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# THE STRESS BEHAVIOR OF THREE ADVANCED NICKEL-BASE SUPERALLOYS DURING HIGH-TEMPERATURE, LOW-CYCLE FATIGUE

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This report is a compilation of data on stress behavior as a function of cycles obtained during high-temperature, low-cycle fatigue tests on three advanced Ni-base superalloys--René 95, AF-115, and AF2-1DA. The data are presented in both tabular and graphical formats. The materials studied are those used for jet-engine turbine disks, and the fatigue tests were conducted at their operating temperatures. The purpose of this report is to make the test data available to the technical community. No discussion is presented on an analysis or an understanding of the data, although some observations are included.

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## FOREWORD

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## SECTION 1
## INTRODUCTION

This report is a compilation of data on stress behavior as a function of cycles obtained during high-temperature, low-cycle fatigue tests on three advanced Ni-base superalloys--René 95, AF-115, and AF2-1DA. The data are presented in both tabular and graphical formats. The materials studied are those used for jet-engine turbine disks, and the fatigue tests were conducted at the operating temperatures of the three materials -- 1200°F, 1400°F and 1400°F, respectively. The purpose of this report is to make the basic test data available to the technical community. No discussion is presented on an analysis or understanding of the data, although some observations are included. The data in this report are a subset of a larger data base. A summary of this data base is given in Ref. 1. The cyclic stress behavior reported here was determined for characteristic tests in this larger data base. Since recording the stress behavior is a very time-consuming and tedious process, not all of the fatigue tests could be analyzed.

The larger data base has been the subject of other studies. Analysis of various life-prediction methods using the René 95 data is given in Refs. 2 - 4. A discussion of the mechanisms of high-temperature, low-cycle fatigue for AF-115 and AF2-1DA can be found in Ref. 5.

## SECTION 2

## DESCRIPTION OF MATERIALS AND SPECIMEN IDENTIFICATION AND GEOMETRY

The materials tested were René 95, AF-115, and AF2-1DA. The René 95 was in the form of two cast and wrought pancakes which underwent thermo-mechanical processing. These were cut from the same ignot and subjected to the same processing. The specimens from the first pancake are identified by a one- or two-digit number such as 9 or 35. Those from the second pancake are identified by a three-digit number in the 200 series such as 220. No difference in fatigue lives or stress-strain behavior between the two pancakes was found. Details of the processing history and microstructure are given in Refs. 6 and 7.

The AF-115 is a powder alloy that has been hot isostatically pressed (HIP). Two different forms of AF-115 were used--one being as-HIP and the other a HIP-and-forged product. The HIP-and-forged product came from the same ignot as the as-HIP product. The specimen labels for these pancakes are given in Table 1. Each specimen had more than one label. Details of the processing and microstructure of these pancakes are given in Refs. 1 and 5.

The AF2-1DA is also a powder alloy but instead of being HIP, it has been superplastically forged (Gatorized). Two pancakes from the same ignot and receiving the same processing treatments were used. Specimens from the first pancake are identified by a number in the 100 series and those from the second, by a number in the 200 series. Table 1 gives alternate designations for the same specimen. The processing and microstructure of AF2-1DA is discussed in Refs. 1 and 5.

The geometry of the fatigue specimens for the AF-115 and AF2-1DA was of the uniform cylindrical type, having 0.25-in. diam. and 0.75-in. length in the gage section. The René 95 specimens were of the hourglass design, with 0.25-in. minimum diameter.

TABLE 1

SPECIMEN IDENTIFICATION

| René 95 | example |
|---|---|
| XX - first pancake | 19 |
| 2XX - second pancake | 225 |

| AF-115 | example |
|---|---|
| 2XX or 2-XX - as-HIP | 202 or 2-2 |
| 5XX or 5-XX - HIP and forged | 503 or 5-3 |

| AF2-1DA | example |
|---|---|
| 1XX or B1-XX - first pancake | 105 or B1-5 |
| 2XX, 2-XX, - second pancake* | 215 or 2-15 |
| or 3XX | 216 or 3-16 |

*2-XX is from 2-1 to 2-15; 3-XX is from 3-16 and beyond.

## SECTION 3

## FATIGUE TESTS AND NOMENCLATURE

The fatigue tests consisted mainly of continuous-cycling and strain-hold tests. The continuous-cycling tests were run at frequencies from 20 to 0.05 cycles per minute (cpm). The hold periods of the strain-hold tests were 1 and 10 min. and occurred in both tension and compression. Some other tests--fast-slow, slow-fast, and intermediate strain-hold--were performed using the René 95. A summary of the test conditions and nomenclature is given in Table 2 and in Fig. 1. Although Table 2 contains only the waveforms for the René 95 tests, it is a relatively simple matter to add the test waveforms which were applied to the other alloys. In addition, Fig. 1 shows only an A-ratio* of infinity. Other A-ratios will shift the origin of the axis in Fig. 1, but the basic waveshapes will be retained.

The nomenclature used for the waveforms is relatively straightforward. The continuous-cycling tests are identified by the test frequency. A test run at 20 cycles per minute is called a "20-cpm" test. The strain-hold tests are identified by the time of the hold. A two-digit code, x/y, is used, with x being the amount of time spent in a tensile hold at maximum strain and y the amount of time in a compressive hold at minimum strain. For example, "1/0" means a one-minute hold in tension only, and "1/10" means a one-minute hold in tension and a ten-minute hold in compression.

The slow-fast (S/F) and fast-slow (F/S) tests are specified by the frequencies of the slow and fast strain rates. A slow-fast test having a strain rate corresponding to a frequency of 0.05 cycles per minute from minimum to maximum strain and a strain rate corresponding to a frequency of 20

*A-ratio = alternating strain divided by mean strain.

cycles per minute from maximum to minimum strain is called a "0.05-20 cpm" test. For some of these tests, the "½" which separates the two numbers -- 0.05-½-20cpm -- indicates that the strain rate was changed from the fast rate to the slow rate halfway between the peak-strain and the zero-strain levels, as shown in Fig. 1.

The intermediate strain-hold tests are identified by an "I" preceding the hold time, i.e., "I1/0". In this test the strain is held for one minute intermediate between the peak compressive and tensile strains.

The fatigue tests were performed by Mar-Test, Inc., using servo-hydraulic fatigue machines. The tests were controlled by the measured axial strain for the AF-115 and AF2-1DA and by a computed axial strain for the René 95. This computed axial strain was determined from the diametral strain through the use of an analog strain computer. Details of the specimen geometry and test procedure can be found in Refs. 8 and 9.

The fatigue tests were conducted at the operating temperature of the material. These temperatures were 1200°F for René 95 and 1400°F for both AF-115 and AF2-1DA.

In all but one of the 20-cpm tests, the load was gradually increased until the desired strain level was reached. An example of gradual loading is shown for Test #22 in Fig. 2. This gradual loading was used in order to avoid overshooting the desired strain limits. The point at which full strain was reached is indicated in the plots and tables of data. The one test where this gradual loading was not used was Test No. 240. In this test the desired strain limit was reached on the first cycle.

In all the fatigue tests, slight adjustments to the control setting were made during the first few cycles to achieve the desired strain level.

For the René 95 data, the stresses near the end of the life of the specimen were dependent upon the location of the tips of the extensometer with respect to the position of the fatigue crack on the specimen. This behavior was due to the hourglass geometry of the René 95 specimens. When the extensometer tip was on the same side as the crack, then the tensile stress rose. If the tip and crack were 90° apart, then this stress dropped. The behavior of the compressive stress is not so well understood.

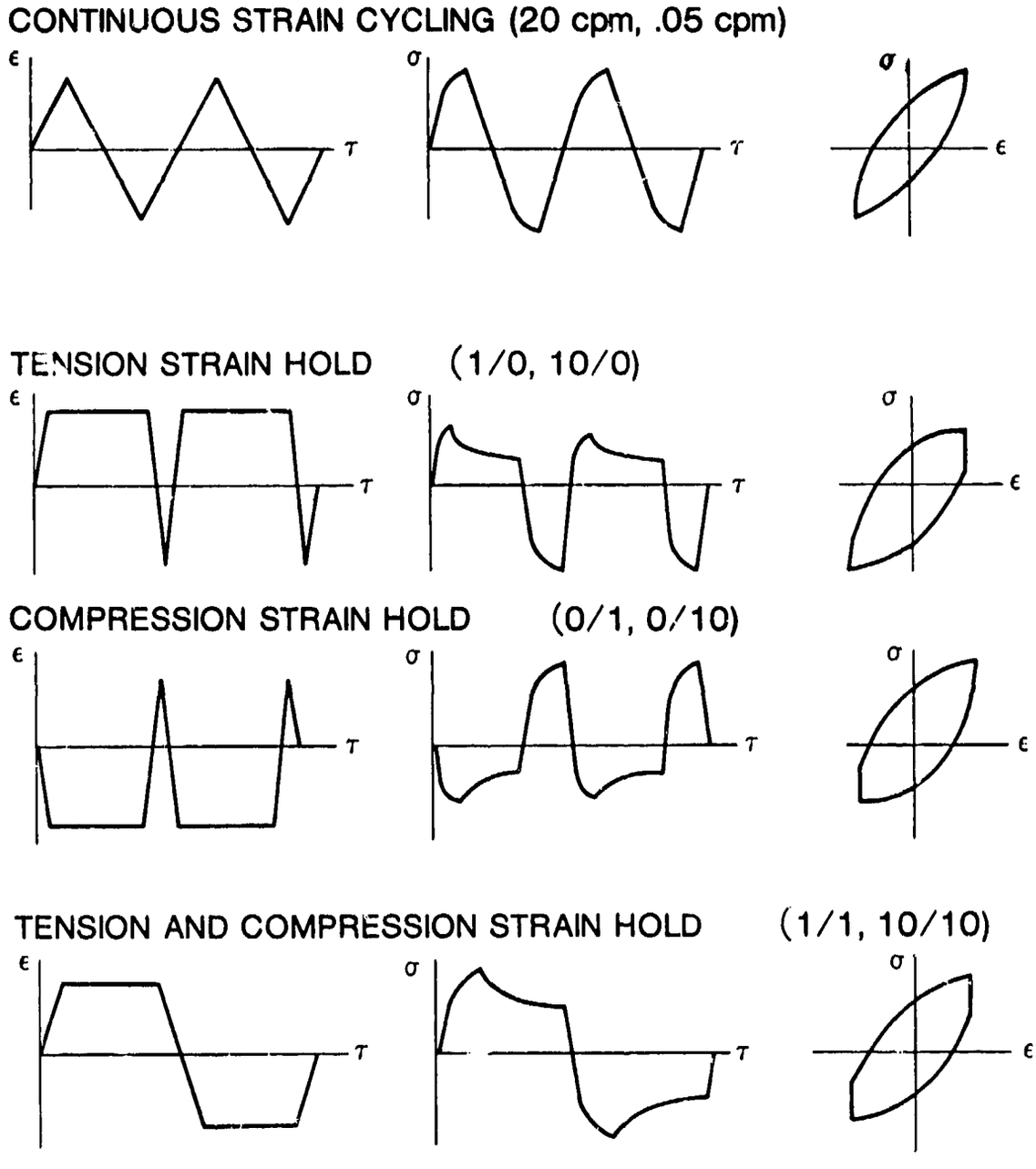
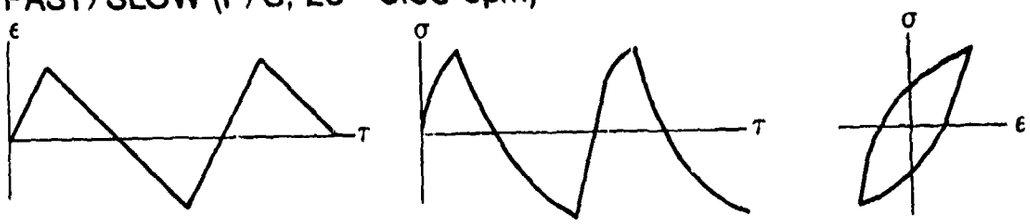
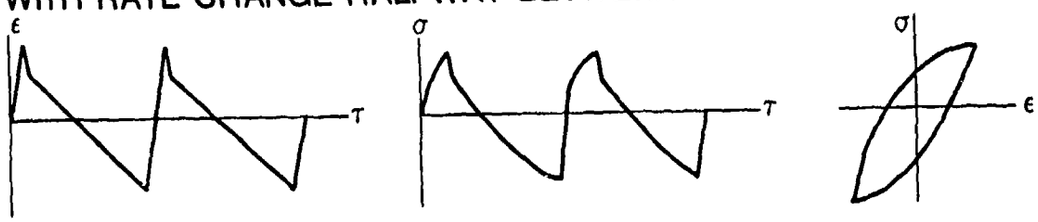



Figure 1. Waveforms and Hysteresis Loops of Fatigue Tests

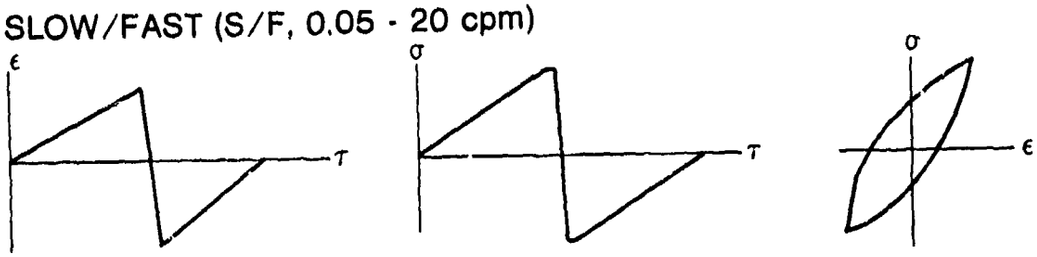
FAST/SLOW (F/S, 20 - 0.05 cpm)




FAST/SLOW (F/S, 20 - ½ - 0.05 cpm)
WITH RATE CHANGE HALFWAY BETWEEN MAX. AND ZERO STRAIN




SLOW/FAST (S/F, 0.05 - 20 cpm)




SLOW/FAST (S/F, 0.05 - ½ - 20 cpm, 1 - ½ - 20 cpm)
WITH RATE CHANGE HALFWAY BETWEEN MIN. AND ZERO STRAIN

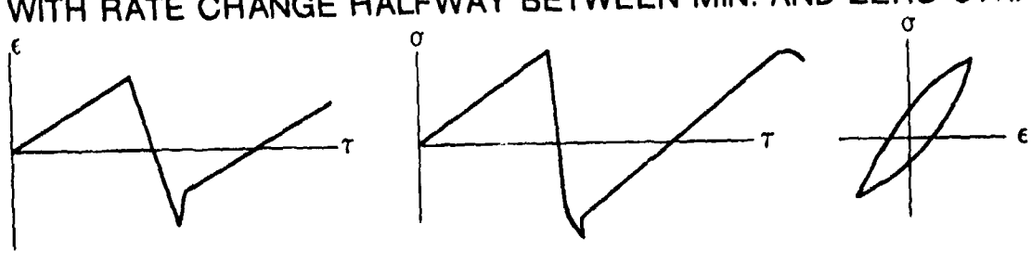
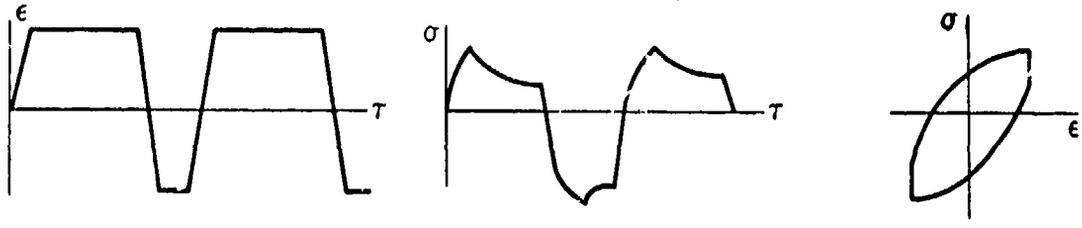


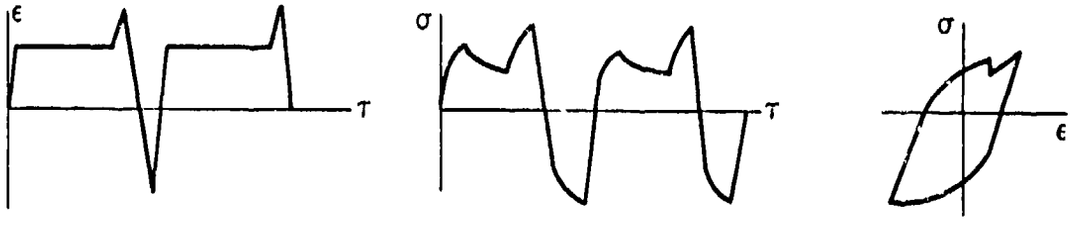

Figure 1 (continued)

UNSYMMETRICAL STRAIN HOLD (10/1)




UNSYMMETRICAL STRAIN HOLD (1/10)

INTERMEDIATE TENSILE STRAIN HOLD (11/0)




INTERMEDIATE COMPRESSIVE STRAIN HOLD (0/11)

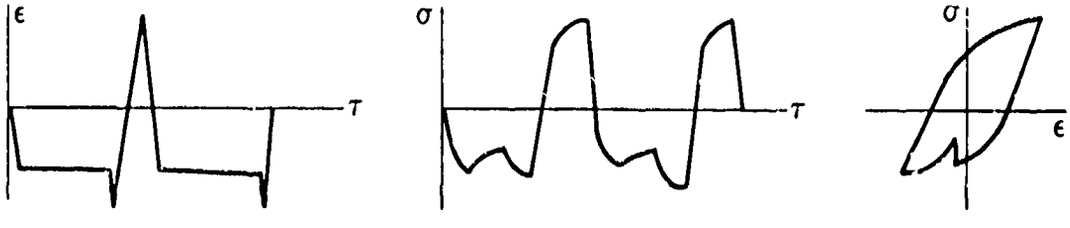



Figure 1 (continued)

TABLE 2

WAVEFORMS AND NOMENCLATURE FOR FATIGUE TESTS

| Symbol | Description |
|---|---|
| 20 cpm | Continuous cycling at a frequency of 20 cycles/min. or 3 sec/cycle. |
| 0.05 cpm | Continuous cycling at a frequency of 0.05 cycles/min. or 20 min./cycle. In all but one of these tests, the plastic strain was the controlled variable. |
| 1-0 | 1-min. hold time at maximum strain in tension. 20-cpm ramps for the strain reversals. |
| 10-0 | As in 1-0, except 10-min. hold time instead of 1 min. |
| 0-1 | 1-min. hold time at maximum strain in compression. 20-cpm ramps for the strain reversals. |
| 0-10 | As in 0-1, except 10-min. hold time instead of 1 min. |
| 1-1 | 1-min. hold time at maximum strain both in tension and compression. 20-cpm ramps for the strain reversals. |
| 10-10 | As in 1-1, except 10-min. hold instead of 1 min. |

TABLE 2 (Continued)

| Symbol | Description |
|---|---|
| 20-0.05 cpm (or F/S) | Continuous cycling at two frequencies. The positive strain rate was 20-cpm, and the negative strain rate was 0.05-cpm. The changes in strain rate occurred at the peak tensile and compressive strains. |
| 20-1/2-0.05 cpm (or F/S) | As in 20-0.05-cpm, except the change from the fast to the slow strain rate occurred halfway between the peak tensile strain and zero strain. |
| 0.05-20-cpm (or S/F) | Continuous cycling at two frequencies. The positive strain rate was 0.05-cpm, and the negative strain rate was 20-cpm. The changes in strain rate occurred at the peak tensile and compressive strains. |
| 0.05-1/2-20 cpm (or S/F) | As in 0.05-20-cpm, except the change from the fast to the slow strain rate occurred halfway between the peak compressive strain and zero strain. |
| 1-1/2-20 cpm (or S/F) | As in 0.05-1/2-20-cpm, except the slow strain rate was 1-cpm. |
| I1-0 | 1-min. hold time before the peak tensile strain. 20-cpm ramps for the strain reversals. |
| 0-I1 | 1-min. hold time before the peak compressive strain. 20-cpm ramps for the strain reversals. |
| 10-1 | 10-min. hold time at the peak tensile strain and 1-min. hold time at the peak compressive strain. 20-cpm ramps for the strain reversals. |
| 1-10 | 1-min. hold time at the peak tensile strain and 10-min. hold time at the peak compressive strain. 20-cpm ramps for the strain reversals. |

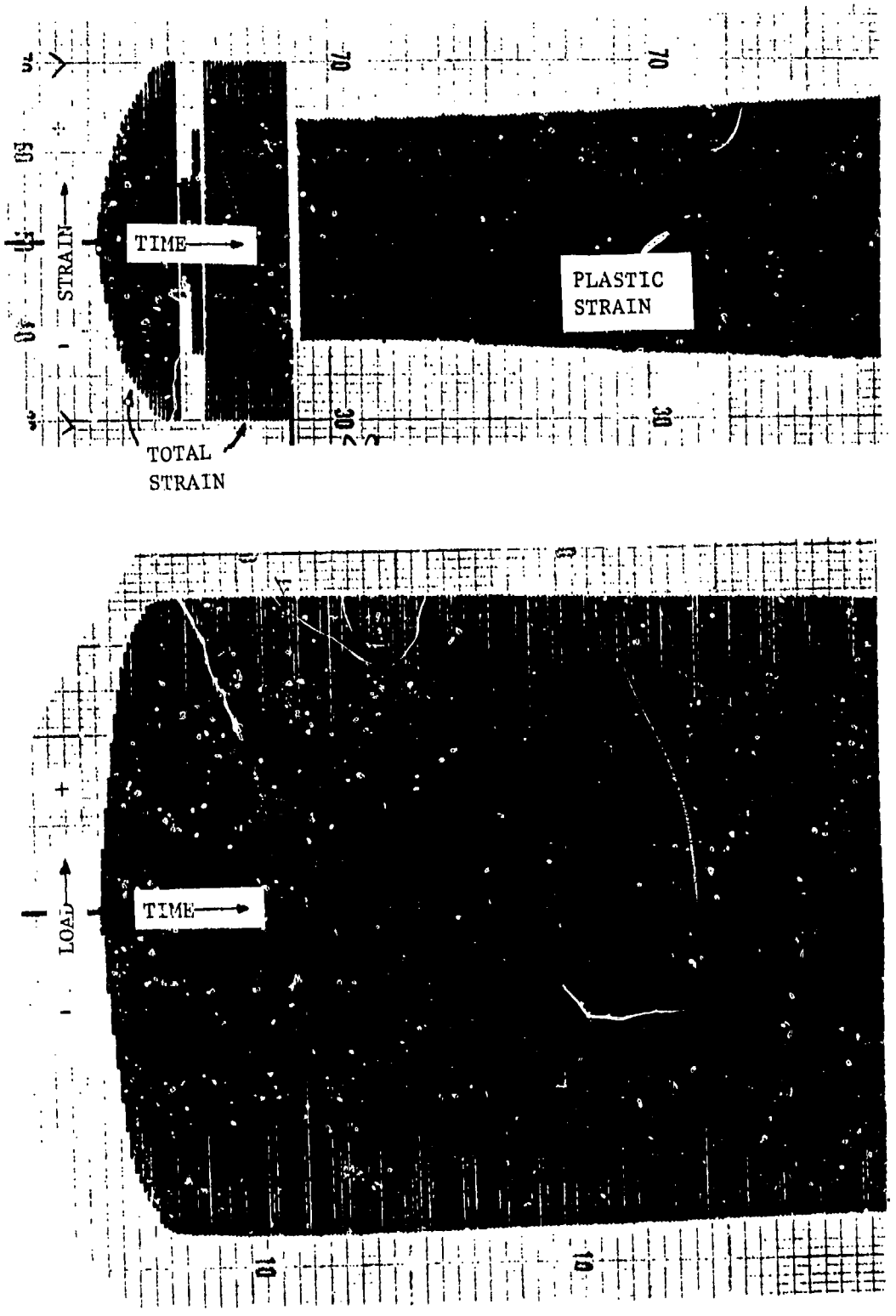



Figure 2 Loading of Specimen No. 22

## SECTION 4

## DATA REDUCTION

The stress was continuously recorded on strip-chart recorders during the fatigue tests. After the test, the time base of these strip-chart records was converted to cycles. Then, the value of the stresses was read by eye from the chart at either a predetermined number of cycles (such as every one hundred cycles) or whenever the value of stress changed significantly. These numbers were punched onto computer cards, and the tables and graphs were prepared after suitable computer programs had been written.

## SECTION 5
## DESCRIPTION OF TABLES AND GRAPHS

A summary of the basic test parameters for the tests in this report is given in Tables 3 - 5. In these tables all stresses and strains are measured at one-half of the specimen life, unless otherwise indicated. The total strainrange is a nominal value, making it easier to identify and compare tests. The actual value varied by ± 0.01% in strain from the nominal value, i.e., a test at 1.20% total strain could be either 1.19 or 1.21%.

The stress behavior during the test is generally presented in three forms--one tabular and two graphical. The tables present the number of cycles (N), the percent of life* (%N), and the stresses ($\sigma$) (in ksi). In the graphs the data are plotted as stress vs percent of life and as stress vs the logarithm of the number of cycles. For most of the René 95 tests, all three forms of data are presented. Those tests where one form is missing are so indicated in Table 3. No graphs were made for the AF-115 and AF2-1DA data.

The René 95 data are organized into five sections--continuous-cycling tests (Section 7), slow-fast and fast-slow tests (Section 8), tensile-only strain-hold tests (Section 9), compressive-only strain-hold tests (Section 10) and tensile-compressive strain-hold tests (Section 11). Within each section, the data for each test are given in a table, followed by plots of $\sigma$ vs % N and $\sigma$ vs log N. The AF-115 and AF2-1DA data are given separately in Sections 12 and 13, respectively.

The tables of stress behavior are fairly self-explanatory. The column labeled "I" is merely a sequential numbering of the data. The columns labeled "Relaxed" contain the amount of stress relaxed during a hold period.

---

*$\%N = (N/N_f) * 100$, where $N_f$ is the cycles to failure.

The amount relaxed in a tensile strain-hold follows the column labeled tensile and likewise for compression. The "Relaxed" columns are used for different purposes for the fast-slow and slow-fast tests, and the purpose is indicated in those tables. The tables containing intermediate-hold data have an additional column labeled "Held Tensile" or "Held Compr." This column gives the stress at which the hold period began. The "Relaxed" column has the same use for these tests as for the other strain-hold tests. Blank spaces in the tabular data indicate that the value could not be measured.

In the plots the same nomenclature as for the tables is used. The graphs clearly point out the gradual loading of the 20-cpm tests. The point at which the strain limits were reached is indicated on the graphs as well as in the tables.

TABLE 3

RENE 95 DATA

| SPEC. NO. | TYPE OF TEST | A-RATIO[a] | TOTAL STRAIN -RANGE (%)[b] | CYCLES TO FAILURE[c] | INEL. STRAIN -RANGE (%) | MAX. TENSILE STRESS (KSI) | MAX. COMPR. STRESS (KSI) | RELAXED TENSILE STRESS (KSI)[d] | RELAXED COMPR. STRESS (KSI)[d] | STRESS AT HOLD PERIOD (KSI)[e] | STRAIN AT HOLD PERIOD (%)[e] | TIME TO FAILURE (HOURS) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17[f,l] | 20CPM | INTY | 2.00 | 234 | .53000 | 178.0 | 195.0 | 0.00 | 0.00 | 0.0 | 0.00 | .20 |
| 18[f,l] | 20CPM | INTY | 1.80 | 307 | .41800 | 175.0 | 186.0 | 0.00 | 0.00 | 0.0 | 0.00 | .26 |
| 22 | 20CPM | INTY | 1.60 | 461 | .31100 | 165.0 | 173.0 | 0.00 | 0.00 | 0.0 | 0.00 | .38 |
| 240 | 20CPM | INTY | 1.60 | 463 | .23500 | 161.1 | 173.5 | 0.00 | 0.00 | 0.0 | 0.00 | .39 |
| 27[m,n] | 20CPM | INTY | 1.20 | 1629 | .13400 | 140.0 | 145.0 | 0.00 | 0.00 | 0.0 | 0.00 | 1.36 |
| 234[m,n] | 20CPM | INTY | .90 | 19160 | .01300 | 99.0 | 133.8 | 0.00 | 0.00 | 0.0 | 0.00 | 15.97 |
| 235[m,n] | 20CPM | INTY | .90 | 22364 | .00850 | 93.2 | 129.2 | 0.00 | 0.00 | 0.0 | 0.00 | 18.64 |
| 264 | 20CPM | +1/5 | 1.20 | 752 | .06500 | 183.3 | 190.4 | 0.00 | 0.00 | 0.0 | 0.00 | .63 |
| 36 | 20CPM | +1 | 1.20 | 1207 | .03800 | 160.0 | 129.0 | 0.00 | 0.00 | 0.0 | 0.00 | 1.01 |
| 37 | 20CPM | -1 | 1.20 | 2126 | .03500 | 115.0 | 168.0 | 0.00 | 0.00 | 0.0 | 0.00 | 1.77 |
| 20[f,l] | .05CPM | INTY | 1.60 | 301 | .25000 | 161.0 | 179.0 | 0.00 | 0.00 | 0.0 | 0.00 | 101.29 |
| 34[l] | .05CPM | INTY | 1.30 | 526 | .12000 | 137.0 | 165.0 | 0.00 | 0.00 | 0.0 | 0.00 | 175.33 |
| 251 | 20-.05CPM | INTY | 1.40 | 636 | .09850[G] | 161.0 | 177.0 | 0.00 | 0.00 | 161.0 | .70 | 114.64 |
| 262 | 20-½-.05CPM | INTY | 1.20 | 1086 | .04700 | 144.0 | 147.0 | 0.00 | 0.00 | 67.5 | .29 | 181.45 |
| 252[i] | .05-20CPM | INTY | 1.40 | 194 | .05645[G] | 166.0 | 175.0 | 0.00 | 0.00 | -175.0 | -.70 | 32.23 |
| 263[i] | .05-20CPM | INTY | 1.40 | 238 | .11500 | 160.0 | 169.2 | 0.00 | 0.00 | -169.0 | -.70 | 39.83 |
| 257[i,m] | 20-½-.05CPM | INTY | .97 | 5288[R] | .04500 | 145.0 | 90.0 | 0.00 | 0.00 | -20.0 | ****j | 833.10 |
| 5 | 1-0 | INTY | 1.80 | 255 | .52200 | 161.0 | 187.0 | 19.10 | 0.00 | 0.0 | 0.00 | 4.47 |
| 10 | 1-0 | INTY | 1.60 | 257 | .29700 | 160.0 | 191.0 | 8.90 | 0.00 | 0.0 | 0.00 | 4.51 |
| 7 | 1-0 | INTY | 1.40 | 748 | .21600 | 138.0 | 178.0 | 8.00 | 0.00 | 0.0 | 0.00 | 13.09 |
| 12 | 1-0 | INTY | 1.20 | 1289 | .09330 | 123.0 | 166.0 | 1.50 | 0.00 | 0.0 | 0.00 | 23.02 |
| 39 | 1-0 | INTY | 1.10 | 1781 | .03900 | 108.0 | 154.0 | 4.80 | 0.00 | 0.0 | 0.00 | 31.17 |
| 38 | 1-0 | INTY | 1.00 | 5313 | .04900 | 101.0 | 148.0 | 1.50 | 0.00 | 0.0 | 0.00 | 87.72 |
| 233 | 1-0 | INTY | 1.00 | 6519 | .03050 | 89.3 | 158.4 | 1.90 | 0.00 | 0.0 | 0.00 | 114.18 |
| 33 | 1-0 | INTY | 1.00 | 9609 | .03800 | 82.8 | 159.0 | .51 | 0.00 | 0.0 | 0.00 | 168.15 |
| 237[m,n] | 1-0 | INTY | .90 | 16418 | .04590 | 73.3 | 151.9 | 1.20 | 0.00 | 0.0 | 0.00 | 287.31 |
| 228 | 10-0 | INTY | 1.40 | 481 | .19500 | 130.0 | 191.0 | 7.56 | 0.00 | 0.0 | 0.00 | 80.57 |
| 40 | 10-0 | INTY | 1.20 | 1705 | .12600 | 105.0 | 173.0 | 6.20 | 0.00 | 0.0 | 0.00 | 285.58 |

Explanation of footnotes at end of table.

TABLE 3

RENE 95 DATA Continued

| SPEC. NO. | TYPE OF TEST | A-RATIO[a] | TOTAL STRAIN -RANGE (%)[b] | CYCLES TO FAILURE[c] | INEL. STRAIN -RANGE (%) | MAX. TENSILE STRESS (KSI) | MAX. COMPR. STRESS (KSI) | RELAXED TENSILE STRESS (KSI)[d] | RELAXED COMPR. STRESS (KSI)[d] | STRESS AT HOLD PERIOD (KSI)[e] | STRAIN AT HOLD PERIOD (%)[e] | TIME TO FAILURE (HOURS) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 242 | I1-0 | INTY | 1.80 | 472 | .42220 | 163.0 | 186.0 | 13.00 | 0.00 | 155.0 | .60 | 8.28 |
| 246 | I1-0 | INTY | 1.80 | 253 | .41200 | 170.0 | 190.0 | 16.50 | 0.00 | 144.0 | .70 | 4.43 |
| 244 | I1-0 | INTY | 1.60 | 447 | .23640 | 154.0 | 181.0 | 10.00 | 0.00 | 144.0 | .70 | 7.81 |
| 232[k,m,n] | I1-0 | +7 | 1.40 | 775 | .10300 | 167.1 | 170.1 | 2.20 | 0.00 | 122.9 | .60 | 13.56 |
| 6 | 0-1 | INTY | 1.80 | 207 | .42900 | 175.0 | 181.0 | 0.00 | 15.00 | 0.0 | 0.00 | 3.50 |
| 11 | 0-1 | INTY | 1.60 | 209 | .45800 | 162.0 | 161.0 | 0.00 | 15.80 | 0.0 | 0.00 | 3.66 |
| 14 | 0-1 | INTY | 1.60 | 219 | .32400 | 177.0 | 174.0 | 0.00 | 10.70 | 0.0 | 0.00 | 3.33 |
| 8 | 0-1 | INTY | 1.40 | 413 | .19200 | 165.0 | 158.0 | 0.00 | 6.20 | 0.0 | 0.00 | 7.30 |
| 13 | 0-1 | INTY | 1.20 | 846 | .03790 | 136.0 | 140.0 | 0.00 | 2.30 | 0.0 | 0.00 | 14.80 |
| 16 | 0-1 | INTY | 1.00 | 3093 | .01030 | 124.0 | 123.0 | 0.00 | .40 | 0.0 | 0.00 | 54.12 |
| 231[o] | 0-1 | -1 | .90 | 5185 | .02200 | 94.6 | 129.4 | 0.00 | 0.00 | 129.4 | 0.00 | 90.74 |
| 222 | 0-10 | INTY | 1.40 | 224 | .13590 | 175.0 | 155.0 | 0.00 | 5.05 | 0.0 | 0.00 | 37.52 |
| 41 | 0-10 | INTY | 1.20 | 283 | .18500 | 164.0 | 117.0 | 0.00 | 14.00 | 0.0 | 0.00 | 47.40 |
| 247 | 0-I1 | INTY | 1.80 | 263 | .35590 | 172.0 | 188.0 | 0.00 | 14.70 | 156.0 | -.70 | 4.60 |
| 1 | 1-1 | INTY | 1.80 | 156 | .55030 | 181.0 | 195.0 | 28.60 | 21.60 | 0.0 | 0.00 | 5.29 |
| 2 | 1-1 | INTY | 1.60 | 238 | .34900 | 170.0 | 184.0 | 18.60 | 14.00 | 0.0 | 0.00 | 8.17 |
| 32 | 1-1 | INTY | 1.40 | 358 | .20100 | 150.0 | 172.0 | 9.70 | 7.10 | 0.0 | 0.00 | 12.13 |
| 9 | 1-1 | INTY | 1.20 | 959 | .12200 | 135.0 | 154.0 | 7.50 | 8.90 | 0.0 | 0.00 | 32.48 |
| 4 | 1-1 | INTY | 1.00 | 1215 | .11600 | 120.0 | 134.0 | 10.80 | 6.70 | 0.0 | 0.00 | 41.52 |
| 15 | 1-1 | INTY | 1.00 | 1288 | .07800 | 117.0 | 136.0 | 6.20 | 5.10 | 0.0 | 0.00 | 43.55 |
| 229 | 1-1 | INTY | .90 | 5277 | .02450 | 95.2 | 128.0 | 0.00 | 0.00 | 0.0 | 0.00 | 179.42 |
| 28 | 10-10 | INTY | 1.80 | 115 | .70100 | 179.0 | 193.0 | 54.60 | 47.70 | 0.0 | 0.00 | 38.41 |
| 31 | 10-10 | INTY | 1.40 | 199 | .49700 | 158.0 | 171.0 | 49.00 | 43.10 | 0.0 | 0.00 | 65.35 |
| 227 | 10-1 | INTY | 1.40 | 455 | .23210 | 144.0 | 176.0 | 23.80 | 13.20 | 0.0 | 0.00 | 83.30 |
| 223 | 10-1 | INTY | 1.20 | 945 | .15850 | 116.0 | 164.0 | 11.60 | 5.30 | 0.0 | 0.00 | 174.93 |
| 226 | 1-10 | INTY | 1.40 | 349 | .22100 | 165.0 | 161.0 | 15.90 | 13.70 | 0.0 | 0.00 | 64.27 |
| 225 | 1-10 | INTY | 1.20 | 464 | .15170 | 150.0 | 140.0 | 12.20 | 10.60 | 0.0 | 0.00 | 85.45 |

Explanation of footnotes on following page.

TABLE 3 Continued

[a]INTY = infinity; nominal value of the A-ratio is given.

[b]Nominal value.

[c]The suffix "R" indicates a runout.

[d]Relaxed tensile stress is the difference between the tensile stress at the beginning and the end of the hold period.

[e]The stress and strain at hold period are the stress and strain at the beginning of the hold period for the intermediate hold tests; however, for the slow-fast and fast-slow tests, they are the stress and strain when the strain rate changed from the fast to the slow rate.

[f]The axial plastic strain was the controlled variable.

[g]Value measured from the hysteresis loop at $N_f/2$.

[h]Specimen was initially cycled at $\Delta\varepsilon$ = 0.97% for 282 cycles using a 0.05-½-20 cpm waveform. Since this precycling was not considered damaging, the value of $N_f$ does not include these cycles.

[i]Test was stopped and restarted. The stress and strain were measured near 5,288 cycles. The large tensile mean stress appears to be an anomaly. Specimen No. 263 was initially cycled under the same conditions as No. 257 but developed a mean compressive stress after 282 cycles.

[j]Value not recorded.

[k]Stress and strain measured at $N_f/4$.

[ℓ]No stress vs. log cycles graph.

[m]No graphs.

[n]Stresses measured only at the beginning, at 50%, and at 75% of the life.

[o]No table.

TABLE 4

AF-115 DATA

| SPEC. NO. | TYPE OF TEST | A-RATIO | TOTAL[a] STRAIN -RANGE (%) | CYCLES[b] TO FAILURE | INEL. STRAIN -RANGE (%) | MAX. TENSILE STRESS (KSI) | MAX. COMPR. STRESS (KSI) | TIME[b] TO FAILURE (HOURS) | ELASTIC MODULUS (KSI*$10^3$) | TEMP (F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 201 | 20CPM | +1 | .90 | 883 | .05000 | 137.0 | 85.3 | .74 | 24.0 | 1400 |
| 202 | 20CPM | +1 | .70 | 2153 | .02000 | 133.6 | 40.0 | 1.79 | 24.5 | 1400 |
| 507 | 20CPM | +1 | .90 | 763+ | .04500 | 141.6 | 81.9 | .64+ | 25.0 | 1400 |
| 502 | 20CPM | +1 | .90 | 1172 | .03500 | 155.6 | 86.5 | .98 | 26.4 | 1400 |
| 508 | 20CPM | +1 | .80 | 2068 | .03500 | 142.3 | 56.9 | 1.72 | 24.9 | 1400 |
| 505 | 20CPM | +1 | .60 | 17257+ | .01000 | 138.6 | 12.8 | 14.40+ | 24.1 | 1400 |

[a]Nominal value

[b]A "+" after the number indicates that the material within the gage length should have lasted more cycles because the specimen broke outside of the gage length.

TABLE 5

AF2-1DA DATA

| SPEC. NO. | TYPE OF TEST | A-RATIO | TOTAL[a] STRAIN -RANGE (%) | CYCLES[b] TO FAILURE | INEL. STRAIN -RANGE (%) | MAX. TENSILE STRESS (KSI) | MAX. COMPR. STRESS (KSI) | TIME[b] TO FAILURE (HOURS) | ELASTIC MODULUS (KSI*10$^3$) | TEMP (F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 202 | 20CPM | +1 | 1.30 | 285 | .29000 | 141.9 | 145.2 | .24 | 25.8 | 1400 |
| 122 | 20CPM | +1 | 1.10 | 688 | .13000 | 131.6 | 123.3 | .57 | 25.2 | 1400 |
| 208 | 20CPM | +1 | 1.10 | 732 | .21000 | 127.2 | 116.1 | .61 | 26.5 | 1400 |
| 219 | 20CPM | +1 | .90 | 1640+ | .07500 | 127.2 | 99.4 | 1.37+ | 25.5 | 1400 |
| 207 | 20CPM | +1 | .80 | 2693 | .07000 | 122.5 | 75.1 | 2.24 | 26.3 | 1400 |
| 224 | 20CPM | +1 | .75 | 3465 | .03500 | 124.4 | 5[illegible]7 | 2.90 | 25.6 | 1400 |
| 225 | 20CPM | +1 | .70 | 3385 | .03500 | 123.7 | 64.0 | 2.82 | 27.4 | 1400 |
| 201 | 20CPM | +1 | .70 | 7164+ | .02000 | 123.3 | 56.4 | 5.92+ | 25.7 | 1400 |
| 215 | 20CPM | +1 | .64 | 10448 | .01600 | 123.3 | 39.7 | 8.70 | 26.1 | 1400 |
| 211 | 20CPM | +1 | .64 | 13228+ | .03400 | 119.3 | 44.9 | 11.00+ | 25.2 | 1400 |
| 121 | 20CPM | +1 | .65 | 14823+ | .02000 | 110.5 | 47.4 | 12.35+ | 24.3 | 1400 |
| 223 | 20CPM | +1 | .60 | 15942+ | .01100 | 114.9 | 43.3 | 13.29+ | 25.1 | 1400 |
| 221 | 20CPM | +1 | .55 | 50260+ | .01500 | 112.1 | 31.0 | 41.88+ | 26.7 | 1400 |
| 205 | 20CPM | +1 | .50 | 84724 | .01600 | 115.3 | 5.9 | 70.60 | 27.0 | 1400 |
| 231 | .2 CPM | +1 | 1.30 | 358 | .33000 | 128.0 | 123.7 | 29.80 | 24.8 | 1400 |
| 232 | .2 CPM | +1 | 1.10 | 608 | .32000 | 114.1 | 111.3 | 50.67 | 27.5 | 1400 |
| 204 | .2 CPM | +1 | 1.10 | 630 | .25000 | 119.3 | 115.3 | 52.50 | 26.2 | 1400 |
| 233 | .2 CPM | +1 | .90 | 1173 | .17000 | 110.5 | 91.5 | 97.75 | 26.0 | 1400 |
| 210 | .2 CPM | +1 | .80 | 2346 | .12000 | 103.4 | 81.5 | 195.50 | 24.7 | 1400 |
| 228 | .2 CPM | +1 | .70 | 3442+ | .04000 | 98.6 | 60.4 | 286.80+ | 23.8 | 1400 |

[a]Nominal value.

[b]A "+" after the number indicates that the material within the gage length should have lasted more cycles because the specimen broke outside of the gage length.

## SECTION 6
## DISCUSSION

The stress behavior during the fatigue test was studied for two reasons. First, it was desired to determine the magnitude of the change in the stresses (and, consequently, the strains) from their value at one-half the fatigue life ($N_f/2$). Most modeling of low-cycle fatigue life is based upon the assumption of stable material behavior and makes use of the values of stress and strain at $N_f/2$ to predict the fatigue life. The assumption of stable material behavior is that cyclic hardening or softening occurs only during the initial stage of the fatigue test and thereafter the stress-strain behavior is stable for the remainder of the test. Thus, the values of stress and strain remain constant during most of the test, and $N_f/2$ becomes a convenient point at which to measure them. Since a question arose as to the validity of this assumption for René 95, the behavior of the stresses was examined.

The second purpose was to determine whether the stress behavior followed a simple pattern. It was known that the tensile-hold tests had compressive mean stresses, while the opposite was true for the compressive-hold tests. It was felt that these mean stresses significantly influenced the fatigue life (Ref. 4). Thus, if a simple relationship could be established between the strain-time waveform and the resulting stresses, then one would be better able to predict the fatigue life.

There was not sufficient time to permit a thorough analysis of the data; therefore, only data trends and observations are reported. These observations concern the René 95 data only. No explanation for them is offered.

René 95 initially strain hardens, maintains a maximum hardness for a short period, and then begins to soften. The softening continues throughout the life of the test specimen. This behavior is shown most clearly in Fig. 3 for Test No. 240, a 20-cpm test at a total strain range of 1.6%. Strain hardening is completed in about ten cycles; this maximum hardness is retained

for about another sixty to seventy cycles until strain-softening sets in. Then the material continually softens until failure at 463 cycles.

The most noticeable aspect of the tensile-only strain-hold tests is the large and rapid shift in the mean stress--especially for tests at the lower strainranges and longer hold times. Figure 4 shows Test No. 233--a 1/0 test at a strainrange of 1.0%--in which the mean stress changed from about zero to -25 ksi during the first 10% of the life. The mean stress continued to shift in the compressive direction throughout the remainder of the test. Shifts to a tensile mean stress occurred for the compression-only strain-hold tests but were less dramatic. Continual shifts in the mean stress also occurred for those tests run at an A-ratio other than infinity.

Although the stresses were continually changing in the tension-only and compression-only strain-hold tests, the amount of stress relaxed during the hold period remained relatively constant throughout the test. That is, the amount of stress relaxed was a function not only of the stress at the beginning of the hold period but also of the history of the cycle--such as the previous maximum or minimum stress. However, for those tests involving both a tensile and compressive hold period, the amount of stress relaxed increased throughout the test.

