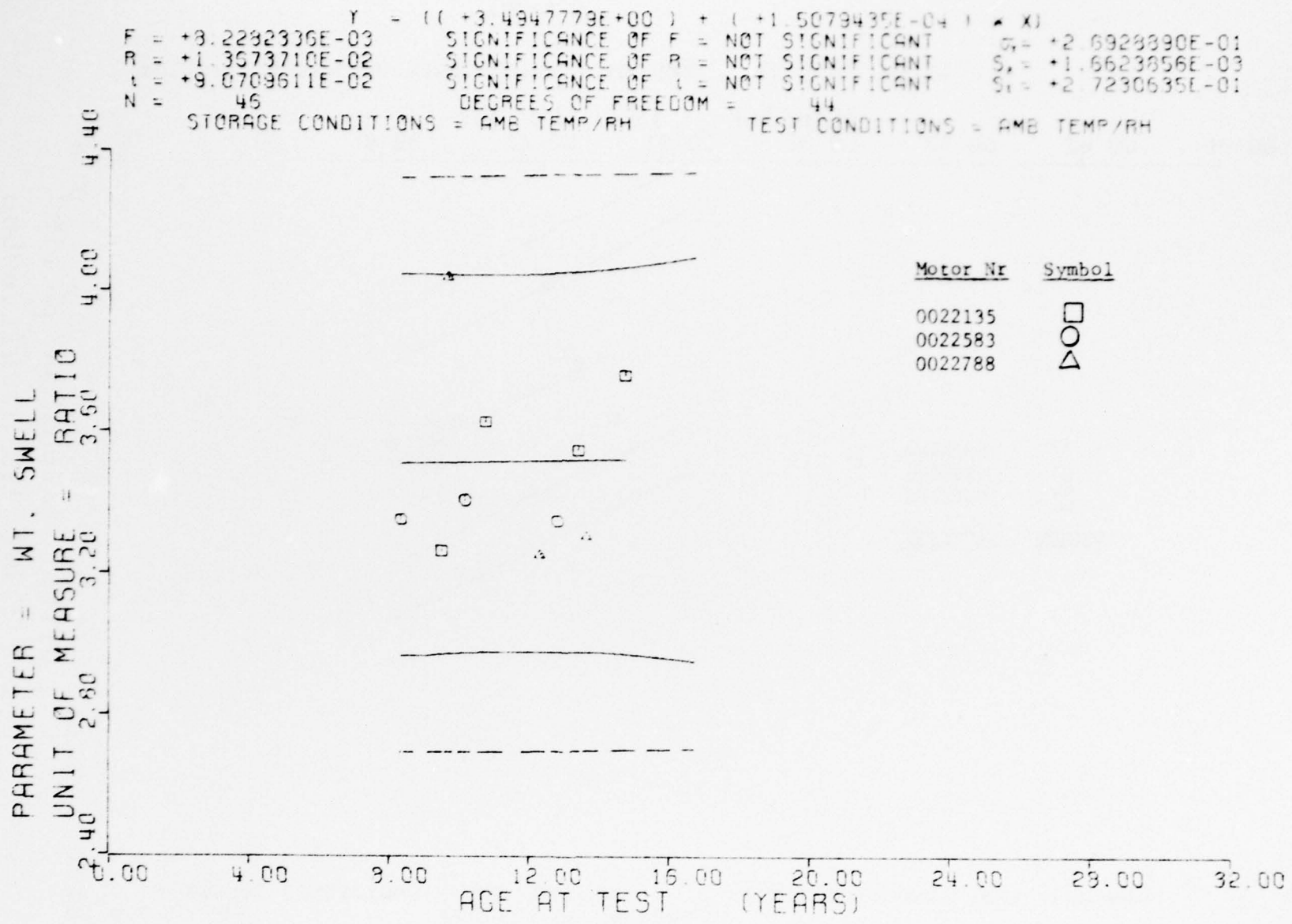
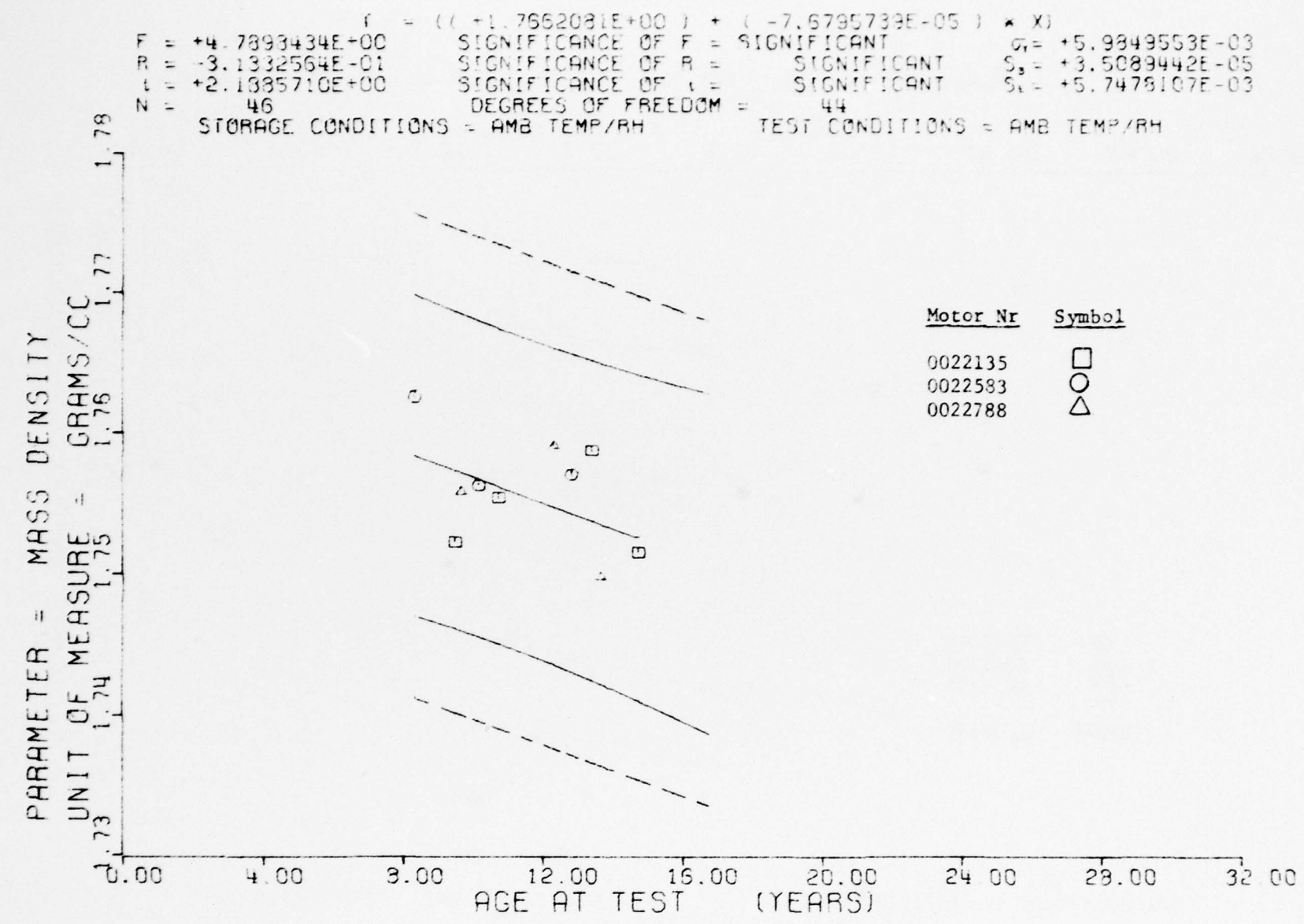