When the stresses were plotted as a function of the logarithm of the number of cycles, the softening and stress shifts described above followed--to a first approximation--a log-linear pattern. However, the initial hardening and area of maximum hardness did not follow such a pattern.

As can be seen from the plots of stress vs logarithm of the cycles (log N), the material does not exhibit a stable cyclic stress-strain behavior. It is continually softening until fracture. When examined on a linear scale, the softening is not so apparent and it may appear to have an asymptotic value. However, when viewed on a logarithmic scale, the softening is seen to be a continuing process.

Since the material continually softens, methods that determine an initiation life from load drop must be used with caution. Most of these methods consider initiation to have taken place when the tensile stress or the stress-range has decreased by 5 or 10% from the initial or maximum value. For a material which continuously softens, such as René 95, these methods could yield erroneous results. A modification to the method can be made for softening materials by taking a 5 or 10% load drop-off from the softening line instead of from the initial or maximum value. The softening line must first be determined by plotting the stress as a function of log N and drawing a line through the data. When the tensile stress falls by 5 or 10% below the stress predicted by this line, then initiation can be considered to have taken place. An example of this method is Test No. 233, in Fig. 5, where the almost vertical drop in the stress indicates where initiation has taken place.

Unequivocal answers as to the purposes for which the study was undertaken cannot be given. The assumption of stable material behavior for René 95 is not valid. However, the degree to which the assumption is satisfied varies with test conditions. For tests at higher strainranges, there is little variation in the stresses from $N_f/2$; however, the variation at lower strainranges is greater. The use of the stresses and strains at $N_f/2$ to model fatigue behavior is problematic. It cannot be strictly justified on the grounds of stable material behavior, but the variation of the stresses from the values at $N_f/2$ may not have that much influence upon fatigue modeling. Also, using the values at $N_f/2$ may be justified because they can be considered characteristic of the particular test condition--i.e., each test condition results in a unique value of stress and strain at $N_f/2$. In addition, there are no other accepted methods of modeling fatigue life except through the use of the values at $N_f/2$.

No simple relationship was found which adequately models the stress behavior during the test. To a first approximation, the stress behavior could be considered to follow a log-linear pattern. However, deviations from this

pattern are apparent in the data during the initial part of the test. Also, the data show deviation from a log-linear pattern during the latter portions of the test.

A final comment concerns the effect of plotting stress as a function of N on a log-log plot. Plots of this type were made in order to determine whether the logarithm of stress yields a more linear relationship with log N than stress itself. Figures 6 and 7 are examples of these types of plots. Taking the logarithm of stress did not produce such a relationship, and no marked contrast between a semi-log and log-log plot was observed.

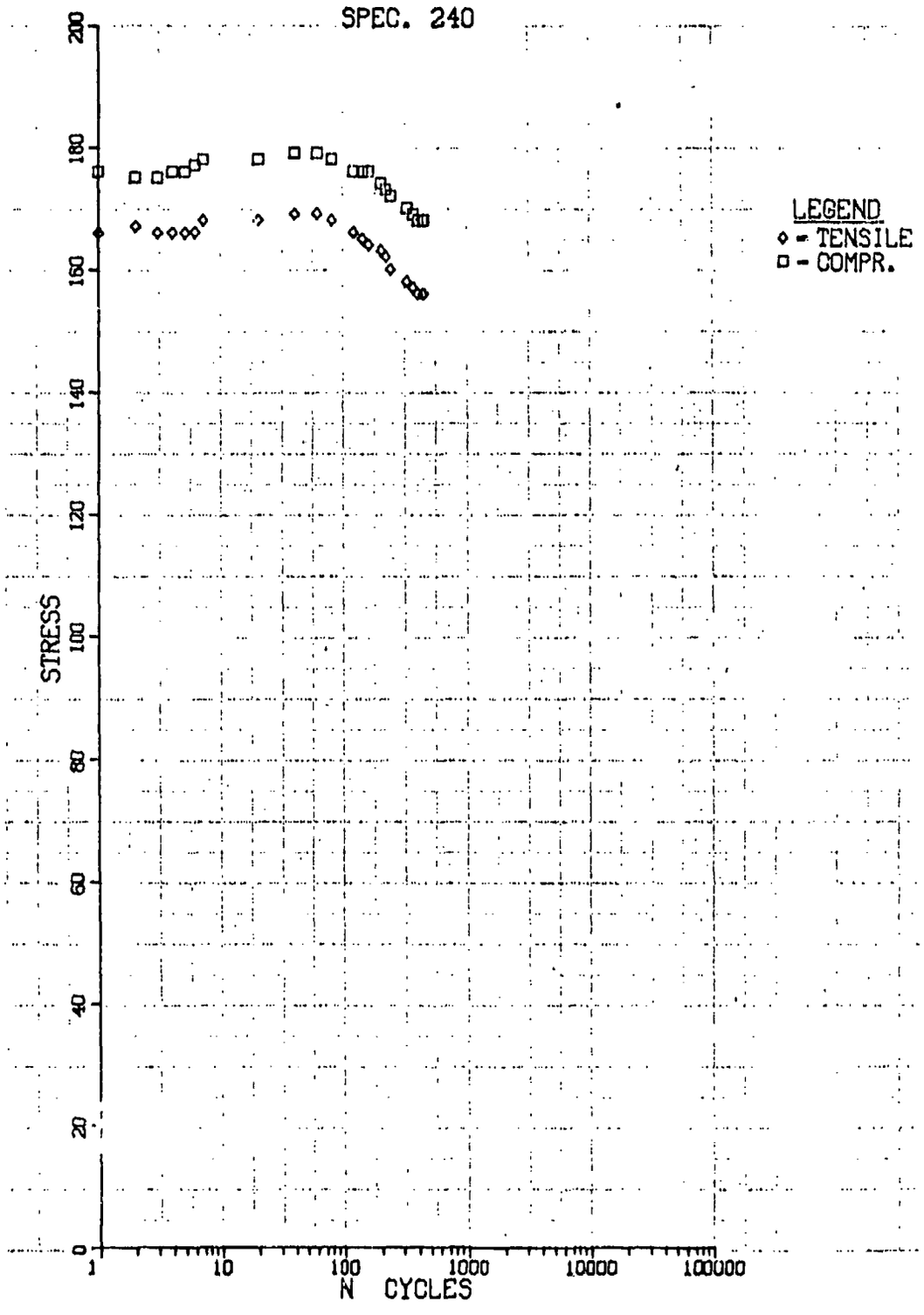



Figure 3. Hardening and Softening of a 20-cpm Test.

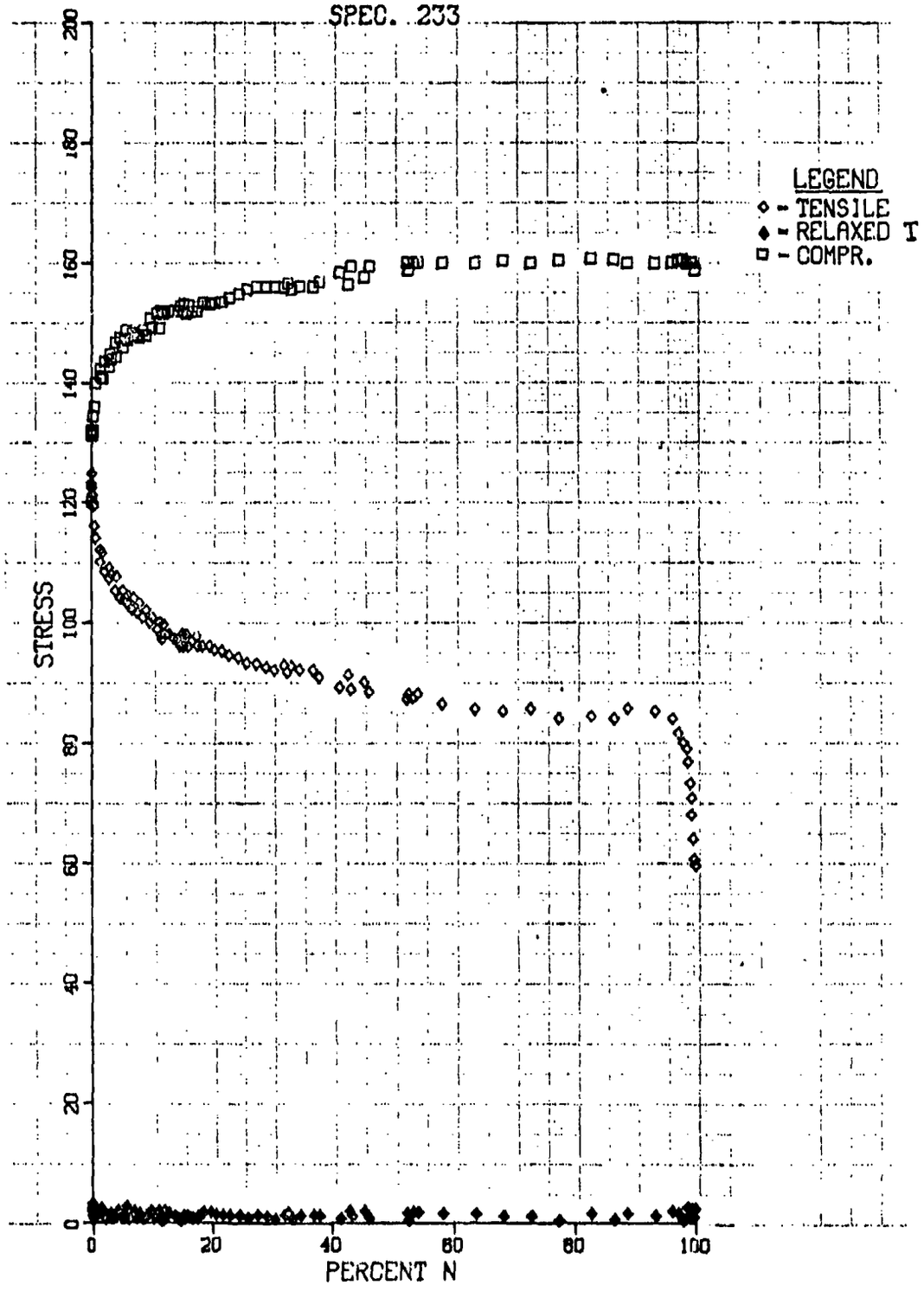



Figure 4. Mean Stress Behavior in a Tensile-Only Strain-Hold Test.

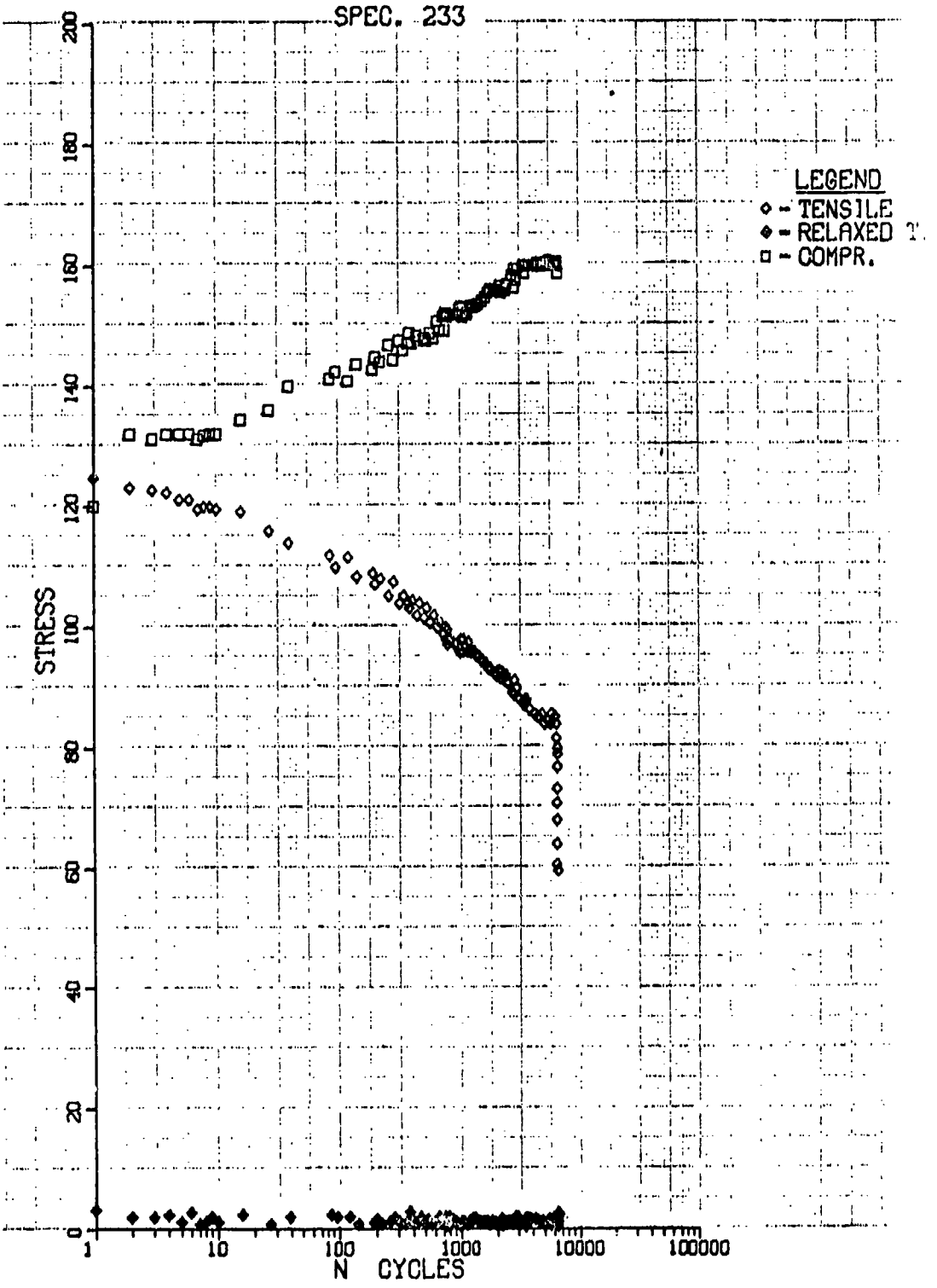



Figure 5. Stress vs. Number of Cycles for Specimen 233.

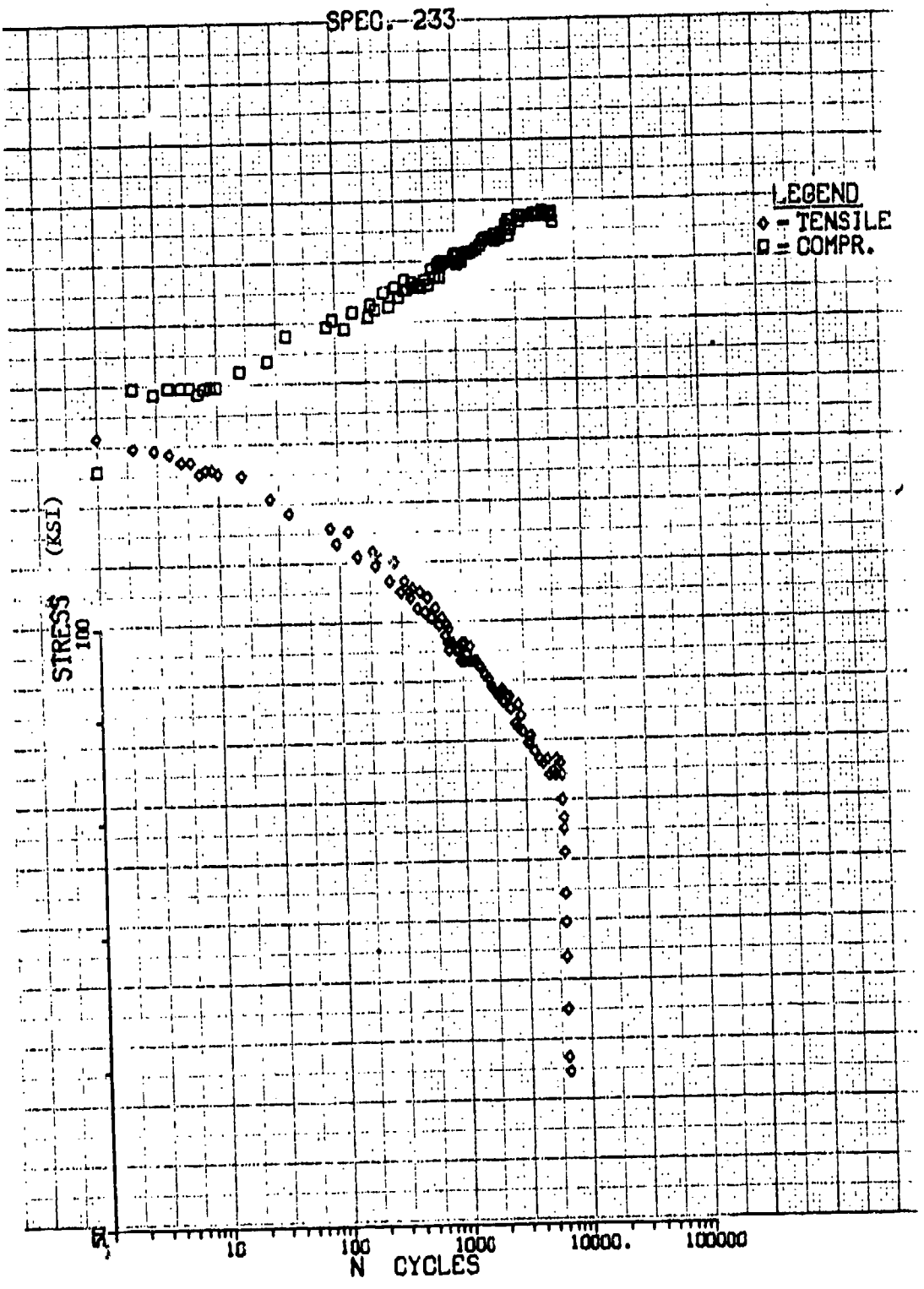



Figure 6. Stress vs. Number of Cycles on a Log-Log Scale for Specimen 233.

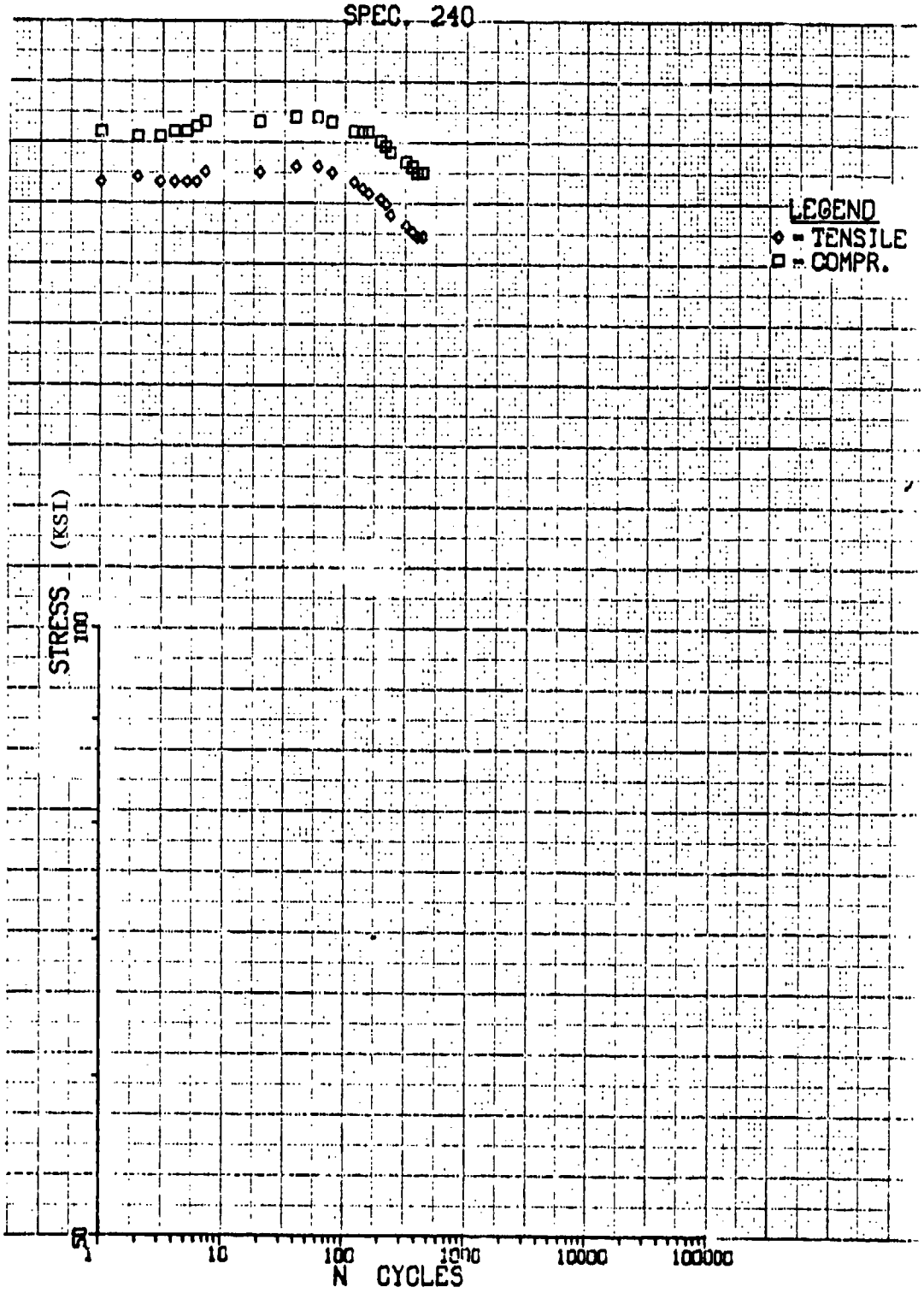



Figure 7. Stress vs. Number of Cycles on a Log-Log Scale for Specimen 240.

## SECTION 7

## RENE 95 CONTINUOUS CYCLING TESTS

Data from the continuous cycling tests on René 95 are presented in this section. These tests are composed of the 20-cpm tests at A-ratios of infinity, plus one, minus one and plus one-fifth, and the 0.05 cpm tests. These data are presented in Tables 6 through 17 and Figures 8 through 23.

TABLE 6

SPECIMEN 17

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 0. | 0.00 | 22. | 0.0 | 7. | 0.0 |
| 2 | 2. | .85 | 53. | 0.0 | 40. | 0.0 |
| 3 | 14.[a] | 5.98 | 175. | 0.0 | 186. | 0.0 |
| 4 | 56. | 23.93 | 180. | 0.0 | 193. | 0.0 |
| 5 | 82. | 35.04 | 180. | 0.0 | 196. | 0.0 |
| 6 | 105. | 44.87 | 179. | 0.0 | 195. | 0.0 |
| 7 | 140. | 59.83 | 176. | 0.0 | 193. | 0.0 |
| 8 | 164. | 70.09 | 174. | 0.0 | 191. | 0.0 |
| 9 | 187. | 79.91 | 172. | 0.0 | 190. | 0.0 |
| 10 | 208. | 88.89 | 171. | 0.0 | 188. | 0.0 |
| 11 | 220. | 94.02 | 170. | 0.0 | | 0.0 |
| 12 | 232. | 99.15 | 168. | 0.0 | | 0.0 |
| 13 | 234. | 100.00 | 148. | 0.0 | 188. | 0.0 |

[a]Full load reached at about 30 cycles.

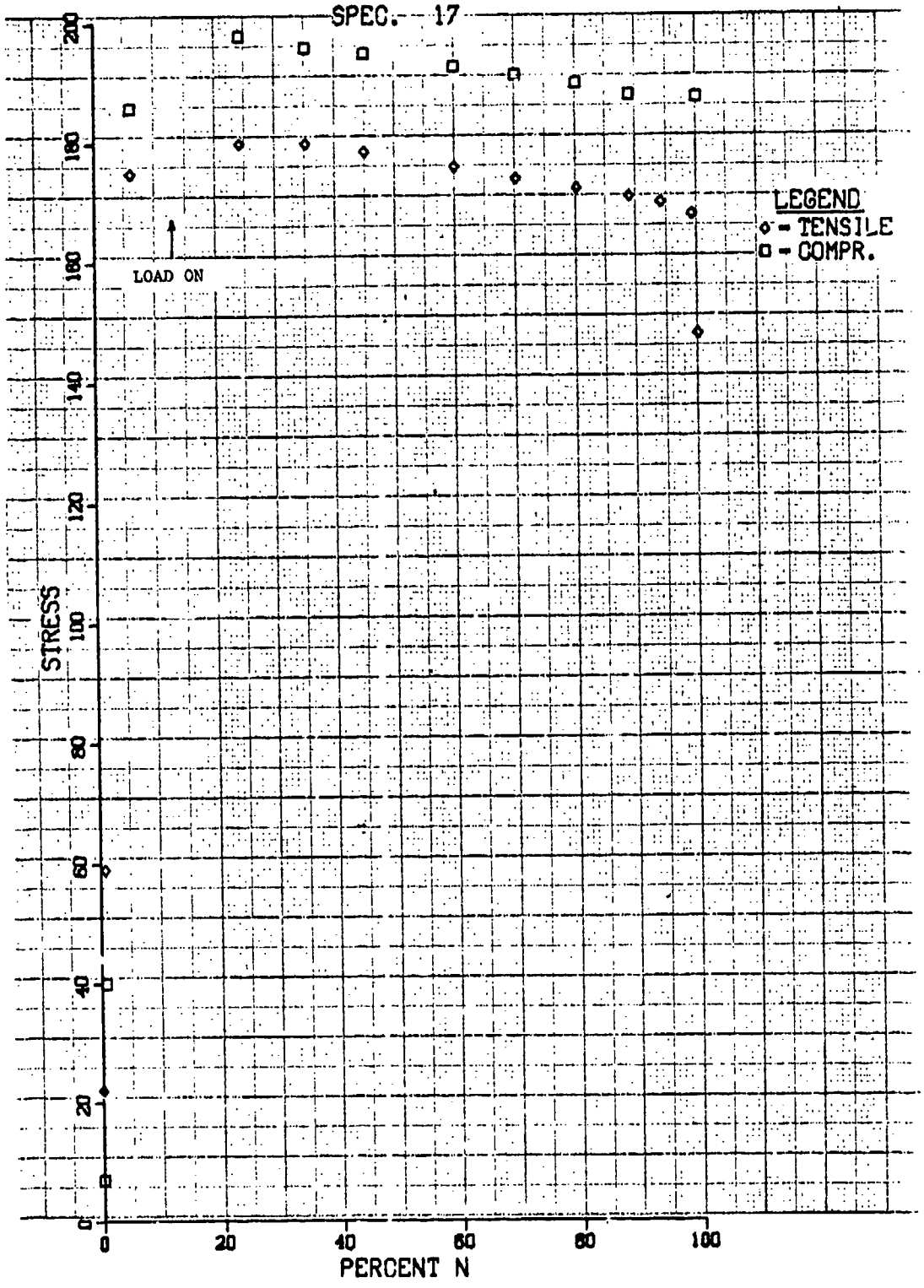

SPEC. 17
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 8.

TABLE 7

SPECIMEN 16

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 0. | 0.00 | 7. | 0.0 | 12. | 0.0 |
| 2 | 4. | 1.30 | 46. | 0.0 | | 0.0 |
| 3 | 7. | 2.28 | 46. | 0.0 | 46. | 0.0 |
| 4 | 12. | 3.91 | 96. | 0.0 | | 0.0 |
| 5 | 13. | 4.23 | 108. | 0.0 | 116. | 0.0 |
| 6 | 18. | 5.86 | 150. | 0.0 | 160. | 0.0 |
| 7 | 21. | 6.84 | 164. | 0.0 | | 0.0 |
| 8 | 30. | 9.77 | 175. | 0.0 | 184. | 0.0 |
| 9 | 39.[a] | 12.70 | 178. | 0.0 | 186. | 0.0 |
| 10 | 59. | 19.22 | 178. | 0.0 | 188. | 0.0 |
| 11 | 79. | 25.73 | 178. | 0.0 | 189. | 0.0 |
| 12 | 98. | 31.92 | 178. | 0.0 | 188. | 0.0 |
| 13 | 116. | 37.79 | | 0.0 | 188. | 0.0 |
| 14 | 120. | 39.09 | | 0.0 | 188. | 0.0 |
| 15 | 122. | 39.74 | 178. | 0.0 | | 0.0 |
| 16 | 131. | 42.67 | 177. | 0.0 | | 0.0 |
| 17 | 138. | 44.95 | | 0.0 | 187. | 0.0 |
| 18 | 144. | 46.91 | 176. | 0.0 | | 0.0 |
| 19 | 147. | 47.88 | | 0.0 | 187. | 0.0 |
| 20 | 152. | 49.51 | 176. | 0.0 | | 0.0 |
| 21 | 159. | 51.79 | 175. | 0.0 | | 0.0 |
| 22 | 180. | 58.63 | 174. | 0.0 | 184. | 0.0 |
| 23 | 199. | 64.82 | 173. | 0.0 | 184. | 0.0 |
| 24 | 238. | 77.52 | 171. | 0.0 | 182. | 0.0 |
| 25 | 277. | 90.23 | 168. | 0.0 | 180. | 0.0 |
| 26 | 307. | 100.00 | 167. | 0.0 | 180. | 0.0 |

[a]Load on

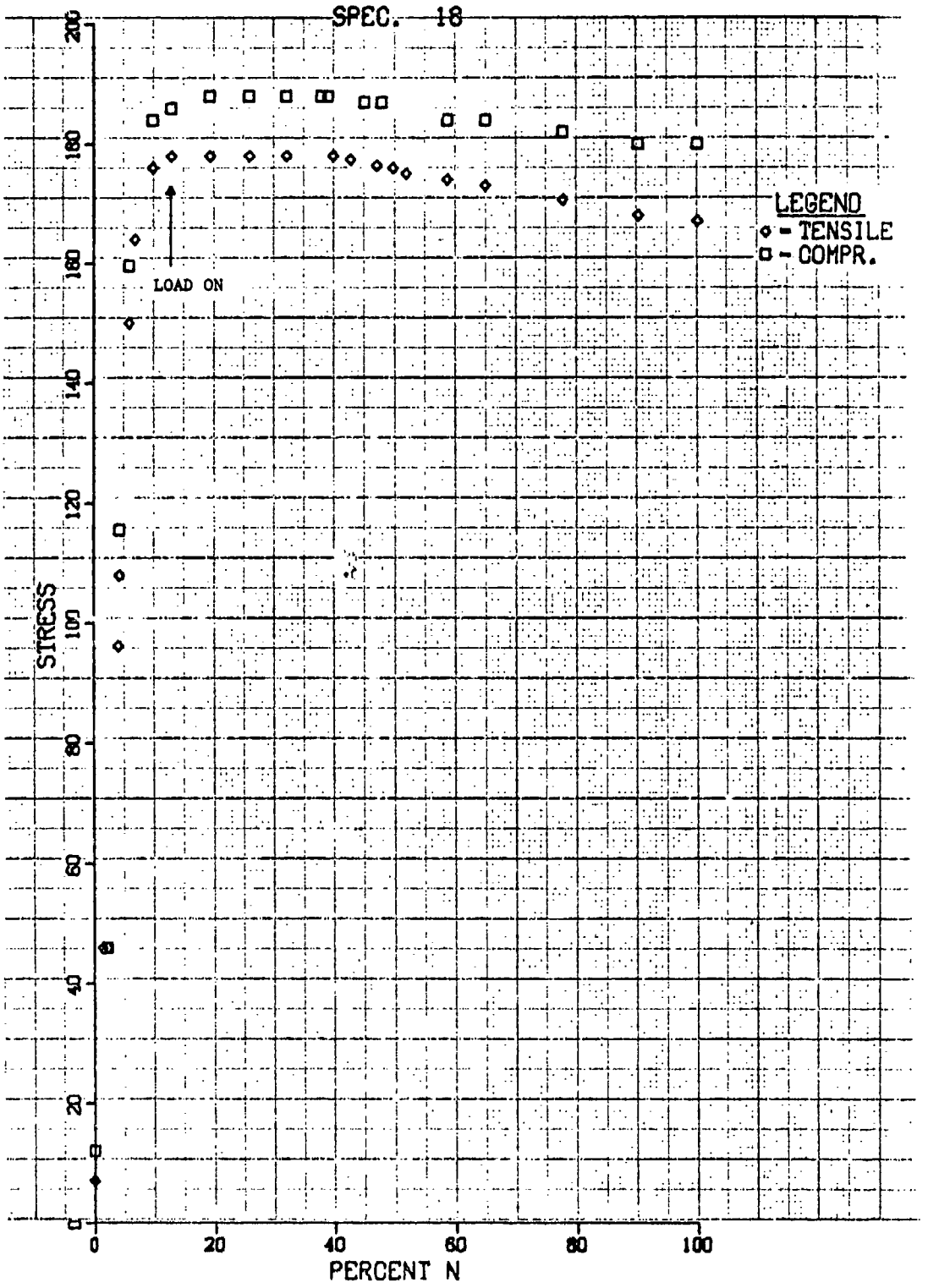

SPEC. 18
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 9.

TABLE 8

SPECIMEN 22

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 0. | 0.00 | 35. | 0.0 | 12. | 0.0 |
| 2 | 9. | 1.95 | 131. | 0.0 | 133. | 0.0 |
| 3 | 23.[a] | 4.99 | 175. | 0.0 | 183. | 0.0 |
| 4 | 41. | 8.89 | 176. | 0.0 | 183. | 0.0 |
| 5 | 65. | 14.10 | 175. | 0.0 | 184. | 0.0 |
| 6 | 115. | 24.95 | 173. | 0.0 | 181. | 0.0 |
| 7 | 157. | 34.06 | 171. | 0.0 | 178. | 0.0 |
| 8 | 230. | 49.89 | 168. | 0.0 | 172. | 0.0 |
| 9 | 295. | 63.99 | 166. | 0.0 | 172. | 0.0 |
| 10 | 355. | 77.01 | 163. | 0.0 | 170. | 0.0 |
| 11 | 415. | 90.02 | 161. | 0.0 | 169. | 0.0 |
| 12 | 456. | 98.92 | 158. | 0.0 | 169. | 0.0 |
| 13 | 461. | 100.00 | 145. | 0.0 | 171. | 0.0 |

[a] Load on

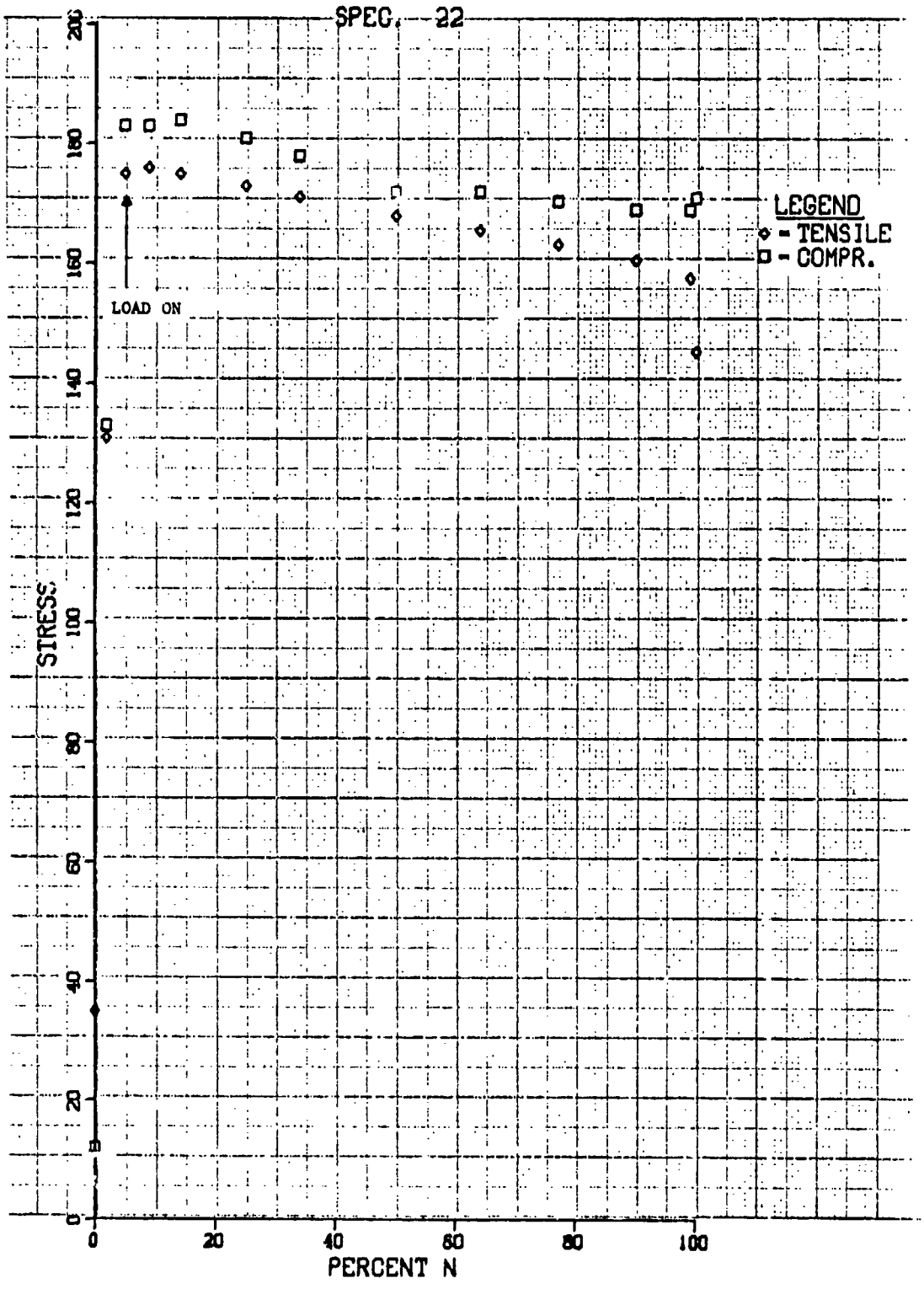

SPEC. 22
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 10.

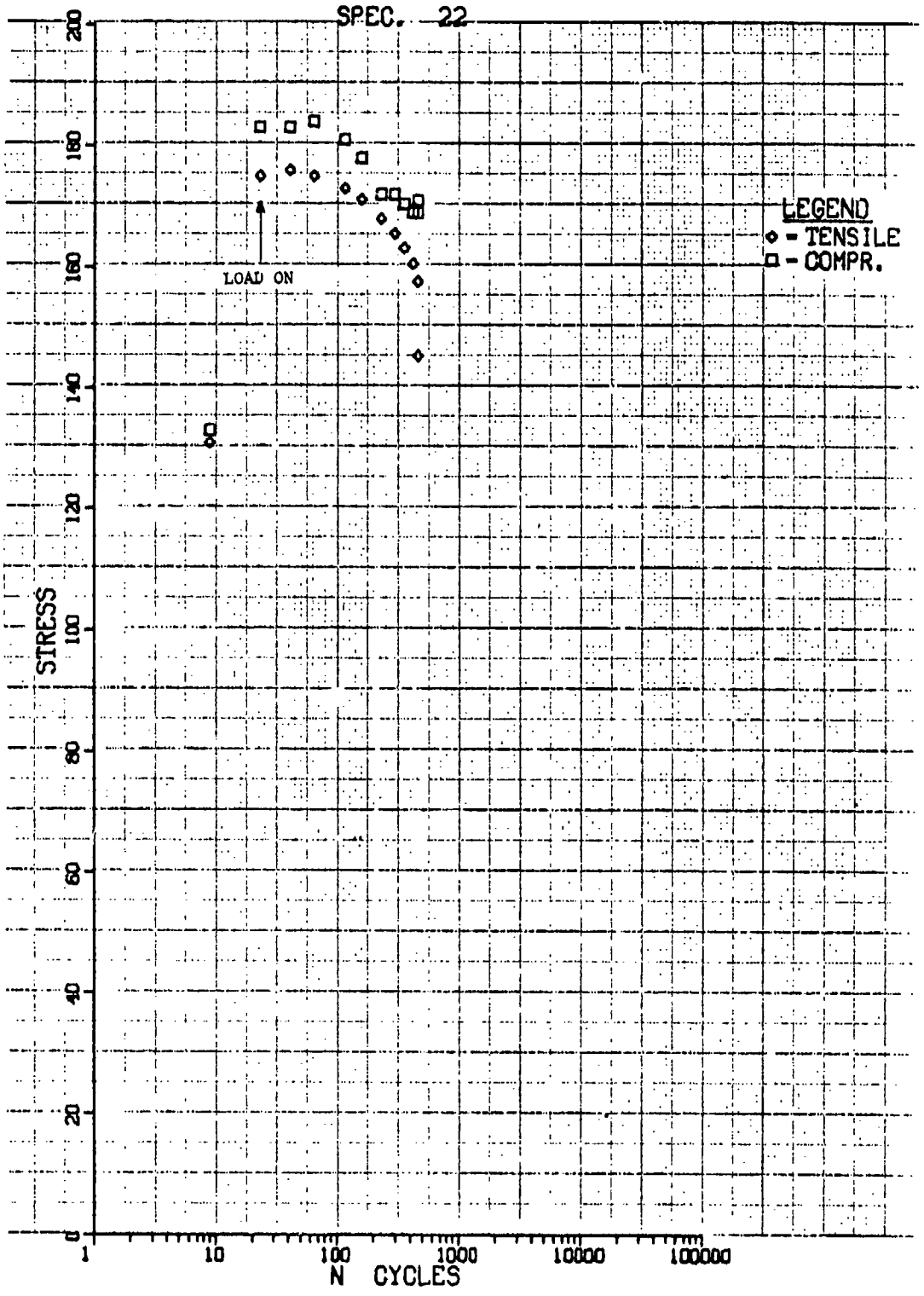

SPEC. 22
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 11.

TABLE 9

SPECIMEN 240

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .22 | 166. | 0.0 | 176. | 0.0 |
| 2 | 2. | .43 | 167. | 0.0 | 175. | 0.0 |
| 3 | 3. | .65 | 166. | 0.0 | 175. | 0.0 |
| 4 | 4. | .86 | 166. | 0.0 | 176. | 0.0 |
| 5 | 5. | 1.08 | 166. | 0.0 | 176. | 0.0 |
| 6 | 6. | 1.30 | 166. | 0.0 | 177. | 0.0 |
| 7 | 7. | 1.51 | 168. | 0.0 | 178. | 0.0 |
| 8 | 20. | 4.32 | 168. | 0.0 | 178. | 0.0 |
| 9 | 40. | 8.64 | 169. | 0.0 | 179. | 0.0 |
| 10 | 60. | 12.96 | 169. | 0.0 | 179. | 0.0 |
| 11 | 80. | 17.28 | 168. | 0.0 | 178. | 0.0 |
| 12 | 120. | 25.92 | 166. | 0.0 | 176. | 0.0 |
| 13 | 140. | 30.24 | 165. | 0.0 | 176. | 0.0 |
| 14 | 160. | 34.56 | 164. | 0.0 | 176. | 0.0 |
| 15 | 200. | 43.20 | 163. | 0.0 | 174. | 0.0 |
| 16 | 220. | 47.52 | 162. | 0.0 | 173. | 0.0 |
| 17 | 240. | 51.84 | 160. | 0.0 | 172. | 0.0 |
| 18 | 320. | 69.11 | 158. | 0.0 | 170. | 0.0 |
| 19 | 360. | 77.75 | 157. | 0.0 | 169. | 0.0 |
| 20 | 400. | 86.39 | 156. | 0.0 | 168. | 0.0 |
| 21 | 440. | 95.03 | 156. | 0.0 | 168. | 0.0 |
| 22 | 450. | 97.19 | 156. | 0.0 | 168. | 0.0 |

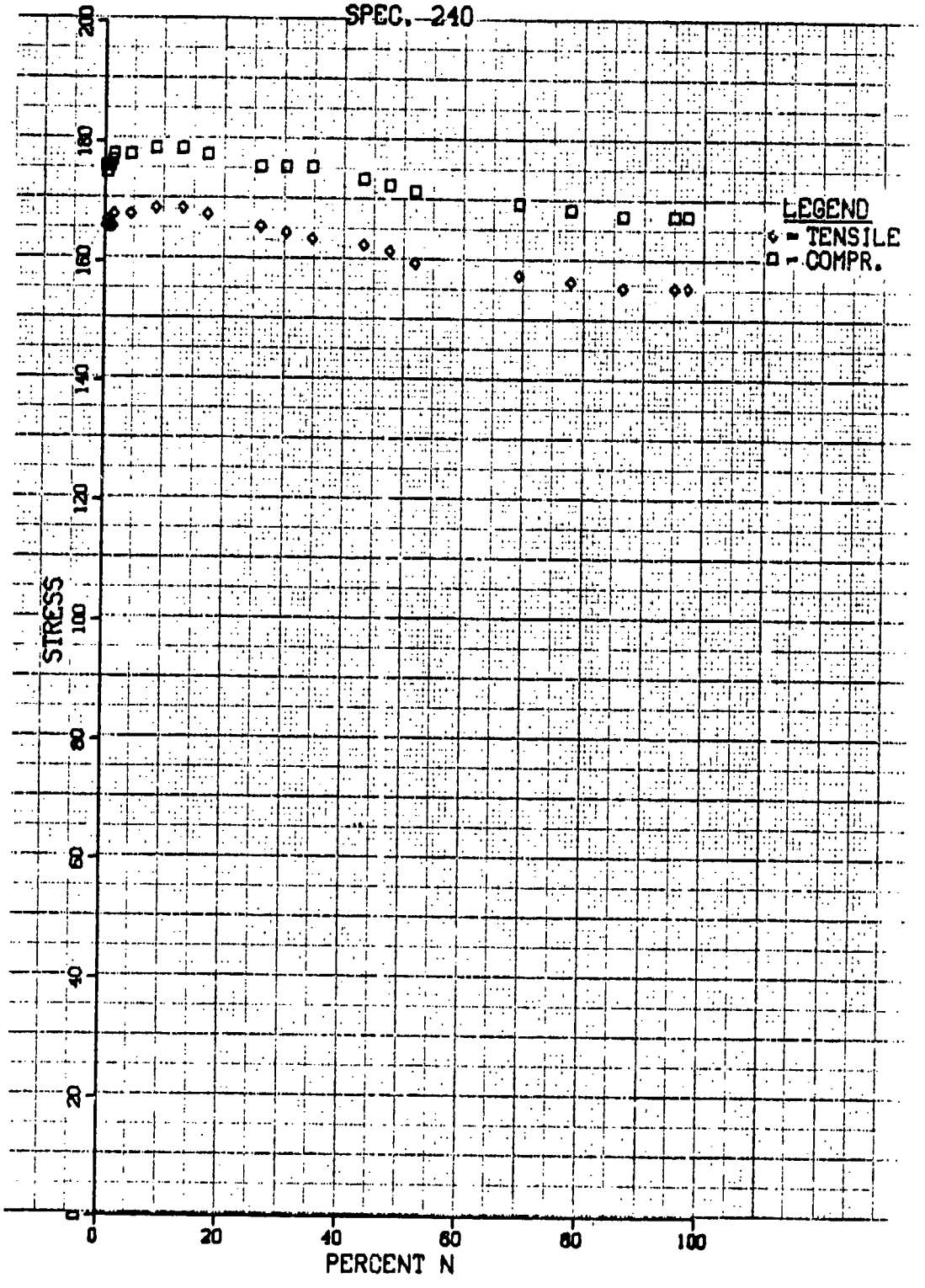

SPEC. 240
LEGEND
◇ = TENSILE
□ = COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 12.

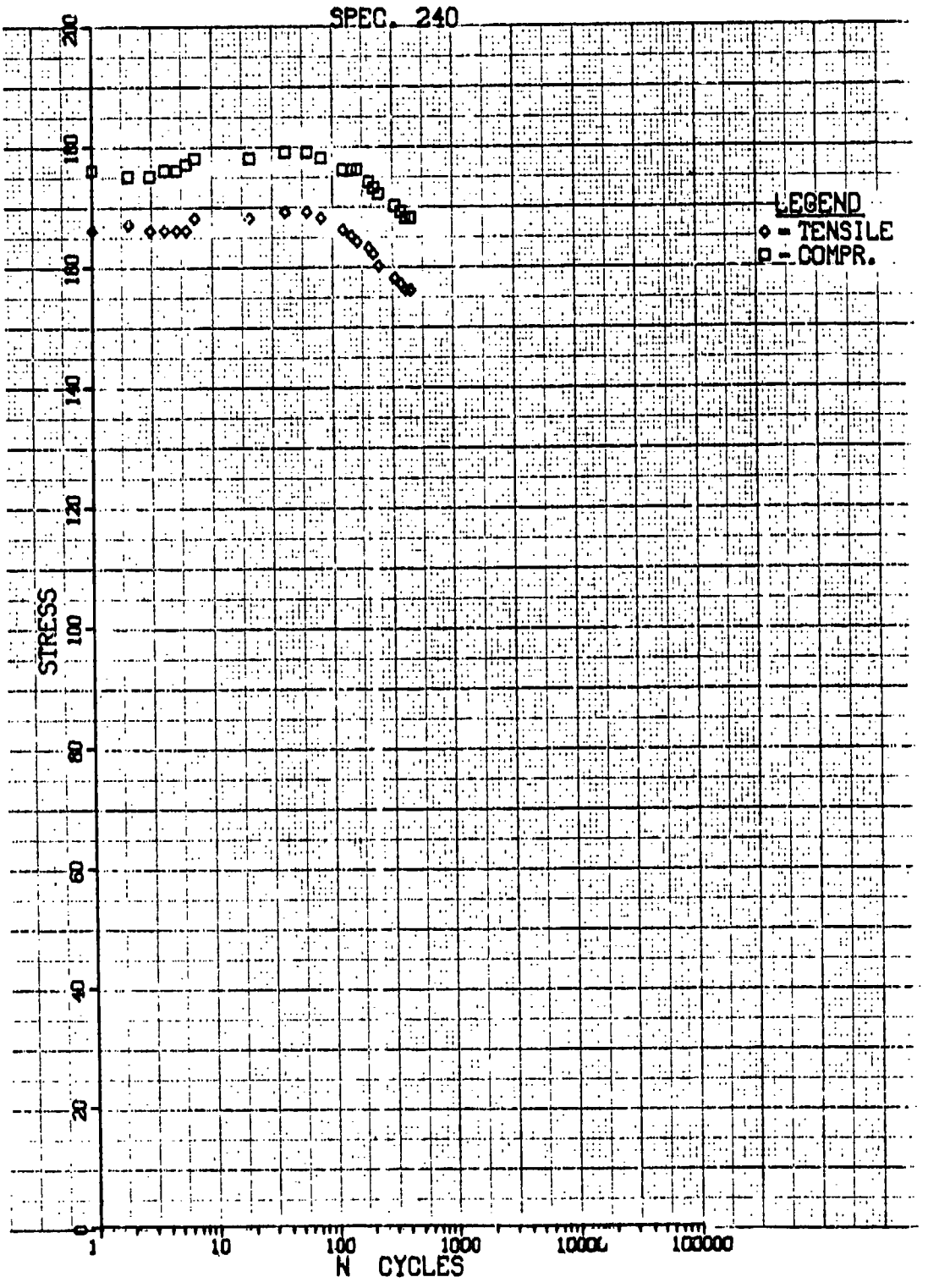

SPEC. 240
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 13.

TABLE 10

SPECIMEN 27

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 0. | 0.00 | 147. | 0.0 | 150. | 0.0 |
| 2 | 2. | .12 | 145. | 0.0 | 151. | 0.0 |
| 3 | 33. | 2.03 | 148. | 0.0 | 151. | 0.0 |
| 4 | 33. | 2.03 | 147. | 0.0 | 150. | 0.0 |
| 5 | 81. | 4.97 | 145. | 0.0 | 151. | 0.0 |
| 6 | 163. | 10.01 | 145. | 0.0 | 150. | 0.0 |
| 7 | 326. | 20.01 | 143. | 0.0 | 149. | 0.0 |
| 8 | 244. | 14.95 | 144. | 0.0 | 149. | 0.0 |
| 9 | 358. | 21.95 | 142. | 0.0 | 148. | 0.0 |
| 10 | 358. | 21.98 | 142. | 0.0 | 149. | 0.0 |
| 11 | 489. | 30.02 | 141. | 0.0 | 147. | 0.0 |
| 12 | 603. | 37.02 | 140. | 0.0 | 147. | 0.0 |
| 13 | 684. | 41.99 | 140. | 0.0 | 147. | 0.0 |
| 14 | 766. | 47.02 | 140. | 0.0 | 146. | 0.0 |
| 15 | 798. | 48.99 | 140. | 0.0 | 147. | 0.0 |
| 16 | 847. | 52.00 | 139. | 0.0 | 147. | 0.0 |
| 17 | 880. | 54.02 | 139. | 0.0 | 146. | 0.0 |
| 18 | 929. | 57.03 | 140. | 0.0 | 146. | 0.0 |
| 19 | 961. | 58.99 | 138. | 0.0 | 145. | 0.0 |
| 20 | 994. | 61.02 | 139. | 0.0 | 146. | 0.0 |
| 21 | 1043. | 64.03 | 138. | 0.0 | 146. | 0.0 |
| 22 | 1124. | 69.00 | 138. | 0.0 | 146. | 0.0 |
| 23 | 1157. | 71.03 | 136. | 0.0 | 146. | 0.0 |
| 24 | 1205. | 73.97 | 137. | 0.0 | 145. | 0.0 |
| 25 | 1287. | 79.01 | 137. | 0.0 | 146. | 0.0 |
| 26 | 1368. | 83.98 | 137. | 0.0 | 145. | 0.0 |
| 27 | 1368. | 83.98 | 136. | 0.0 | 145. | 0.0 |
| 28 | 1401. | 86.00 | 136. | 0.0 | 144. | 0.0 |
| 29 | 1434. | 88.03 | 136. | 0.0 | 146. | 0.0 |
| 30 | 1482. | 90.98 | 135. | 0.0 | 145. | 0.0 |
| 31 | 1564. | 96.01 | 133. | 0.0 | 146. | 0.0 |
| 32 | 1596. | 97.97 | 129. | 0.0 | 147. | 0.0 |
| 33 | 1629. | 100.00 | 124. | 0.0 | 149. | 0.0 |

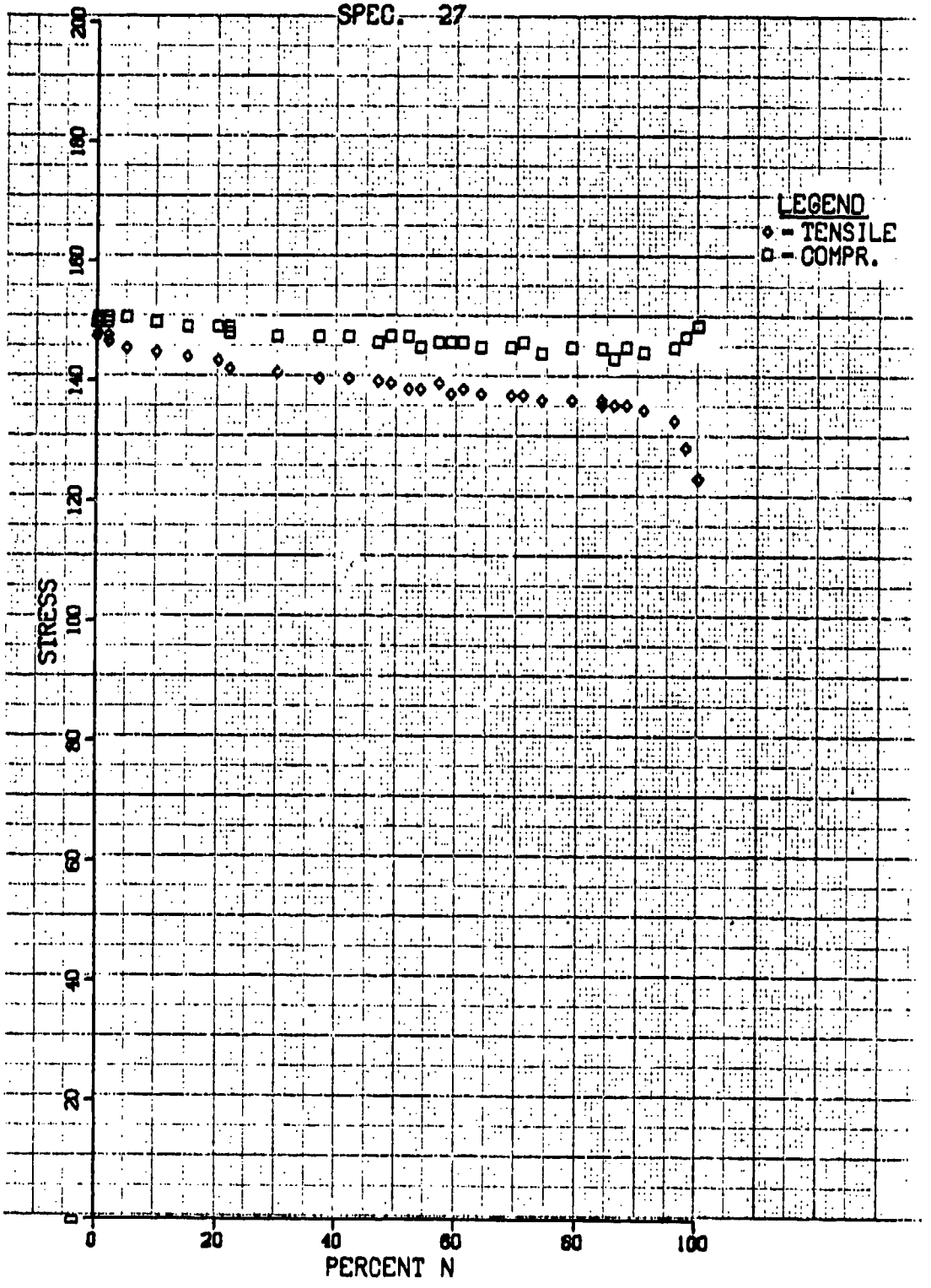

SPEC. 27
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 14.

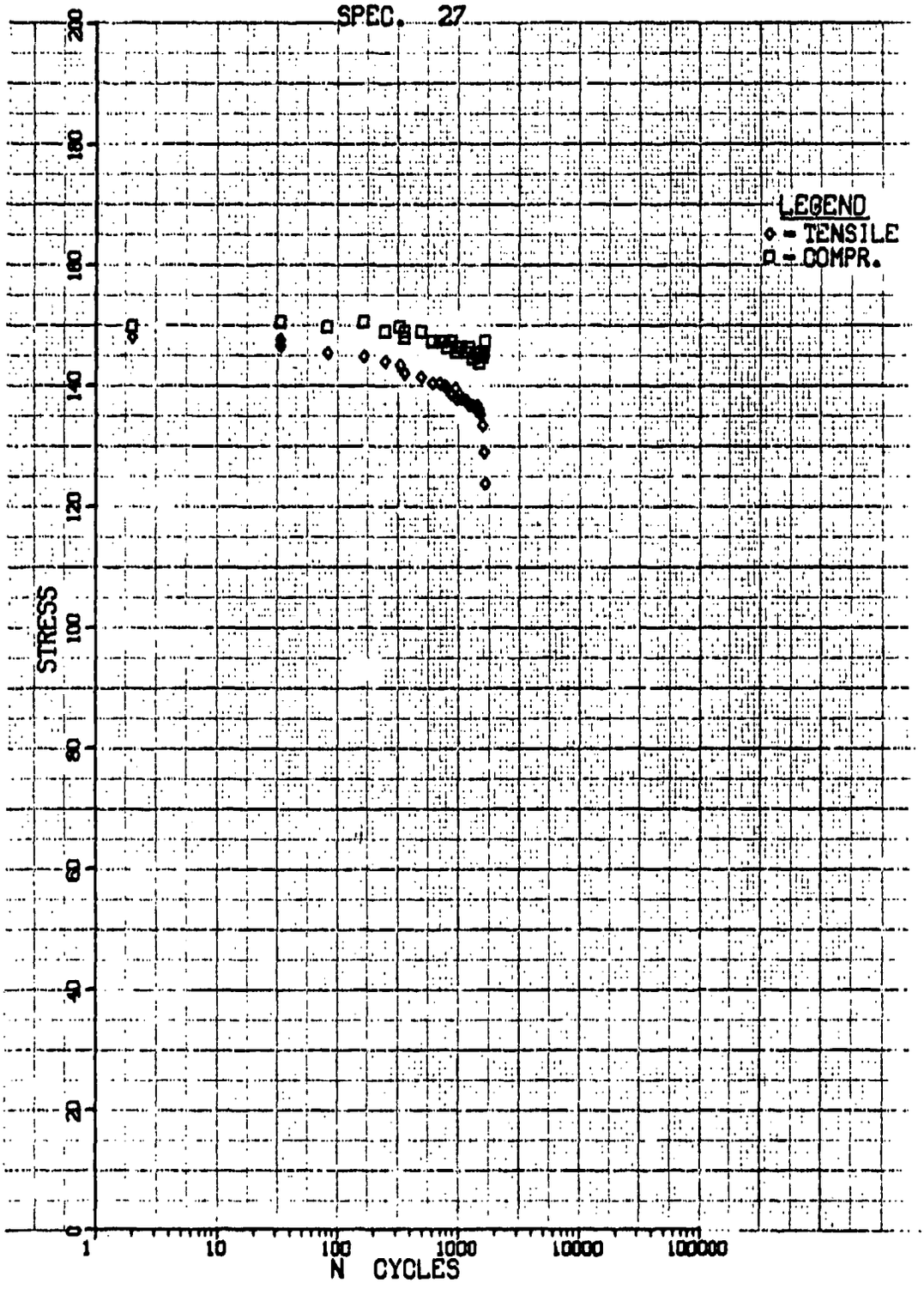

SPEC. 27
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 15.

TABLE 11

SPECIMEN 234

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .01 | 2. | 0.0 | 13. | 0.0 |
| 2 | 2. | .01 | 22. | 0.0 | 32. | 0.0 |
| 3 | 3. | .02 | 36. | 0.0 | 49. | 0.0 |
| 4 | 4. | .02 | 53. | 0.0 | 64. | 0.0 |
| 5 | 5. | .03 | 67. | 0.0 | 72. | 0.0 |
| 6 | 6. | .03 | 73. | 0.0 | 78. | 0.0 |
| 7 | 7. | .04 | 77. | 0.0 | 88. | 0.0 |
| 8 | 8. | .04 | 81. | 0.0 | 92. | 0.0 |
| 9 | 9. | .05 | 89. | 0.0 | 100. | 0.0 |
| 10 | 10. | .05 | 96. | 0.0 | 106. | 0.0 |
| 11 | 11. | .06 | 102. | 0.0 | 110. | 0.0 |
| 12 | 12. | .06 | 104. | 0.0 | 114. | 0.0 |
| 13 | 13. | .07 | 107. | 0.0 | 117. | 0.0 |
| 14 | 14.[a] | .07 | 111. | 0.0 | 120. | 0.0 |
| 15 | 15. | .08 | 112. | 0.0 | 120. | 0.0 |
| 16 | 16. | .08 | 112. | 0.0 | 120. | 0.0 |
| 17 | 17. | .09 | 112. | 0.0 | 120. | 0.0 |
| 18 | 18. | .09 | 112. | 0.0 | 120. | 0.0 |
| 19 | 19. | .10 | 113. | 0.0 | 120. | 0.0 |
| 20 | 20. | .10 | 113. | 0.0 | 120. | 0.0 |
| 21 | 9580. | 50.00 | 99. | 0.0 | 135. | 0.0 |
| 22 | 14370. | 75.00 | 99. | 0.0 | 135. | 0.0 |

[a]Load on

TABLE 12

SPECIMEN 235

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .00 | 4. | 0.0 | 12. | 0.0 |
| 2 | 2. | .01 | 16. | 0.0 | 24. | 0.0 |
| 3 | 3. | .01 | 28. | 0.0 | 36. | 0.0 |
| 4 | 4. | .02 | 42. | 0.0 | 54. | 0.0 |
| 5 | 5. | .02 | 58. | 0.0 | 69. | 0.0 |
| 6 | 6. | .03 | 70. | 0.0 | 76. | 0.0 |
| 7 | 9. | .04 | 86. | 0.0 | 104. | 0.0 |
| 8 | 10. | .04 | 96. | 0.0 | 109. | 0.0 |
| 9 | 11. | .05 | 100. | 0.0 | 112. | 0.0 |
| 10 | 12. | .05 | 106. | 0.0 | 116. | 0.0 |
| 11 | 13. | .06 | 108. | 0.0 | 117. | 0.0 |
| 12 | 14.[a] | .06 | 110. | 0.0 | 117. | 0.0 |
| 13 | 19. | .08 | 112. | 0.0 | 117. | 0.0 |
| 14 | 11182. | 50.00 | 120. | 0.0 | 130. | 0.0 |
| 15 | 16773. | 75.00 | 100. | 0.0 | 130. | 0.0 |

[a]Load on

TABLE 13

SPECIMEN 264

| | | | ---------STRESSES-------- | | | |
|---|---|---|---|---|---|---|
| I | N | %N | TENSILE | RELAXED | COMPR. | RELAXED |
| 1 | 1. | .13 | **** | 0.0 | 78. | 0.0 |
| 2 | 2. | .27 | 191. | 0.0 | 81. | 0.0 |
| 3 | 3. | .40 | 192. | 0.0 | 83. | 0.0 |
| 4 | 4. | .53 | 189. | 0.0 | 88. | 0.0 |
| 5 | 5. | .66 | 189. | 0.0 | 88. | 0.0 |
| 6 | 20. | 2.66 | 190. | 0.0 | 94. | 0.0 |
| 7 | 40. | 5.32 | 190. | 0.0 | 96. | 0.0 |
| 8 | 176. | 23.40 | 187. | 0.0 | 100. | 0.0 |
| 9 | 315. | 41.89 | 185. | 0.0 | 101. | 0.0 |
| 10 | 400. | 53.19 | 184. | 0.0 | 102. | 0.0 |
| 11 | 500. | 66.49 | 182. | 0.0 | 104. | 0.0 |
| 12 | 735. | 97.74 | 175. | 0.0 | 108. | 0.0 |

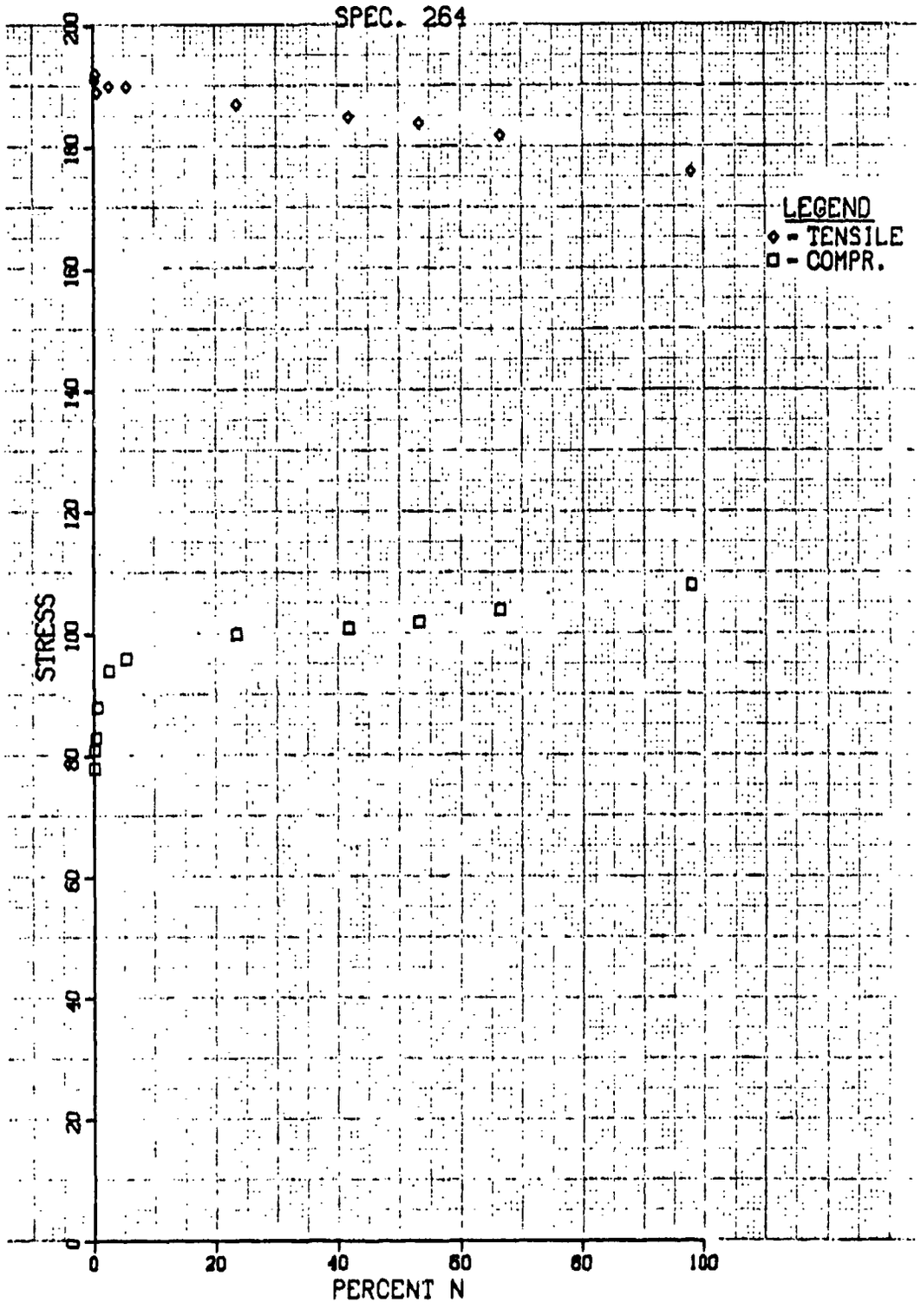

SPEC. 264
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 16.

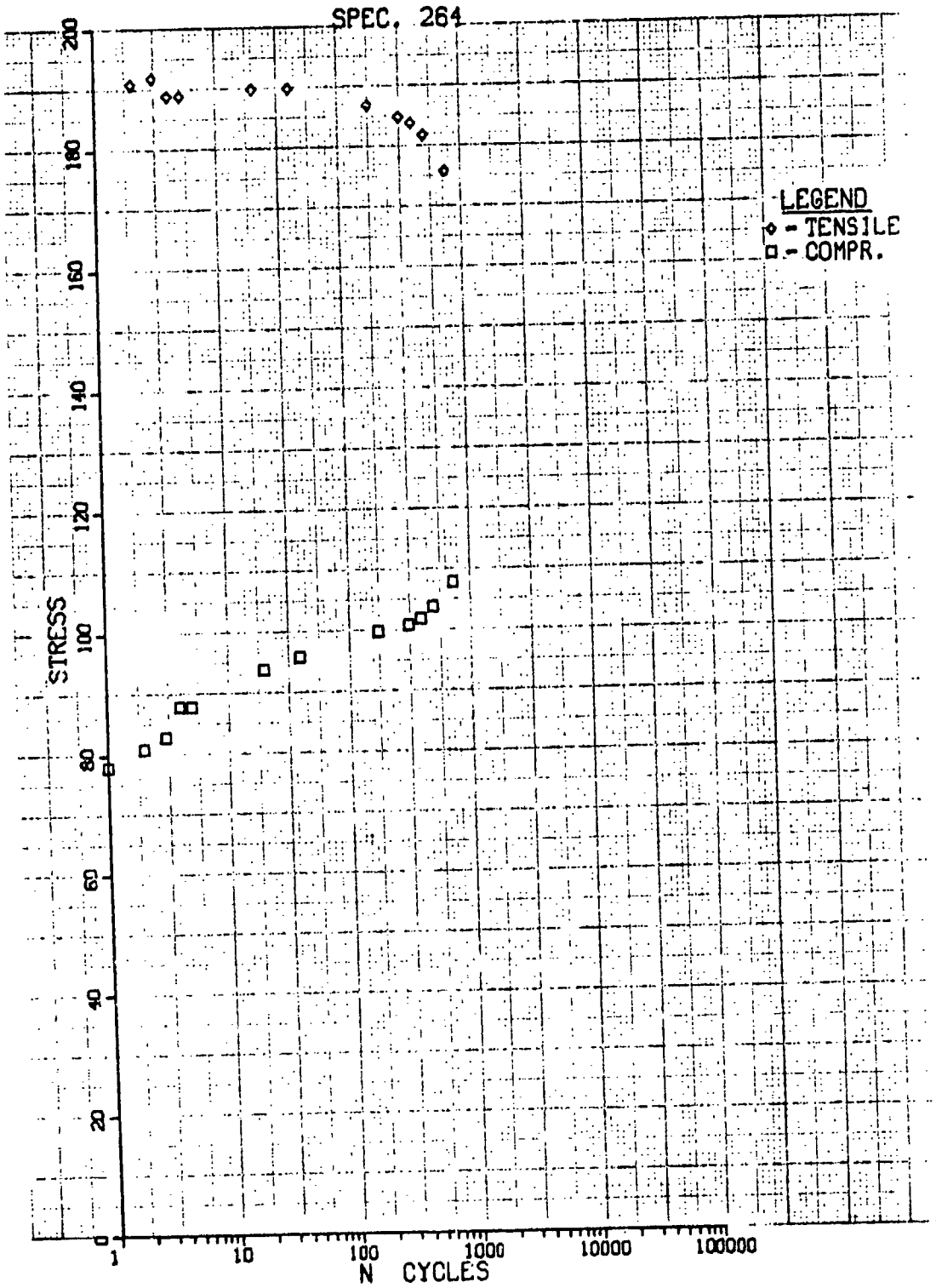

SPEC. 264
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 17.

TABLE 14

SPECIMEN 36

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 4. | .33 | 124. | 0.0 | -4. | 0.0 |
| 2 | 9. | .75 | 163. | 0.0 | 28. | 0.0 |
| 3 | 12. | .99 | 155. | 0.0 | 33. | 0.0 |
| 4 | 15. | 1.24 | 166. | 0.0 | 52. | 0.0 |
| 5 | 23. | 1.91 | 169. | 0.0 | 93. | 0.0 |
| 6 | 28. | 2.32 | 165. | 0.0 | 100. | 0.0 |
| 7 | 32. | 2.65 | 168. | 0.0 | 111. | 0.0 |
| 8 | 37. | 3.07 | 172. | 0.0 | 120. | 0.0 |
| 9 | 42.[a] | 3.48 | 173. | 0.0 | 124. | 0.0 |
| 10 | 59. | 4.89 | 171. | 0.0 | 127. | 0.0 |
| 11 | 81. | 6.71 | 169. | 0.0 | 128. | 0.0 |
| 12 | 85. | 7.04 | 169. | 0.0 | 128. | 0.0 |
| 13 | 194. | 16.07 | 167. | 0.0 | 130. | 0.0 |
| 14 | 314. | 26.01 | 165. | 0.0 | 130. | 0.0 |
| 15 | 474. | 39.27 | 163. | 0.0 | 130. | 0.0 |
| 16 | 593. | 49.13 | 161. | 0.0 | 130. | 0.0 |
| 17 | 793. | 65.70 | 160. | 0.0 | 129. | 0.0 |
| 18 | 895. | 74.15 | 158. | 0.0 | 130. | 0.0 |
| 19 | 1113. | 92.21 | 155. | 0.0 | 130. | 0.0 |
| 20 | 1193. | 98.84 | 152. | 0.0 | 132. | 0.0 |
| 21 | 1233. | 100.00 | 143. | 0.0 | 140. | 0.0 |

[a]Load on

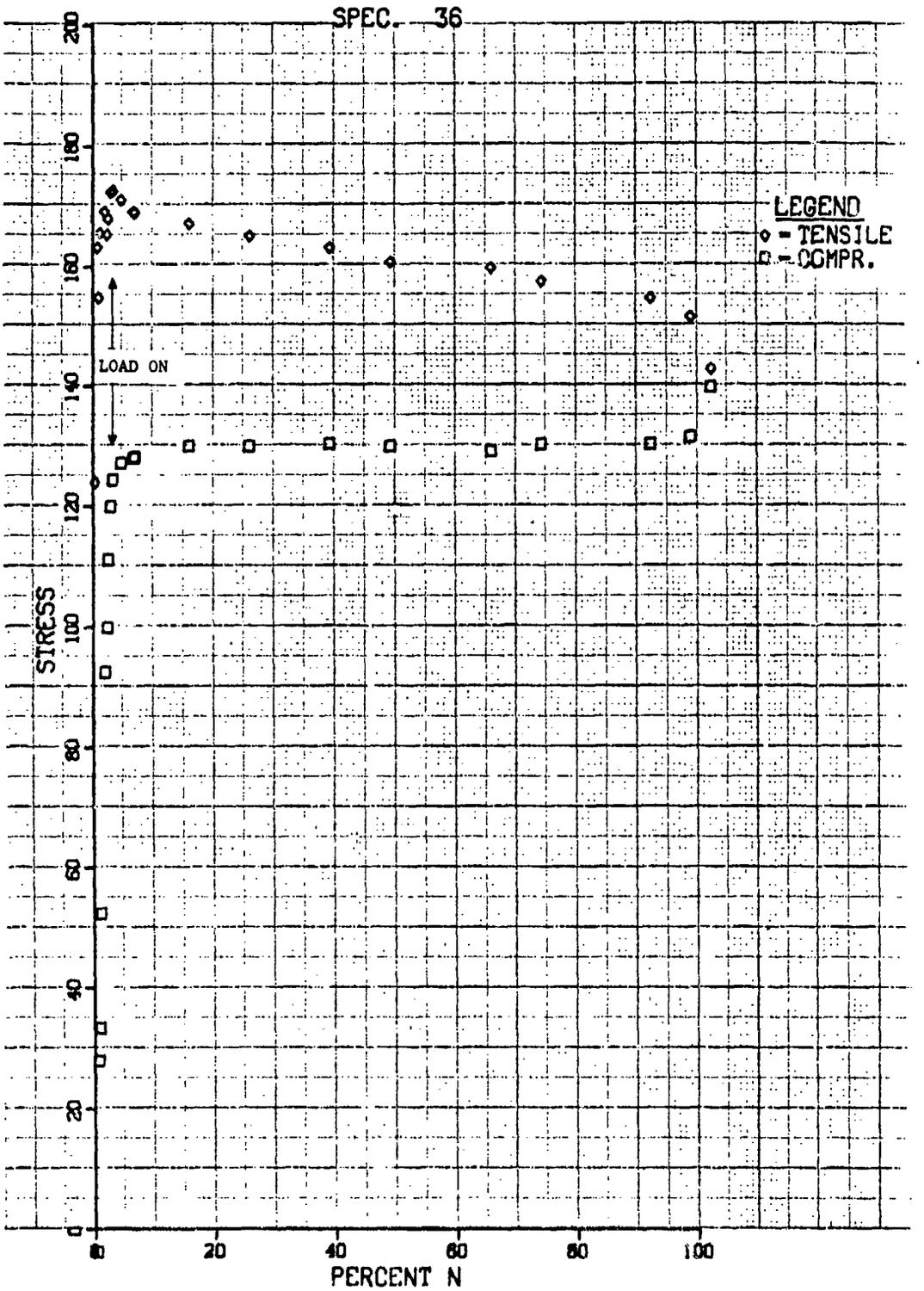

SPEC. 36
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 18.

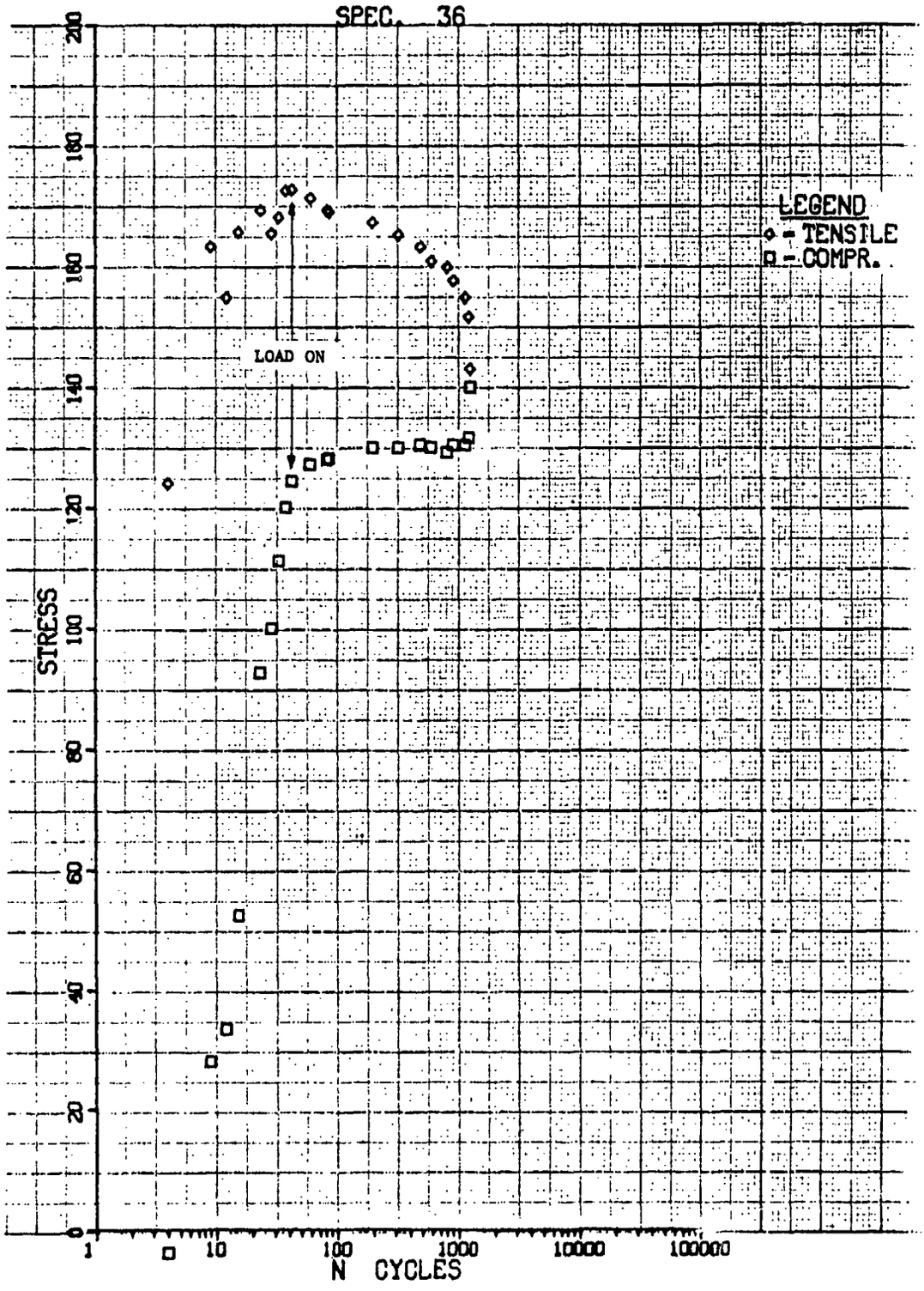

SPEC. 36
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 19.

TABLE 15

SPECIMEN 37

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 3. | .14 | -1. | 0.0 | 70. | 0.0 |
| 2 | 5. | .24 | -1. | 0.0 | 107. | 0.0 |
| 3 | 8. | .38 | 0. | 0.0 | 137. | 0.0 |
| 4 | 10. | .47 | 12. | 0.0 | 160. | 0.0 |
| 5 | 16. | .75 | 76. | 0.0 | 176. | 0.0 |
| 6 | 28. | 1.32 | 105. | 0.0 | 180. | 0.0 |
| 7 | 39.[a] | 1.83 | 112. | 0.0 | 180. | 0.0 |
| 8 | 54. | 2.54 | 113. | 0.0 | 177. | 0.0 |
| 9 | 82. | 3.86 | 114. | 0.0 | 176. | 0.0 |
| 10 | 97. | 4.56 | 116. | 0.0 | 176. | 0.0 |
| 11 | 124. | 5.83 | 114. | 0.0 | 176. | 0.0 |
| 12 | 342. | 16.09 | 116. | 0.0 | 174. | 0.0 |
| 13 | 499. | 23.47 | 117. | 0.0 | 172. | 0.0 |
| 14 | 700. | 32.93 | 115. | 0.0 | 172. | 0.0 |
| 15 | 938. | 44.12 | 115. | 0.0 | 170. | 0.0 |
| 16 | 1100. | 51.74 | 116. | 0.0 | 168. | 0.0 |
| 17 | 1417. | 66.65 | 114. | 0.0 | 168. | 0.0 |
| 18 | 1777. | 83.58 | 112. | 0.0 | 166. | 0.0 |
| 19 | 1858. | 87.39 | 110. | 0.0 | 165. | 0.0 |
| 20 | 1938. | 91.16 | 105. | 0.0 | 164. | 0.0 |
| 21 | 1978. | 93.04 | 102. | 0.0 | 166. | 0.0 |
| 22 | 2018. | 94.92 | 96. | 0.0 | 165. | 0.0 |
| 23 | 2059. | 96.85 | 84. | 0.0 | 165. | 0.0 |

[a]Load on

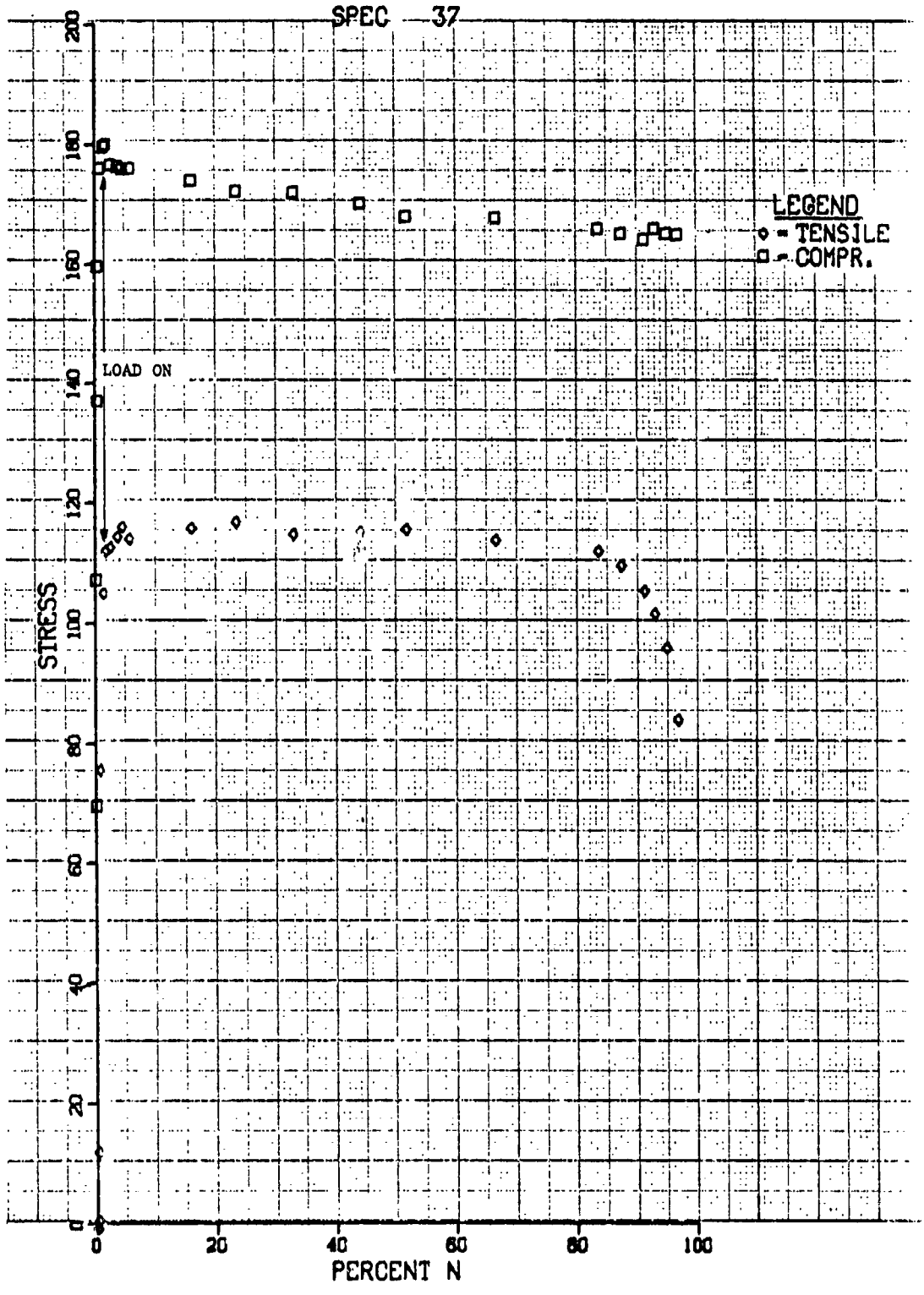

SPEC 37
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 20.

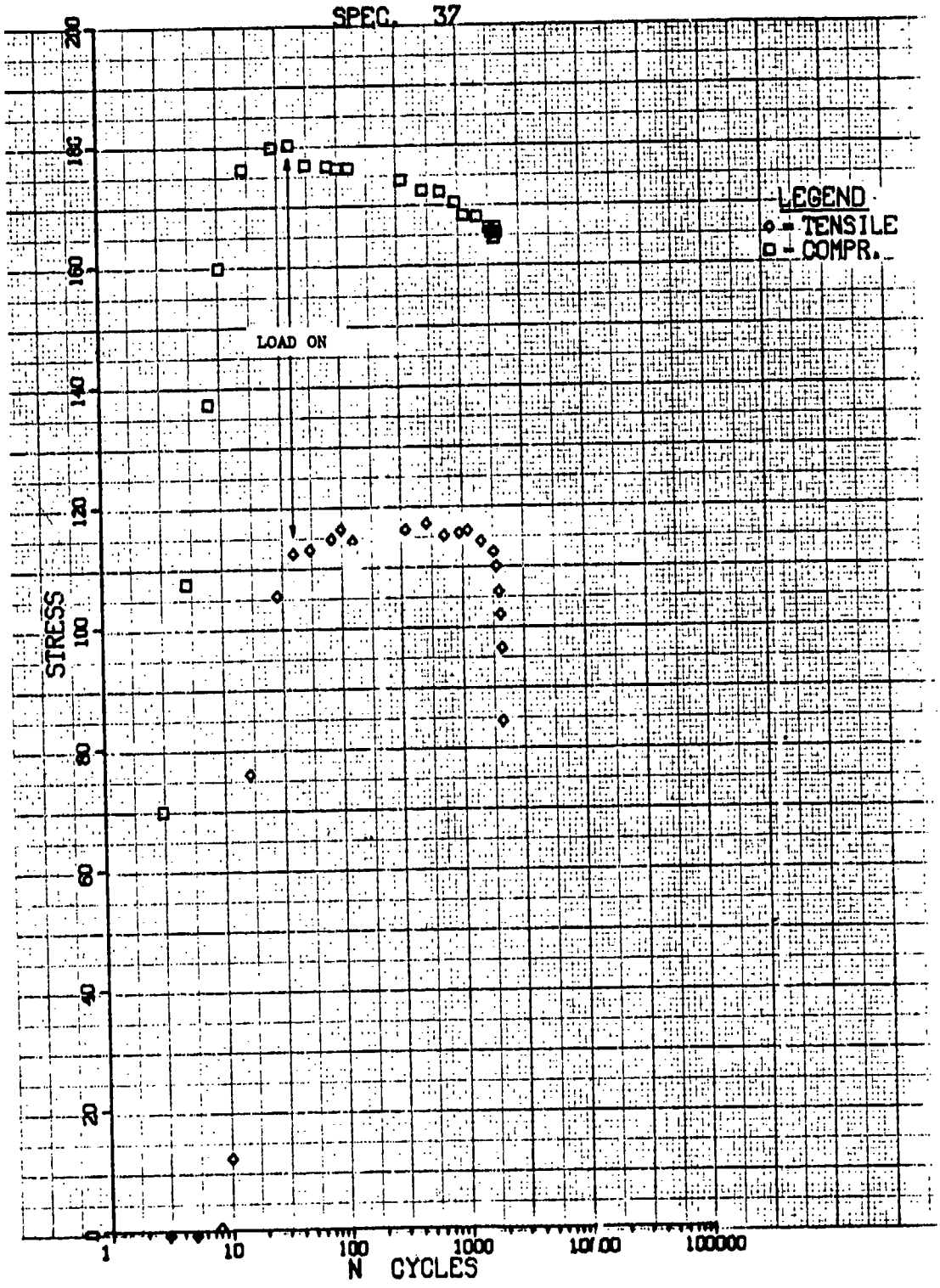

SPEC. 37
LEGEND
◇ - TENSILE
□ - COMPR.
LOAD ON
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 21.