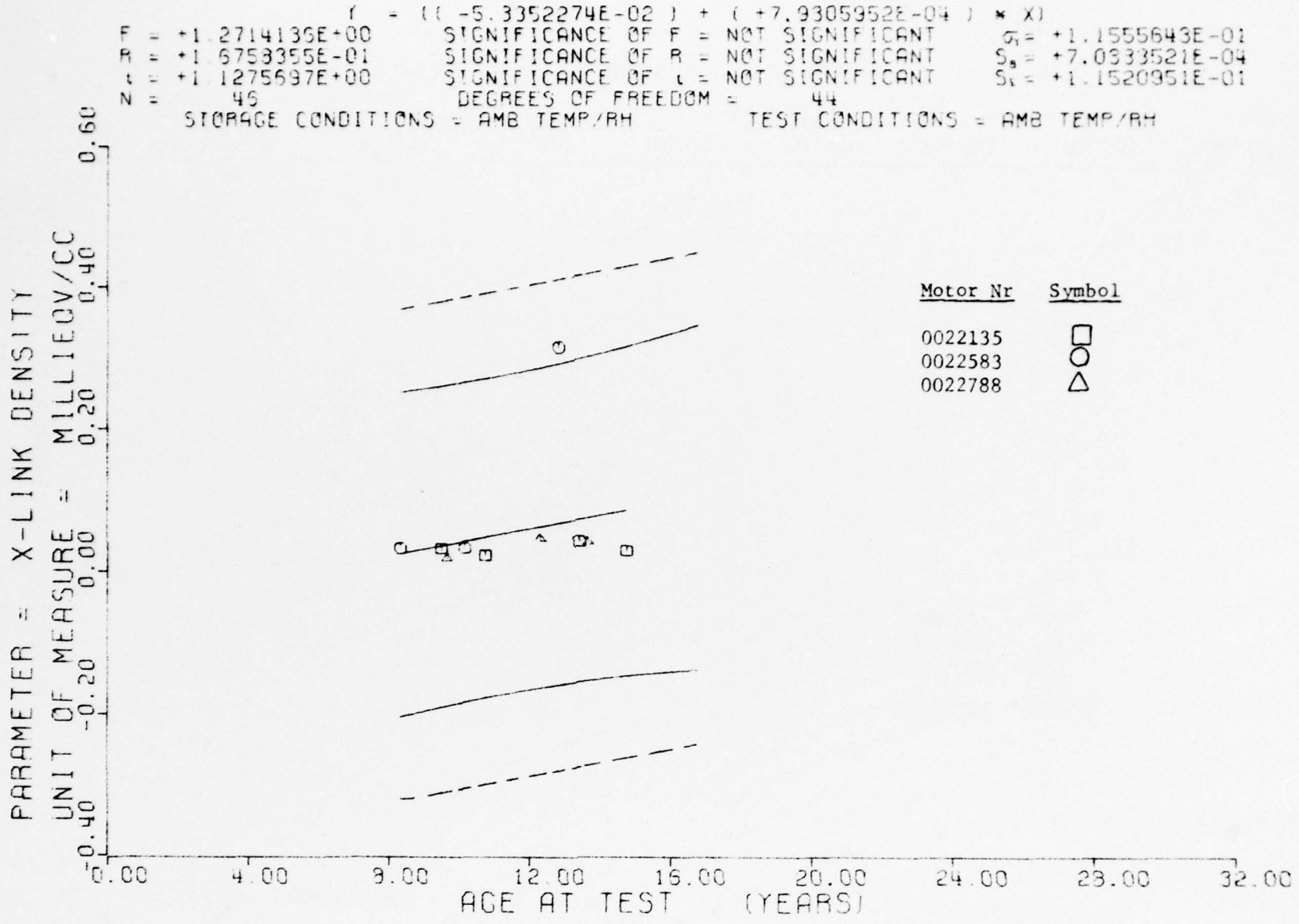