TABLE 16

SPECIMEN 20

| I | N | ZN | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .33 | 164. | 0.0 | 178. | 0.0 |
| 2 | 2. | .66 | 166. | 0.0 | 180. | 0.0 |
| 3 | 3. | .99 | 166. | 0.0 | 181. | 0.0 |
| 4 | 4. | 1.32 | 166. | 0.0 | 181. | 0.0 |
| 5 | 5. | 1.65 | 166. | 0.0 | 182. | 0.0 |
| 6 | 6. | 1.98 | 166. | 0.0 | 182. | 0.0 |
| 7 | 7. | 2.31 | 166. | 0.0 | 183. | 0.0 |
| 8 | 8. | 2.64 | 165. | 0.0 | 182. | 0.0 |
| 9 | 9. | 2.97 | 166. | 0.0 | 183. | 0.0 |
| 10 | 10. | 3.30 | 165. | 0.0 | 183. | 0.0 |
| 11 | 20. | 6.60 | 165. | 0.0 | 185. | 0.0 |
| 12 | 30. | 9.90 | 165. | 0.0 | 185. | 0.0 |
| 13 | 40. | 13.20 | 165. | 0.0 | 184. | 0.0 |
| 14 | 50. | 16.50 | 165. | 0.0 | 184. | 0.0 |
| 15 | 60. | 19.80 | 165. | 0.0 | 184. | 0.0 |
| 16 | 70. | 23.10 | 165. | 0.0 | 185. | 0.0 |
| 17 | 79. | 26.07 | 165. | 0.0 | 183. | 0.0 |
| 18 | 80. | 26.40 | 165. | 0.0 | 181. | 0.0 |
| 19 | 81. | 26.73 | 165. | 0.0 | 182. | 0.0 |
| 20 | 90. | 29.70 | 164. | 0.0 | 183. | 0.0 |
| 21 | 100. | 33.00 | 163. | 0.0 | 184. | 0.0 |
| 22 | 110 | 36.30 | 164. | 0.0 | 182. | 0.0 |
| 23 | 117. | 38.61 | 164. | 0.0 | 183. | 0.0 |
| 24 | 120. | 39.60 | 164. | 0.0 | 181. | 0.0 |
| 25 | 123. | 40.59 | 162. | 0.0 | 181. | 0.0 |
| 26 | 128. | 42.24 | 164. | 0.0 | 181. | 0.0 |
| 27 | 130. | 42.90 | 164. | 0.0 | 181. | 0.0 |
| 28 | 140. | 46.20 | 162. | 0.0 | 180. | 0.0 |
| 29 | 150. | 49.50 | 162. | 0.0 | 180. | 0.0 |
| 30 | 160. | 52.81 | 162. | 0.0 | 180. | 0.0 |
| 31 | 170. | 56.11 | 161. | 0.0 | 180. | 0.0 |
| 32 | 180. | 59.41 | 161. | 0.0 | 180. | 0.0 |
| 33 | 190. | 62.71 | 161. | 0.0 | 179. | 0.0 |
| 34 | 200. | 66.01 | 160. | 0.0 | 176. | 0.0 |
| 35 | 210. | 69.31 | 160. | 0.0 | 176. | 0.0 |
| 36 | 220. | 72.61 | 160. | 0.0 | 176. | 0.0 |
| 37 | 230. | 75.91 | 160. | 0.0 | 175. | 0.0 |
| 38 | 240. | 79.21 | 160. | 0.0 | 175. | 0.0 |
| 39 | 250. | 82.51 | 160. | 0.0 | 175. | 0.0 |
| 40 | 260. | 85.81 | 160. | 0.0 | 175. | 0.0 |
| 41 | 265. | 87.46 | 160. | 0.0 | 174. | 0.0 |
| 42 | 270. | 89.11 | 159. | 0.0 | 174. | 0.0 |
| 43 | 272. | 89.77 | 160. | 0.0 | 173. | 0.0 |
| 44 | 273. | 90.10 | 158. | 0.0 | 176. | 0.0 |
| 45 | 274. | 90.43 | 159. | 0.0 | 174. | 0.0 |
| 46 | 280. | 92.41 | 160. | 0.0 | 175. | 0.0 |
| 47 | 285. | 94.06 | 160. | 0.0 | 175. | 0.0 |
| 48 | 290. | 95.71 | 160. | 0.0 | 175. | 0.0 |
| 49 | 292. | 96.37 | 162. | 0.0 | 175. | 0.0 |
| 50 | 293. | 96.70 | 165. | 0.0 | 175. | 0.0 |
| 51 | 294. | 97.03 | 165. | 0.0 | 175. | 0.0 |
| 52 | 295. | 97.36 | 159. | 0.0 | 175. | 0.0 |
| 53 | 296. | 97.69 | 159. | 0.0 | 173. | 0.0 |
| 54 | 297. | 98.02 | 160. | 0.0 | 175. | 0.0 |
| 55 | 298. | 98.35 | 160. | 0.0 | 173. | 0.0 |
| 56 | 299. | 98.68 | 161. | 0.0 | 174. | 0.0 |
| 57 | 300. | 99.01 | 168. | 0.0 | 175. | 0.0 |
| 58 | 301. | 99.34 | 169. | 0.0 | 176. | 0.0 |
| 59 | 302. | 99.67 | 169. | 0.0 | 176. | 0.0 |
| 60 | 303. | | 160. | 0.0 | 179. | 0.0 |

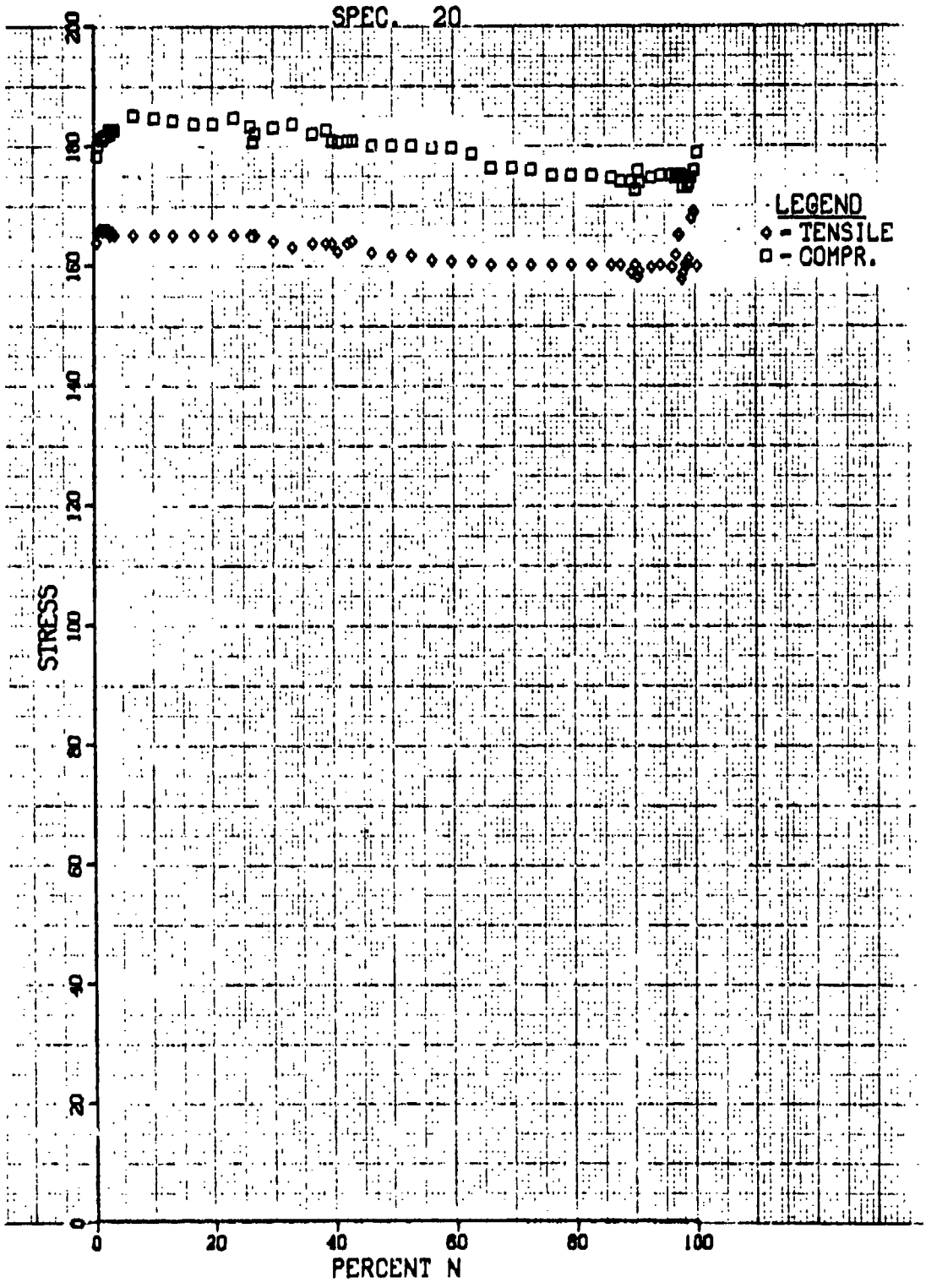

SPEC. 20
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 22.

TABLE 17

Specimen 34

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .19 | 150. | 0.0 | 157. | 0.0 |
| 2 | 2. | .39 | 150. | 0.0 | 159. | 0.0 |
| 3 | 3. | .58 | 150. | 0.0 | 161. | 0.0 |
| 4 | 4. | .78 | 151. | 0.0 | 160. | 0.0 |
| 5 | 5. | .97 | 150. | 0.0 | 161. | 0.0 |
| 6 | 6. | 1.17 | 150. | 0.0 | 162. | 0.0 |
| 7 | 7. | 1.36 | 150. | 0.0 | 162. | 0.0 |
| 8 | 8. | 1.56 | 150. | 0.0 | 162. | 0.0 |
| 9 | 13. | 2.53 | 150. | 0.0 | 164. | 0.0 |
| 10 | 14. | 2.73 | 150. | 0.0 | 163. | 0.0 |
| 11 | 18. | 3.51 | 150. | 0.0 | 164. | 0.0 |
| 12 | 19. | 3.70 | 149. | 0.0 | 164. | 0.0 |
| 13 | 25. | 4.87 | 148. | 0.0 | 165. | 0.0 |
| 14 | 26. | 5.07 | 148. | 0.0 | 164. | 0.0 |
| 15 | 30. | 5.85 | 147. | 0.0 | 165. | 0.0 |
| 16 | 31. | 6.04 | 147. | 0.0 | 165. | 0.0 |
| 17 | 38. | 7.41 | 146. | 0.0 | 165. | 0.0 |
| 18 | 43. | 8.38 | 146. | 0.0 | 165. | 0.0 |
| 19 | 49. | 9.55 | 145. | 0.0 | 165. | 0.0 |
| 20 | 65. | 12.67 | 144. | 0.0 | 165. | 0.0 |
| 21 | 82. | 15.98 | 144. | 0.0 | 165. | 0.0 |
| 22 | 100. | 19.49 | 142. | 0.0 | 166. | 0.0 |
| 23 | 112. | 21.83 | 142. | 0.0 | 165. | 0.0 |
| 24 | 142. | 27.68 | 141. | 0.0 | 165. | 0.0 |
| 25 | 172. | 33.53 | 140. | 0.0 | 166. | 0.0 |
| 26 | 190. | 37.04 | 140. | 0.0 | 165. | 0.0 |
| 27 | 224. | 43.66 | 140. | 0.0 | 165. | 0.0 |
| 28 | 242. | 47.17 | 140. | 0.0 | 165. | 0.0 |
| 29 | 260. | 50.68 | 140. | 0.0 | 165. | 0.0 |
| 30 | 270. | 52.63 | 139. | 0.0 | 165. | 0.0 |
| 31 | 265. | 51.66 | 139. | 0.0 | 165. | 0.0 |
| 32 | 294. | 57.31 | 138. | 0.0 | 165. | 0.0 |
| 33 | 310. | 60.43 | 139. | 0.0 | 165. | 0.0 |
| 34 | 328. | 63.94 | 136. | 0.0 | 163. | 0.0 |
| 35 | 340. | 66.28 | 139. | 0.0 | 161. | 0.0 |
| 36 | 347. | 67.64 | 140. | 0.0 | 160. | 0.0 |
| 37 | 358. | 69.79 | 140. | 0.0 | 160. | 0.0 |
| 38 | 370. | 72.12 | 140. | 0.0 | 159. | 0.0 |
| 39 | 394. | 76.80 | 141. | 0.0 | 158. | 0.0 |
| 40 | 412. | 80.31 | 141. | 0.0 | 156. | 0.0 |
| 41 | 424. | 82.65 | 143. | 0.0 | 156. | 0.0 |
| 42 | 442. | 86.16 | 143. | 0.0 | 155. | 0.0 |
| 43 | 461. | 89.86 | 143. | 0.0 | 154. | 0.0 |
| 44 | 472. | 92.01 | 144. | 0.0 | 152. | 0.0 |
| 45 | 478. | 93.18 | 145. | 0.0 | 152. | 0.0 |
| 46 | 484. | 94.35 | 145. | 0.0 | 151. | 0.0 |
| 47 | 496. | 96.69 | 145. | 0.0 | 148. | 0.0 |
| 48 | 502. | 97.86 | 146. | 0.0 | 145. | 0.0 |
| 49 | 508. | 99.03 | 147. | 0.0 | 143. | 0.0 |
| 50 | 513. | 100.00 | 149. | 0.0 | 140. | 0.0 |

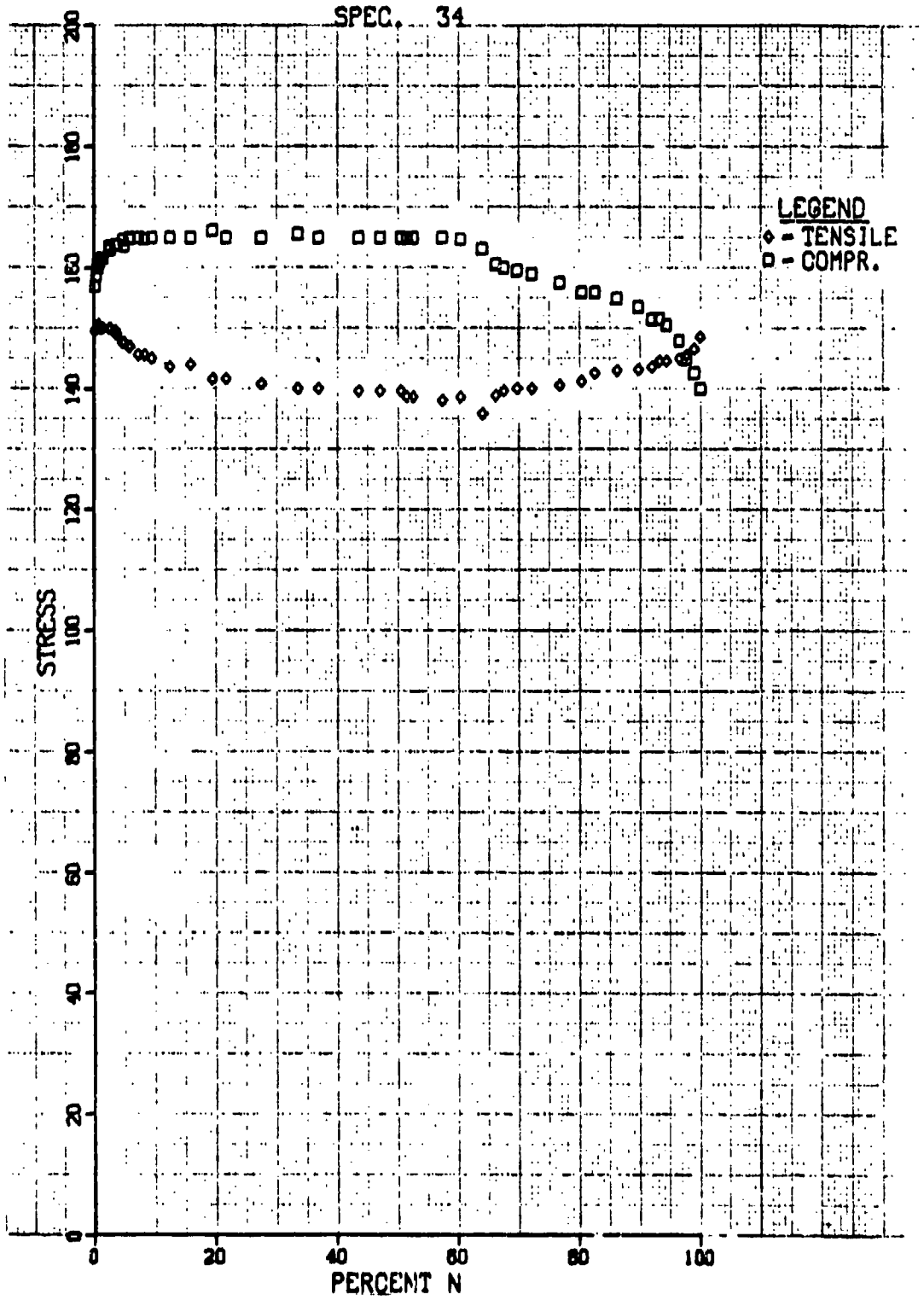

SPEC. 34
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 23.

## SECTION 8

## RENE 95 SLOW-FAST AND FAST-SLOW TESTS

This section is composed of data from the slow-fast and fast-slow tests conducted using René 95. These data are presented in Tables 18 through 22 and Figures 24 through 31.

TABLE 18

SPECIMEN 251

| I | J | XN | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .15 | 166. | 0.0 | 173. | 0.0 |
| 2 | 2. | .31 | 165. | 0.0 | 175. | 0.0 |
| 3 | 3. | .47 | 165. | 0.0 | 176. | 0.0 |
| 4 | 4. | .63 | 165. | 0.0 | 177. | 0.0 |
| 5 | 5. | .79 | 165. | 0.0 | 176. | 0.0 |
| 6 | 6. | .94 | 165. | 0.0 | 176. | 0.0 |
| 7 | 7. | 1.10 | 165. | 0.0 | 176. | 0.0 |
| 8 | 8. | 1.25 | 166. | 0.0 | 179. | 0.0 |
| 9 | 9. | 1.41 | 163. | 0.0 | 174. | 0.0 |
| 10 | 10. | 1.57 | 164. | 0.0 | 177. | 0.0 |
| 11 | 11. | 1.72 | 165. | 0.0 | 177. | 0.0 |
| 12 | 12. | 1.88 | 165. | 0.0 | 174. | 0.0 |
| 13 | 13. | 2.04 | 163. | 0.0 | 178. | 0.0 |
| 14 | 14. | 2.19 | 164. | 0.0 | 178. | 0.0 |
| 15 | 16. | 2.51 | 165. | 0.0 | 177. | 0.0 |
| 16 | 17. | 2.66 | 165. | 0.0 | 180. | 0.0 |
| 17 | 18. | 2.82 | 163. | 0.0 | 178. | 0.0 |
| 18 | 19. | 2.98 | 164. | 0.0 | 178. | 0.0 |
| 19 | 21. | 3.29 | 165. | 0.0 | 179. | 0.0 |
| 20 | 22. | 3.45 | 164. | 0.0 | 177. | 0.0 |
| 21 | 23. | 3.61 | 165. | 0.0 | 177. | 0.0 |
| 22 | 25. | 3.92 | 165. | 0.0 | 178. | 0.0 |
| 23 | 26. | 4.08 | 164. | 0.0 | 180. | 0.0 |
| 24 | 27. | 4.23 | 162. | 0.0 | 178. | 0.0 |
| 25 | 28. | 4.39 | 164. | 0.0 | 178. | 0.0 |
| 26 | 29. | 4.55 | 164. | 0.0 | 180. | 0.0 |
| 27 | 30. | 4.70 | 163. | 0.0 | 178. | 0.0 |
| 28 | 38. | 6.11 | 164. | 0.0 | 181. | 0.0 |
| 29 | 40. | 6.27 | 161. | 0.0 | 180. | 0.0 |
| 30 | 50. | 7.04 | 163. | 0.0 | 178. | 0.0 |
| 31 | 55. | 8.62 | 163. | 0.0 | 181. | 0.0 |
| 32 | 56. | 8.78 | 161. | 0.0 | 179. | 0.0 |
| 33 | 58. | 9.09 | 164. | 0.0 | 179. | 0.0 |
| 34 | 60. | 9.40 | 161. | 0.0 | 179. | 0.0 |
| 35 | 64. | 10.03 | 163. | 0.0 | 179. | 0.0 |
| 36 | 66. | 10.34 | 160. | 0.0 | 178. | 0.0 |
| 37 | 67. | 10.50 | 163. | 0.0 | 179. | 0.0 |
| 38 | 69. | 10.82 | 160. | 0.0 | 179. | 0.0 |
| 39 | 80. | 12.54 | 163. | 0.0 | 180. | 0.0 |
| 40 | 82. | 12.85 | 160. | 0.0 | 179. | 0.0 |
| 41 | 90. | 14.11 | 163. | 0.0 | 180. | 0.0 |

Table continued on following page.

TABLE 18 Continued

SPECIMEN 251

| I | J | XN | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 42 | 92. | 14.42 | 160. | 0.0 | 180. | 0.0 |
| 43 | 99. | 15.52 | 161. | 0.0 | 178. | 0.0 |
| 44 | 101. | 15.83 | 162. | 0.0 | 180. | 0.0 |
| 45 | 115. | 18.03 | 159. | 0.0 | 179. | 0.0 |
| 46 | 117. | 18.34 | 160. | 0.0 | 181. | 0.0 |
| 47 | 134. | 21.00 | 161. | 0.0 | 180. | 0.0 |
| 48 | 180. | 28.21 | 159. | 0.0 | 178. | 0.0 |
| 49 | 220. | 34.48 | 159. | 0.0 | 179. | 0.0 |
| 50 | 259. | 40.60 | 159. | 0.0 | 179. | 0.0 |
| 51 | 285. | 44.67 | 160. | 0.0 | 175. | 0.0 |
| 52 | 300. | 47.02 | 159. | 0.0 | 179. | 0.0 |
| 53 | 320. | 50.15 | 160. | 0.0 | 176. | 0.0 |
| 54 | 345. | 54.08 | 160. | 0.0 | 177. | 0.0 |
| 55 | 370. | 57.99 | 160. | 0.0 | 177. | 0.0 |
| 56 | 400. | 62.70 | 160. | 0.0 | 177. | 0.0 |
| 57 | 423. | 66.30 | 159. | 0.0 | 178. | 0.0 |
| 58 | 435. | 68.18 | 160. | 0.0 | 176. | 0.0 |
| 59 | 446. | 69.91 | 160. | 0.0 | 176. | 0.0 |
| 60 | 470. | 73.67 | 160. | 0.0 | 176. | 0.0 |
| 61 | 495. | 77.59 | 160. | 0.0 | 176. | 0.0 |
| 62 | 510. | 79.94 | 160. | 0.0 | 176. | 0.0 |
| 63 | 530. | 83.07 | 160. | 0.0 | 176. | 0.0 |
| 64 | 545. | 85.42 | 161. | 0.0 | 176. | 0.0 |
| 65 | 560. | 87.77 | 160. | 0.0 | 176. | 0.0 |
| 66 | 570. | 89.34 | 160. | 0.0 | 177. | 0.0 |
| 67 | 575. | 90.13 | 160. | 0.0 | 179. | 0.0 |
| 68 | 585. | 91.69 | 160. | 0.0 | 178. | 0.0 |
| 69 | 595. | 93.26 | 161. | 0.0 | 179. | 0.0 |
| 70 | 600. | 94.04 | 161. | 0.0 | 179. | 0.0 |
| 71 | 605. | 94.83 | 161. | 0.0 | 180. | 0.0 |
| 72 | 610. | 95.61 | 162. | 0.0 | 180. | 0.0 |
| 73 | 615. | 96.39 | 161. | 0.0 | 180. | 0.0 |
| 74 | 620. | 97.18 | 161. | 0.0 | 181. | 0.0 |
| 75 | 627. | 98.28 | 161. | 0.0 | 182. | 0.0 |
| 76 | 632. | 99.06 | 161. | 0.0 | 184. | 0.0 |
| 77 | 635. | 99.53 | 161. | 0.0 | 185. | 0.0 |
| 78 | 637. | 99.84 | 161. | 0.0 | 188. | 0.0 |
| 79 | 638. | | 160. | 0.0 | 190. | 0.0 |

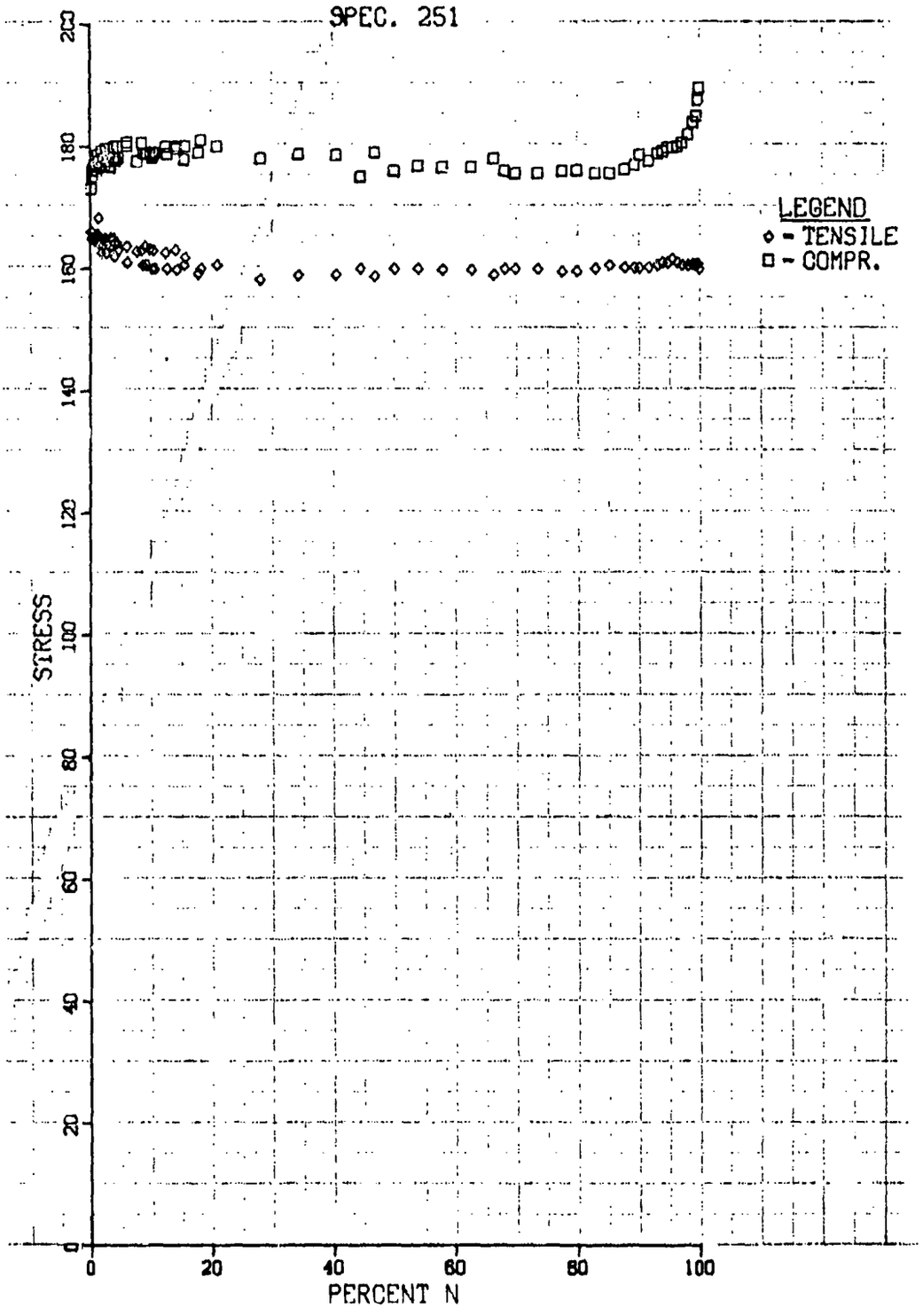

SPEC. 251
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 24.

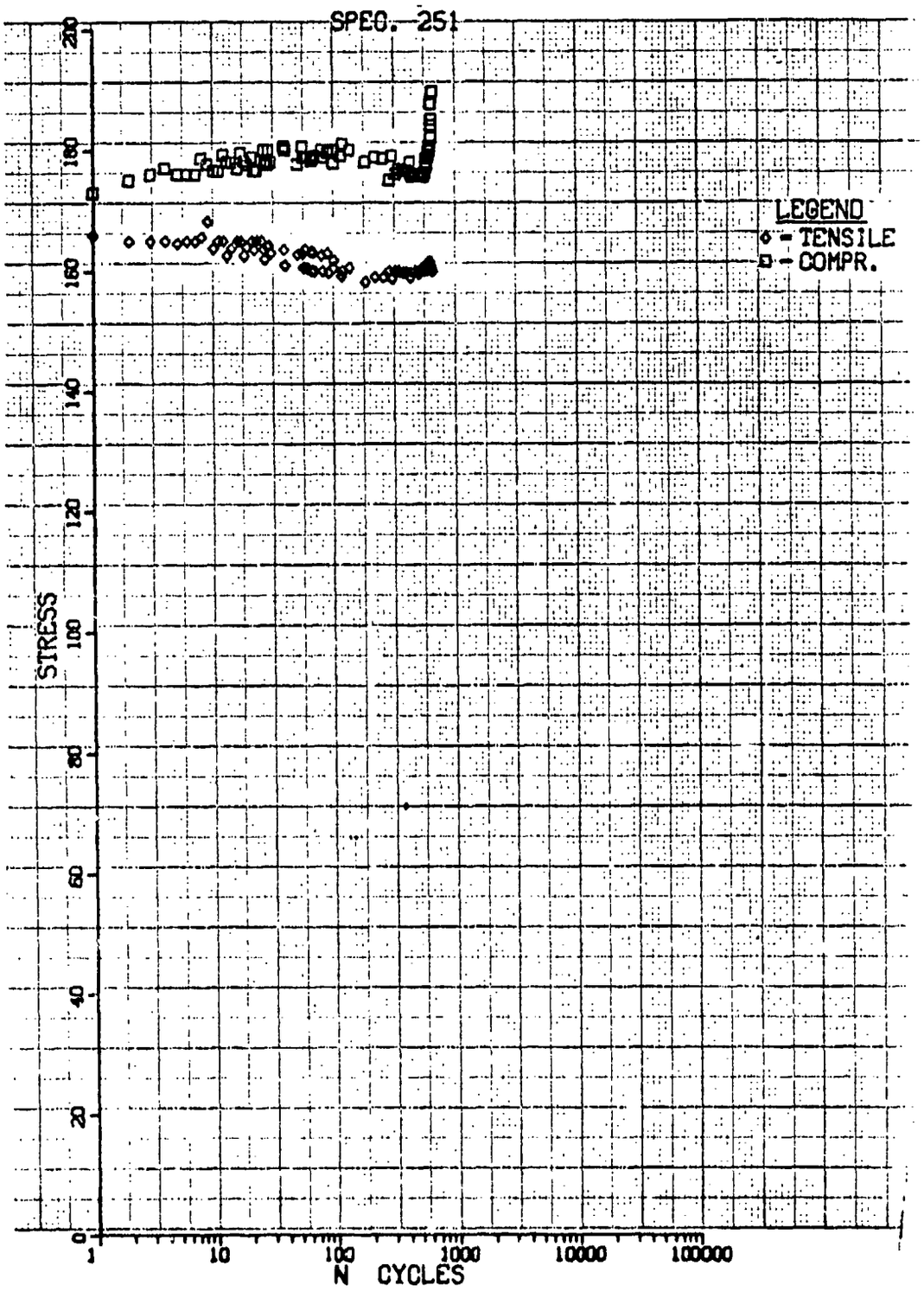

SPEC. 251
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 25.

TABLE 19

SPECIMEN 262

| I | N | %N | STRESSES TENSILE | RELAXED[1] | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 143. | 73.8 | 151. | 0.0 |
| 2 | 2. | 0. | 144. | 78.8 | 150. | 0.0 |
| 3 | 3. | 0. | 144. | 76.3 | 150. | 0.0 |
| 4 | 10. | 1. | 140. | 77.5 | 154. | 0.0 |
| 5 | 20. | 2. | 141. | 78.8 | 154. | 0.0 |
| 6 | 40. | 4. | 140. | 77.5 | 153. | 0.0 |
| 7 | 88. | 8. | 138. | 76.3 | 156. | 0.0 |
| 8 | 120. | 11. | 140. | 77.5 | 153. | 0.0 |
| 9 | 413. | 38. | 145. | 80.0 | 148. | 0.0 |
| 10 | 160. | 15. | 143. | 80.0 | 150. | 0.0 |
| 11 | 455. | 42. | 141. | 78.8 | 150. | 0.0 |
| 12 | 545. | 50. | 143. | 75.0 | 149. | 0.0 |
| 13 | 620. | 57. | 145. | 78.8 | 148. | 0.0 |
| 14 | 903. | 83. | 143. | 77.5 | 145. | 0.0 |
| 15 | 1006. | 93. | 140. | 77.5 | 145. | 0.0 |
| 16 | 1035. | 95. | 138. | 75.0 | 145. | 0.0 |
| 17 | 1048. | 97. | 135. | 75.0 | 148. | 0.0 |
| 18 | 1071. | 99. | 128. | 72.5 | 145. | 0.0 |
| 19 | 1083. | 100. | 123. | 75.0 | 150. | 0.0 |
| 20 | 1084. | 100. | 120. | 72.5 | 151. | 0.0 |
| 21 | 1085. | 100. | 118. | 75.0 | | 0.0 |

[1]Tensile stress minus the relaxed stress is equal to the stress at which the rate change was made.

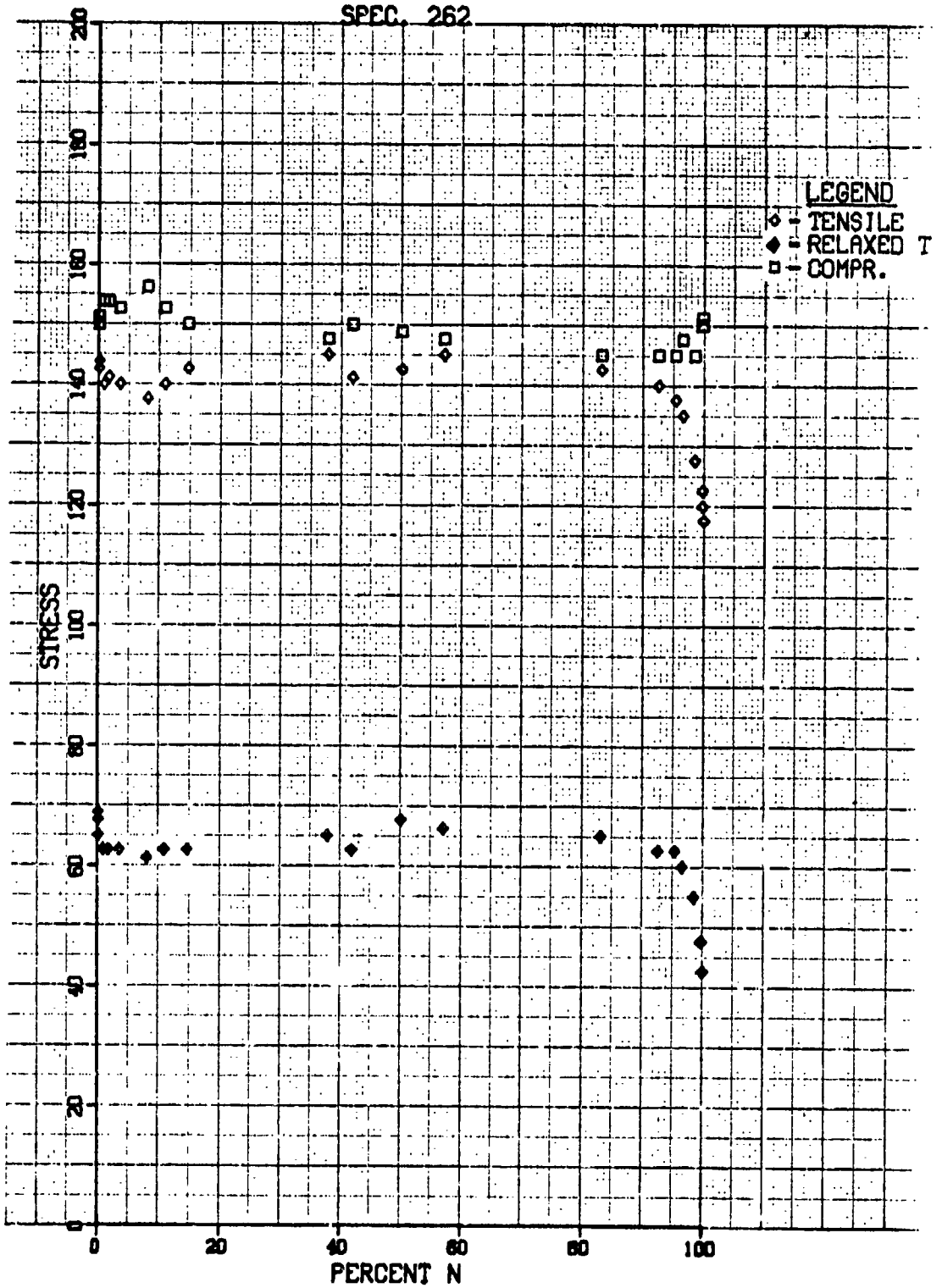

SPEC. 262
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 26.

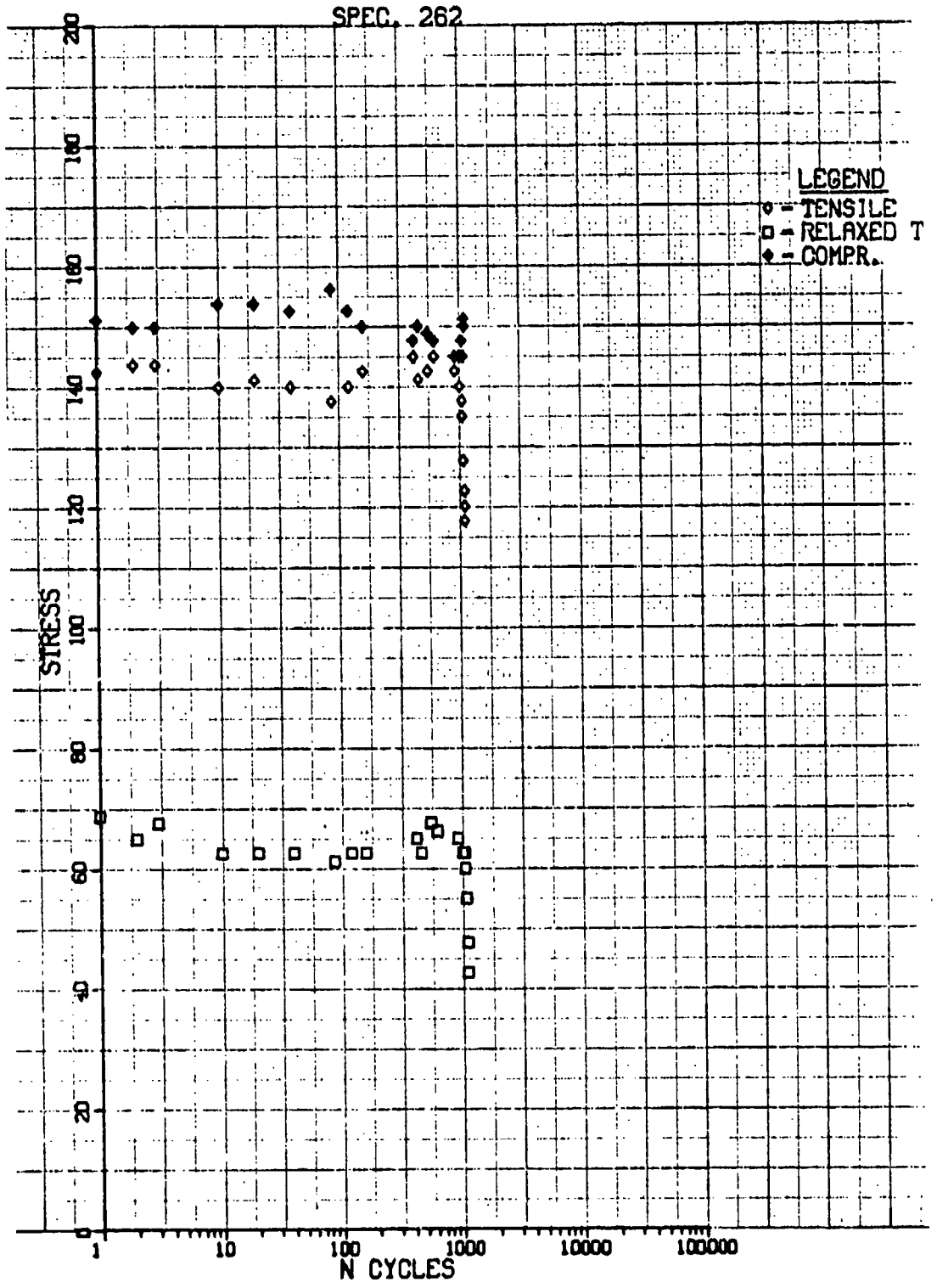

SPEC. 262
LEGEND
◊ - TENSILE
□ - RELAXED T
◆ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 27.

TABLE 20

SPECIMEN 252

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .52 | 170. | 0.0 | 178. | 0.0 |
| 2 | 2. | 1.03 | 169. | 0.0 | 176. | 0.0 |
| 3 | 3. | 1.55 | 169. | 0.0 | 176. | 0.0 |
| 4 | 4. | 2.06 | 169. | 0.0 | 176. | 0.0 |
| 5 | 5. | 2.58 | 168. | 0.0 | 177. | 0.0 |
| 6 | 6. | 3.09 | 169. | 0.0 | 177. | 0.0 |
| 7 | 7. | 3.61 | 169. | 0.0 | 175. | 0.0 |
| 8 | 8. | 4.12 | 170. | 0.0 | 175. | 0.0 |
| 9 | 9. | 4.64 | 169. | 0.0 | 175. | 0.0 |
| 10 | 10. | 5.15 | 170. | 0.0 | 175. | 0.0 |
| 11 | 15. | 7.73 | 170. | 0.0 | 174. | 0.0 |
| 12 | 25. | 12.89 | 170. | 0.0 | 174. | 0.0 |
| 13 | 40. | 20.62 | 168. | 0.0 | 175. | 0.0 |
| 14 | 55. | 28.35 | 168. | 0.0 | 175. | 0.0 |
| 15 | 65. | 33.51 | 167. | 0.0 | 175. | 0.0 |
| 16 | 85. | 43.81 | 166. | 0.0 | 175. | 0.0 |
| 17 | 95. | 48.97 | 166. | 0.0 | 175. | 0.0 |
| 18 | 116. | 59.79 | 164. | 0.0 | 176. | 0.0 |
| 19 | 130. | 67.01 | 164. | 0.0 | 176. | 0.0 |
| 20 | 145. | 74.74 | 163. | 0.0 | 176. | 0.0 |
| 21 | 160. | 82.47 | 162. | 0.0 | 176. | 0.0 |
| 22 | 170. | 87.63 | 161. | 0.0 | 176. | 0.0 |
| 23 | 180. | 92.78 | 160. | 0.0 | 176. | 0.0 |
| 24 | 185. | 95.36 | 159. | 0.0 | 176. | 0.0 |
| 25 | 188. | 96.91 | 157. | 0.0 | 176. | 0.0 |
| 26 | 190. | 97.94 | 155. | 0.0 | 177. | 0.0 |
| 27 | 193. | 99.48 | 152. | 0.0 | 178. | 0.0 |
| 28 | 194. | 100.00 | 142. | 0.0 | 178. | 0.0 |

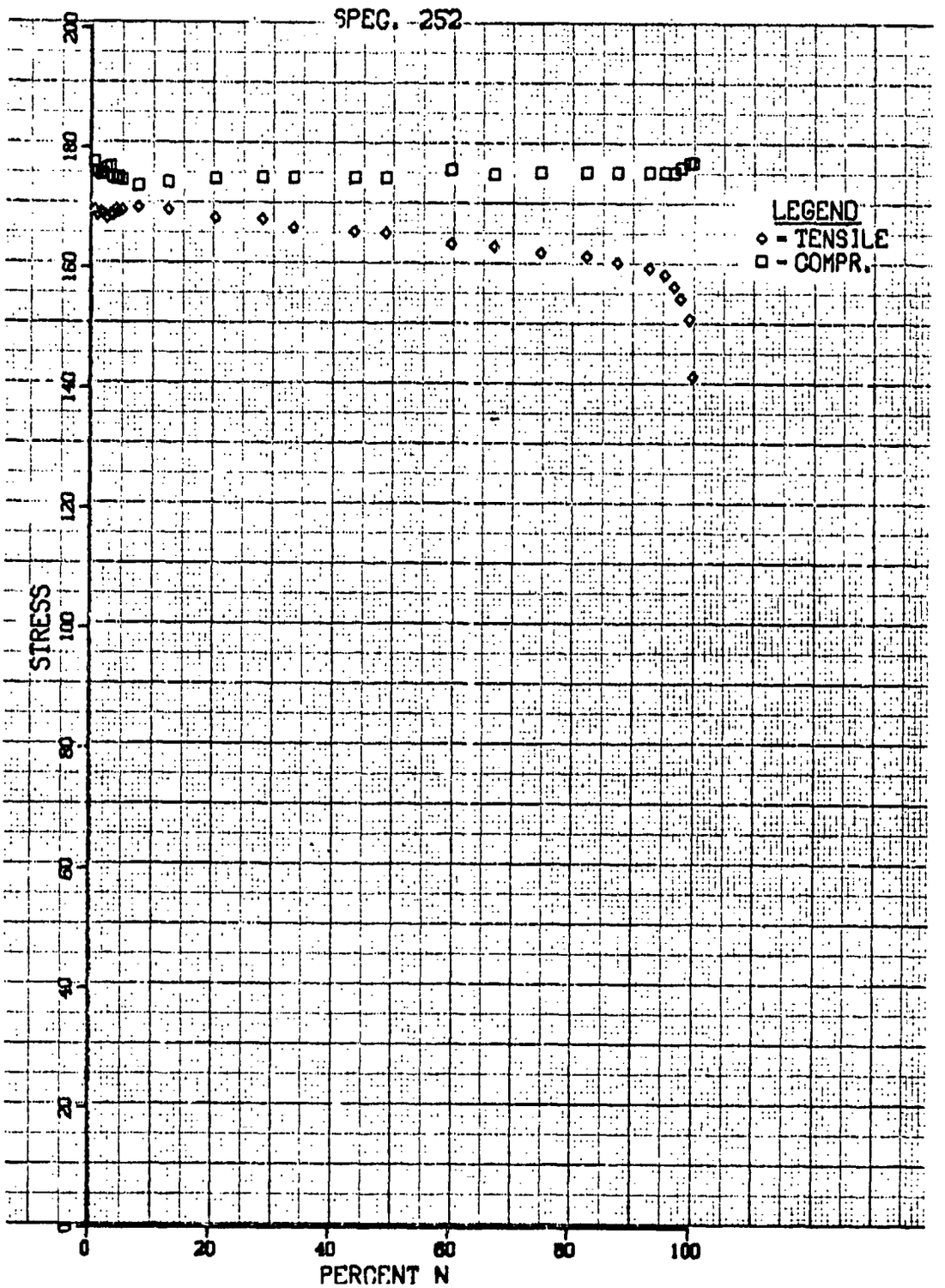

SPEC. 252
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 28.