Y = ((+3.4947773E+00) + (+1.5079435E-04 * X)
F = +8.2282336E-03 SIGNIFICANCE OF F = NOT SIGNIFICANT σ = +2.6928890E-01
R = +1.3573710E-02 SIGNIFICANCE OF R = NOT SIGNIFICANT S = +1.6623056E-03
t = +9.0708611E-02 SIGNIFICANCE OF t = NOT SIGNIFICANT St = +2.7230635E-01
N = 46 DEGREES OF FREEDOM = 44
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = WT. SWELL
UNIT OF MEASURE = RATIO
4.40
4.00
3.60
3.20
2.80
2.40
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II, DISSECTED MTRS, OUTER, SOL GEL, WT. SWELL RATIO

Figure 53



STAGE II, DISSECTED MTRS, OUTER, SOL GEL, MASS DENSITY

Figure 54



STAGE II. DISSECTED MTRS, OUTER, SOL GEL, CROSS-LINK DENSITY

Figure 55

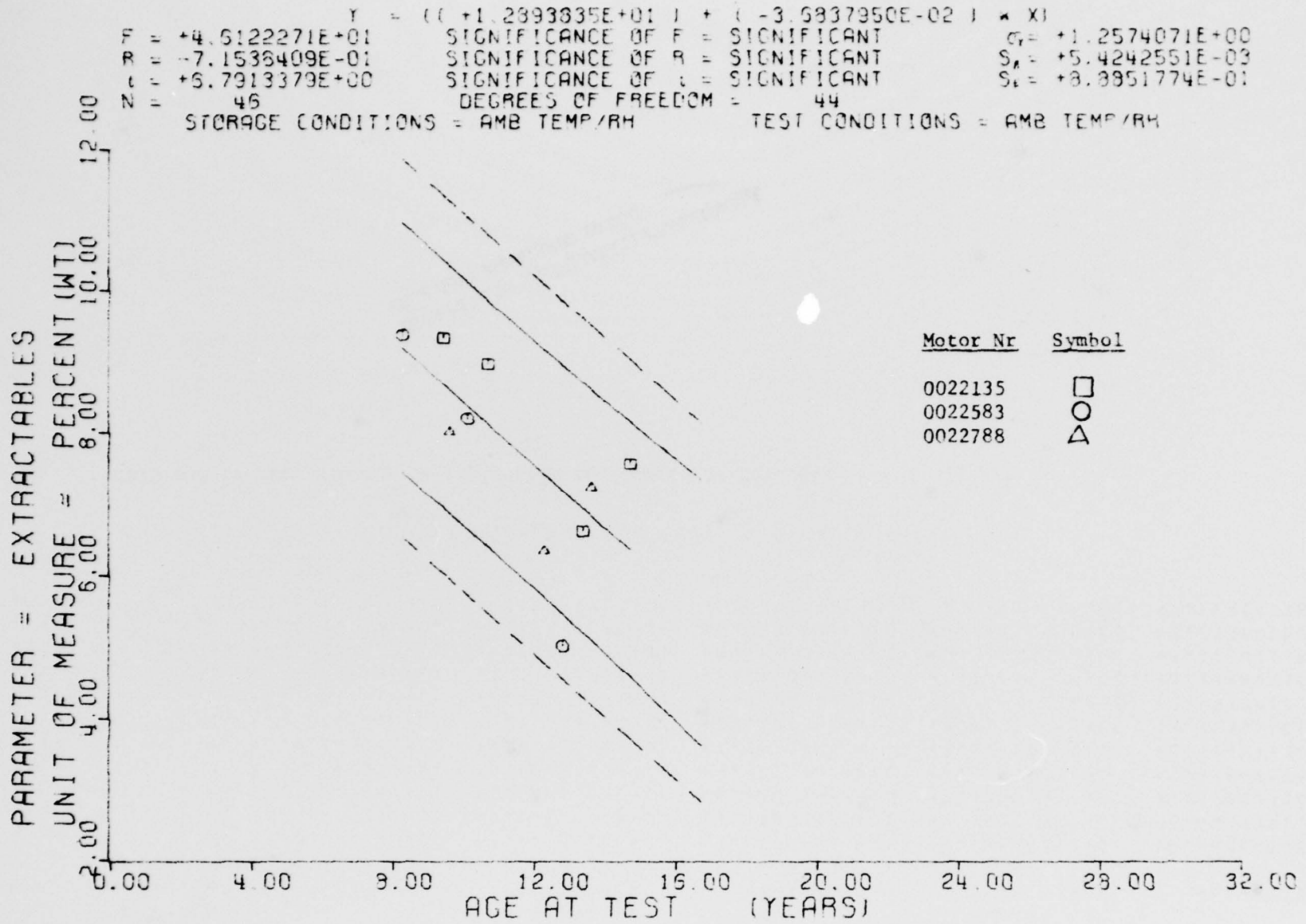

Y = (+1.2393835E+01) + (-3.9837950E-02) * X1
F = +4.5122271E+01 SIGNIFICANCE OF F = SIGNIFICANT σr = +1.2574071E+00
R = -7.1538409E-01 SIGNIFICANCE OF R = SIGNIFICANT SA = +5.4242551E-03
t = +6.7913379E+00 SIGNIFICANCE OF t = SIGNIFICANT St = +8.8851774E-01
N = 46 DEGREES OF FREEDOM = 44
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = EXTRACTABLES
UNIT OF MEASURE = PERCENT (WT)
2.00
4.00
6.00
8.00
10.00
12.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II, DISSECTED MTRS, OUTER, SOL GEL, EXTRACTABLE