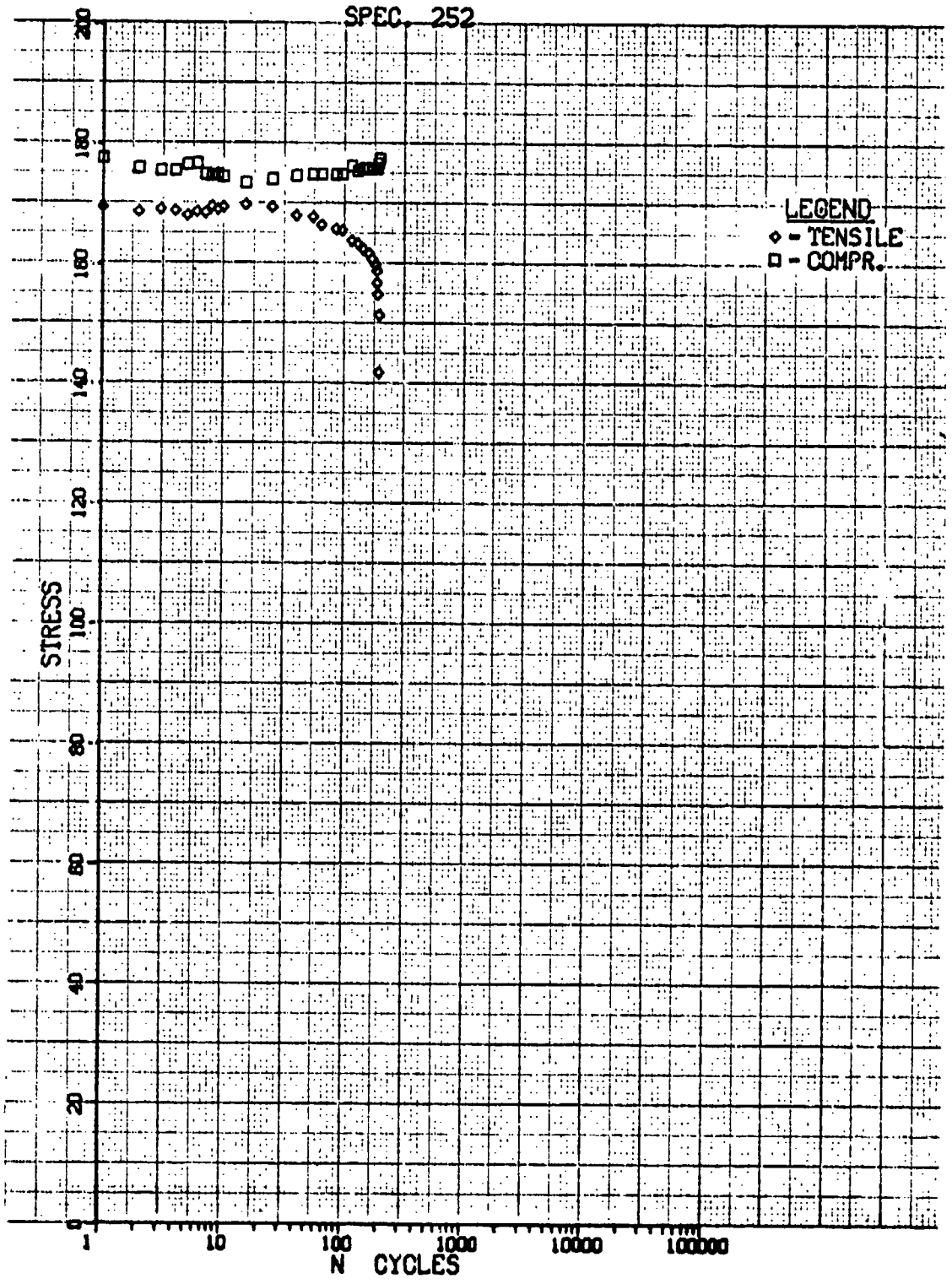

SPEC. 252
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 29.

TABLE 21

SPECIMEN 263[2]

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD[1] COMPR. |
|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 120. | 0. | 0.0 | 118. | 58. |
| 2 | 2. | 0. | 121. | 0. | 0.0 | 119. | 59. |
| 3 | 3. | 1. | 121. | 0. | 0.0 | 119. | 59. |
| 4 | 10. | 2. | 120. | 0. | 0.0 | 120. | 60. |
| 5 | 13. | 3. | 118. | 0. | 0.0 | 122. | 62. |
| 6 | 17. | 3. | 116. | 0. | 0.0 | 124. | 64. |
| 7 | 54. | 10. | 120. | 0. | 0.0 | 121. | 62. |
| 8 | 66. | 13. | 122. | 0. | 0.0 | 119. | 58. |
| 9 | 74. | 14. | 124. | 0. | 0.0 | 117. | 56. |
| 10 | 93. | 18. | 123. | 0. | 0.0 | 118. | 58. |
| 11 | 94. | 18. | 111. | 0. | 0.0 | 129. | 70. |
| 12 | 95. | 18. | 112. | 0. | 0.0 | 129. | 66. |
| 13 | 96. | 18. | 112. | 0. | 0.0 | 128. | 64. |
| 14 | 150. | 29. | 116. | 0. | 0.0 | 124. | 64. |
| 15 | 200. | 38. | 111. | 0. | 0.0 | 130. | 70. |
| 16 | 210. | 40. | 110. | 0. | 0.0 | 130. | 70. |
| 17 | 220. | 42. | 109. | 0. | 0.0 | 132. | 71. |
| 18 | 240. | 46. | 108. | 0. | 0.0 | 133. | 73. |
| 19 | 250. | 48. | 111. | 0. | 0.0 | 130. | 70. |
| 20 | 265. | 51. | 114. | 0. | 0.0 | 127. | 68. |
| 21 | 277. | 53. | 114. | 0. | 0.0 | 127. | 68. |
| 22 | 283. | 54. | 162. | 0. | 0.0 | 165. | |
| 23 | 288. | 55. | 164. | 0. | 0.0 | 166. | |
| 24 | 307. | 59. | 164. | 0. | 0.0 | 167. | |
| 25 | 332. | 64. | 162. | 0. | 0.0 | 169. | |
| 26 | 347. | 67. | 160. | 0. | 0.0 | 171. | |
| 27 | 417. | 80. | 160. | 0. | 0.0 | 170. | |
| 28 | 431. | 83. | 160. | 0. | 0.0 | 168. | |
| 29 | 438. | 84. | 159. | 0. | 0.0 | 169. | |
| 30 | 442. | 85. | 160. | 0. | 0.0 | 168. | |
| 31 | 497. | 96. | 162. | 0. | 0.0 | 164. | |
| 32 | 519. | 100. | 168. | 0. | 0.0 | 156. | |
| 33 | 525. | 101. | 168. | 0. | 0.0 | 155. | |

[1] This stress is the compressive stress at which the rate change was made.

[2] Two different histories were imposed on this specimen. Everything above the dashed line was a 0.05-½-20 cpm test at a total strain-range of 0.97%. Everything below the dashed line was a 0.05-20 cpm test at a total strain-range of 1.4%. This condition was run until failure.

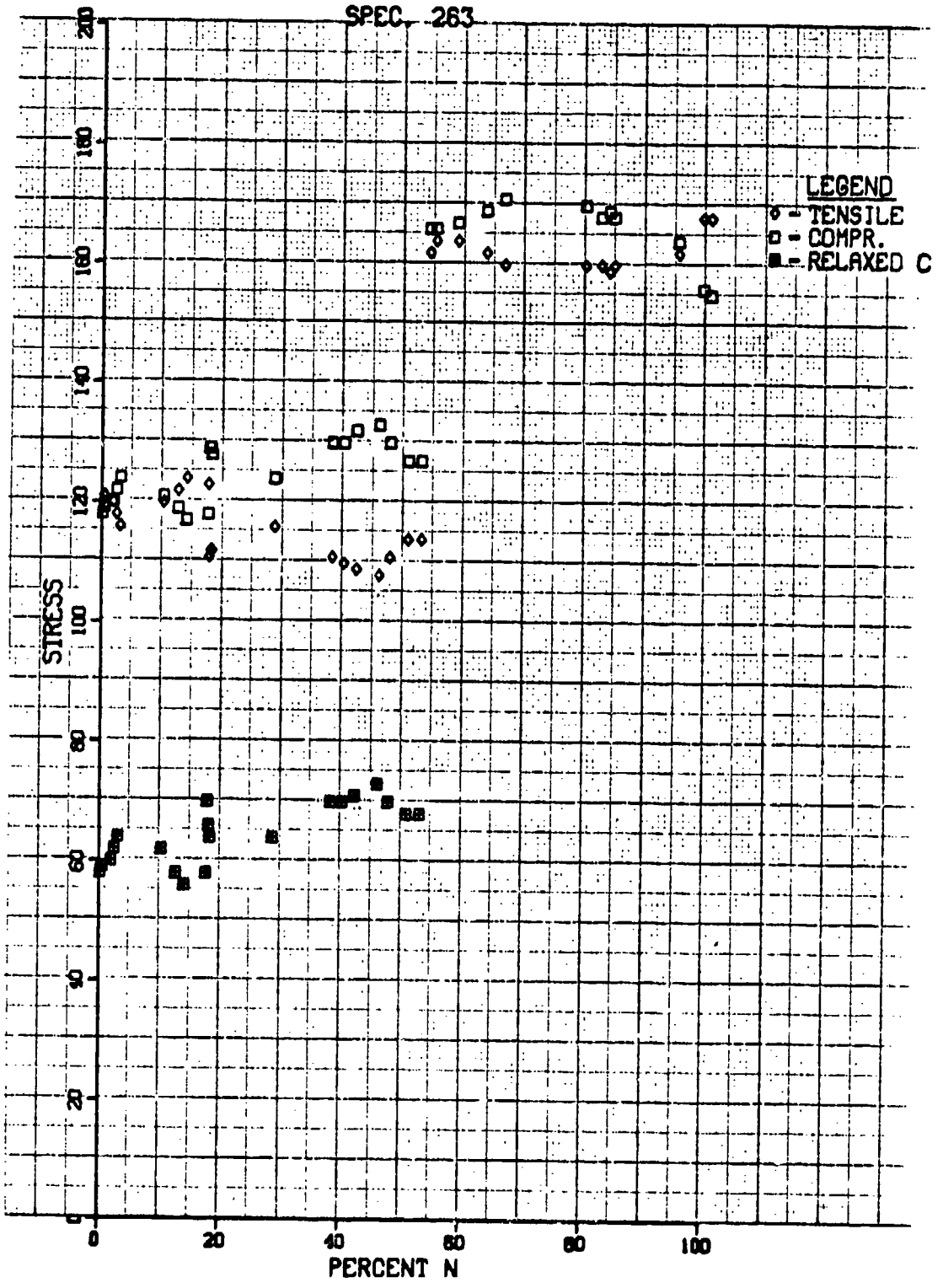

SPEC. 263
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
PERCENT N

Figure 30.

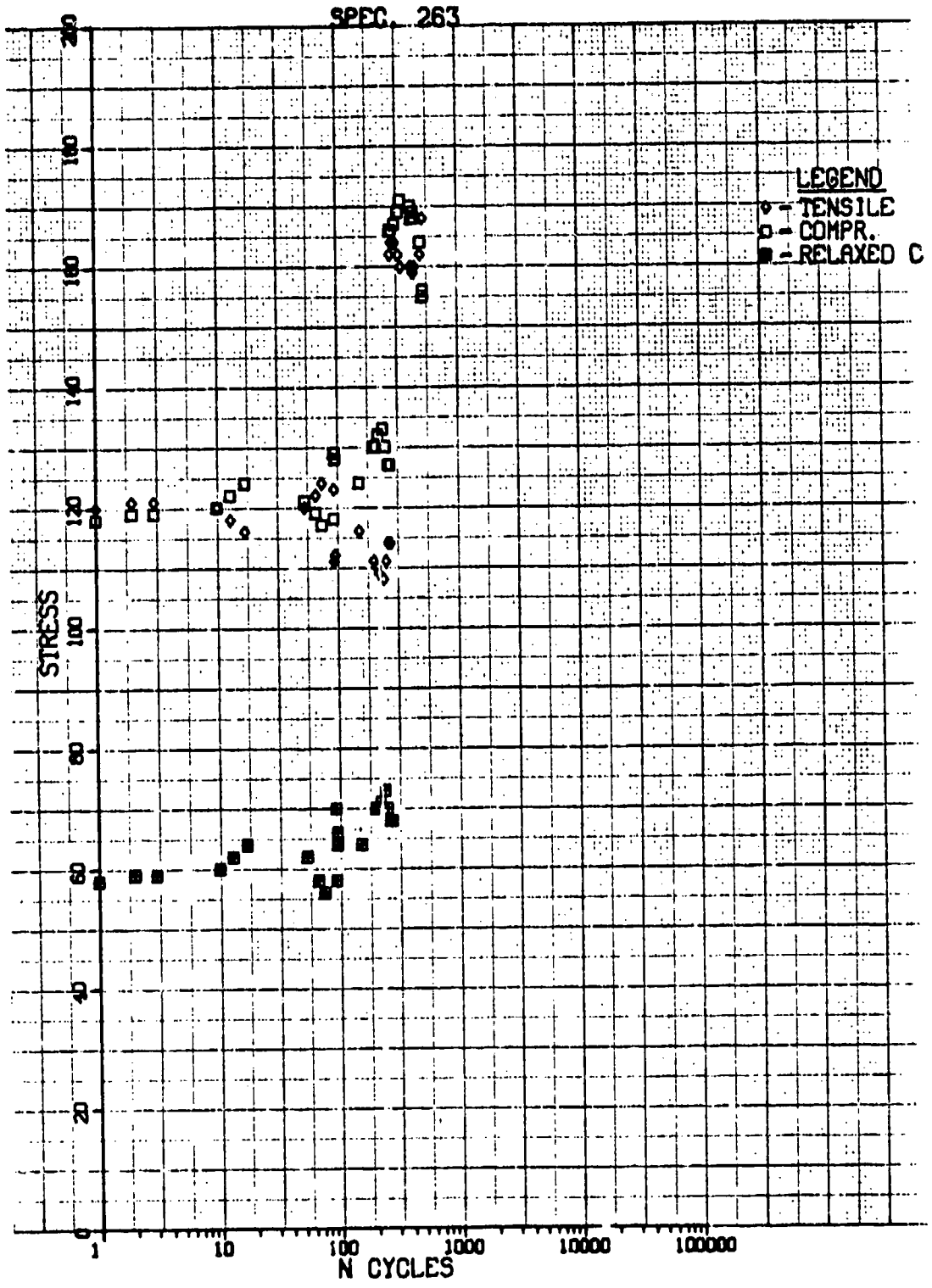

SPEC. 263
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 31.

TABLE 22

SPECIMEN 257[1]

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD[2] COMPR. | RELAXED COMPR. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 119. | 0. | 0.0 | 117. | 91. | 91.3 |
| 2 | 2. | 0. | 117. | 0. | 0.0 | 122. | 98. | 98.3 |
| 3 | 3. | 0. | 117. | 0. | 0.0 | 125. | 59. | 58.5 |
| 4 | 4. | 0. | 117. | 0. | 0.0 | 117. | 56. | 56.2 |
| 5 | 5. | 0. | 117. | 0. | 0.0 | 119. | 56. | 56.2 |
| 6 | 6. | 0. | 117. | 0. | 0.0 | 125. | 59. | 58.5 |
| 7 | 3. | 0. | 115. | 0. | 0.0 | 122. | 59. | 58.5 |
| 8 | 142. | 3. | 122. | 0. | 0.0 | 117. | 54. | 53.8 |
| 9 | 240. | 5. | 126. | 0. | 0.0 | 112. | 49. | 49.1 |
| 10 | 244. | 5. | 122. | 0. | 0.0 | 117. | 54. | 53.8 |
| 11 | 478. | 9. | 126. | 0. | 0.0 | 112. | 49. | 49.1 |
| 12 | 481. | 9. | 122. | 0. | 0.0 | 117. | 54. | 53.8 |
| 13 | 483. | 9. | 126. | 0. | 0.0 | 112. | 49. | 49.1 |
| 14 | 570. | 11. | 131. | 0. | 0.0 | 105. | 42. | 42.1 |
| 15 | 544. | 10. | 129. | 0. | 0.0 | 105. | 47. | 46.8 |
| 16 | 612. | 12. | 136. | 0. | 0.0 | 103. | 40. | 39.8 |
| 17 | 660. | 12. | 143. | 0. | 0.0 | 95. | 30. | 30.4 |
| 18 | 661. | 13. | 136. | 0. | 0.0 | 103. | 40. | 39.8 |
| 19 | 670. | 13. | 131. | 0. | 0.0 | 110. | 44. | 44.5 |
| 20 | 673. | 13. | 133. | 0. | 0.0 | 105. | 42. | 42.1 |
| 21 | 700. | 13. | 131. | 0. | 0.0 | 117. | 44. | 44.5 |
| 22 | 730. | 14. | 133. | 0. | 0.0 | 105. | 42. | 42.1 |
| 23 | 801. | 15. | 133. | 0. | 0.0 | 105. | 40. | 39.8 |
| 24 | 1413. | 27. | 140. | 0. | 0.0 | 101. | 35. | 35.1 |
| 25 | 1417. | 27. | 140. | 0. | 0.0 | 95. | 35. | 35.1 |
| 26 | 2610. | 49. | 143. | 0. | 0.0 | 94. | 30. | 30.4 |
| 27 | 2650. | 50. | 145. | 0. | 0.0 | 94. | 30. | 30.4 |
| 28 | 2654. | 50. | 75. | 0. | 0.0 | 75. | 30. | 30.4 |
| 29 | 2655. | 50. | 105. | 0. | 0.0 | 87. | 28. | 28.1 |
| 30 | 2656. | 50. | 119. | 0. | 0.0 | 87. | 23. | 23.4 |
| 31 | 2657. | 50. | 126. | 0. | 0.0 | 91. | 26. | 25.7 |
| 32 | 2658. | 50. | 131. | 0. | 0.0 | 91. | 26. | 25.7 |
| 33 | 2659. | 50. | 133. | 0. | 0.0 | 81. | 23. | 23.4 |
| 34 | 2660. | 50. | 133. | 0. | 0.0 | 83. | 23. | 23.4 |
| 35 | 2661. | 50. | 133. | 0. | 0.0 | 81. | 21. | 21.1 |
| 36 | 2662. | 50. | 136. | 0. | 0.0 | 87. | 21. | 21.1 |
| 37 | 2663. | 50. | 136. | 0. | 0.0 | 87. | 21. | 21.1 |
| 38 | 2673. | 51. | 133. | 0. | 0.0 | 87. | 21. | 21.1 |
| 39 | 2845. | 54. | 138. | 0. | 0.0 | 84. | 19. | 18.7 |
| 40 | 2855. | 54. | 136. | 0. | 0.0 | 84. | 19. | 18.7 |
| 41 | 2865. | 55. | 140. | 0. | 0.0 | 82. | 16. | 16.4 |
| 42 | 2866. | 55. | 138. | 0. | 0.0 | 84. | 19. | 18.7 |
| 43 | 3254. | 62. | 140. | 0. | 0.0 | 82. | 16. | 16.4 |
| 44 | 3304. | 62. | 138. | 0. | 0.0 | 84. | 16. | 16.4 |
| 45 | 3404. | 64. | 138. | 0. | 0.0 | 84. | 16. | 16.4 |
| 46 | 3929. | 74. | 136. | 0. | 0.0 | 87. | 21. | 21.1 |
| 47 | 3935. | 74. | 136. | 0. | 0.0 | 87. | 21. | 21.1 |
| 48 | 3936. | 74. | 131. | 0. | 0.0 | 83. | 21. | 21.1 |
| 49 | 3941. | 75. | 136. | 0. | 0.0 | 91. | 19. | 18.7 |
| 50 | 4074. | 77. | 129. | 0. | 0.0 | 94. | 26. | 25.7 |
| 51 | 4075. | 77. | 133. | 0. | 0.0 | 84. | 21. | 21.1 |
| 52 | 4229. | 80. | 133. | 0. | 0.0 | 87. | 21. | 21.1 |
| 53 | 4230. | 80. | 126. | 0. | 0.0 | 94. | 26. | 25.7 |
| 54 | 4231. | 80. | 133. | 0. | 0.0 | 89. | 21. | 21.1 |
| 55 | 4234. | 81. | 131. | 0. | 0.0 | | 26. | 25.7 |
| 56 | 4364. | 83. | 131. | 0. | 0.0 | 91. | 23. | 23.4 |
| 57 | 4393. | 83. | 129. | 0. | 0.0 | 91. | 26. | 25.7 |
| 58 | 4397. | 83. | 131. | 0. | 0.0 | 89. | 23. | 23.4 |
| 59 | 4654. | 88. | 129. | 0. | 0.0 | 91. | 26. | 25.7 |
| 60 | 4659. | 88. | 131. | 0. | 0.0 | 89. | 23. | 23.4 |
| 61 | 5288. | 100. | 131. | 0. | 0.0 | 89. | 23. | 23.4 |

[1]All the stresses below the dashed line should be multiplied by 1.068 to obtain the correct value.

[2]This is the compressive stress at which the rate change was made.

## SECTION 9

## RENÉ 95 TENSILE-ONLY STRAIN-HOLD TESTS

Data from tensile-only strain-hold tests on René 95 are presented in Tables 23 through 37 and Figures 32 through 57. The hold periods were for one and ten minutes at the peak tensile strain and for one minute at a tensile strain between the zero and peak strain levels.

TABLE 23

SPECIMEN 5

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 168. | 11.3 | 180. | 0.0 |
| 2 | 2. | 1. | 169. | 18.8 | 181. | 0.0 |
| 3 | 3. | 1. | 170. | 20.0 | 183. | 0.0 |
| 4 | 4. | 2. | 170. | 22.5 | 183. | 0.0 |
| 5 | 6. | 2. | 170. | 21.3 | 185. | 0.0 |
| 6 | 12. | 5. | 170. | 25.0 | 186. | 0.0 |
| 7 | 17. | 7. | 170. | 25.0 | 188. | 0.0 |
| 8 | 25. | 10. | 169. | 23.8 | 188. | 0.0 |
| 9 | 33. | 13. | 168. | 22.5 | 189. | 0.0 |
| 10 | 39. | 15. | 166. | 23.8 | 190. | 0.0 |
| 11 | 40. | 16. | 166. | 21.3 | 189. | 0.0 |
| 12 | 55. | 22. | 165. | 18.8 | 189. | 0.0 |
| 13 | 82. | 32. | 165. | 22.5 | 189. | 0.0 |
| 14 | 85. | 33. | 164. | 22.5 | 188. | 0.0 |
| 15 | 97. | 38. | 163. | 20.0 | 188. | 0.0 |
| 16 | 113. | 44. | 161. | 21.3 | 188. | 0.0 |
| 17 | 131. | 51. | 160. | 16.3 | 186. | 0.0 |
| 18 | 132. | 52. | 160. | 20.0 | 186. | 0.0 |
| 19 | 158. | 62. | 160. | 22.5 | 188. | 0.0 |
| 20 | 160. | 63. | 160. | 20.0 | 186. | 0.0 |
| 21 | 170. | 67. | 159. | 20.0 | 188. | 0.0 |
| 22 | 180. | 71. | 158. | 20.0 | 186. | 0.0 |
| 23 | 197. | 77. | 156. | 18.8 | 186. | 0.0 |
| 24 | 204. | 80. | 155. | 17.5 | 186. | 0.0 |
| 25 | 206. | 81. | 156. | 16.3 | 184. | 0.0 |
| 26 | 207. | 81. | 158. | 20.0 | 185. | 0.0 |
| 27 | 215. | 84. | 156. | 20.0 | 185. | 0.0 |
| 28 | 219. | 86. | 155. | 20.0 | 186. | 0.0 |
| 29 | 238. | 93. | 154. | 18.8 | 185. | 0.0 |
| 30 | 240. | 94. | 153. | 18.5 | 185. | 0.0 |
| 31 | 246. | 96. | 151. | 21.3 | 185. | 0.0 |
| 32 | 254. | 100. | 151. | 20.0 | 184. | 0.0 |

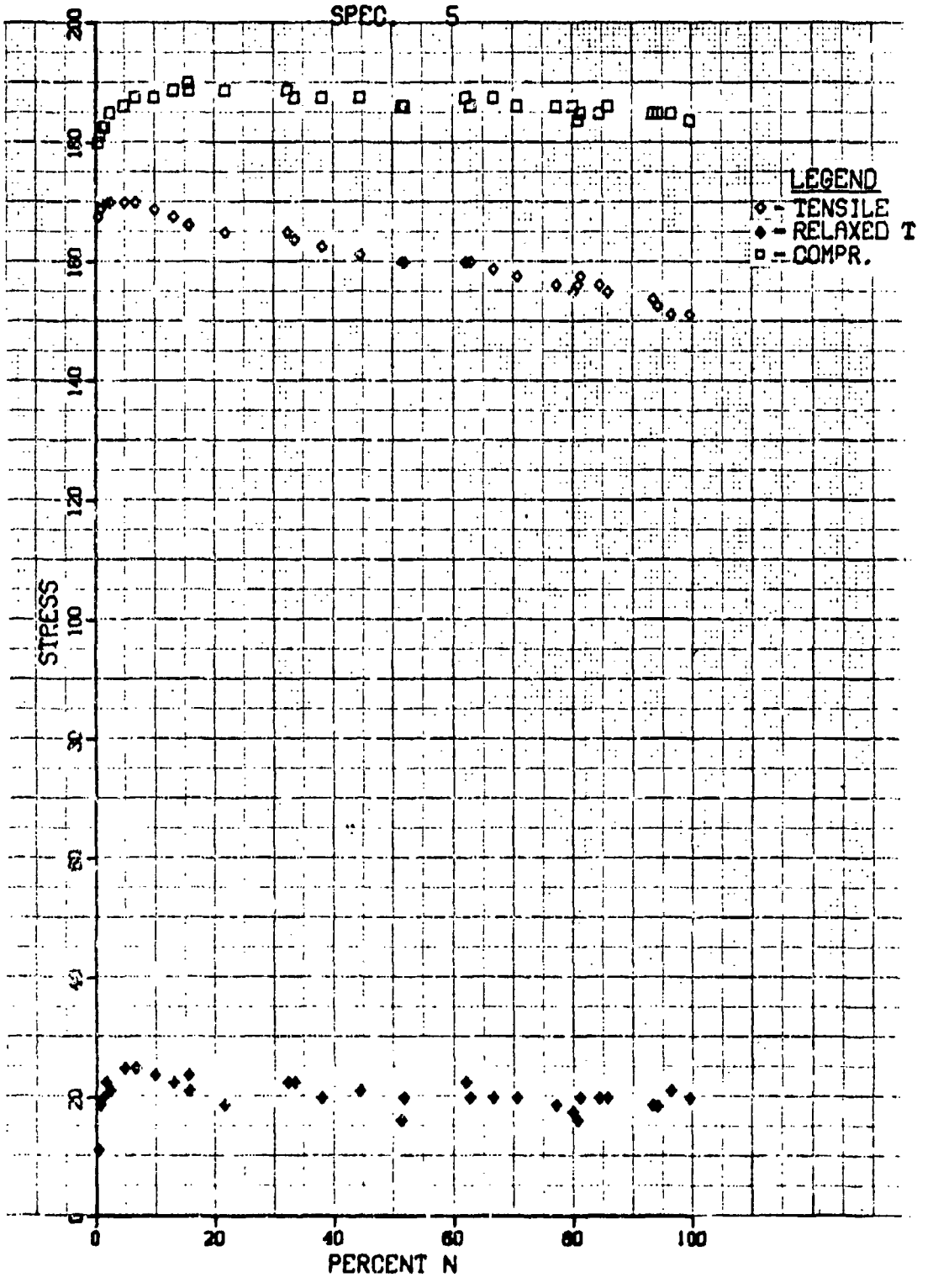

SPEC. 5
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 32.

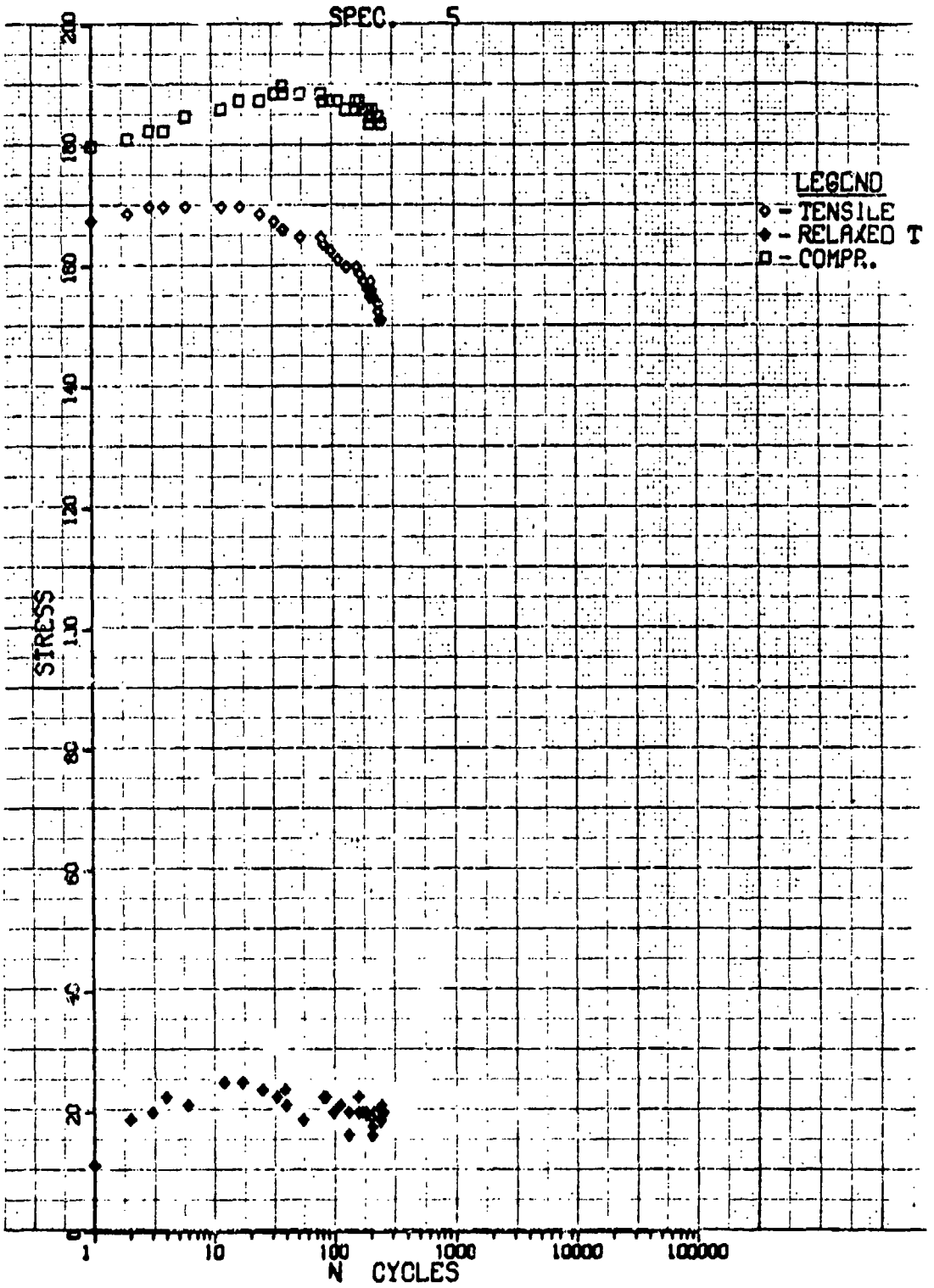

SPEC. 5
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 33.

TABLE 24

SPECIMEN 10

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 175. | 7.5 | 181. | 0.0 |
| 2 | 2. | 1. | 173. | 7.5 | 185. | 0.0 |
| 3 | 3. | 1. | 173. | 7.5 | 185. | 0.0 |
| 4 | 5. | 2. | 173. | 8.8 | 186. | 0.0 |
| 5 | 8. | 3. | 173. | 10.0 | 189. | 0.0 |
| 6 | 10. | 4. | 173. | 10.0 | 190. | 0.0 |
| 7 | 15. | 6. | 173. | 11.3 | 190. | 0.0 |
| 8 | 25. | 10. | 171. | 11.3 | 190. | 0.0 |
| 9 | 30. | 12. | 170. | 10.0 | 191. | 0.0 |
| 10 | 40. | 16. | 170. | 11.3 | 191. | 0.0 |
| 11 | 50. | 19. | 168. | 10.0 | 193. | 0.0 |
| 12 | 70. | 27. | 165. | 10.0 | 193. | 0.0 |
| 13 | 110. | 43. | 163. | 10.0 | 191. | 0.0 |
| 14 | 130. | 51. | 160. | 8.8 | 191. | 0.0 |
| 15 | 160. | 62. | 159. | 8.8 | 190. | 0.0 |
| 16 | 180. | 70. | 158. | 10.0 | 190. | 0.0 |
| 17 | 200. | 78. | 156. | 10.0 | 190. | 0.0 |
| 18 | 215. | 84. | 155. | 8.8 | 190. | 0.0 |
| 19 | 230. | 89. | 153. | 7.5 | 190. | 0.0 |
| 20 | 235. | 91. | 153. | 10.0 | 190. | 0.0 |
| 21 | 239. | 93. | 151. | 8.8 | 190. | 0.0 |
| 22 | 245. | 95. | 150. | 10.0 | 189. | 0.0 |
| 23 | 248. | 96. | 148. | 10.0 | 190. | 0.0 |
| 24 | 252. | 98. | 145. | 10.0 | 190. | 0.0 |
| 25 | 254. | 99. | 143. | 8.8 | 190. | 0.0 |
| 26 | 256. | 100. | 140. | 10.0 | 190. | 0.0 |
| 27 | 257. | 100. | 138. | 10.0 | 190. | 0.0 |
| 28 | 258. | 100. | 125. | | | 0.0 |

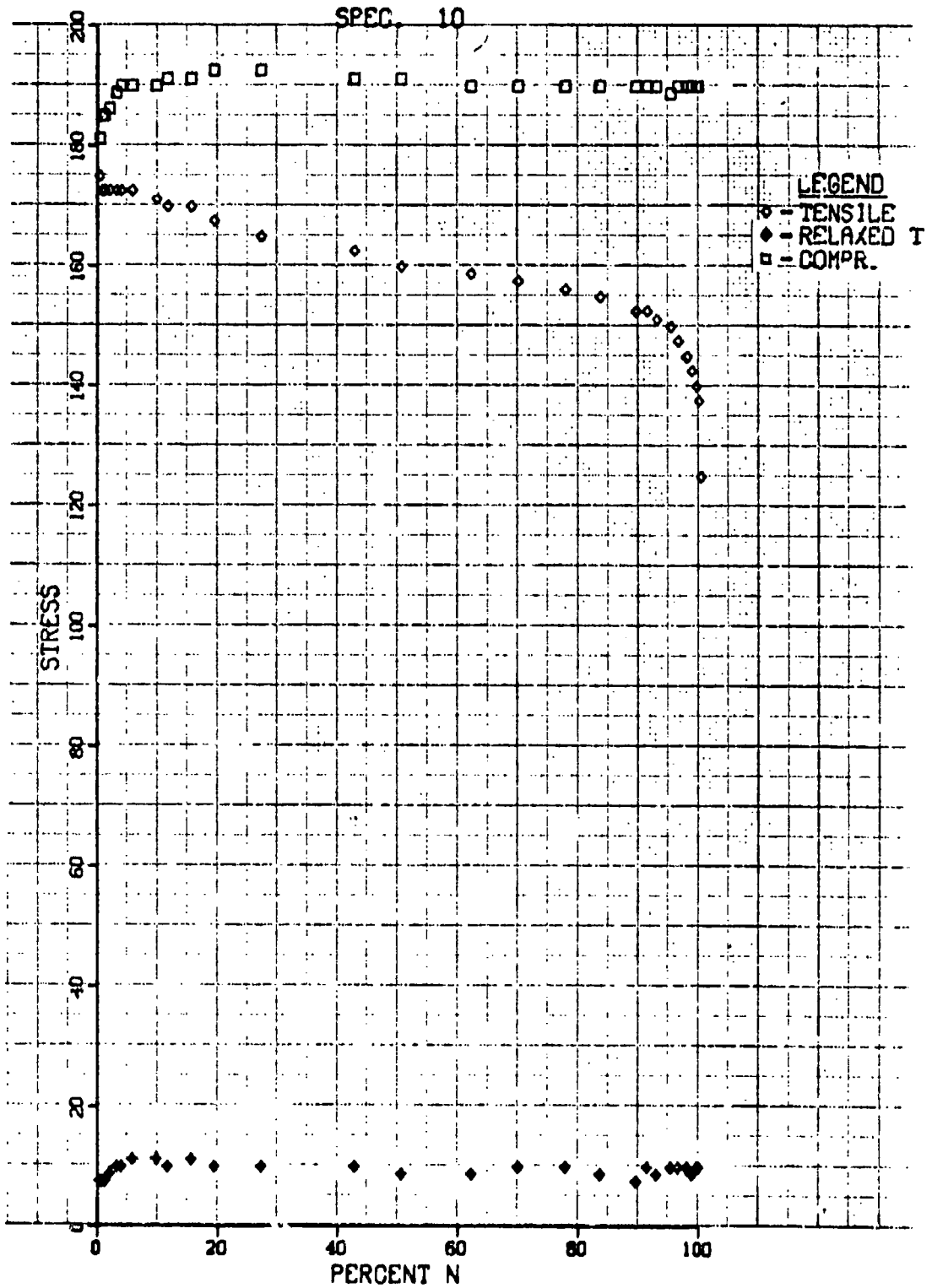

SPEC. 10
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 34.

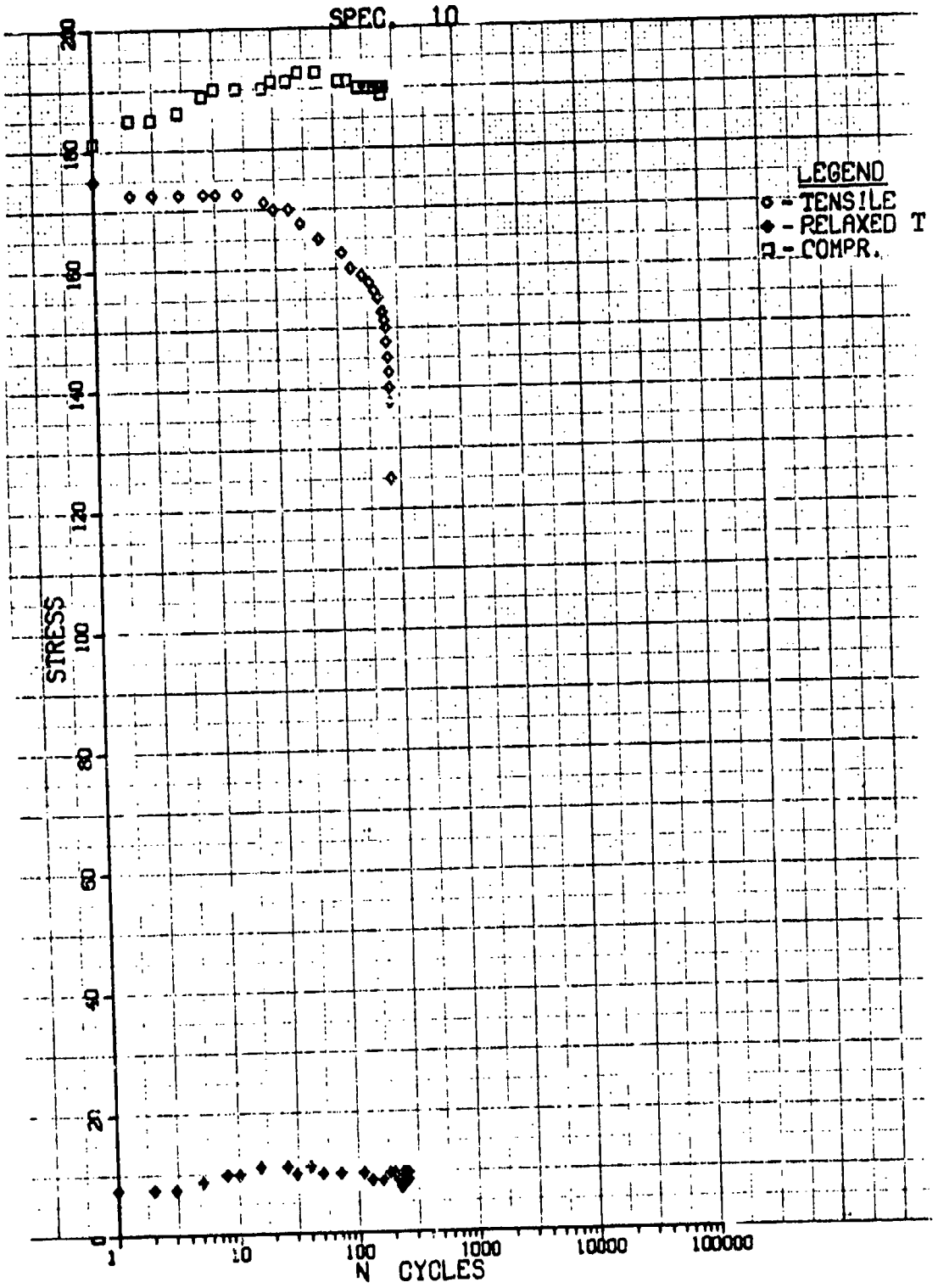

SPEC. 10
LEGEND
○ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 35.