Figure 56

**** LINEAR REGRESSION ANALYSIS ****

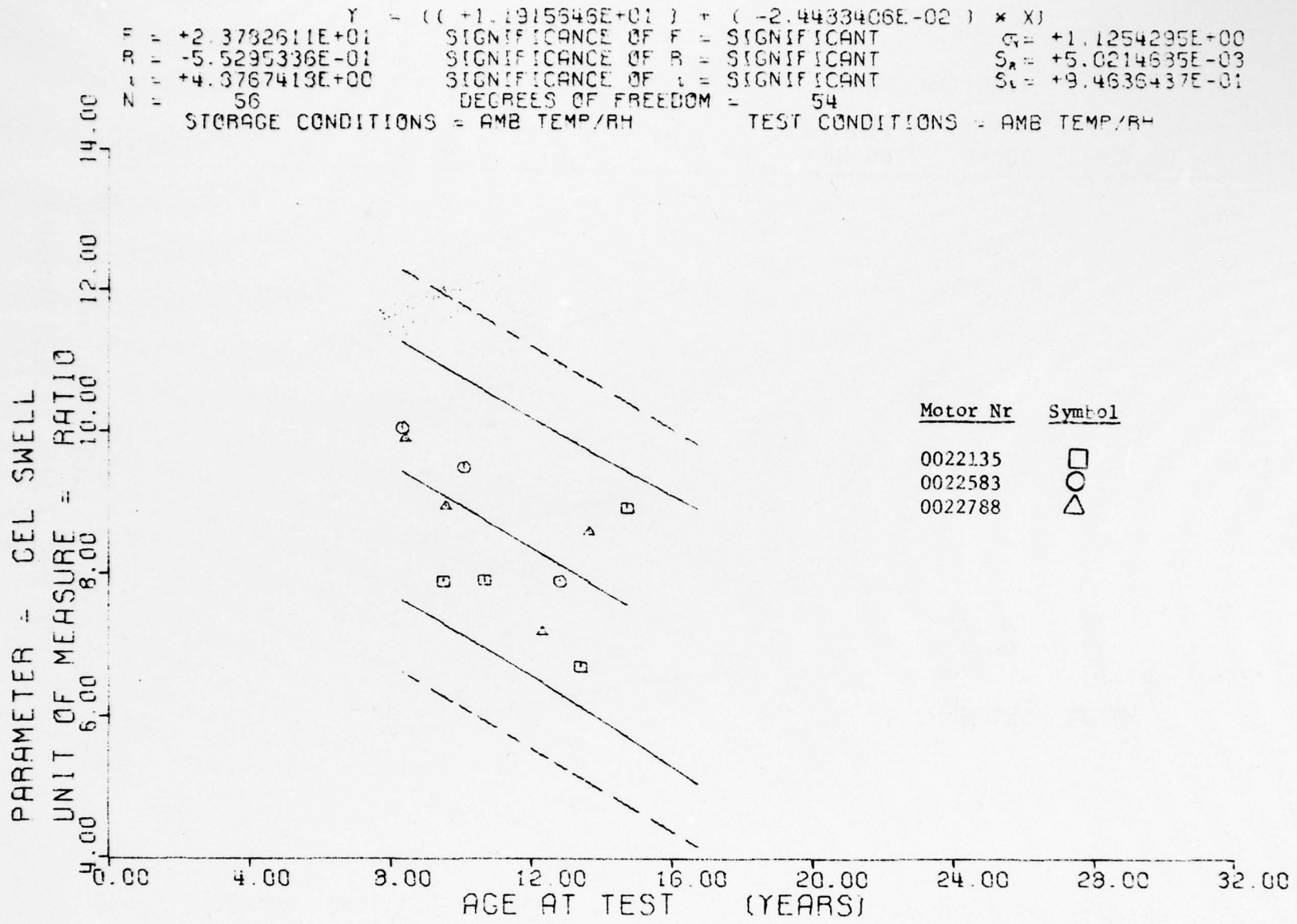
*** ANALYSIS OF TIME SERIES **

AGE (MONTHS)	BEGINNING PAIR NUMBER	MEAN Y	STANDARD DEVIATION	MAXIMUM Y	MINIMUM Y	REGRESSION Y
100.0	0	+1.07c9284E+01	+7.9CE8913E-02	+1.C18c+55E+01	+9.3F8.95F+00	+9.466eCE4E+CC
101.0	10	+9.814073[E+00	+7.3970413E-01	+1.C72[A95E+01	+8.9[2A5EE+CC	+9.442317.E+CC
110.0	5	+7.CCEC71EE+CC	+4.C321901E-01	+8.4CC[95EE+CC	+7.+03E6[7E+CC	+9.123[c71E+CC
110.0	0	+8.902109EE+00	+1.C07240[E+00	+9.4771+5E+CC	+C.912E[95E+CC	+9.C5[7E7E+CC
121.0	0	+9.E0[410EE+CC	+1.9E81[3EC-01	+3.7c71+95E+CC	+9.2[4[9[8E+CC	+8.9[2E4E5E+CC
120.0	0	+7.9c[E9[2E+CC	+C.7E314[4E-02	+C.C[07[48E+CC	+7.812[.E5+CC	+9.7E11[9EE+CC
130.0	3	+7.1[3E[4CE+CC	+3.[7[[74EE-01	+7.[2c+[3F+CC	+8.7[C14[6E+CC	+8.[9[3[1EE+CC
140.0	3	+7.903796[E+CC	+1.113E3[8C-01	+C.C19J+[2F+CC	+7.7.C[[3F+CC	+C.1[[4C11E+CC
151.0	3	+C.703[9EEE+CC	+4.2+413[1E-01	+8.[7CE[5EE+CC	+C.2C2[+3E5+CC	+7.[73011[E+CC
164.0	4	+C.CC1E21EE+CC	+2.C12[277E-01	+C.CCC[[9E+CC	+8.3[[+[[3E+CC	+7.E[3E[7EE+CC
177.0	4	+8.[34C[1CE+CC.	+C.713EC73E-01	+9.23+E+5EE+CC	+C.[+[2[9[5+CC	+7.EC11[77E+CC

STAGE II, DISSECTED ATME, INNER, SCL CEL, CEL SHELL RATIC

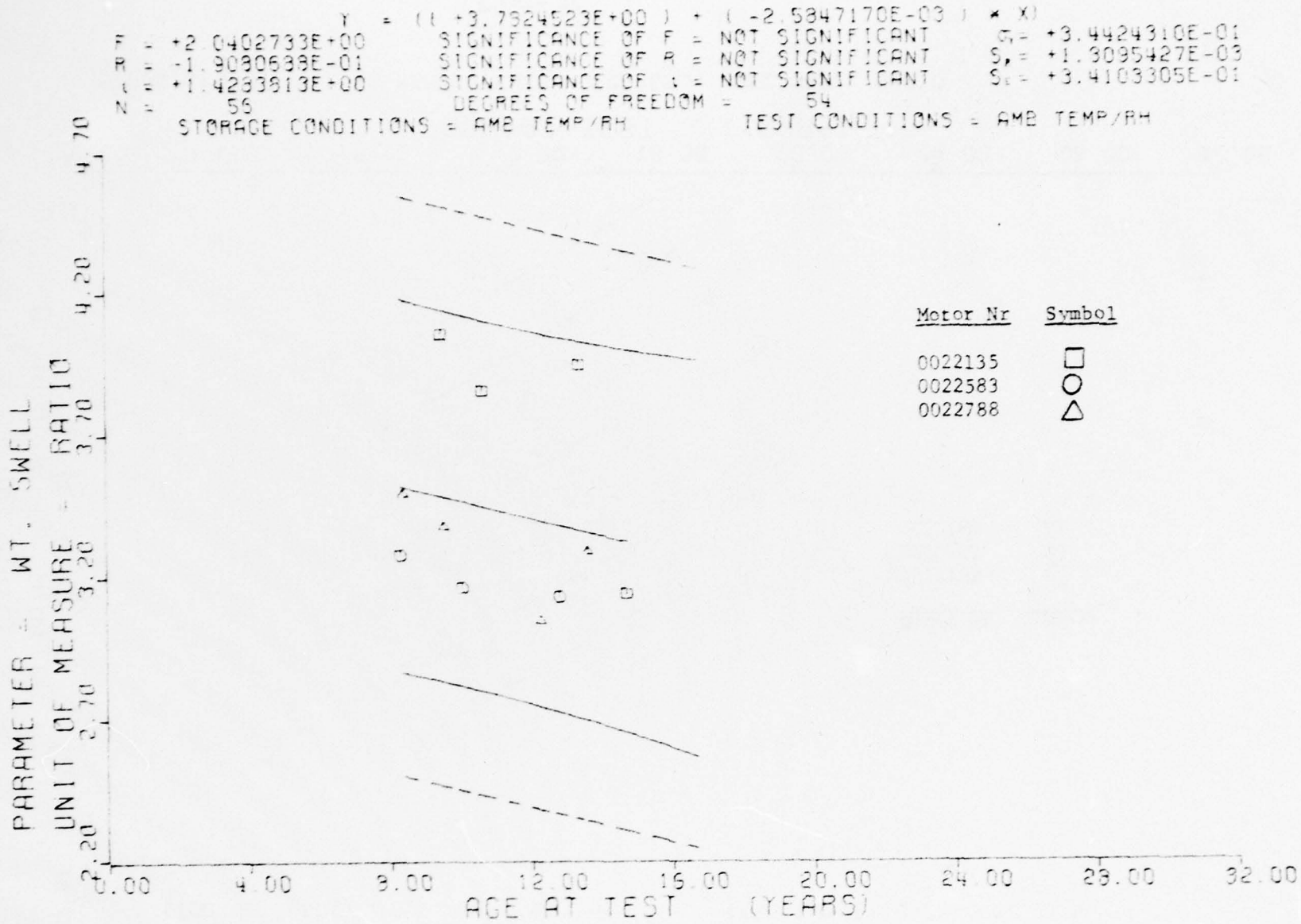
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STAGE II. DISSECTED MTRS, INNER. SOL GEL, GEL SWELL RATIO