TABLE 25

SPECIMEN 7

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 163. | 8.8 | 166. | 0.0 |
| 2 | 2. | 0. | 161. | 11.3 | 170. | 0.0 |
| 3 | 3. | 0. | 159. | 7.5 | 170. | 0.0 |
| 4 | 4. | 1. | 160. | 11.3 | 171. | 0.0 |
| 5 | 5. | 1. | 159. | 7.5 | 171. | 0.0 |
| 6 | 7. | 1. | 158. | 10.0 | 171. | 0.0 |
| 7 | 8. | 1. | 158. | 11.3 | 173. | 0.0 |
| 8 | 10. | 1. | 155. | 8.8 | 170. | 0.0 |
| 9 | 11. | 1. | 155. | 10.0 | 170. | 0.0 |
| 10 | 15. | 2. | 155. | 7.5 | 171. | 0.0 |
| 11 | 35. | 5. | 153. | 10.0 | 170. | 0.0 |
| 12 | 37. | 5. | 150. | 23.8 | 170. | 0.0 |
| 13 | 77. | 10. | 148. | 10.0 | 170. | 0.0 |
| 14 | 93. | 12. | 145. | 8.8 | 173. | 0.0 |
| 15 | 140. | 19. | 143. | 7.5 | 173. | 0.0 |
| 16 | 155. | 21. | 141. | 8.8 | 175. | 0.0 |
| 17 | 157. | 21. | 145. | 7.5 | 170. | 0.0 |
| 18 | 163. | 22. | 145. | 12.5 | 179. | 0.0 |
| 19 | 164. | 22. | 141. | 8.8 | 179. | 0.0 |
| 20 | 220. | 29. | 140. | 10.0 | 175. | 0.0 |
| 21 | 230. | 31. | 140. | 5.0 | 173. | 0.0 |
| 22 | 352. | 47. | 139. | 8.8 | 173. | 0.0 |
| 23 | 353. | 47. | 138. | 6.3 | 173. | 0.0 |
| 24 | 373. | 50. | 135. | 7.5 | 175. | 0.0 |
| 25 | 560. | 75. | 135. | 13.8 | 176. | 0.0 |
| 26 | 561. | 75. | 131. | 10.0 | 178. | 0.0 |
| 27 | 565. | 76. | 128. | 7.5 | 185. | 0.0 |
| 28 | 568. | 76. | 131. | 1.3 | 180. | 0.0 |
| 29 | 569. | 76. | 135. | 2.5 | 175. | 0.0 |
| 30 | 570. | 76. | 140. | 3.8 | 170. | 0.0 |
| 31 | 571. | 76. | 143. | 7.5 | 170. | 0.0 |
| 32 | 575. | 77. | 140. | 7.5 | 171. | 0.0 |
| 33 | 578. | 77. | 138. | 15.0 | | 0.0 |
| 34 | 579. | 77. | 133. | 10.0 | | 0.0 |
| 35 | 580. | 78. | 130. | 7.5 | | 0.0 |
| 36 | 605. | 81. | 138. | 10.0 | 175. | 0.0 |
| 37 | 690. | 92. | 135. | 6.3 | 173. | 0.0 |
| 38 | 710. | 95. | 130. | 10.0 | 175. | 0.0 |
| 39 | 715. | 96. | 135. | 6.3 | 170. | 0.0 |
| 40 | 725. | 97. | 134. | 12.5 | 176. | 0.0 |
| 41 | 730. | 98. | 131. | 5.0 | 174. | 0.0 |
| 42 | 741. | 99. | 130. | 7.5 | 173. | 0.0 |
| 43 | 745. | 100. | 128. | 7.5 | 170. | 0.0 |
| 44 | 748. | 100. | 128. | 10.0 | 175. | 0.0 |

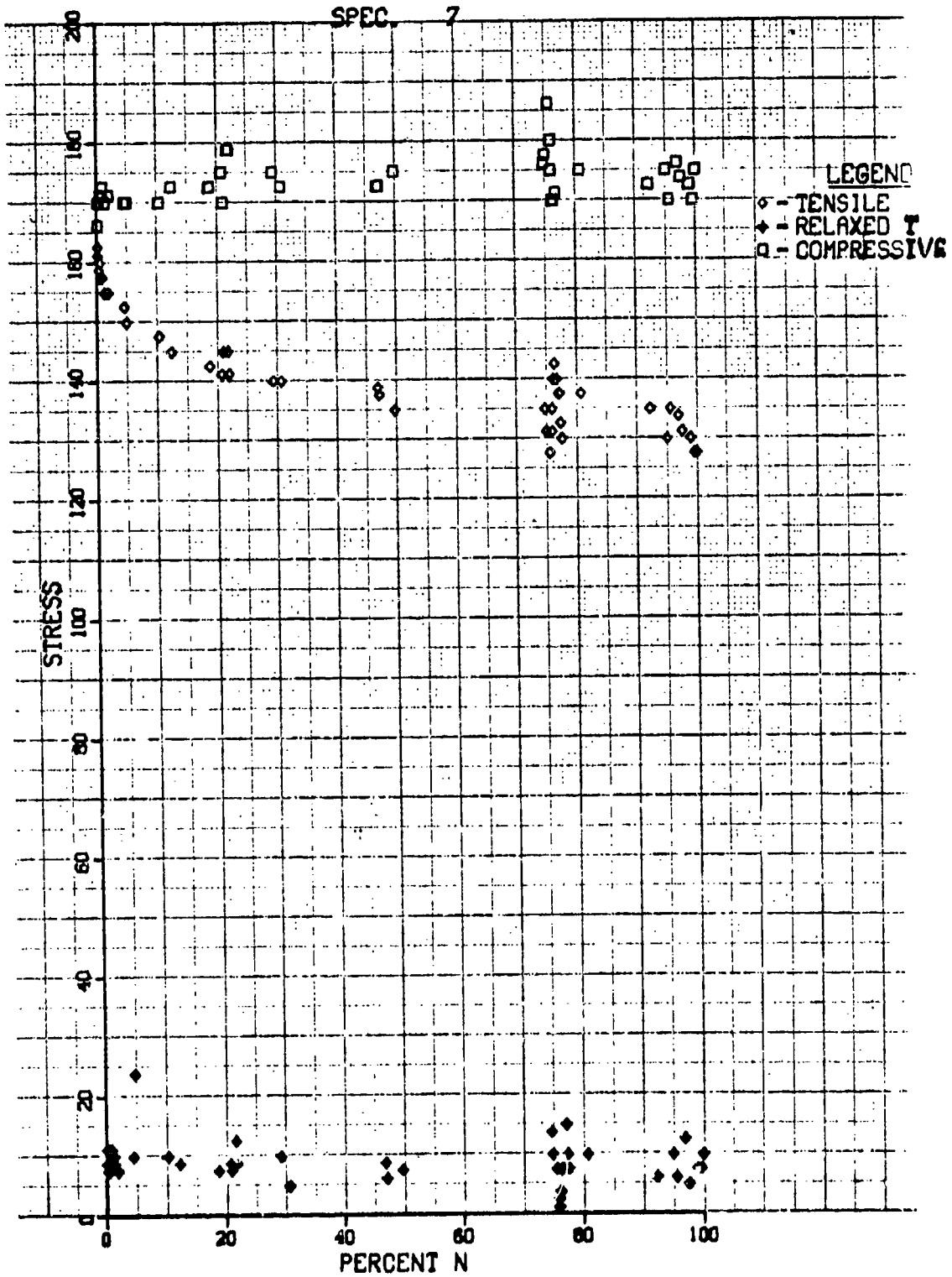

SPEC. 7
LEGEND
- TENSILE
- RELAXED T
- COMPRESSIVE
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 36.

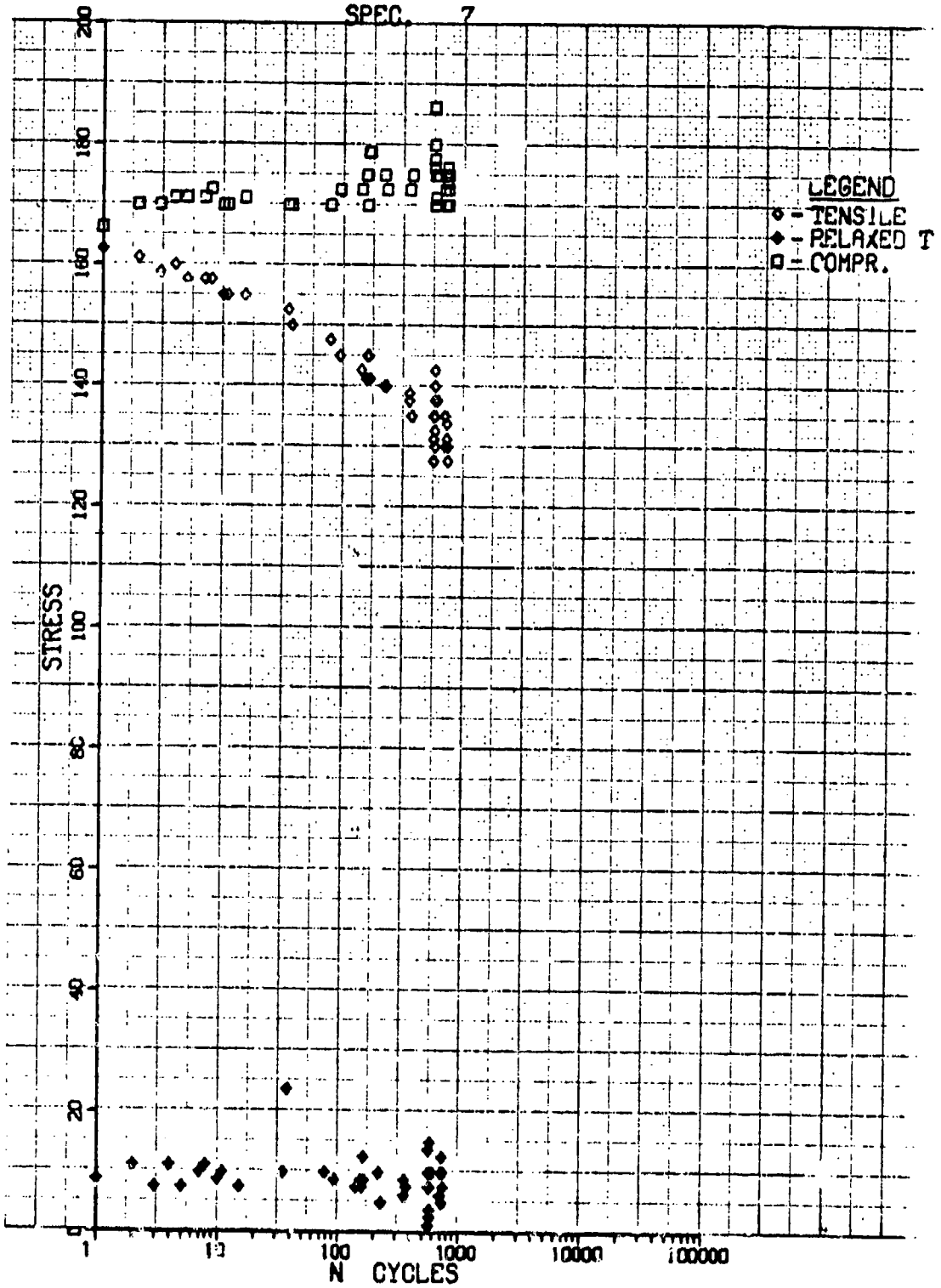

SPEC. 7
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 37.

TABLE 26

SPECIMEN 12

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 151. | 1.3 | 143. | 0.0 |
| 2 | 2. | 0. | 150. | 0.0 | 155. | 0.0 |
| 3 | 3. | 0. | 151. | 1.3 | 156. | 0.0 |
| 4 | 5. | 0. | 150. | 2.5 | 156. | 0.0 |
| 5 | 6. | 0. | 150. | 5.0 | 160. | 0.0 |
| 6 | 12. | 1. | 146. | 1.3 | 161. | 0.0 |
| 7 | 22. | 2. | 145. | 0.0 | 161. | 0.0 |
| 8 | 24. | 2. | 145. | 1.3 | 163. | 0.0 |
| 9 | 32. | 2. | 143. | 1.3 | 164. | 0.0 |
| 10 | 51. | 4. | 141. | 1.3 | 165. | 0.0 |
| 11 | 60. | 5. | 140. | 0.0 | 165. | 0.0 |
| 12 | 70. | 5. | 141. | 1.3 | 164. | 0.0 |
| 13 | 80. | 6. | 140. | 0.0 | 165. | 0.0 |
| 14 | 99. | 8. | 140. | 1.3 | 165. | 0.0 |
| 15 | 117. | 9. | 139. | 1.3 | 165. | 0.0 |
| 16 | 139. | 11. | 138. | 1.3 | 165. | 0.0 |
| 17 | 195. | 15. | 136. | 1.3 | 166. | 0.0 |
| 18 | 252. | 20. | 135. | 1.3 | 168. | 0.0 |
| 19 | 317. | 25. | 134. | 1.3 | 168. | 0.0 |
| 20 | 393. | 30. | 133. | 1.3 | 168. | 0.0 |
| 21 | 441. | 34. | 131. | 1.3 | 168. | 0.0 |
| 22 | 613. | 48. | 130. | 1.3 | 168. | 0.0 |
| 23 | 774. | 60. | 129. | 1.3 | 168. | 0.0 |
| 24 | 852. | 66. | 128. | 1.3 | 168. | 0.0 |
| 25 | 965. | 75. | 126. | 1.3 | 169. | 0.0 |
| 26 | 1015. | 79. | 125. | 1.3 | 168. | 0.0 |
| 27 | 1035. | 80. | 124. | 1.3 | 170. | 0.0 |
| 28 | 1112. | 86. | 123. | 1.3 | 170. | 0.0 |
| 29 | 1190. | 92. | 121. | 1.3 | 170. | 0.0 |
| 30 | 1216. | 94. | 120. | 1.3 | 170. | 0.0 |
| 31 | 1245. | 97. | 118. | 2.5 | 171. | 0.0 |
| 32 | 1254. | 97. | 115. | 2.5 | 171. | 0.0 |
| 33 | 1264. | 98. | 110. | 2.5 | 171. | 0.0 |
| 34 | 1266. | 98. | 108. | 1.3 | 171. | 0.0 |
| 35 | 1273. | 99. | 105. | 3.8 | 171. | 0.0 |
| 36 | 1276. | 99. | 103. | 2.5 | 171. | 0.0 |
| 37 | 1283. | 100. | 99. | 3.8 | 171. | 0.0 |
| 38 | 1284. | 100. | 98. | 2.5 | 171. | 0.0 |
| 39 | 1285. | 100. | 98. | 3.8 | 171. | 0.0 |
| 40 | 1286. | 100. | 96. | | | 0.0 |

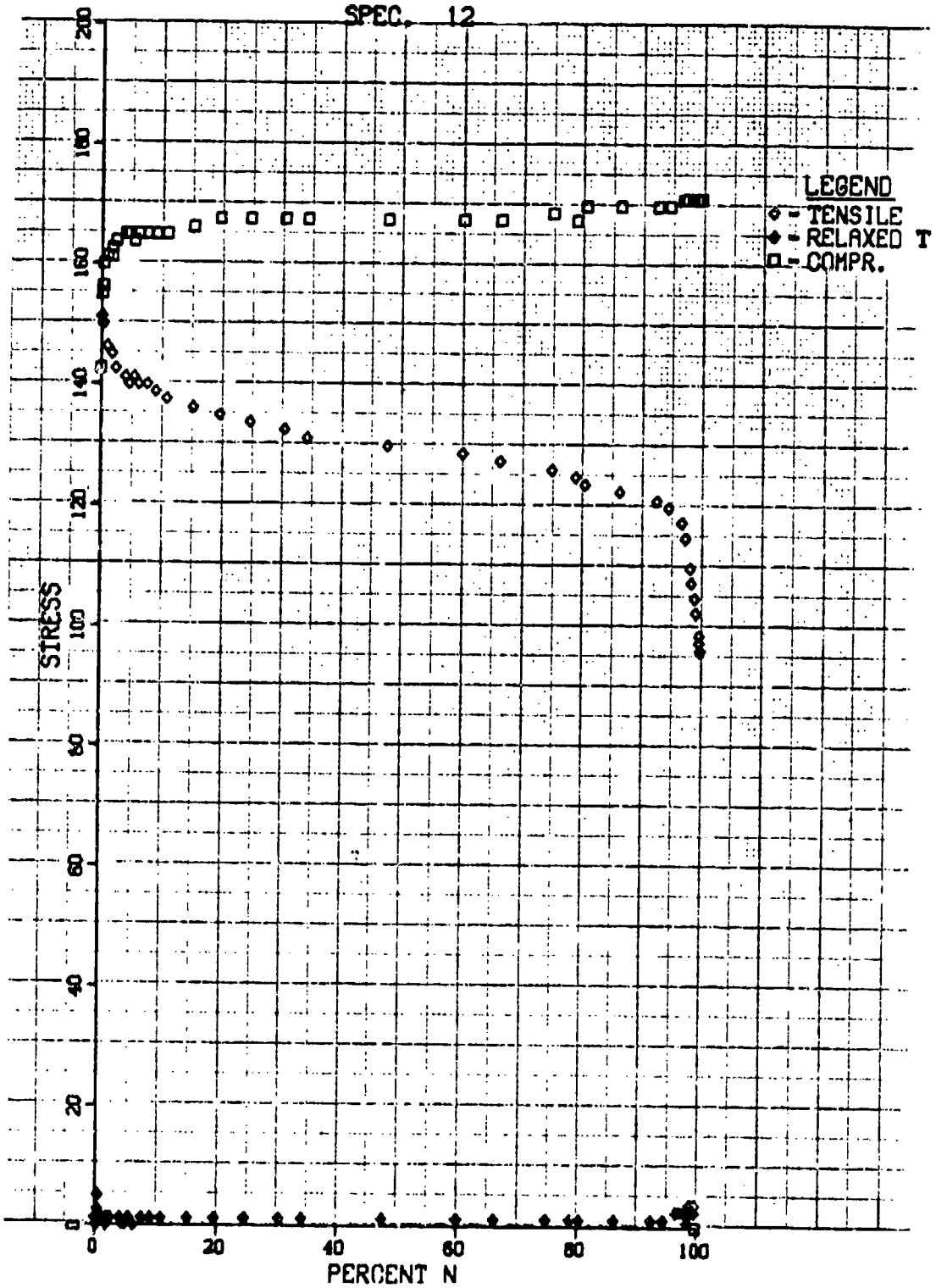

SPEC. 12
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 38.

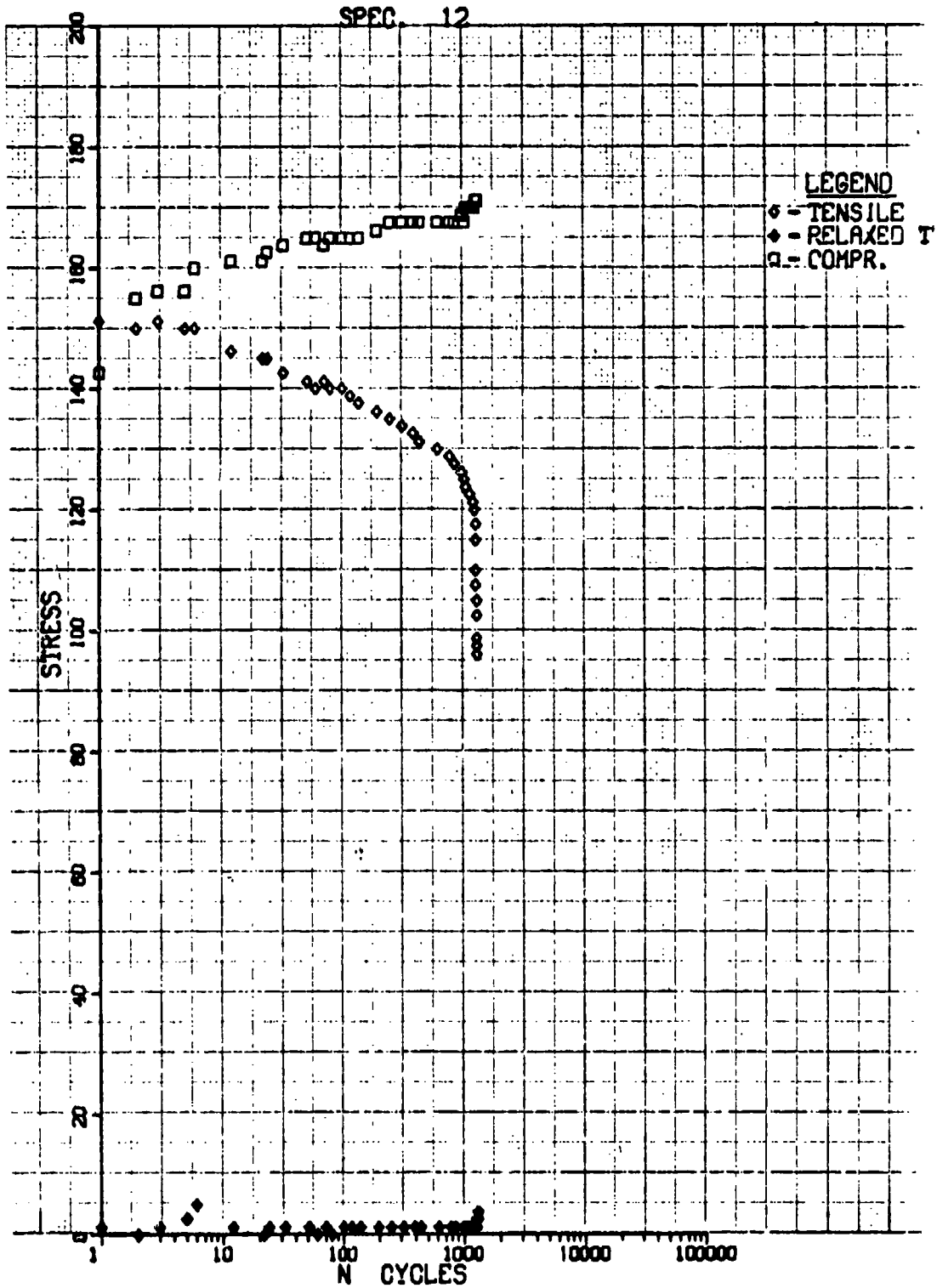

SPEC. 12
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 39.

TABLE 27

SPECIMEN 39

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 136. | 5.0 | 138. | 0.0 |
| 2 | 2. | 0. | 135. | 5.0 | 145. | 0.0 |
| 3 | 3. | 0. | 133. | 6.3 | 143. | 0.0 |
| 4 | 4. | 0. | 131. | 5.0 | 145. | 0.0 |
| 5 | 5. | 0. | 131. | 5.0 | 145. | 0.0 |
| 6 | 15. | 1. | 129. | 6.3 | 146. | 0.0 |
| 7 | 20. | 1. | 128. | 6.3 | 148. | 0.0 |
| 8 | 29. | 2. | 123. | 3.8 | 150. | 0.0 |
| 9 | 30. | 2. | 125. | 5.0 | 150. | 0.0 |
| 10 | 49. | 3. | 123. | 6.3 | 150. | 0.0 |
| 11 | 73. | 4. | 121. | 6.3 | 151. | 0.0 |
| 12 | 75. | 4. | 120. | 6.3 | 153. | 0.0 |
| 13 | 77. | 4. | 119. | 6.3 | 155. | 0.0 |
| 14 | 87. | 5. | 120. | 5.0 | 151. | 0.0 |
| 15 | 100. | 6. | 119. | 5.0 | 153. | 0.0 |
| 16 | 144. | 8. | 118. | 6.3 | 155. | 0.0 |
| 17 | 190. | 11. | 116. | 6.3 | 155. | 0.0 |
| 18 | 215. | 12. | 115. | 6.3 | 155. | 0.0 |
| 19 | 261. | 15. | 113. | 5.0 | 158. | 0.0 |
| 20 | 272. | 15. | 118. | 5.0 | 151. | 0.0 |
| 21 | 317. | 18. | 115. | 5.0 | 155. | 0.0 |
| 22 | 444. | 25. | 113. | 5.0 | 155. | 0.0 |
| 23 | 458. | 26. | 115. | 5.0 | 153. | 0.0 |
| 24 | 503. | 34. | 115. | 5.0 | 154. | 0.0 |
| 25 | 1259. | 71. | 110. | 5.0 | 155. | 0.0 |
| 26 | 1275. | 72. | 109. | 6.3 | 155. | 0.0 |
| 27 | 1317. | 74. | 108. | 6.3 | 155. | 0.0 |
| 28 | 1320. | 74. | 110. | 6.3 | 155. | 0.0 |
| 29 | 1558. | 87. | 108. | 6.3 | 155. | 0.0 |
| 30 | 1589. | 89. | 106. | 6.3 | 155. | 0.0 |
| 31 | 1750. | 98. | 108. | 7.5 | 153. | 0.0 |
| 32 | 1759. | 99. | 105. | 7.5 | 155. | 0.0 |
| 33 | 1773. | 100. | 106. | 6.3 | 155. | 0.0 |
| 34 | 1774. | 100. | 108. | 8.8 | 155. | 0.0 |
| 35 | 1775. | 100. | 108. | 7.5 | 154. | 0.0 |
| 36 | 1776. | 100. | 109. | 7.5 | 153. | 0.0 |
| 37 | 1777. | 100. | 110. | 8.8 | 155. | 0.0 |
| 38 | 1778. | 100. | 110. | 5.0 | 153. | 0.0 |

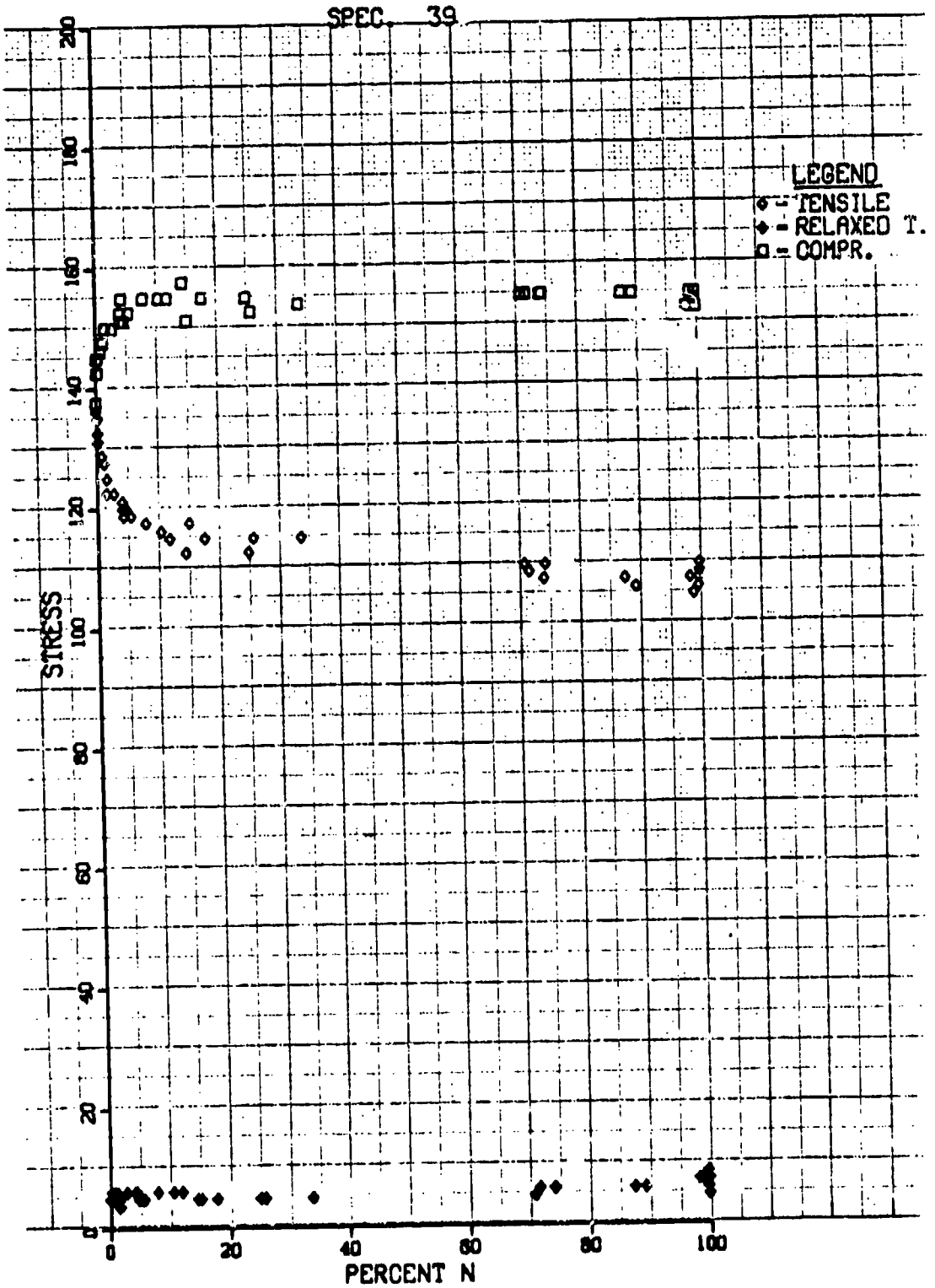

SPEC. 39
LEGEND
TENSILE
RELAXED T.
COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 40.

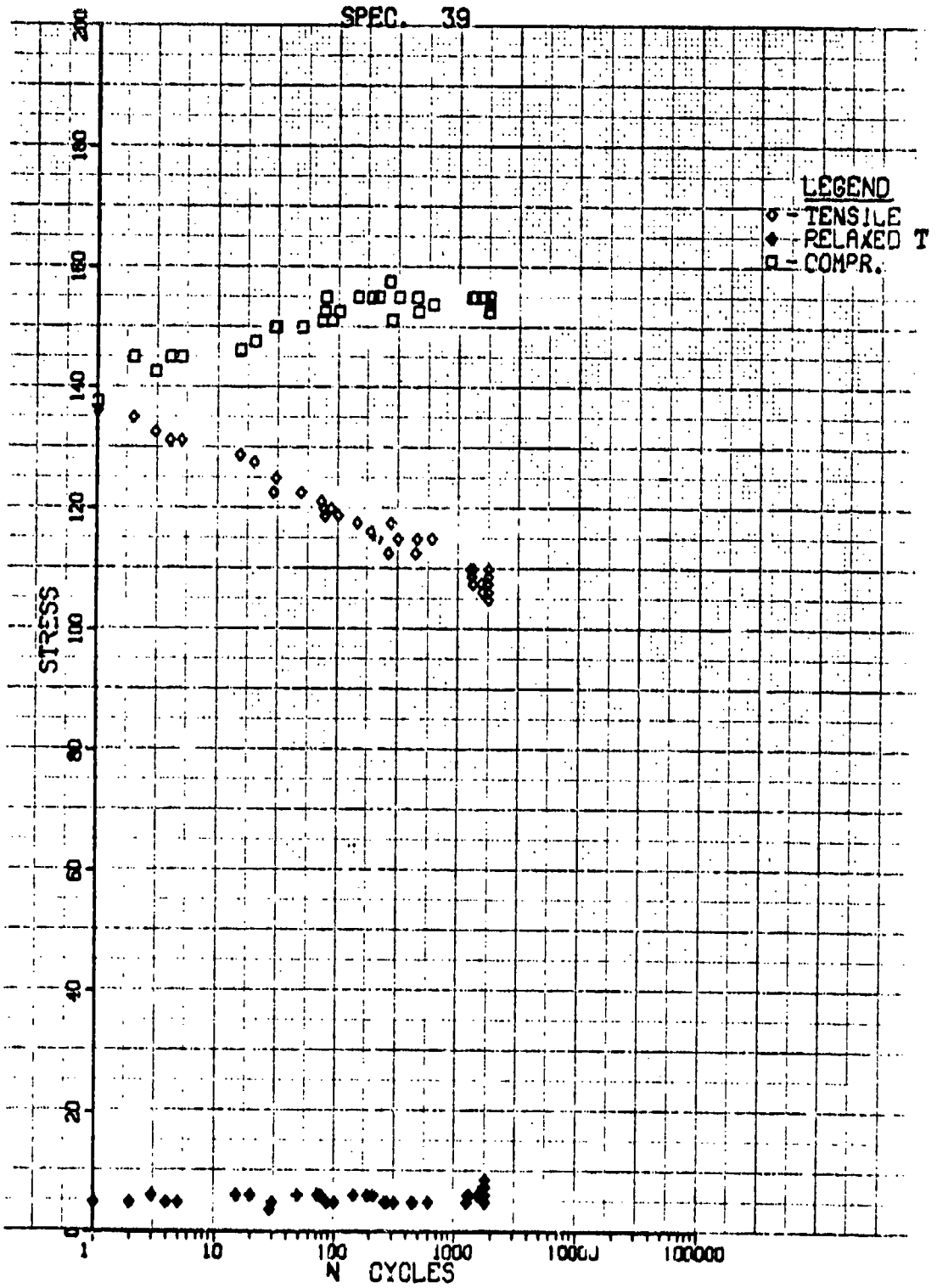

SPEC. 39
LEGEND
σ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 41.

TABLE 28

SPECIMEN 36

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 163. | 2.5 | 158. | 0.0 |
| 2 | 2. | 0. | 161. | 2.5 | 164. | 0.0 |
| 3 | 3. | 0. | 160. | 2.5 | 165. | 0.0 |
| 4 | 4. | 0. | 159. | 1.3 | 164. | 0.0 |
| 5 | 5. | 0. | 159. | 1.3 | 165. | 0.0 |
| 6 | 10. | 0. | 158. | 2.5 | 166. | 0.0 |
| 7 | 12. | 0. | 156. | 2.5 | 168. | 0.0 |
| 8 | 21. | 0. | 155. | 2.5 | 169. | 0.0 |
| 9 | 29. | 1. | 151. | 2.5 | 171. | 0.0 |
| 10 | 31. | 1. | 153. | 2.5 | 170. | 0.0 |
| 11 | 38. | 1. | 151. | 2.5 | 170. | 0.0 |
| 12 | 48. | 1. | 150. | 1.3 | 171. | 0.0 |
| 13 | 58. | 1. | 149. | 2.5 | 173. | 0.0 |
| 14 | 59. | 1. | 149. | 1.3 | 173. | 0.0 |
| 15 | 60. | 1. | 150. | 2.5 | 173. | 0.0 |
| 16 | 86. | 2. | 148. | 3.8 | 175. | 0.0 |
| 17 | 96. | 2. | 146. | 1.3 | 175. | 0.0 |
| 18 | 105. | 2. | 145. | 1.3 | 175. | 0.0 |
| 19 | 115. | 2. | 143. | 1.3 | 176. | 0.0 |
| 20 | 124. | 2. | 141. | 1.3 | 176. | 0.0 |
| 21 | 161. | 3. | 141. | 1.3 | 180. | 0.0 |
| 22 | 162. | 3. | 143. | 2.5 | 176. | 0.0 |
| 23 | 201. | 4. | 141. | 2.5 | 181. | 0.0 |
| 24 | 211. | 4. | 140. | 1.3 | 181. | 0.0 |
| 25 | 344. | 7. | 139. | 1.3 | 183. | 0.0 |
| 26 | 385. | 8. | 138. | 1.3 | 181. | 0.0 |
| 27 | 400. | 8. | 138. | 2.5 | 181. | 0.0 |
| 28 | 497. | 10. | 140. | 2.5 | 181. | 0.0 |
| 29 | 506. | 10. | 138. | 1.3 | 181. | 0.0 |
| 30 | 600. | 12. | 136. | 1.3 | 183. | 0.0 |
| 31 | 707. | 14. | 135. | 1.3 | 183. | 0.0 |
| 32 | 753. | 15. | 136. | 1.3 | 181. | 0.0 |
| 33 | 868. | 17. | 135. | 1.3 | 184. | 0.0 |
| 34 | 915. | 18. | 134. | 1.3 | 184. | 0.0 |
| 35 | 945. | 19. | 133. | 1.3 | 185. | 0.0 |
| 36 | 1002. | 20. | 135. | 2.5 | 184. | 0.0 |
| 37 | 1087. | 22. | 136. | 2.5 | 183. | 0.0 |
| 38 | 1107. | 22. | 135. | 2.5 | 183. | 0.0 |
| 39 | 1143. | 23. | 133. | 1.3 | 184. | 0.0 |
| 40 | 1353. | 27. | 130. | 2.5 | 185. | 0.0 |
| 41 | 1381. | 28. | 129. | 2.5 | 188. | 0.0 |
| 42 | 1392. | 28. | 128. | 2.5 | 186. | 0.0 |
| 43 | 1508. | 30. | 129. | 2.5 | 186. | 0.0 |
| 44 | 1515. | 30. | 128. | 2.5 | 188. | 0.0 |
| 45 | 1716. | 34. | 126. | 1.3 | 185. | 0.0 |

Table continued on following page.

TABLE 28 Continued

SPECIMEN 38

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 46 | 1736. | 35. | 125. | 2.5 | 185. | 0.0 |
| 47 | 1751. | 35. | 129. | 2.5 | 186. | 0.0 |
| 48 | 1800. | 36. | 130. | 2.5 | 185. | 0.0 |
| 49 | 2290. | 46. | 128. | 2.5 | | 0.0 |
| 50 | 2534. | 51. | 125. | 5.0 | 188. | 0.0 |
| 51 | 2600. | 52. | 124. | 3.8 | 189. | 0.0 |
| 52 | 2915. | 58. | 126. | 2.5 | 190. | 0.0 |
| 53 | 3503. | 70. | 123. | 2.5 | 188. | 0.0 |
| 54 | 3700. | 74. | 124. | 2.5 | 188. | 0.0 |
| 55 | 3750. | 75. | 125. | 2.5 | 186. | 0.0 |
| 56 | 4100. | 82. | 121. | 2.5 | 188. | 0.0 |
| 57 | 4185. | 83. | 120. | 2.5 | 189. | 0.0 |
| 58 | 4300. | 86. | 124. | 3.8 | 188. | 0.0 |
| 59 | 4604. | 92. | 123. | 2.5 | 185. | 0.0 |
| 60 | 4623. | 92. | 120. | 2.5 | 186. | 0.0 |
| 61 | 4699. | 94. | 119. | 2.5 | 186. | 0.0 |
| 62 | 4700. | 94. | 118. | 2.5 | 186. | 0.0 |
| 63 | 4795. | 95. | 116. | 2.5 | 186. | 0.0 |
| 64 | 4823. | 96. | 115. | 2.5 | 185. | 0.0 |
| 65 | 4835. | 96. | 114. | 2.5 | | 0.0 |
| 66 | 4850. | 97. | 113. | 2.5 | | 0.0 |
| 67 | 4865. | 97. | 111. | 1.3 | | 0.0 |
| 68 | 4875. | 97. | 110. | 2.5 | | 0.0 |
| 69 | 4893. | 98. | 109. | 2.5 | | 0.0 |
| 70 | 4900. | 98. | 108. | 2.5 | 185. | 0.0 |
| 71 | 4912. | 98. | 105. | 5.0 | | 0.0 |
| 72 | 4920. | 98. | 104. | 3.8 | | 0.0 |
| 73 | 4940. | 99. | 100. | 1.3 | | 0.0 |
| 74 | 4947. | 99. | 99. | 3.8 | | 0.0 |
| 75 | 4948. | 99. | 98. | 2.5 | | 0.0 |
| 76 | 4950. | 99. | 96. | 1.3 | | 0.0 |
| 77 | 4956. | 99. | 95. | 1.3 | | 0.0 |
| 78 | 4966. | 99. | 94. | 2.5 | | 0.0 |
| 79 | 4968. | 99. | 93. | 1.3 | | 0.0 |
| 80 | 4970. | 99. | 91. | 2.5 | | 0.0 |
| 81 | 4976. | 99. | 88. | 2.5 | | 0.0 |
| 82 | 4979. | 99. | 86. | 2.5 | | 0.0 |
| 83 | 4983. | 99. | 84. | 1.3 | | 0.0 |
| 84 | 4985. | 99. | 83. | 1.3 | | 0.0 |
| 85 | 4997. | 100. | 81. | 1.3 | | 0.0 |
| 86 | 4999. | 100. | 80. | 2.5 | | 0.0 |
| 87 | 5005. | 100. | 78. | 2.5 | | 0.0 |
| 88 | 5007. | 100. | 76. | 2.5 | | 0.0 |
| 89 | 5013. | 100. | 74. | 1.3 | | 0.0 |
| 90 | 5016. | 100. | 73. | 1.3 | | 0.0 |

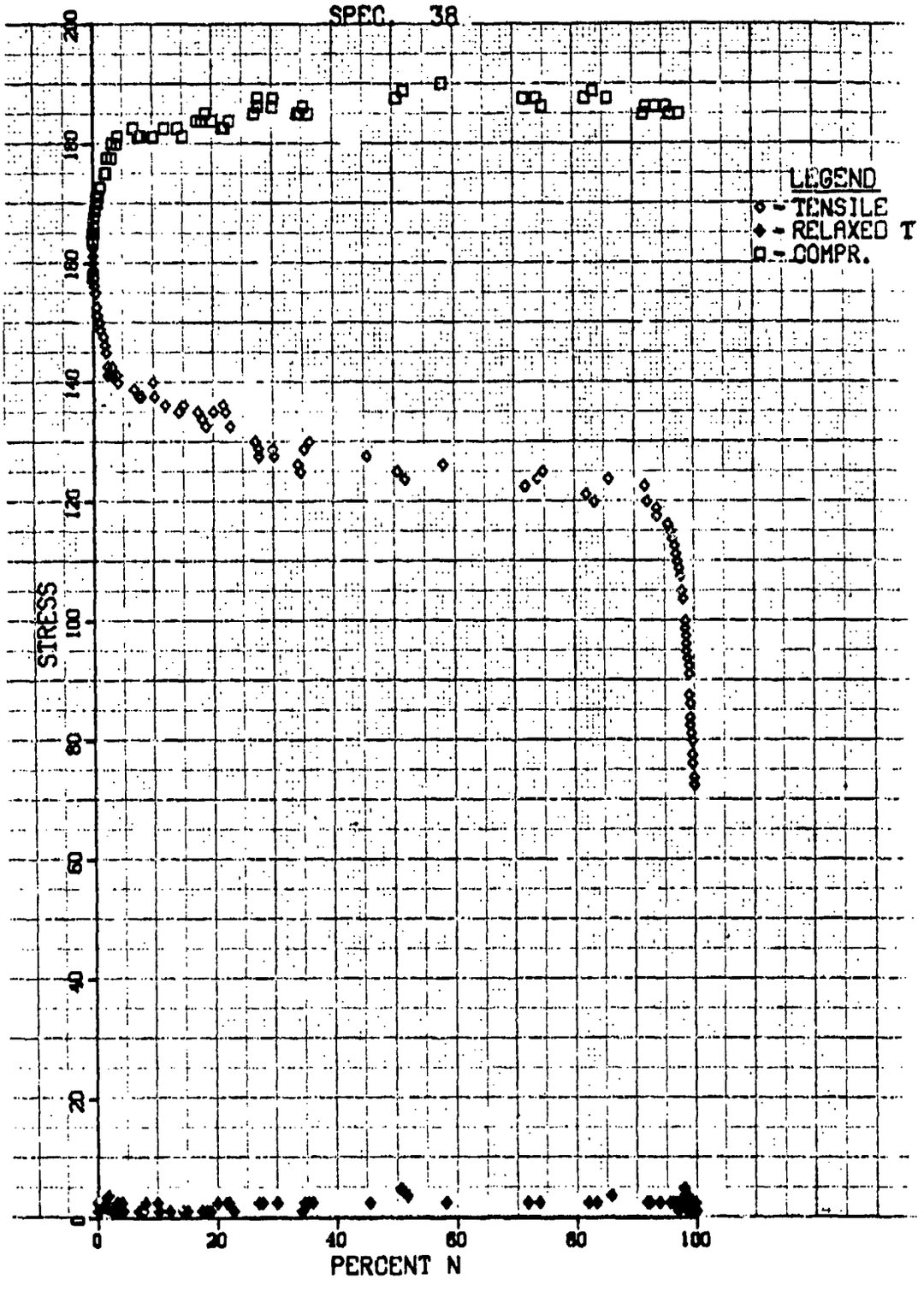

SPEC. 38
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 42.

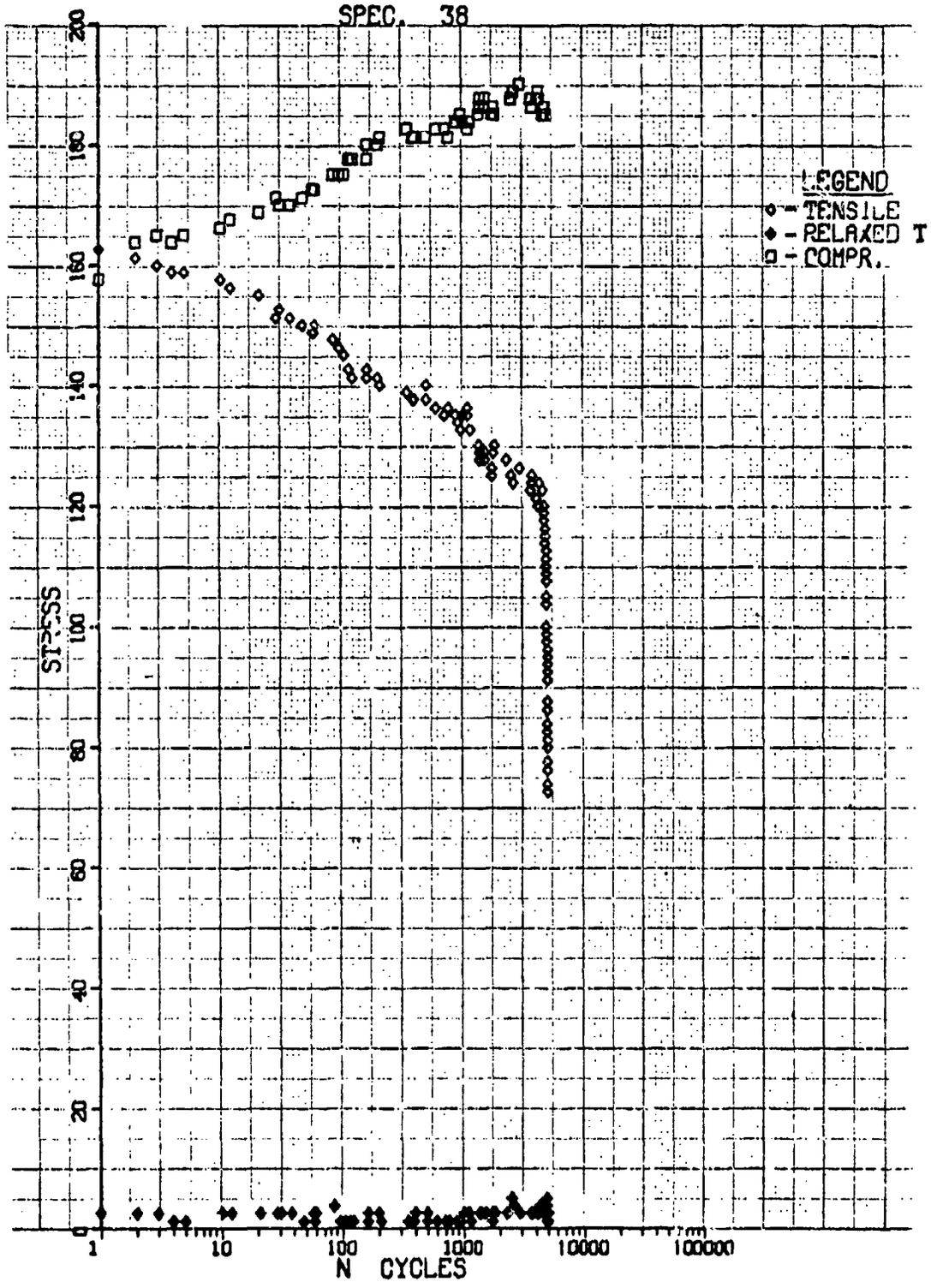

SPEC. 38
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 43.