Figure 57



STAGE II. DISSECTED MTRS. INNER. SOL GEL. WT. SWELL RATIO

Figure 58

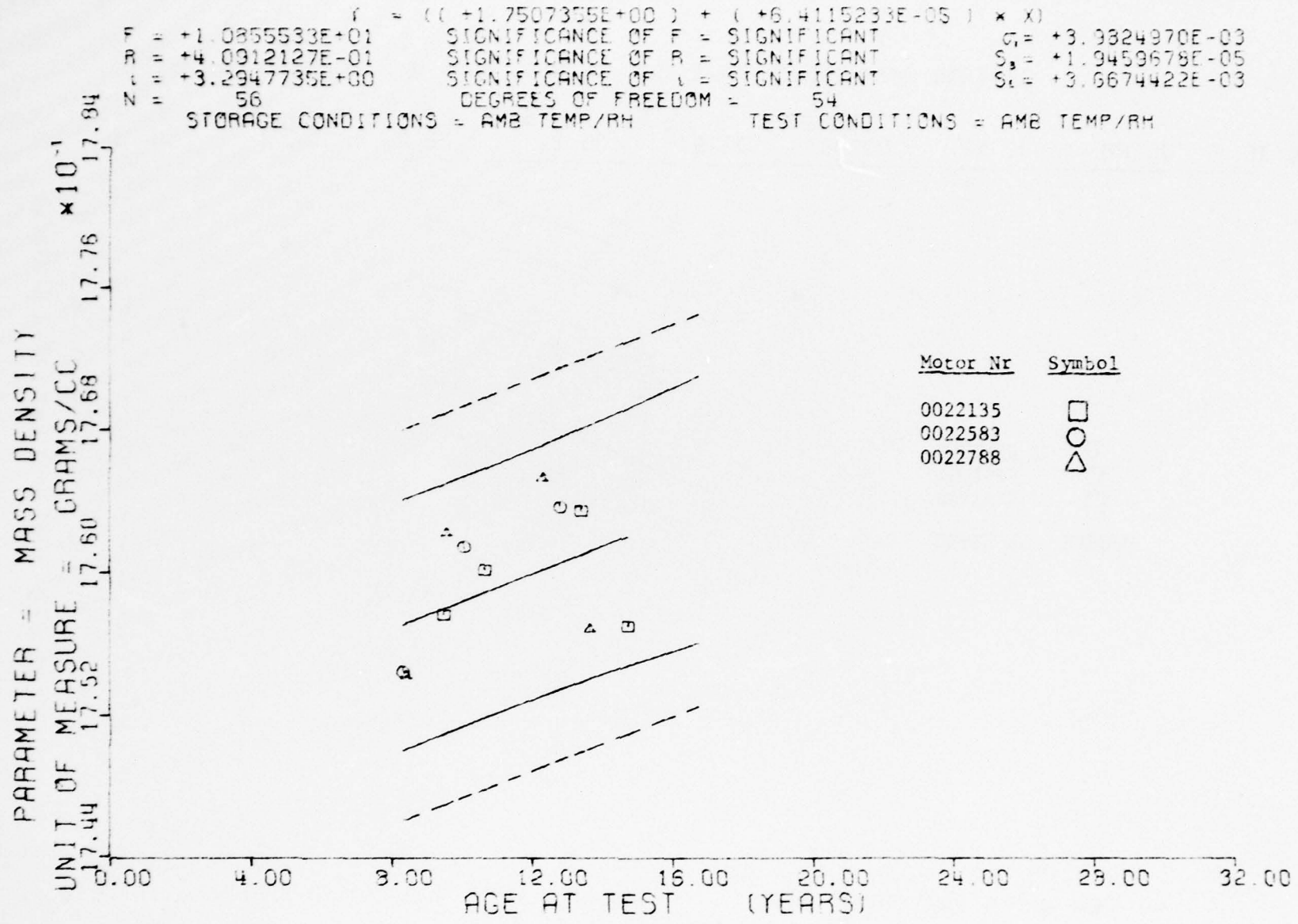

Y = ((+1.7507355E+00) + (+6.4115233E-05) * X)
F = +1.0855533E+01 SIGNIFICANCE OF F = SIGNIFICANT σ1 = +3.9324870E-03
R = +4.0912127E-01 SIGNIFICANCE OF R = SIGNIFICANT Sb = +1.9459678E-05
i = +3.2947735E+00 SIGNIFICANCE OF i = SIGNIFICANT Si = +3.6674422E-03
N = 56 DEGREES OF FREEDOM = 54
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = MASS DENSITY
UNIT OF MEASURE = GRAMS/CC x10-1
17.84
17.76
17.68
17.60
17.52
17.44
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II. DISSECTED MTRS. INNER, SOL GEL, MASS DENSITY