TABLE 29

SPECIMEN 235

| J | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 125. | 3.2 | 120. | 0.0 |
| 2 | 2. | 0. | 123. | 2.0 | 132. | 0.0 |
| 3 | 3. | 0. | 123. | 2.0 | 131. | 0.0 |
| 4 | 4. | 0. | 122. | 2.4 | 132. | 0.0 |
| 5 | 5. | 0. | 121. | 1.2 | 132. | 0.0 |
| 6 | 6. | 0. | 121. | 2.8 | 132. | 0.0 |
| 7 | 7. | 0. | 120. | .8 | 131. | 0.0 |
| 8 | 8. | 0. | 120. | 1.2 | 132. | 0.0 |
| 9 | 9. | 0. | 120. | 2.0 | 132. | 0.0 |
| 10 | 10. | 0. | 120. | 1.2 | 132. | 0.0 |
| 11 | 16. | 0. | 115. | 2.4 | 134. | 0.0 |
| 12 | 27. | 0. | 116. | .8 | 136. | 0.0 |
| 13 | 39. | 1. | 114. | 2.0 | 140. | 0.0 |
| 14 | 85. | 1. | 112. | 2.4 | 141. | 0.0 |
| 15 | 96. | 1. | 110. | 2.0 | 142. | 0.0 |
| 16 | 120. | 2. | 112. | 2.0 | 141. | 0.0 |
| 17 | 142. | 2. | 108. | .8 | 144. | 0.0 |
| 18 | 190. | 3. | 109. | 1.0 | 143. | 0.0 |
| 19 | 200. | 3. | 107. | 1.6 | 145. | 0.0 |
| 20 | 220. | 3. | 108. | .8 | 144. | 0.0 |
| 21 | 256. | 4. | 105. | 1.2 | 147. | 0.0 |
| 22 | 280. | 4. | 106. | 2.0 | 144. | 0.0 |
| 23 | 314. | 5. | 104. | .8 | 148. | 0.0 |
| 24 | 339. | 5. | 105. | .8 | 146. | 0.0 |
| 25 | 370. | 6. | 104. | 2.8 | 147. | 0.0 |
| 26 | 302. | 6. | 103. | 2.0 | 149. | 0.0 |
| 27 | 395. | 6. | 104. | .8 | 147. | 0.0 |
| 28 | 440. | 7. | 102. | 1.2 | 148. | 0.0 |
| 29 | 453. | 7. | 104. | 2.0 | 146. | 0.0 |
| 30 | 497. | 8. | 102. | .8 | 148. | 0.0 |
| 31 | 520. | 8. | 103. | 1.6 | 146. | 0.0 |
| 32 | 565. | 9. | 101. | .8 | 149. | 0.0 |
| 33 | 600. | 9. | 102. | 1.2 | 148. | 0.0 |
| 34 | 645. | 10. | 100. | 2.0 | 151. | 0.0 |
| 35 | 670. | 10. | 101. | .8 | 149. | 0.0 |
| 36 | 723. | 11. | 99. | 2.0 | 152. | 0.0 |
| 37 | 749. | 11. | 100. | .4 | 149. | 0.0 |
| 38 | 759. | 12. | 98. | 1.2 | 152. | 0.0 |
| 39 | 770. | 12. | 97. | .4 | 152. | 0.0 |
| 40 | 782. | 12. | 100 | 2.0 | 152. | 0.0 |
| 41 | 795. | 12. | 98. | 1.2 | 152. | 0.0 |
| 42 | 940. | 13. | 96. | 1.6 | 152. | 0.0 |
| 43 | 996. | 14. | 97. | 1.2 | 152. | 0.0 |
| 44 | 940. | 14. | 97. | .8 | 152. | 0.0 |
| 45 | 965. | 15. | 96. | .4 | 153. | 0.0 |
| 46 | 998. | 15. | 95. | 1.2 | 152. | 0.0 |
| 47 | 1010. | 15. | 96. | .8 | 153. | 0.0 |
| 48 | 1034. | 16. | 98. | 1.2 | 152. | 0.0 |
| 49 | 1055. | 16. | 96. | 1.0 | 153. | 0.0 |
| 50 | 1100. | 17. | 97. | .8 | 152. | 0.0 |
| 51 | 1146. | 18. | 95. | .8 | 152. | 0.0 |
| 52 | 1160. | 18. | 96. | 1.2 | 153. | 0.0 |
| 53 | 1215. | 19. | 96. | 1.6 | 153. | 0.0 |
| 54 | 1295. | 20. | 96. | 1.8 | 153. | 0.0 |
| 55 | 1340. | 21. | 95. | 1.4 | 153. | 0.0 |
| 56 | 1420. | 22. | 95. | 1.2 | 154. | 0.0 |
| 57 | 1500. | 23. | 94. | 1.2 | 154. | 0.0 |
| 58 | 1604. | 25. | 94. | 1.2 | 155. | 0.0 |

Table continued on following page.

TABLE 29 Continued

SPECIMEN 233

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 59 | 1594. | 26. | 93. | .8 | 156. | 0.0 |
| 60 | 1796. | 28. | 93. | 1.2 | 156. | 0.0 |
| 61 | 1900. | 29. | 92. | 1.0 | 156. | 0.0 |
| 62 | 2000. | 31. | 92. | .8 | 156. | 0.0 |
| 63 | 2104. | 32. | 93. | 1.2 | 156. | 0.0 |
| 64 | 2140. | 33. | 92. | 1.6 | 157. | 0.0 |
| 65 | 2165. | 33. | 93. | .8 | 156. | 0.0 |
| 66 | 2275. | 35. | 92. | 1.2 | 156. | 0.0 |
| 67 | 2410. | 37. | 92. | 1.2 | 156. | 0.0 |
| 68 | 2480. | 38. | 91. | 1.2 | 157. | 0.0 |
| 69 | 2700. | 41. | 89. | .8 | 155. | 0.0 |
| 70 | 2803. | 43. | 91. | 2.0 | 156. | 0.0 |
| 71 | 2824. | 43. | 89. | 1.2 | 159. | 0.0 |
| 72 | 2960. | 45. | 90. | 2.0 | 158. | 0.0 |
| 73 | 3020. | 46. | 88. | .8 | 159. | 0.0 |
| 74 | 3417. | 52. | 87. | 1.6 | 160. | 0.0 |
| 75 | 3440. | 53. | 88. | .4 | 159. | 0.0 |
| 76 | 3485. | 53. | 87. | 1.8 | 160. | 0.0 |
| 77 | 3540. | 54. | 88. | 1.8 | 160. | 0.0 |
| 78 | 3804. | 58. | 86. | 1.6 | 160. | 0.0 |
| 79 | 4148. | 64. | 86. | 1.6 | 160. | 0.0 |
| 80 | 4454. | 68. | 85. | 1.2 | 160. | 0.0 |
| 81 | 4752. | 73. | 86. | 1.2 | 160. | 0.0 |
| 82 | 5155. | 77. | 84. | .4 | 160. | 0.0 |
| 83 | 5400. | 83. | 84. | 1.6 | 161. | 0.0 |
| 84 | 5652. | 87. | 84. | .6 | 161. | 0.0 |
| 85 | 5900. | 89. | 86. | 1.6 | 160. | 0.0 |
| 86 | 6107. | 93. | 85. | 1.2 | 160. | 0.0 |
| 87 | 6260. | 96. | 84. | 2.0 | 160. | 0.0 |
| 88 | 6349. | 97. | 82. | 1.6 | 160. | 0.0 |
| 89 | 6393. | 98. | 80. | .4 | 161. | 0.0 |
| 90 | 6440. | 99. | 79. | 2.6 | 160. | 0.0 |
| 91 | 6450. | 99. | 77. | 1.2 | 160. | 0.0 |
| 92 | 6473. | 99. | 73. | 1.2 | 160. | 0.0 |
| 93 | 6484. | 99. | 71. | 2.0 | 160. | 0.0 |
| 94 | 6498. | 99. | 68. | 2.4 | 160. | 0.0 |
| 95 | 6507. | 100. | 64. | 2.0 | 160. | 0.0 |
| 96 | 6517. | 100. | 61. | 1.0 | 160. | 0.0 |
| 97 | 6530. | 100. | 60. | 2.4 | 159. | 0.0 |

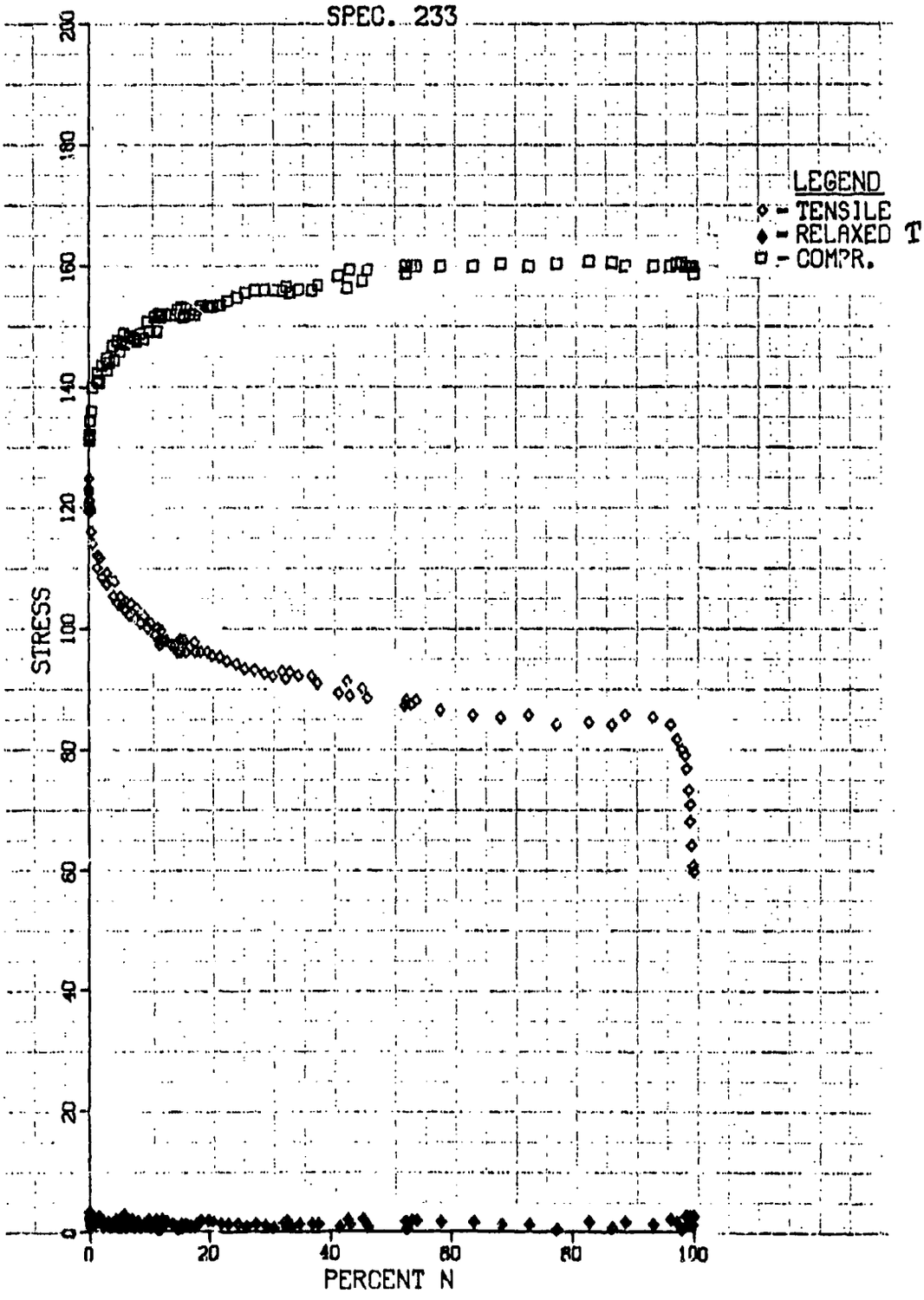

SPEC. 233
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 44.

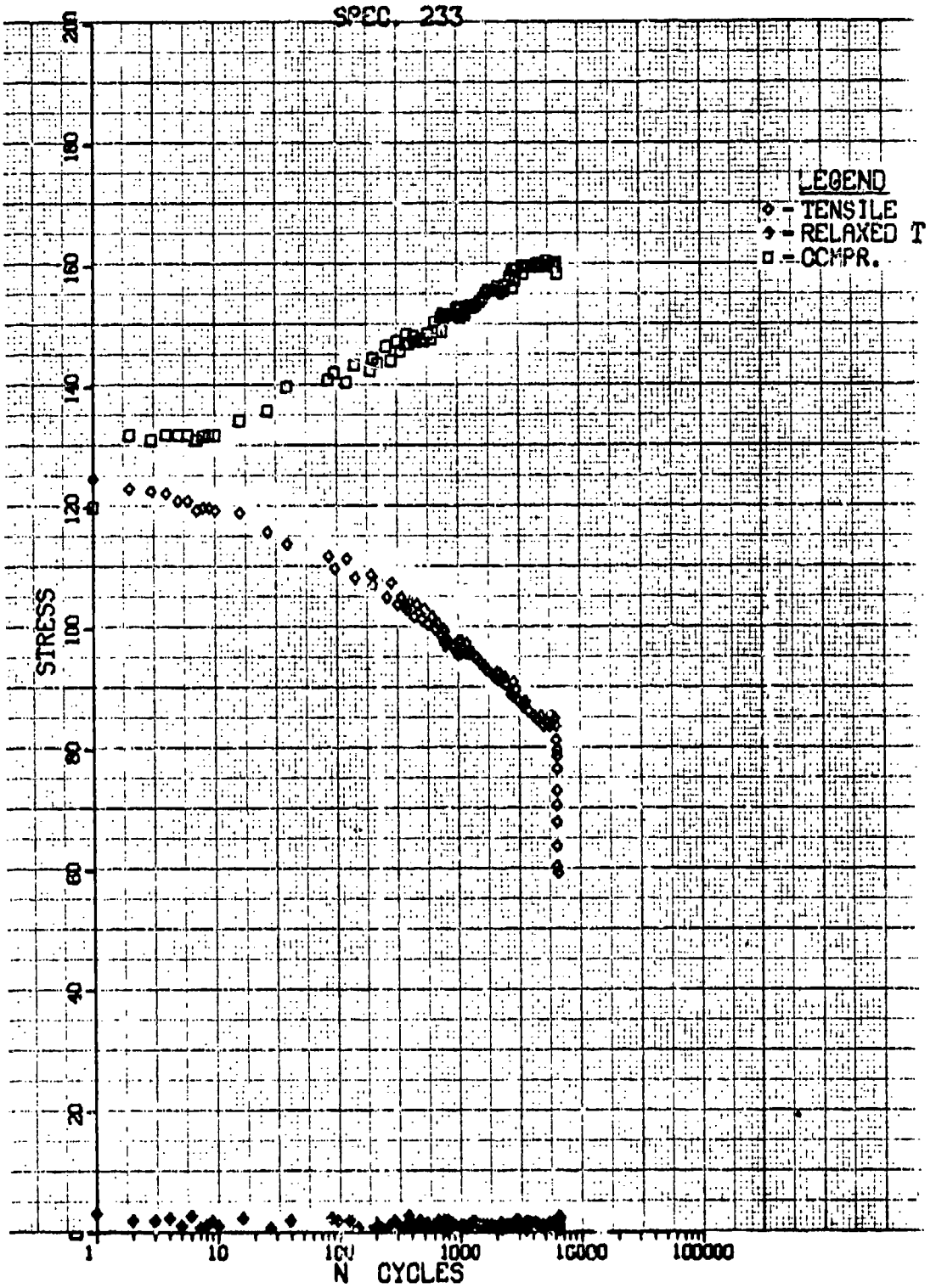

SPEC. 233
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 45.

TABLE 30

SPECIMEN 33

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 121. | -1.3 | 128. | 0.0 |
| 2 | 2. | 0. | 123. | | 139. | 0.0 |
| 3 | 3. | 0. | | 0.0 | 134. | 0.0 |
| 4 | 4. | 0. | | | 134. | 0.0 |
| 5 | 12. | 0. | 114. | 0.0 | | 0.0 |
| 6 | 16. | 0. | | 0.0 | 136. | 0.0 |
| 7 | 17. | 0. | | 0.0 | 138. | 0.0 |
| 8 | 26. | 0. | 113. | 0.0 | 138. | 0.0 |
| 9 | 28. | 0. | 113. | 0.0 | | 0.0 |
| 10 | 40. | 0. | 110. | 0.0 | 140. | 0.0 |
| 11 | 74. | 1. | 109. | 0.0 | 141. | 0.0 |
| 12 | 84. | 1. | 105. | 0.0 | 143. | 0.0 |
| 13 | 113. | 1. | 105. | 0.0 | 144. | 0.0 |
| 14 | 126. | 1. | 105. | 0.0 | 145. | 0.0 |
| 15 | 170. | 2. | 104. | 0.0 | 145. | 0.0 |
| 16 | 226. | 2. | 103. | 0.0 | | 0.0 |
| 17 | 300. | 3. | 100. | 0.0 | | 0.0 |
| 18 | 400. | 4. | 99. | 0.0 | | 0.0 |
| 19 | 453. | 5. | 98. | 0.0 | | 0.0 |
| 20 | 565. | 6. | 96. | 0.0 | | 0.0 |
| 21 | 697. | 7. | 95. | 0.0 | | 0.0 |
| 22 | 913. | 10. | 94. | 0.0 | | 0.0 |
| 23 | 1002. | 10. | 93. | 0.0 | | 0.0 |
| 24 | 1100. | 11. | 91. | 0.0 | | 0.0 |
| 25 | 1135. | 12. | 95. | 0.0 | 151. | 0.0 |
| 26 | 1150. | 12. | 94. | 0.0 | 151. | 0.0 |
| 27 | 1264. | 13. | 93. | 0.0 | 153. | 0.0 |
| 28 | 1350. | 14. | 91. | 0.0 | 153. | 0.0 |
| 29 | 1500. | 16. | 90. | 0.0 | 154. | 0.0 |
| 30 | 1600. | 17. | 90. | 0.0 | 155. | 0.0 |
| 31 | 2069. | 22. | 89. | 0.0 | 155. | 0.0 |
| 32 | 2383. | 25. | 88. | 0.0 | 156. | 0.0 |
| 33 | 2600. | 27. | 85. | 0.0 | 156. | 0.0 |
| 34 | 2800. | 29. | 85. | 0.0 | 158. | 0.0 |
| 35 | 4000. | 42. | 84. | 0.0 | 158. | 0.0 |
| 36 | 4375. | 46. | 84. | 0.0 | 159. | 0.0 |
| 37 | 4398. | 46. | 83. | 0.0 | 159. | 0.0 |
| 38 | 4800. | 50. | 83. | 0.0 | 159. | 0.0 |
| 39 | 5370. | 53. | 81. | 0.0 | 160. | 0.0 |
| 40 | 6000. | 62. | 80. | 0.0 | 160. | 0.0 |
| 41 | 6229. | 65. | 79. | 0.0 | 161. | 0.0 |
| 42 | 6300. | 66. | 80. | 0.0 | 160. | 0.0 |
| 43 | 6385. | 66. | 79. | 0.0 | 161. | 0.0 |
| 44 | 6450. | 67. | 79. | 0.0 | 160. | 0.0 |
| 45 | 6500. | 68. | 79. | 0.0 | 161. | 0.0 |
| 46 | 6515. | 68. | 80. | 0.0 | 160. | 0.0 |
| 47 | 6690. | 70. | 79. | 0.0 | 161. | 0.0 |
| 48 | 6714. | 70. | 79. | 0.0 | 161. | 0.0 |
| 49 | 6804. | 71. | 80. | 0.0 | 160. | 0.0 |
| 50 | 7003. | 73. | 79. | 0.0 | 160. | 0.0 |
| 51 | 7433. | 77. | 78. | 0.0 | 161. | 0.0 |
| 52 | 7503. | 78. | 79. | 0.0 | 160. | 0.0 |
| 53 | 7586. | 79. | 78. | 0.0 | 161. | 0.0 |
| 54 | 7690. | 82. | 80. | 0.0 | 163. | 0.0 |
| 55 | 7800. | 82. | 81. | 0.0 | 161. | 0.0 |
| 56 | 7925. | 82. | 79. | 0.0 | 161. | 0.0 |
| 57 | 7900. | 83. | 80. | 0.0 | 161. | 0.0 |
| 58 | 8400. | 87. | 79. | 1.3 | 161. | 0.0 |
| 59 | 8801. | 92. | 78. | 1.3 | 163. | 0.0 |
| 60 | 8900. | 93. | 79. | 1.3 | 163. | 0.0 |
| 61 | 9199. | 95. | 78. | 1.3 | 163. | 0.0 |
| 62 | 9340. | 97. | 80. | 2.5 | 163. | 0.0 |
| 63 | 9450. | 98. | 81. | 1.3 | 163. | 0.0 |
| 64 | 9495. | 99. | 83. | 1.3 | 163. | 0.0 |
| 65 | 9511. | 99. | 84. | 1.3 | 163. | 0.0 |
| 66 | 9517. | 99. | 85. | 2.5 | 163. | 0.0 |
| 67 | 9530. | 99. | 85. | 1.3 | 164. | 0.0 |
| 68 | 9536. | 99. | 86. | 1.3 | 163. | 0.0 |
| 69 | 9540. | 99. | 83. | 2.5 | 163. | 0.0 |
| 70 | 9556. | 99. | 89. | 2.5 | 164. | 0.0 |
| 71 | 9568. | 100. | 91. | 2.5 | 164. | 0.0 |
| 72 | 9574. | 100. | 91. | 2.5 | 165. | 0.0 |

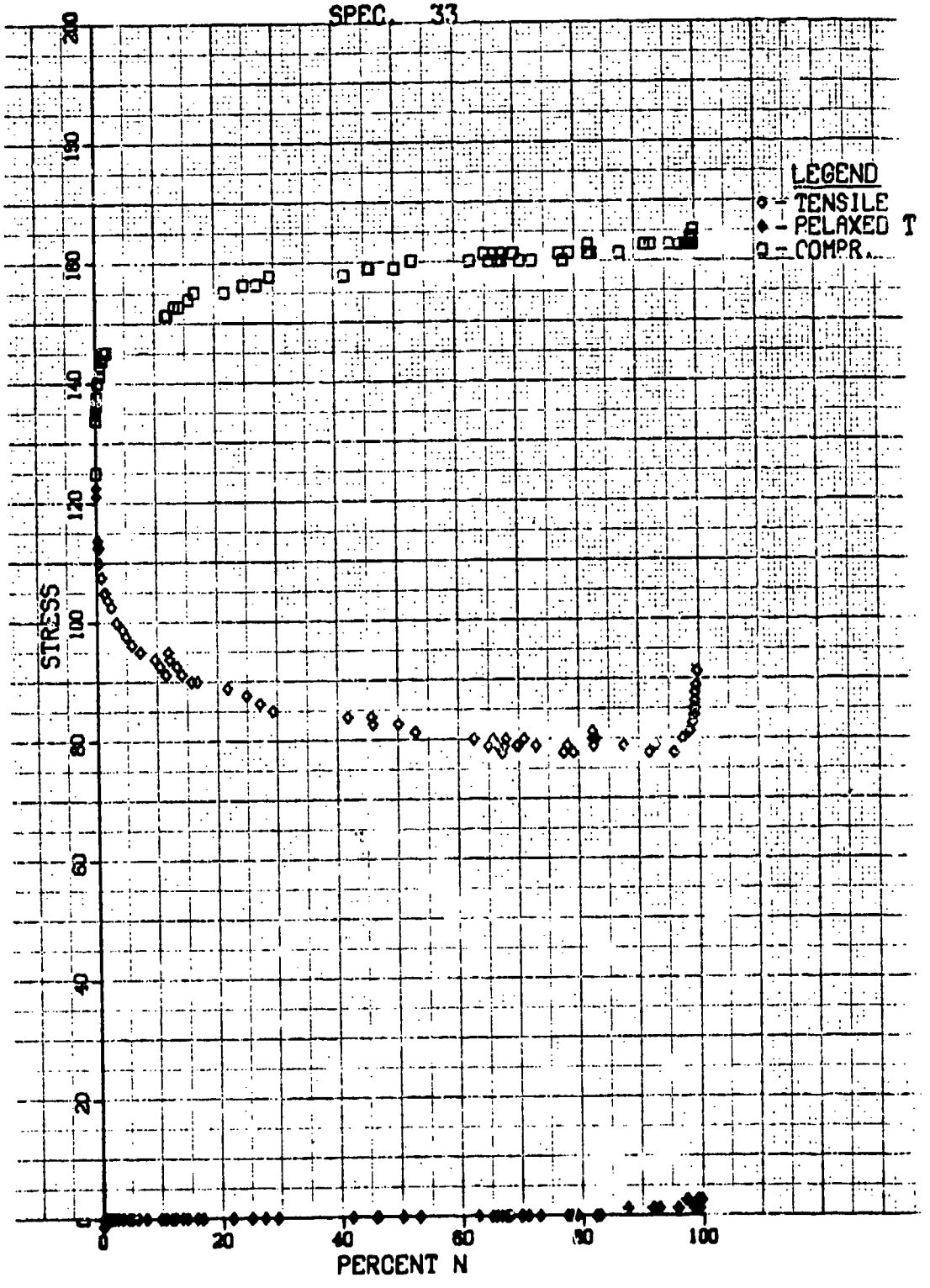

SPEC. 33
LEGEND
TENSILE
RELAXED T
COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 46.

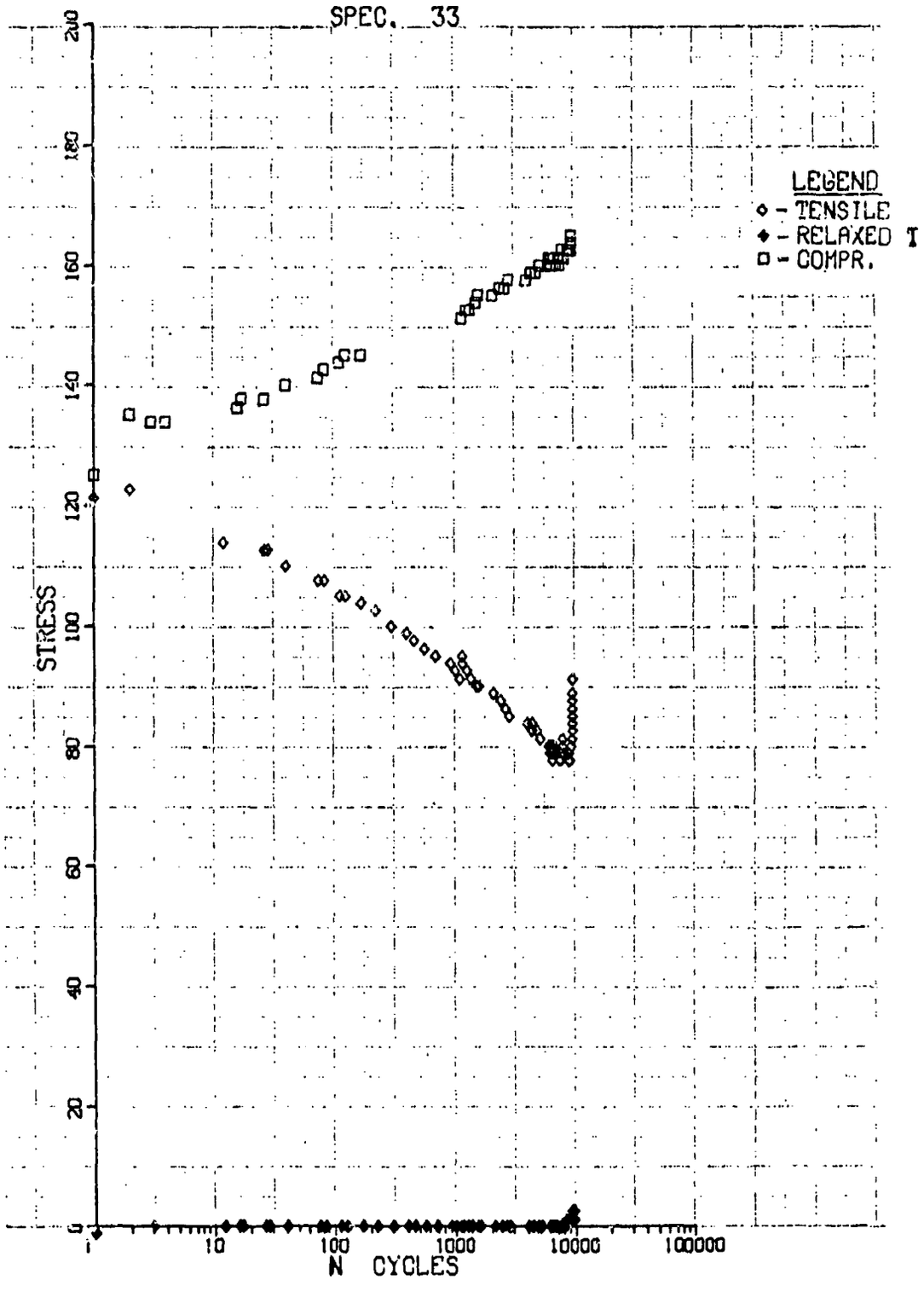

SPEC. 33
LEGEND
◇ - TENSILE
◆ - RELAXED
□ - COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 47.

TABLE 31

SPECIMEN 237

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | .01 | 114. | 2.0 | 112. | 0.0 |
| 2 | 2. | .01 | 112. | 2.0 | 112. | 0.0 |
| 3 | 9. | .05 | 109. | 1.0 | 116. | 0.0 |
| 4 | 10. | .06 | 109. | 2.0 | 117. | 0.0 |
| 5 | 11. | .07 | 108. | 1.0 | 117. | 0.0 |
| 6 | 19. | .12 | 106. | 2.0 | 119. | 0.0 |
| 7 | 20. | .12 | 106. | 2.0 | 120. | 0.0 |
| 8 | 8209. | 50.00 | 74. | 2.0 | 149. | 0.0 |
| 9 | 12314. | 75.00 | 70. | 1.0 | 152. | 0.0 |

TABLE 32

SPECIMEN 228

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 167. | 11.0 | 165. | 0.0 |
| 2 | 2. | 0. | 160. | 8.0 | 177. | 0.0 |
| 3 | 3. | 1. | 150. | 8.0 | 175. | 0.0 |
| 4 | 4. | 1. | 158. | 9.0 | 176. | 0.0 |
| 5 | 5. | 1. | 157. | 8.0 | 177. | 0.0 |
| 6 | 10. | 2. | 153. | 7.0 | 179. | 0.0 |
| 7 | 16. | 3. | 150. | 7.0 | 181. | 0.0 |
| 8 | 22. | 5. | 148. | 8.0 | 182. | 0.0 |
| 9 | 28. | 6. | 146. | 8.0 | 182. | 0.0 |
| 10 | 34. | 7. | 145. | 7.0 | 184. | 0.0 |
| 11 | 46. | 10. | 144. | 8.0 | 184. | 0.0 |
| 12 | 52. | 11. | 142. | 7.0 | 185. | 0.0 |
| 13 | 64. | 13. | 141. | 6.0 | 185. | 0.0 |
| 14 | 70. | 15. | 140. | 8.0 | 186. | 0.0 |
| 15 | 81. | 17. | 139. | 6.0 | 187. | 0.0 |
| 16 | 88. | 18. | 138. | 8.0 | 188. | 0.0 |
| 17 | 105. | 22. | 135. | 7.0 | 189. | 0.0 |
| 18 | 111. | 23. | 136. | 10.0 | 190. | 0.0 |
| 19 | 117. | 24. | 136. | 9.0 | 189. | 0.0 |
| 20 | 129. | 27. | 134. | 8.0 | 190. | 0.0 |
| 21 | 153. | 32. | 132. | 8.0 | 191. | 0.0 |
| 22 | 160. | 33. | 131. | 7.0 | 191. | 0.0 |
| 23 | 208. | 43. | 130. | 7.0 | 190. | 0.0 |
| 24 | 213. | 44. | 131. | 9.0 | 192. | 0.0 |
| 25 | 231. | 48. | 130. | 9.0 | 191. | 0.0 |
| 26 | 246. | 51. | 129. | 9.0 | 192. | 0.0 |
| 27 | 248. | 52. | 132. | 9.0 | 192. | 0.0 |
| 28 | 272. | 57. | 130. | 8.0 | 190. | 0.0 |
| 29 | 278. | 58. | 129. | 9.0 | 192. | 0.0 |
| 30 | 284. | 59. | 128. | 8.0 | 192. | 0.0 |
| 31 | 308. | 64. | 128. | 10.0 | 192. | 0.0 |
| 32 | 319. | 66. | 128. | 11.0 | 192. | 0.0 |
| 33 | 326. | 68. | 127. | 9.0 | 192. | 0.0 |
| 34 | 331. | 69. | 128. | 12.0 | 193. | 0.0 |
| 35 | 360. | 75. | 126. | 10.0 | 192. | 0.0 |
| 36 | 371. | 77. | 125. | 9.0 | 192. | 0.0 |
| 37 | 383. | 80. | 124. | 10.0 | 194. | 0.0 |
| 38 | 389. | 81. | 123. | 9.0 | 193. | 0.0 |
| 39 | 395. | 82. | 124. | 10.0 | 193. | 0.0 |
| 40 | 437. | 91. | 122. | 9.0 | 192. | 0.0 |
| 41 | 449. | 93. | 120. | 12.0 | 192. | 0.0 |
| 42 | 455. | 95. | 116. | 12.0 | 192. | 0.0 |
| 43 | 461. | 96. | 106. | 12.0 | 192. | 0.0 |
| 44 | 462. | 96. | 102. | | | 0.0 |
| 45 | 467. | 97. | 88. | 10.0 | 193. | 0.0 |
| 46 | 468. | 97. | 84. | | | 0.0 |
| 47 | 473. | 98. | 63. | 11.0 | 196. | 0.0 |
| 48 | 474. | 99. | 53. | | | 0.0 |

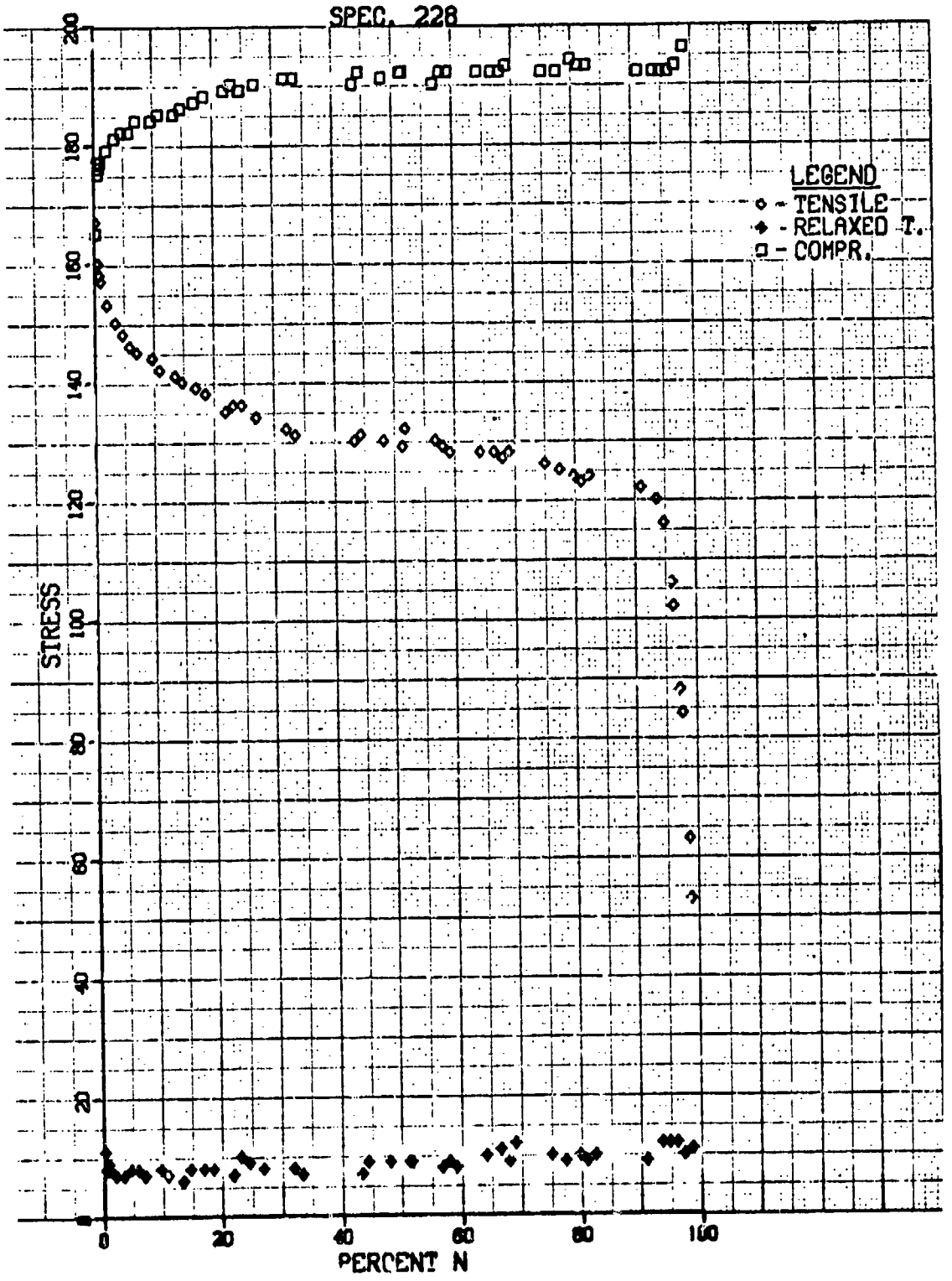

SPEC. 228
LEGEND
- TENSILE
- RELAXED T.
- COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
20
40
60
80
100
PERCENT N

Figure 48.

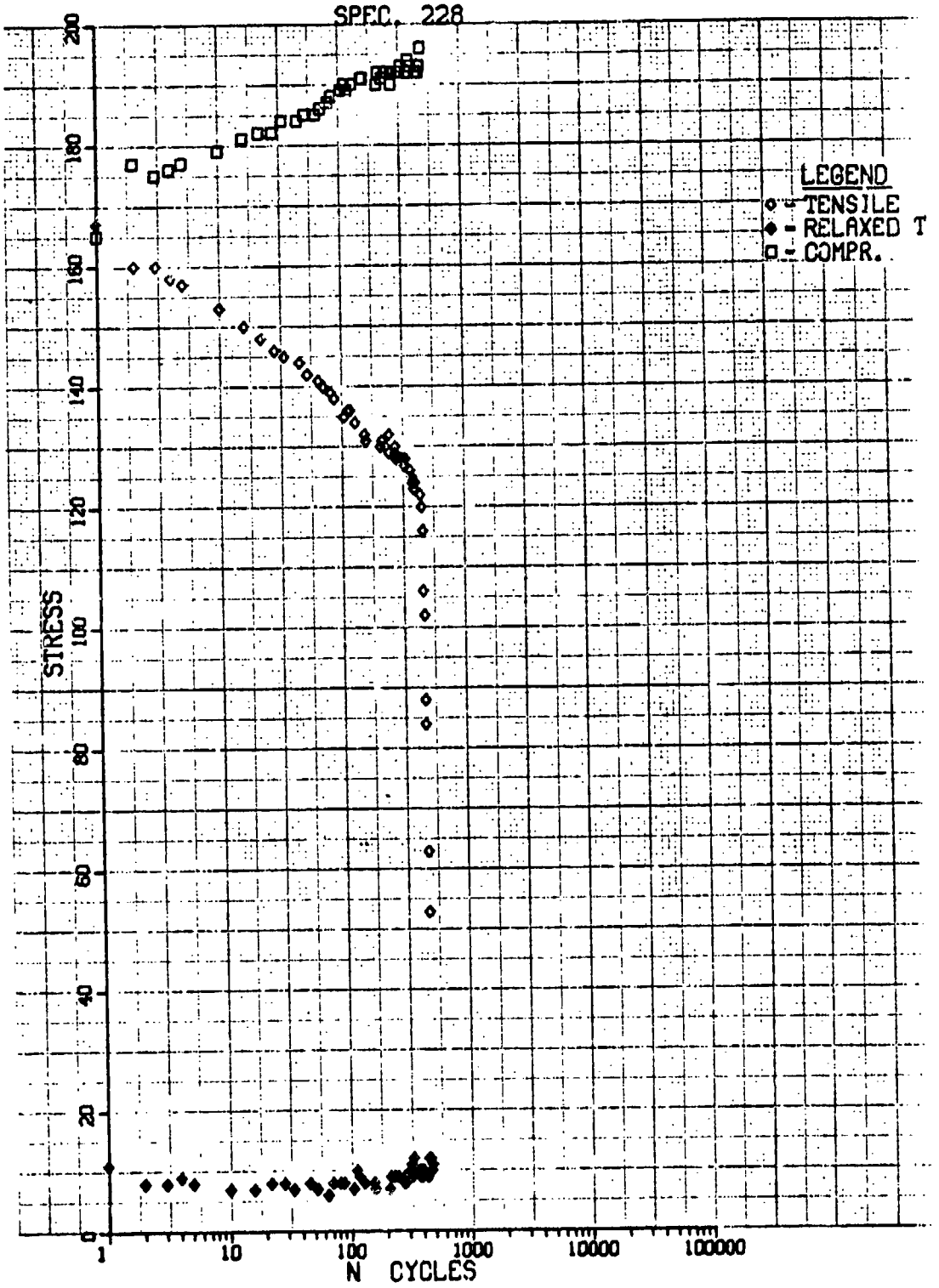

SPEC. 228
LEGEND
TENSILE
RELAXED T
COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 49.

TABLE 33

SPECIMEN 40

| I | N | XN | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 153. | 10.0 | 153. | 0.0 |
| 2 | 2. | 0. | 146. | 7.5 | 163. | 0.0 |
| 3 | 3. | 0. | 145. | 10.0 | 160. | 0.0 |
| 4 | 4. | 0. | 141. | 6.3 | 160. | 0.0 |
| 5 | 7. | 0. | 138. | 5.0 | 163. | 0.0 |
| 6 | 10. | 1. | 136. | 5.0 | 164. | 0.0 |
| 7 | 19. | 1. | 133. | 5.0 | 166. | 0.0 |
| 8 | 31. | 2. | 129. | 3.8 | 168. | 0.0 |
| 9 | 43. | 3. | 126. | 5.0 | 170. | 0.0 |
| 10 | 55. | 3. | 125. | 5.0 | 171. | 0.0 |
| 11 | 67. | 4. | 124. | 3.8 | 173. | 0.0 |
| 12 | 71. | 4. | 123. | 5.0 | 174. | 0.0 |
| 13 | 91. | 5. | 121. | 5.0 | 174. | 0.0 |
| 14 | 102. | 6. | 120. | 5.0 | 175. | 0.0 |
| 15 | 114. | 7. | 124. | 8.5 | 173. | 0.0 |
| 16 | 118. | 7. | 121. | 6.3 | 174. | 0.0 |
| 17 | 129. | 8. | 120. | 5.0 | 171. | 0.0 |
| 18 | 137. | 8. | 121. | 6.3 | 171. | 0.0 |
| 19 | 177. | 10. | 120. | 5.0 | 173. | 0.0 |
| 20 | 201. | 12. | 119. | 3.8 | 173. | 0.0 |
| 21 | 213. | 12. | 119. | 6.3 | 173. | 0.0 |
| 22 | 239. | 14. | 115. | 3.8 | 174. | 0.0 |
| 23 | 253. | 15. | 118. | 5.0 | 174. | 0.0 |
| 24 | 287. | 17. | 116. | 5.0 | 175. | 0.0 |
| 25 | 345. | 20. | 115. | 5.0 | 175. | 0.0 |
| 26 | 485. | 29. | 114. | 6.3 | 176. | 0.0 |
| 27 | 525. | 31. | 113. | 5.0 | 176. | 0.0 |
| 28 | 535. | 31. | 113. | 6.3 | 176. | 0.0 |
| 29 | 631. | 37. | 111. | 5.0 | 178. | 0.0 |
| 30 | 643. | 38. | 111. | 6.3 | 178. | 0.0 |
| 31 | 691. | 41. | 110. | 6.3 | 179. | 0.0 |
| 32 | 774. | 45. | 109. | 6.3 | 179. | 0.0 |
| 33 | 812. | 48. | 108. | 6.3 | 180. | 0.0 |
| 34 | 1025. | 60. | 110. | 7.5 | 176. | 0.0 |
| 35 | 1241. | 73. | 106. | 6.3 | 178. | 0.0 |
| 36 | 1256. | 74. | 106. | 6.3 | 178. | 0.0 |
| 37 | 1264. | 74. | 108. | 7.5 | 178. | 0.0 |
| 38 | 1276. | 75. | 106. | 6.3 | 175. | 0.0 |
| 39 | 1396. | 82. | 105. | 6.3 | 176. | 0.0 |
| 40 | 1406. | 83. | 105. | 7.5 | 178. | 0.0 |
| 41 | 1538. | 90. | 104. | 8.8 | 178. | 0.0 |
| 42 | 1575. | 92. | 105. | 10.0 | 176. | 0.0 |
| 43 | 1610. | 94. | 104. | 8.8 | 176. | 0.0 |
| 44 | 1611. | 94. | 103. | 7.5 | 175. | 0.0 |
| 45 | 1650. | 97. | 101. | 3.8 | 176. | 0.0 |
| 46 | 1657. | 97. | 100. | 2.5 | 178. | 0.0 |
| 47 | 1694. | 99. | 99. | 8.8 | 175. | 0.0 |
| 48 | 1701. | 100. | 95. | 10.0 | 175. | 0.0 |
| 49 | 1702. | 100. | 94. | 8.8 | 175. | 0.0 |
| 50 | 1703. | 100. | 93. | 10.0 | 175. | 0.0 |
| 51 | 1704. | 100. | 95. | 10.0 | 175. | 0.0 |
| 52 | 1705. | 100. | 83. | 7.5 | 174. | 0.0 |
| 53 | 1706. | 100. | 83. | | | 0.0 |

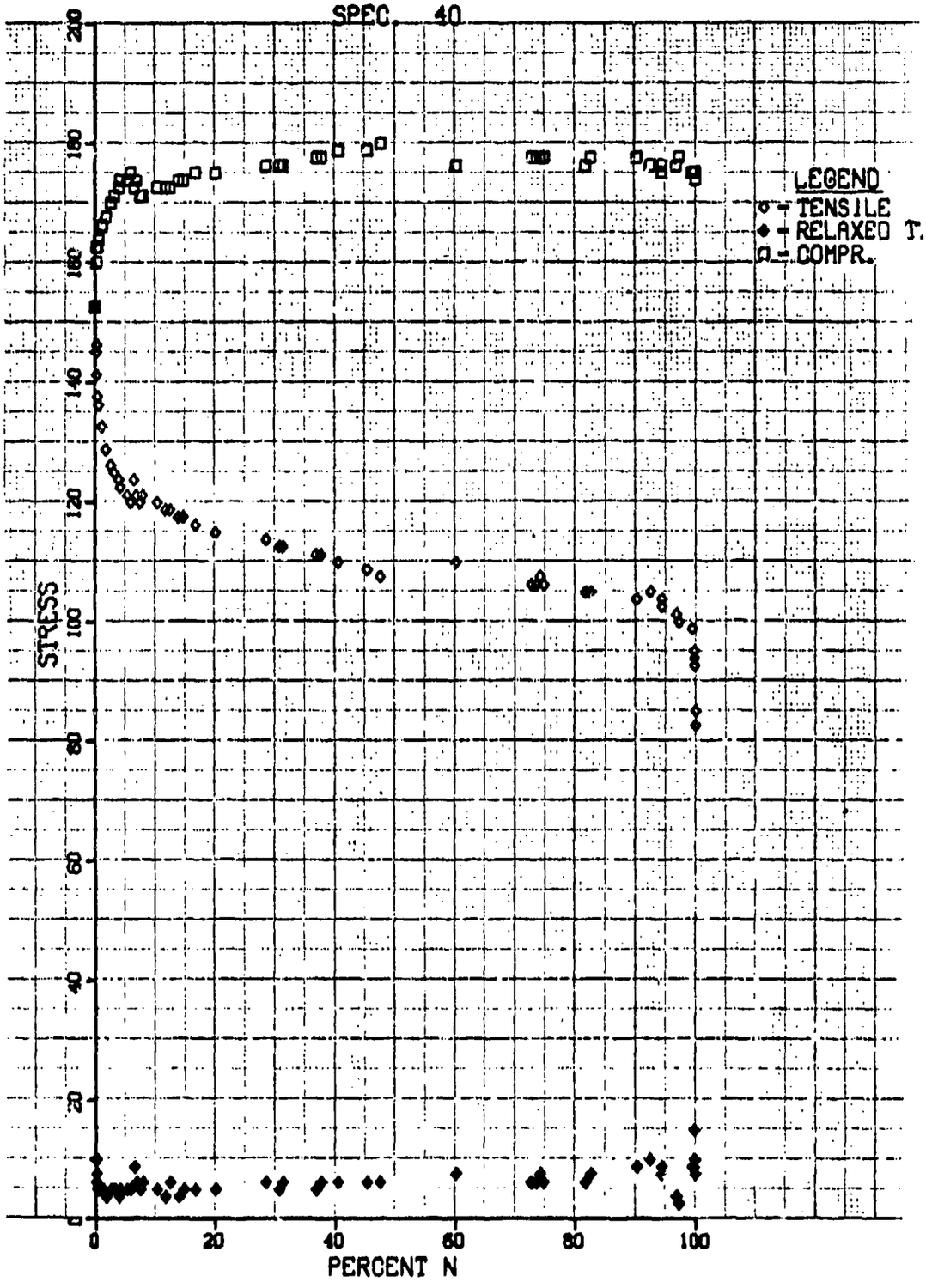

SPEC. 40
LEGEND
TENSILE
RELAXED T.
COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 50.