Figure 59

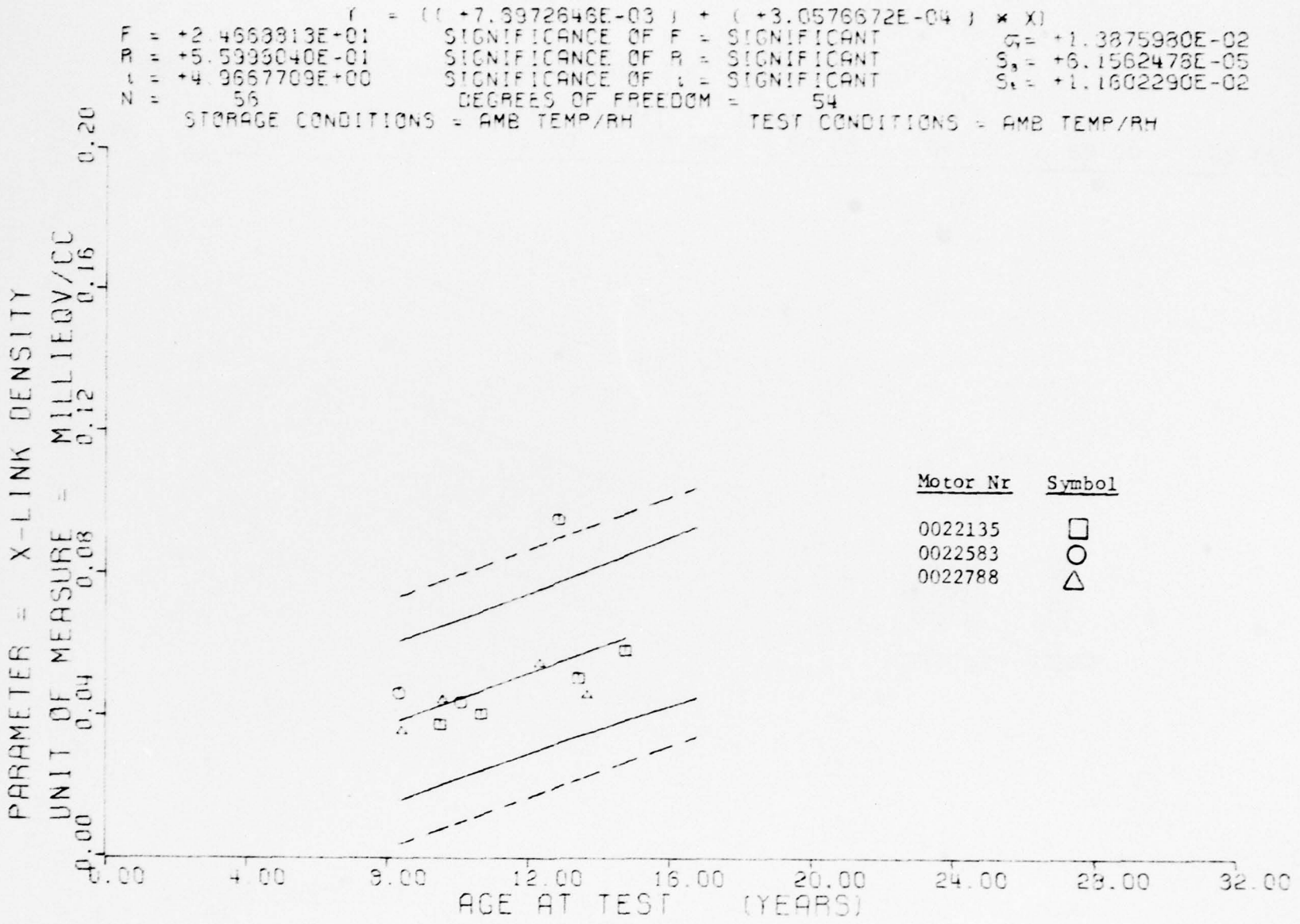

Y = ((+7.3372646E-03) + (+3.0576672E-04) * X)
F = +2.4668813E+01 SIGNIFICANCE OF F = SIGNIFICANT σ = +1.3875980E-02
R = +5.5330040E-01 SIGNIFICANCE OF R = SIGNIFICANT S_a = +6.1562476E-05
t = +4.9667709E+00 SIGNIFICANCE OF t = SIGNIFICANT S_t = +1.1602290E-02
N = 56 DEGREES OF FREEDOM = 54
STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH
PARAMETER = X-LINK DENSITY
UNIT OF MEASURE = MILLIEQV/CC
0.00
0.04
0.08
0.12
0.16
0.20
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr Symbol
0022135
0022583
0022788
STAGE II. DISSECTED MTRS, INNER, SOL GEL, CROSS-LINK DENSITY

Figure 60

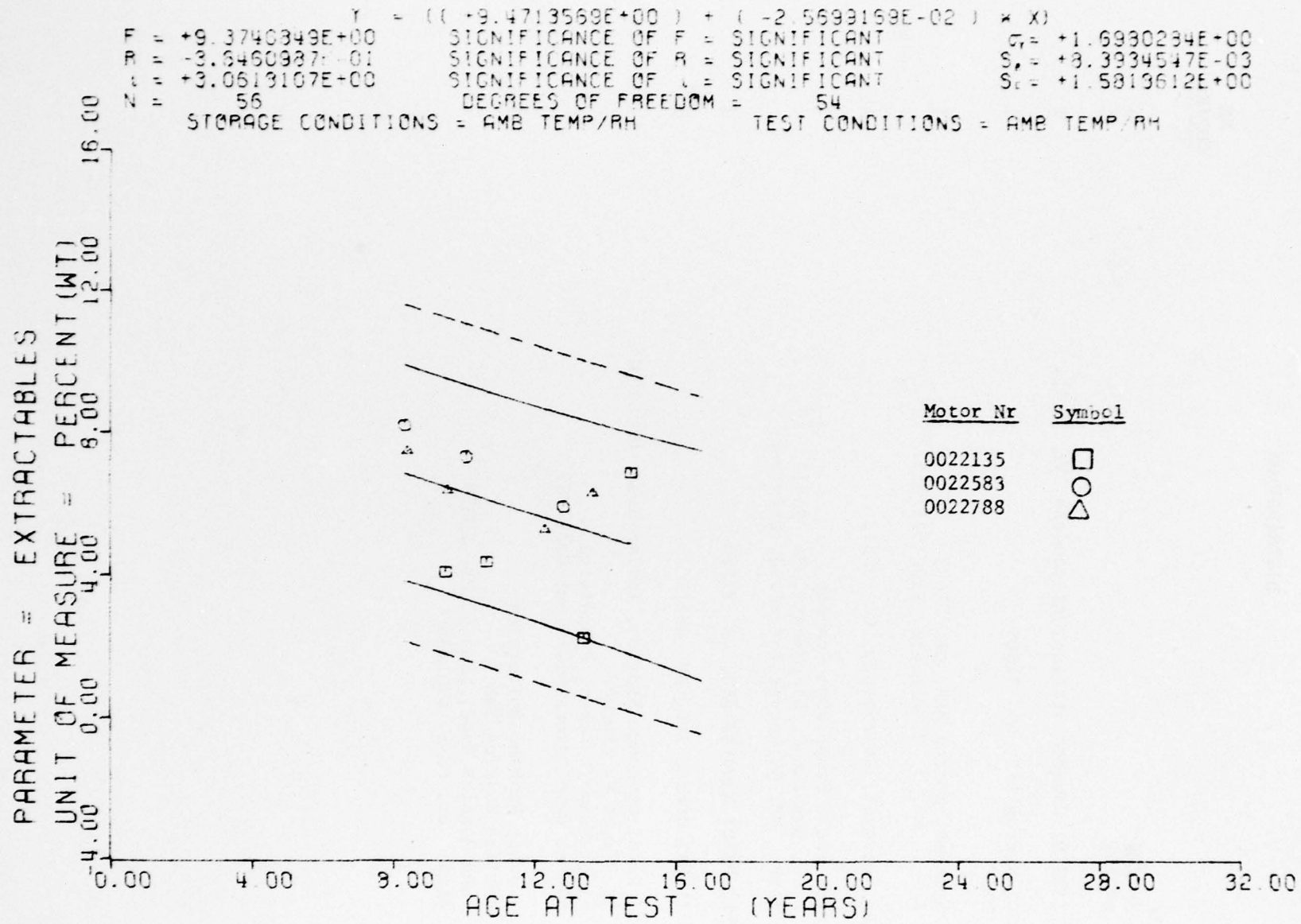

Y = ((+9.4713568E+00) + (-2.5693169E-02) * X)
F = +9.3740348E+00
R = -3.6460987E-01
t = +3.0613107E+00
N = 56
SIGNIFICANCE OF F = SIGNIFICANT
SIGNIFICANCE OF R = SIGNIFICANT
SIGNIFICANCE OF t = SIGNIFICANT
DEGREES OF FREEDOM = 54
σr = +1.6930234E+00
Sb = +8.3934547E-03
Sc = +1.5813612E+00
STORAGE CONDITIONS = AMB TEMP/RH
TEST CONDITIONS = AMB TEMP/RH
PARAMETER = EXTRACTABLES
UNIT OF MEASURE = PERCENT (WT)
16.00
12.00
8.00
4.00
0.00
-4.00
0.00
4.00
8.00
12.00
16.00
20.00
24.00
28.00
32.00
AGE AT TEST (YEARS)
Motor Nr
Symbol
0022135
0022583
0022788
STAGE II, DISSECTED MTRS, INNER, SOL CEL, EXTRACTABLE

Figure 61

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SAC (LGBM) Offutt AFB, NB 68113	1
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7. AUTHOR(s) Neal M. Hansen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Propellant Lab Section Directorate of Maintenance Hill AFB, UT 84056		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Service Engineering Division Directorate of Materiel Management Hill AFB, UT 84056		12. REPORT DATE March 1979 13. NUMBER OF PAGES 145
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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dissected Motor Solid Propellant
Minuteman Safeguard

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report contains test data from propellant and case bond materials from two Minuteman Stage II dissected motors. Testing was performed in accordance with Service Engineering General Test Directive GTD-1 Dissect dated 28 June 1974 and Project M83258C.

Statistical analysis includes data from both inner (ANP 2864) and outer (ANP 2862) propellant from the two dissected motors for this test period and includes a third motor from the previous test periods.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

Linear regression plots using unique symbols to identify the three motors were used to indicate trends. Most of the propellant specimens were prepared and tested in the axial orientation, that is, parallel to the longitudinal axis of the motor.