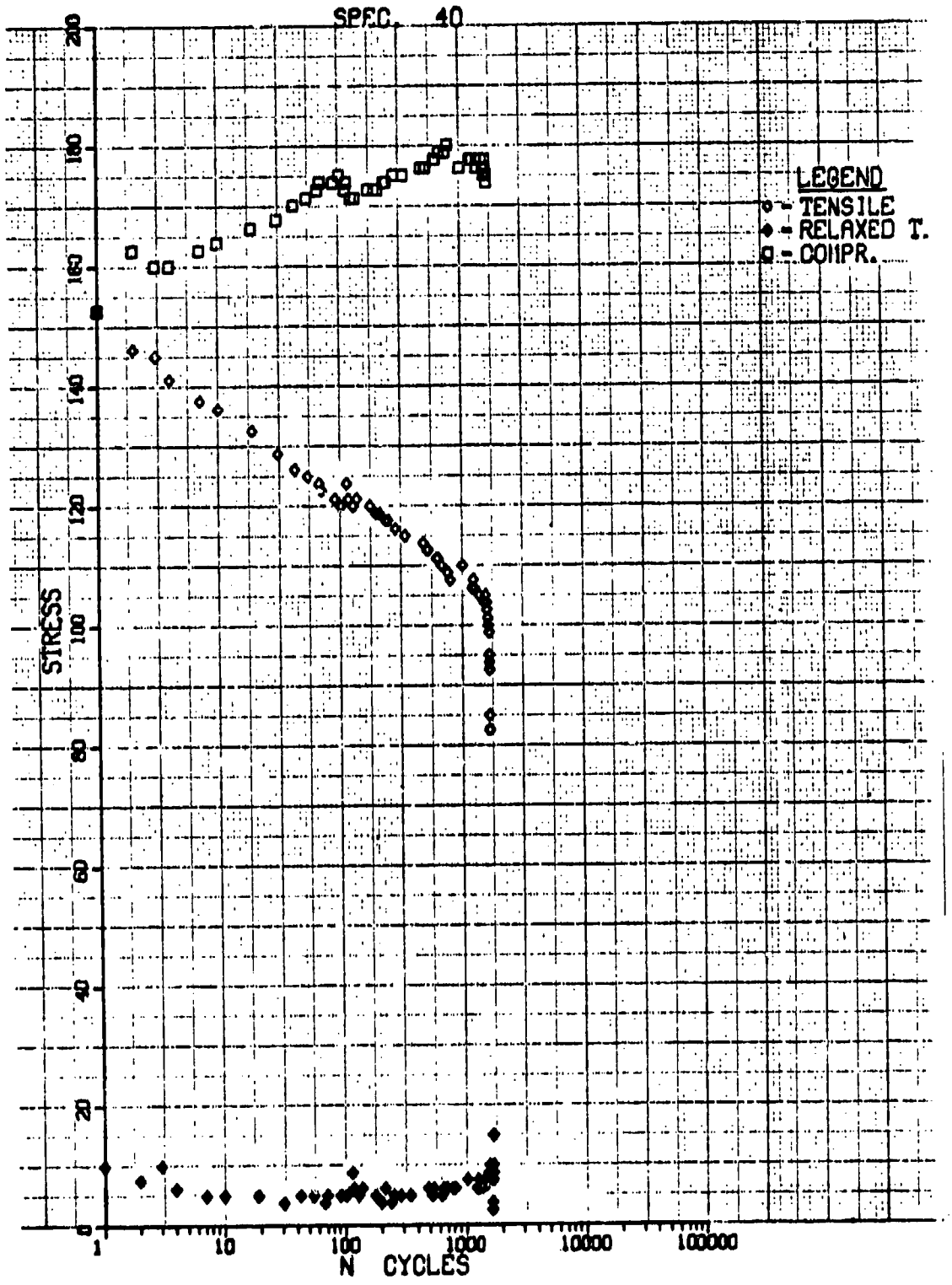

SPEC. 40
LEGEND
- TENSILE
- RELAXED T.
- COMPR.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 51.

TABLE 34

SPECIMEN 242

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD COMPR. | RELAXED COMPR. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 172. | 158. | 8.0 | 184. | 0. | 0.0 |
| 2 | 2. | 0. | 172. | 166. | 14.0 | 184. | 0. | 0.0 |
| 3 | 3. | 1. | 172. | 166. | 14.0 | 185. | 0. | 0.0 |
| 4 | 4. | 1. | 174. | 168. | 15.0 | 185. | 0. | 0.0 |
| 5 | 20. | 4. | 172. | 168. | 16.0 | 183. | 0. | 0.0 |
| 6 | 31. | 7. | 172. | 168. | 17.0 | 188. | 0. | 0.0 |
| 7 | 46. | 10. | 171. | 166. | 16.0 | 188. | 0. | 0.0 |
| 8 | 62. | 13. | 170. | 164. | 15.0 | 183. | 0. | 0.0 |
| 9 | 77. | 16. | 169. | 163. | 15.0 | 183. | 0. | 0.0 |
| 10 | 92. | 19. | 168. | 162. | 15.0 | 188. | 0. | 0.0 |
| 11 | 111. | 24. | 168. | 160. | 14.0 | 188. | 0. | 0.0 |
| 12 | 123. | 26. | 167. | 160. | 15.0 | 183. | 0. | 0.0 |
| 13 | 124. | 26. | 166. | 160. | 16.0 | 188. | 0. | 0.0 |
| 14 | 152. | 32. | 164. | 158. | 14.0 | 188. | 0. | 0.0 |
| 15 | 209. | 44. | 164. | 156. | 13.0 | 188. | 0. | 0.0 |
| 16 | 222. | 47. | 164. | 155. | 13.0 | 188. | 0. | 0.0 |
| 17 | 250. | 53. | 162. | 154. | 14.0 | 188. | 0. | 0.0 |
| 18 | 270. | 57. | 162. | 154. | 14.0 | 186. | 0. | 0.0 |
| 19 | 295. | 63. | 160. | 152. | 13.0 | 183. | 0. | 0.0 |
| 20 | 340. | 72. | 160. | 151. | 12.0 | 185. | 0. | 0.0 |
| 21 | 384. | 81. | 157. | 150. | 14.0 | 190. | 0. | 0.0 |
| 22 | 400. | 85. | 160. | 150. | 13.0 | 184. | 0. | 0.0 |
| 23 | 416. | 88. | 158. | 150. | 14.0 | 184. | 0. | 0.0 |
| 24 | 430. | 91. | 157. | 148. | 12.0 | 184. | 0. | 0.0 |
| 25 | 445. | 94. | 156. | 148. | 14.0 | 184. | 0. | 0.0 |
| 26 | 460. | 97. | 152. | 146. | 16.0 | 184. | 0. | 0.0 |

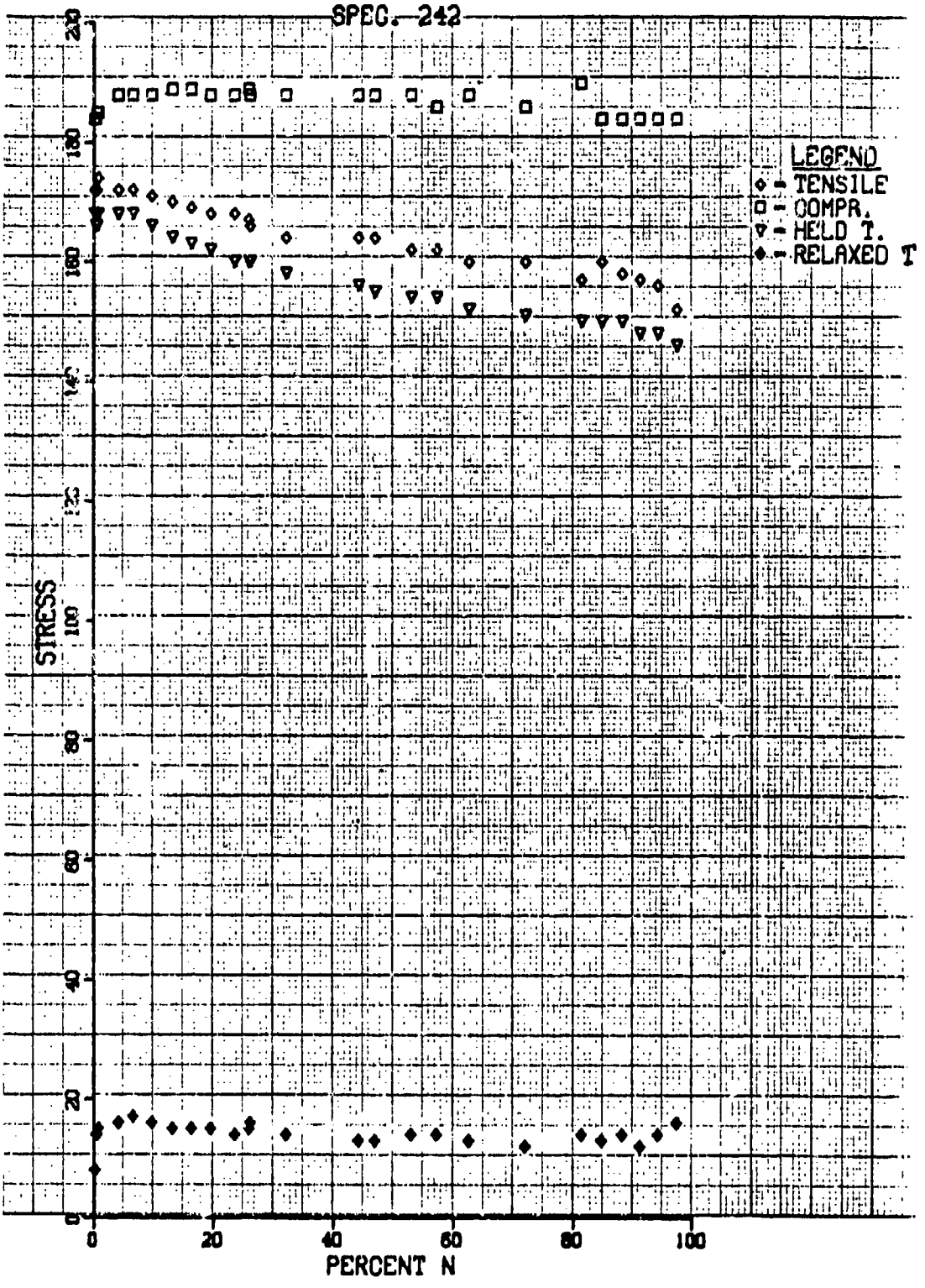

SPEC. 242
LEGEND
◇ - TENSILE
□ - COMPR.
▽ - HELD T.
◆ - RELAXED T
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 52.

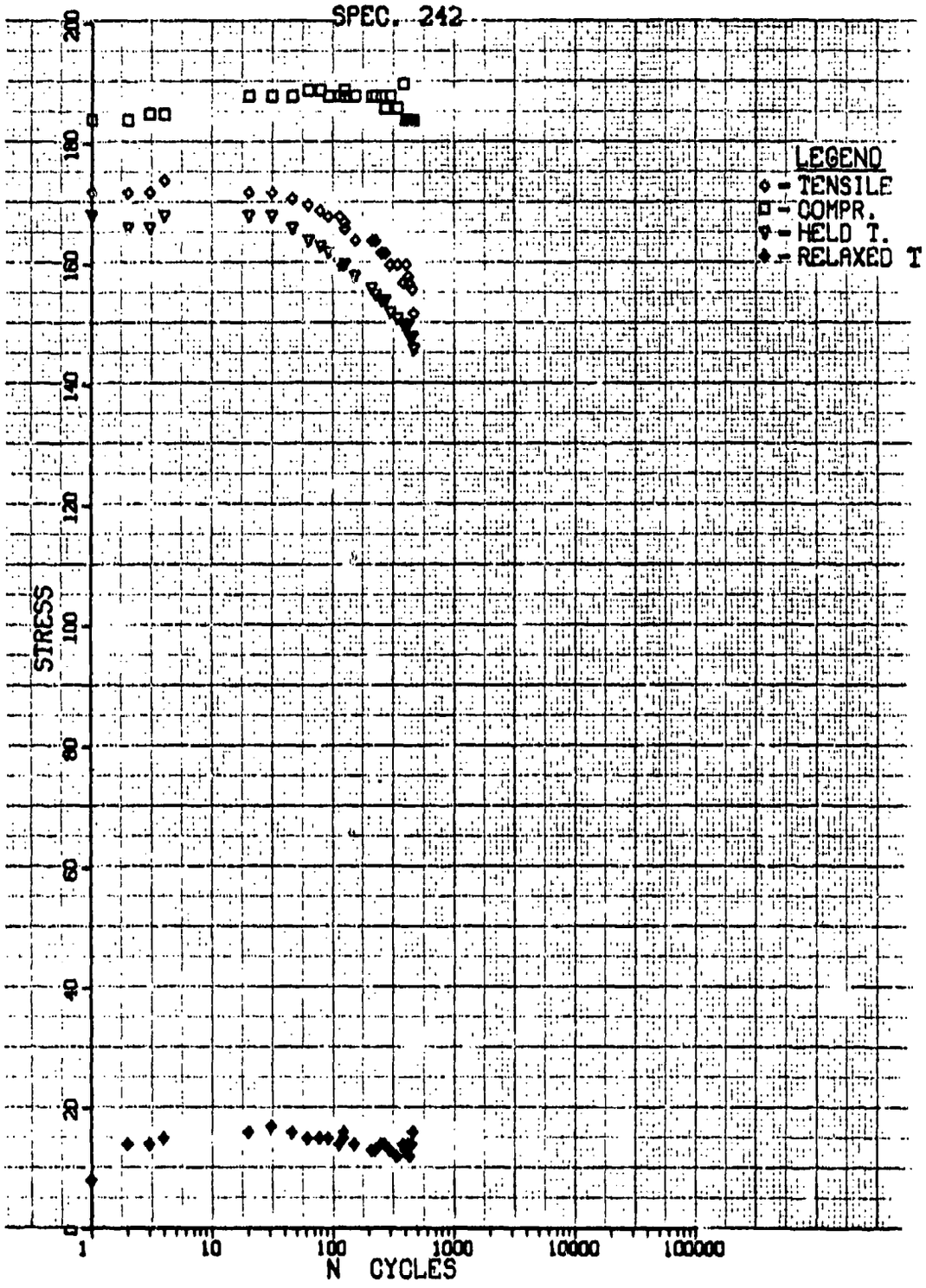

SPEC. 242
LEGEND
◇ - TENSILE
□ - COMPR.
▽ - HELD T.
◆ - RELAXED T
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 53.

TABLE 35

SPECIMEN 246

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD COMPR. | RELAXED COMPR. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 171. | 167. | 10.2 | 185. | 0. | 0.0 |
| 2 | 2. | 1. | 175. | 168. | 23.2 | 185. | 0. | 0.0 |
| 3 | 3. | 1. | 176. | 160. | 16.4 | 180. | 0. | 0.0 |
| 4 | 4. | 2. | 175. | 157. | 17.0 | 188. | 0. | 0.0 |
| 5 | 5. | 2. | 176. | 160. | 21.4 | 186. | 0. | 0.0 |
| 6 | 6. | 2. | 175. | 157. | 20.2 | 185. | 0. | 0.0 |
| 7 | 8. | 3. | 175. | 156. | 19.6 | 185. | 0. | 0.0 |
| 8 | 11. | 4. | 175. | 154. | 18.0 | 187. | 0. | 0.0 |
| 9 | 13. | 5. | 175. | 153. | 18.0 | 186. | 0. | 0.0 |
| 10 | 16. | 6. | 175. | 152. | 18.4 | 188. | 0. | 0.0 |
| 11 | 17. | 7. | 175. | 152. | 17.2 | 188. | 0. | 0.0 |
| 12 | 20. | 8. | 175. | 152. | 17.6 | 188. | 0. | 0.0 |
| 13 | 23. | 9. | 173. | 151. | 18.2 | | 0. | 0.0 |
| 14 | 29. | 11. | 174. | 150. | 18.0 | 189. | 0. | 0.0 |
| 15 | 32. | 13. | 174. | 150. | 16.8 | 189. | 0. | 0.0 |
| 16 | 39. | 15. | 174. | 149. | 18.0 | 189. | 0. | 0.0 |
| 17 | 40. | 16. | 175. | 149. | 16.4 | 189. | 0. | 0.0 |
| 18 | 48. | 19. | 173. | 148. | 17.2 | 189. | 0. | 0.0 |
| 19 | 58. | 23. | 172. | 147. | 17.0 | 191. | 0. | 0.0 |
| 20 | 69. | 27. | 172. | 147. | 16.0 | 189. | 0. | 0.0 |
| 21 | 77. | 30. | 172. | 147. | 17.4 | 190. | 0. | 0.0 |
| 22 | 86. | 34. | 172. | 146. | 16.8 | 190. | 0. | 0.0 |
| 23 | 96. | 38. | 172. | 145. | 15.4 | 190. | 0. | 0.0 |
| 24 | 97. | 38. | 171. | 145. | 17.2 | 190. | 0. | 0.0 |
| 25 | 98. | 39. | 173. | 144. | 13.2 | 189. | 0. | 0.0 |
| 26 | 99. | 39. | 172. | 146. | 15.8 | 189. | 0. | 0.0 |
| 27 | 105. | 42. | 172. | 145. | 15.6 | 190. | 0. | 0.0 |
| 28 | 117. | 46. | 171. | 144. | 16.4 | 190. | 0. | 0.0 |
| 29 | 124. | 49. | 170. | 144. | 16.6 | 192. | 0. | 0.0 |
| 30 | 125. | 49. | 171. | 144. | 16.0 | 191. | 0. | 0.0 |
| 31 | 134. | 53. | 171. | 144. | 15.6 | 190. | 0. | 0.0 |
| 32 | 145. | 57. | 171. | 144. | 17.2 | 190. | 0. | 0.0 |
| 33 | 153. | 60. | 171. | 143. | 16.0 | 190. | 0. | 0.0 |
| 34 | 156. | [illegible] | 169. | 143. | 16.0 | 190. | 0. | 0.0 |
| 35 | 162. | 64. | 169. | 142. | 15.4 | 191. | 0. | 0.0 |
| 36 | 172. | 68. | 169. | 143. | 16.4 | 190. | 0. | 0.0 |
| 37 | 181. | 72. | 168. | 143. | 17.0 | 191. | 0. | 0.0 |
| 38 | 183. | 72. | 169. | 143. | 16.0 | 190. | 0. | 0.0 |
| 39 | 192. | 76. | 168. | 142. | 16.8 | 191. | 0. | 0.0 |
| 40 | 202. | 80. | 168. | 141. | 15.0 | 190. | 0. | 0.0 |
| 41 | 210. | 83. | 168. | 142. | 16.2 | 190. | 0. | 0.0 |
| 42 | 217. | 84. | 168. | 141. | 15.2 | 190. | 0. | 0.0 |
| 43 | 220. | 87. | 168. | 140. | 16.0 | 191. | 0. | 0.0 |
| 44 | 229. | 91. | 166. | 140. | 16.8 | 192. | 0. | 0.0 |
| 45 | 230. | 91. | 168. | 140. | 14.0 | 190. | 0. | 0.0 |
| 46 | 239. | 94. | 167. | 140. | 15.4 | 190. | 0. | 0.0 |
| 47 | 251. | 99. | 165. | 140. | 16.4 | 191. | 0. | 0.0 |

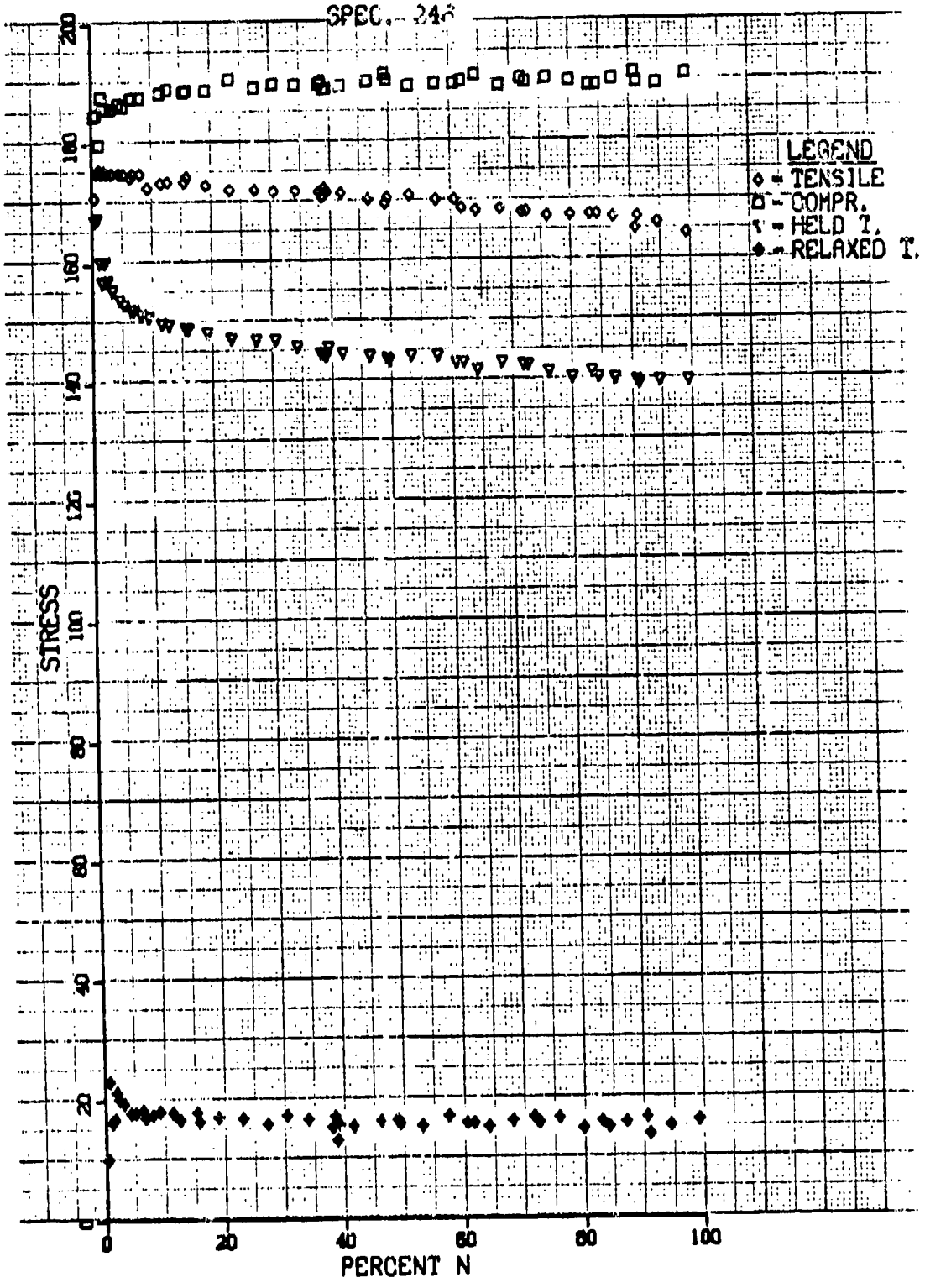

SPEC. 242
LEGEND
◇ = TENSILE
□ = COMPR.
▽ = HELD T.
◆ = RELAXED T.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 54.

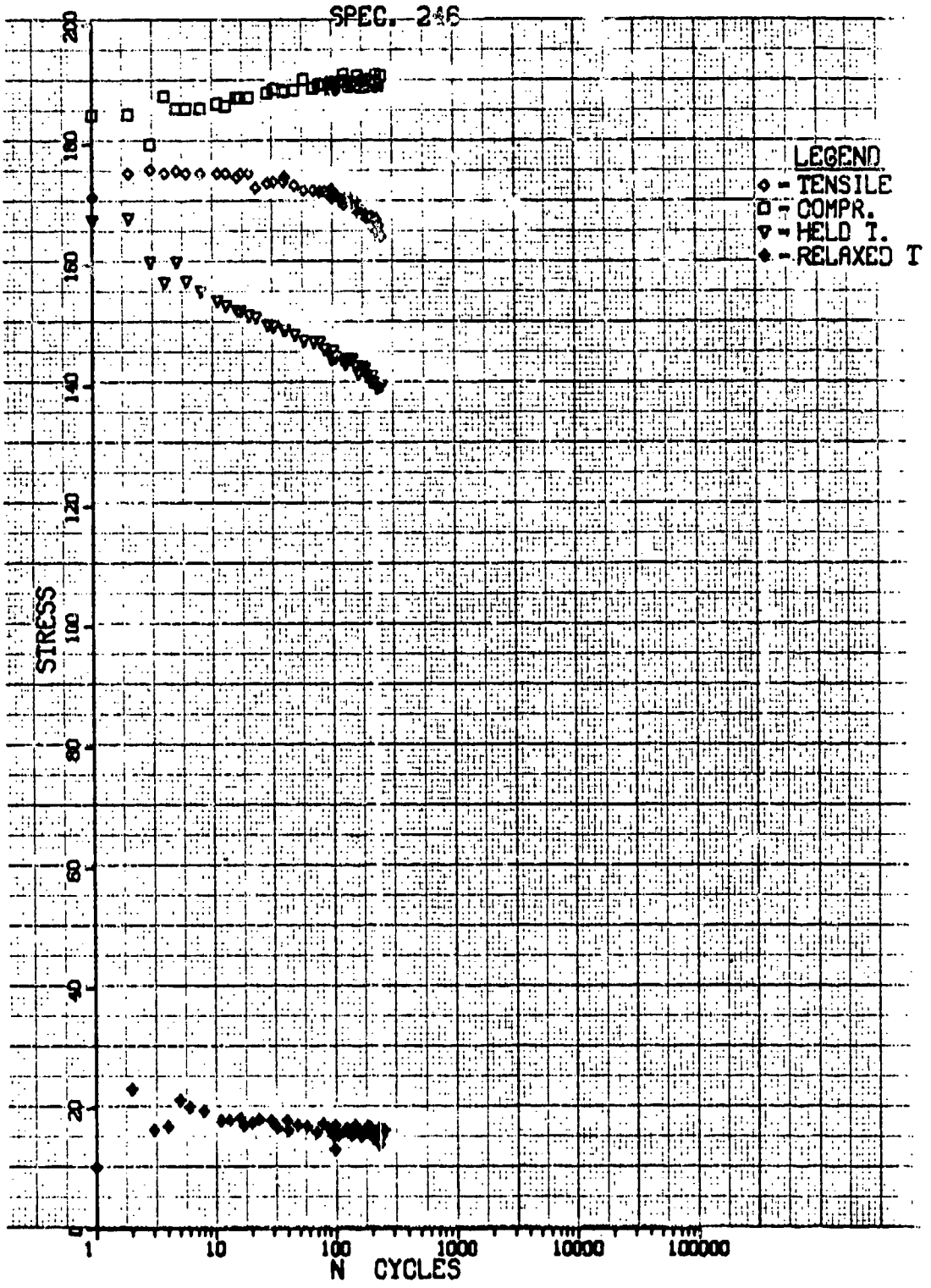

SPEC. 246
LEGEND
◇ - TENSILE
□ - COMPR.
▽ - HELD T.
◆ - RELAXED T
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 55.

TABLE 36

SPECIMEN 244

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD COMPR. | RELAXED COMPR. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 170. | 160. | 4.0 | 176. | 0. | 0.0 |
| 2 | 2. | 0. | 168. | 150. | 13.0 | 175. | 0. | 0.0 |
| 3 | 3. | 1. | 168. | 159. | 11.0 | 175. | 0. | 0.0 |
| 4 | 4. | 1. | 168. | 159. | 15.0 | 175. | 0. | 0.0 |
| 5 | 5. | 1. | 168. | 159. | 15.0 | 175. | 0. | 0.0 |
| 6 | 13. | 3. | 166. | 158. | 13.0 | 177. | 0. | 0.0 |
| 7 | 30. | 7. | 164. | 154. | 12.0 | 180. | 0. | 0.0 |
| 8 | 49. | 11. | 163. | 153. | 11.0 | 180. | 0. | 0.0 |
| 9 | 60. | 13. | 162. | 152. | 12.0 | 180. | 0. | 0.0 |
| 10 | 75. | 17. | 161. | 151. | 11.0 | 180. | 0. | 0.0 |
| 11 | 90. | 20. | 160. | 149. | 11.0 | 181. | 0. | 0.0 |
| 12 | 110. | 25. | 160. | 149. | 11.0 | 180. | 0. | 0.0 |
| 13 | 121. | 27. | 159. | 148. | 11.0 | 180. | 0. | 0.0 |
| 14 | 136. | 30. | 158. | 148. | 12.0 | 181. | 0. | 0.0 |
| 15 | 151. | 34. | 156. | 146. | 11.0 | 182. | 0. | 0.0 |
| 16 | 170. | 38. | 156. | 146. | 11.0 | 182. | 0. | 0.0 |
| 17 | 230. | 51. | 154. | 144. | 11.0 | 182. | 0. | 0.0 |
| 18 | 241. | 54. | 155. | 144. | 12.0 | 180. | 0. | 0.0 |
| 19 | 290. | 65. | 154. | 143. | 11.0 | 180. | 0. | 0.0 |
| 20 | 321. | 72. | 151. | 142. | 12.0 | 182. | 0. | 0.0 |
| 21 | 340. | 76. | 152. | 141. | 10.0 | 181. | 0. | 0.0 |
| 22 | 367. | 82. | 152. | 140. | 9.0 | 180. | 0. | 0.0 |
| 23 | 411. | 92. | 151. | 140. | 11.0 | 180. | 0. | 0.0 |
| 24 | 426. | 95. | 152. | 141. | 11.0 | 180. | 0. | 0.0 |
| 25 | 430. | 96. | 150. | 140. | 12.0 | 180. | 0. | 0.0 |
| 26 | 441. | 99. | 156. | 144. | 10.0 | 180. | 0. | 0.0 |
| 27 | 444. | 99. | 157. | 148. | 12.0 | 180. | 0. | 0.0 |
| 28 | 446. | 100. | 160. | 149. | 13.0 | 180. | 0. | 0.0 |
| 29 | 447. | 100. | | 152. | | | 0. | 0.0 |

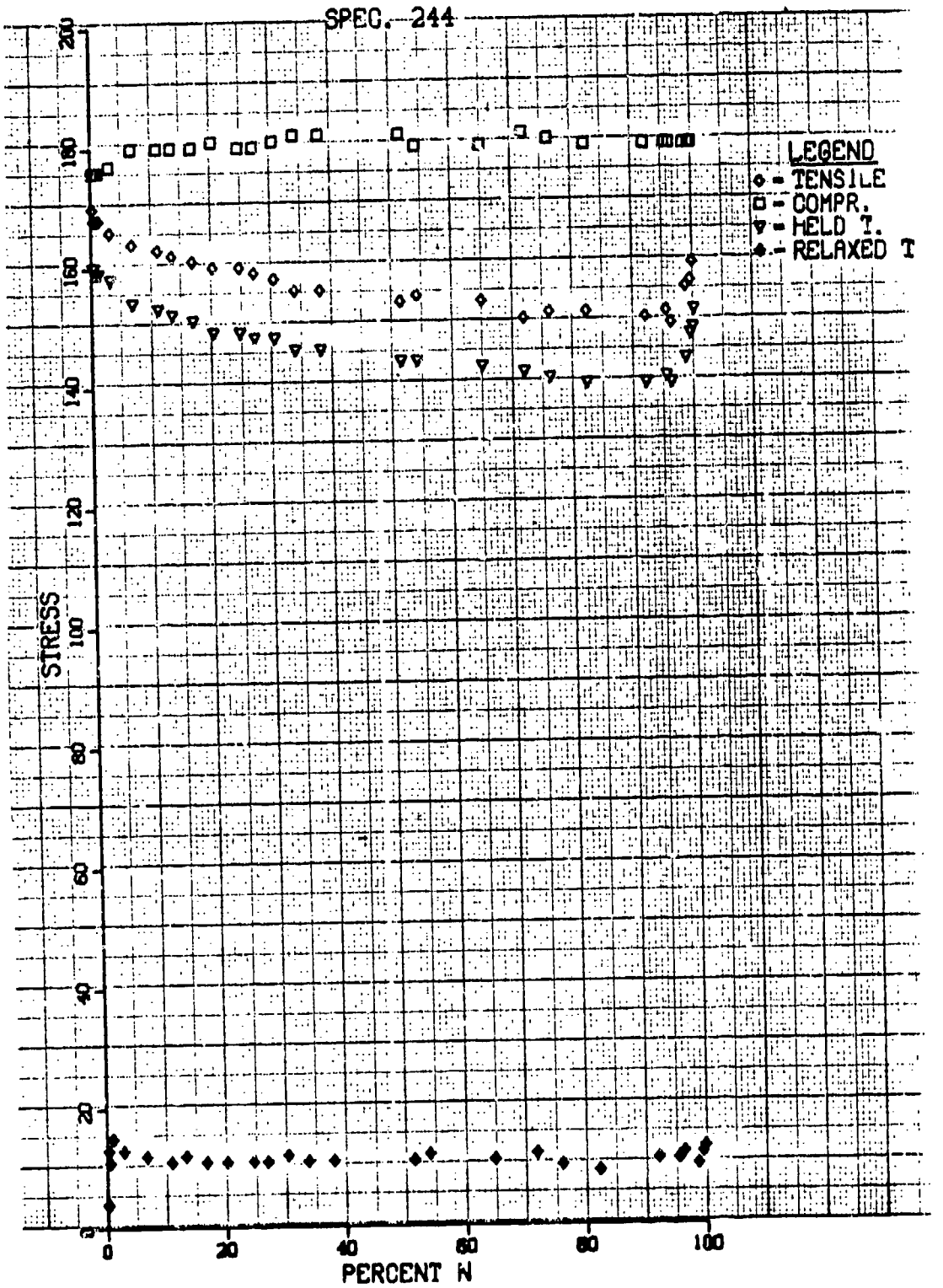

SPEC. 244
LEGEND
◇ - TENSILE
□ - COMPR.
▽ - HELD T.
◆ - RELAXED T
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 56.

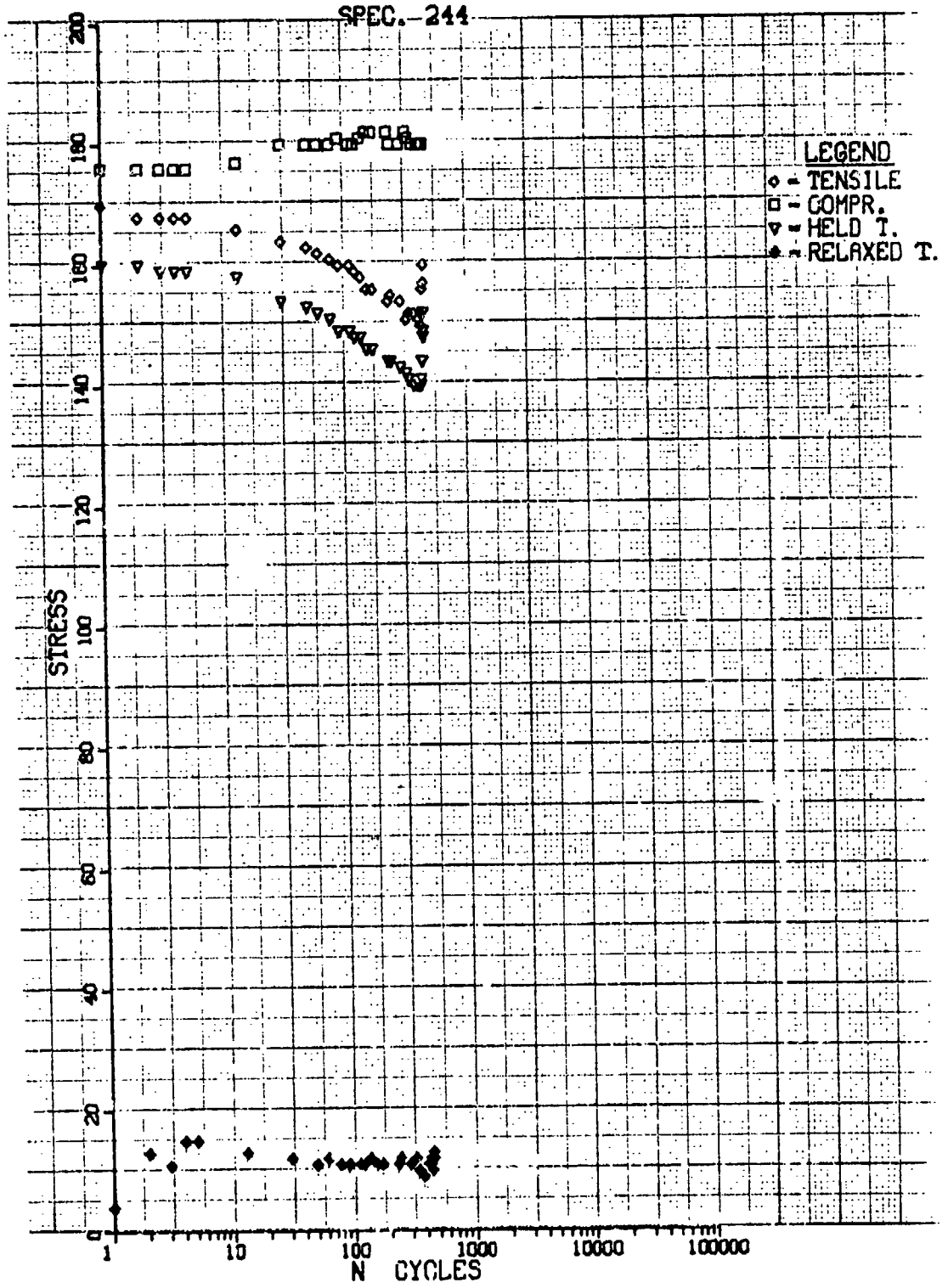

SPEC. 244
LEGEND
◇ - TENSILE
□ - COMPR.
▽ - HELD T.
◆ - RELAXED T.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 57.

TABLE 37

SPECIMEN 232

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD COMPR. | RELAXED COMPR. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 172. | 146. | 0.0 | 156. | 0. | 0.0 |
| 2 | 2. | 0. | 172. | 133. | 1.0 | 164. | 0. | 0.0 |
| 3 | 3. | 0. | 172. | 134. | 0.0 | 164. | 0. | 0.0 |
| 4 | 4. | 1. | 172. | 138. | 4.0 | 164. | 0. | 0.0 |
| 5 | 5. | 1. | 172. | 136. | 2.0 | 164. | 0. | 0.0 |
| 6 | 6. | 1. | 172. | 136. | 4.0 | 164. | 0. | 0.0 |
| 7 | 7. | 1. | 172. | 134. | 3.0 | 165. | 0. | 0.0 |
| 8 | 8. | 1. | 170. | 133. | 5.0 | 165. | 0. | 0.0 |
| 9 | 15. | 2. | 170. | 132. | 6.0 | 166. | 0. | 0.0 |
| 10 | 388. | 50. | | 120. | 2.0 | | 0. | 0.0 |
| 11 | 381. | 75. | | 120. | 4.0 | | 0. | 0.0 |

## SECTION 10

## RENÉ 95 COMPRESSIVE-ONLY STRAIN-HOLD TESTS

This section contains data for compressive-only strain-hold tests performed on René 95. Hold periods of one and ten minutes were employed at the peak compressive strain and for one minute at a strain between the peak compressive and zero strain levels. The data are presented in Tables 38 through 46 and Figures 58 through 77.

TABLE 38

SPECIMEN 6

| | | | STRESSES | | | |
|---|---|---|---|---|---|---|
| I | N | %N | TENSILE | RELAXED | COMPR. | RELAXED |
| 1 | 1. | .48 | 173. | 0.0 | 183. | 6.3 |
| 2 | 2. | .97 | 175. | 0.0 | 185. | 15.0 |
| 3 | 30. | 14.49 | 179. | 0.0 | 186. | 16.3 |
| 4 | 65. | 31.40 | 178. | 0.0 | 185. | 16.3 |
| 5 | 75. | 36.23 | 178. | 0.0 | 184. | 16.3 |
| 6 | 100. | 48.31 | 178. | 0.0 | 180. | 12.5 |
| 7 | 110. | 53.14 | 178. | 0.0 | 180. | 13.8 |
| 8 | 125. | 60.39 | 178. | 0.0 | 180. | 15.0 |
| 9 | 150. | 72.46 | 178. | 0.0 | 179. | 15.0 |
| 10 | 160. | 77.29 | 178. | 0.0 | 178. | 12.5 |
| 11 | 180. | 86.96 | 175. | 0.0 | 176. | 13.8 |
| 12 | 197. | 95.17 | 174. | 0.0 | 175. | 13.8 |
| 13 | 200. | 96.62 | 173. | 0.0 | 176. | 13.8 |
| 14 | 204. | 98.55 | 170. | 0.0 | 176. | 13.8 |
| 15 | 205. | 99.03 | 168. | 0.0 | 176. | 13.8 |
| 16 | 206. | 99.52 | 161. | 0.0 | 178. | 15.0 |

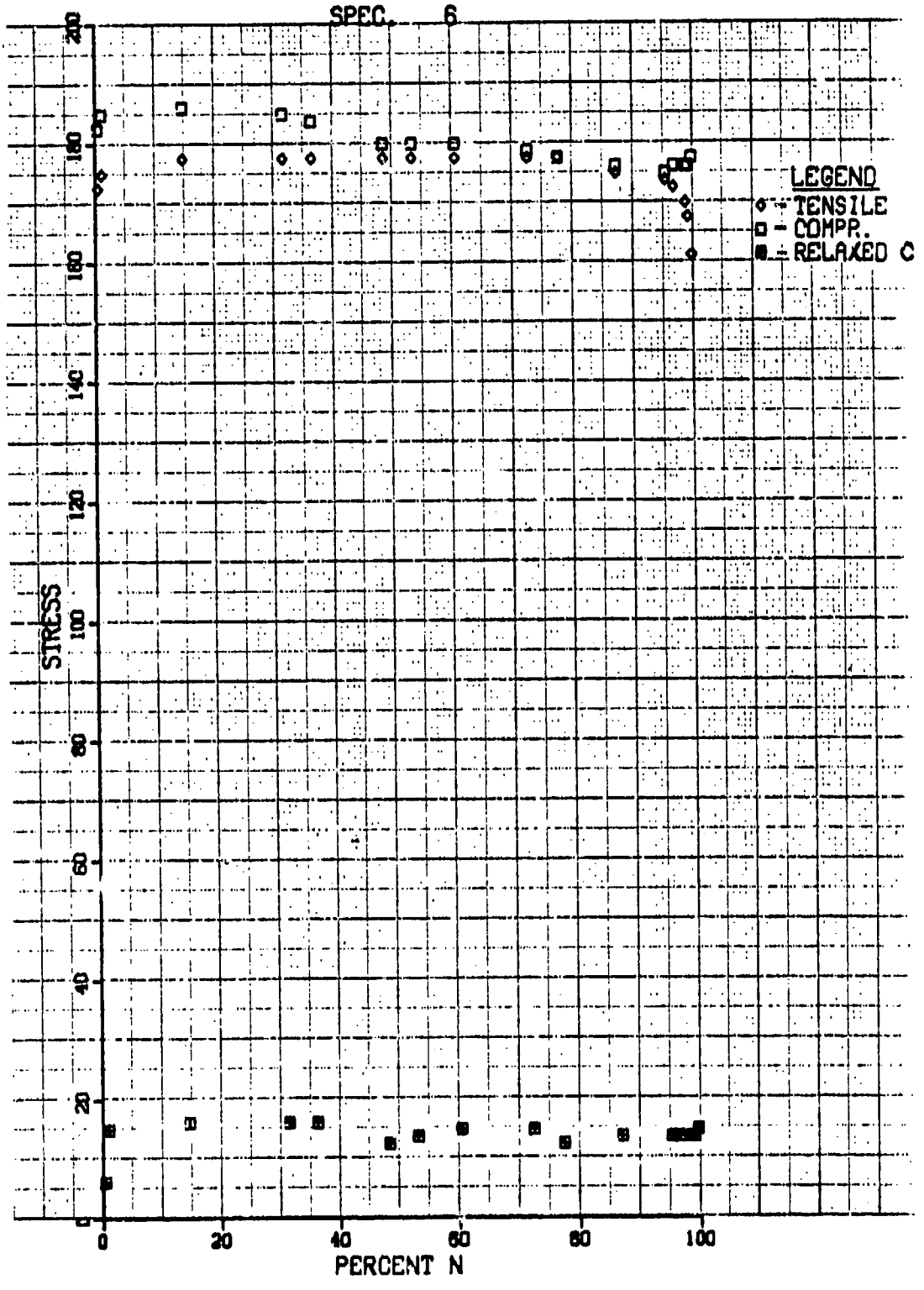

SPEC. 6
LEGEND
TENSILE
COMPR.
RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
20
40
60
80
100
PERCENT N

Figure 58.

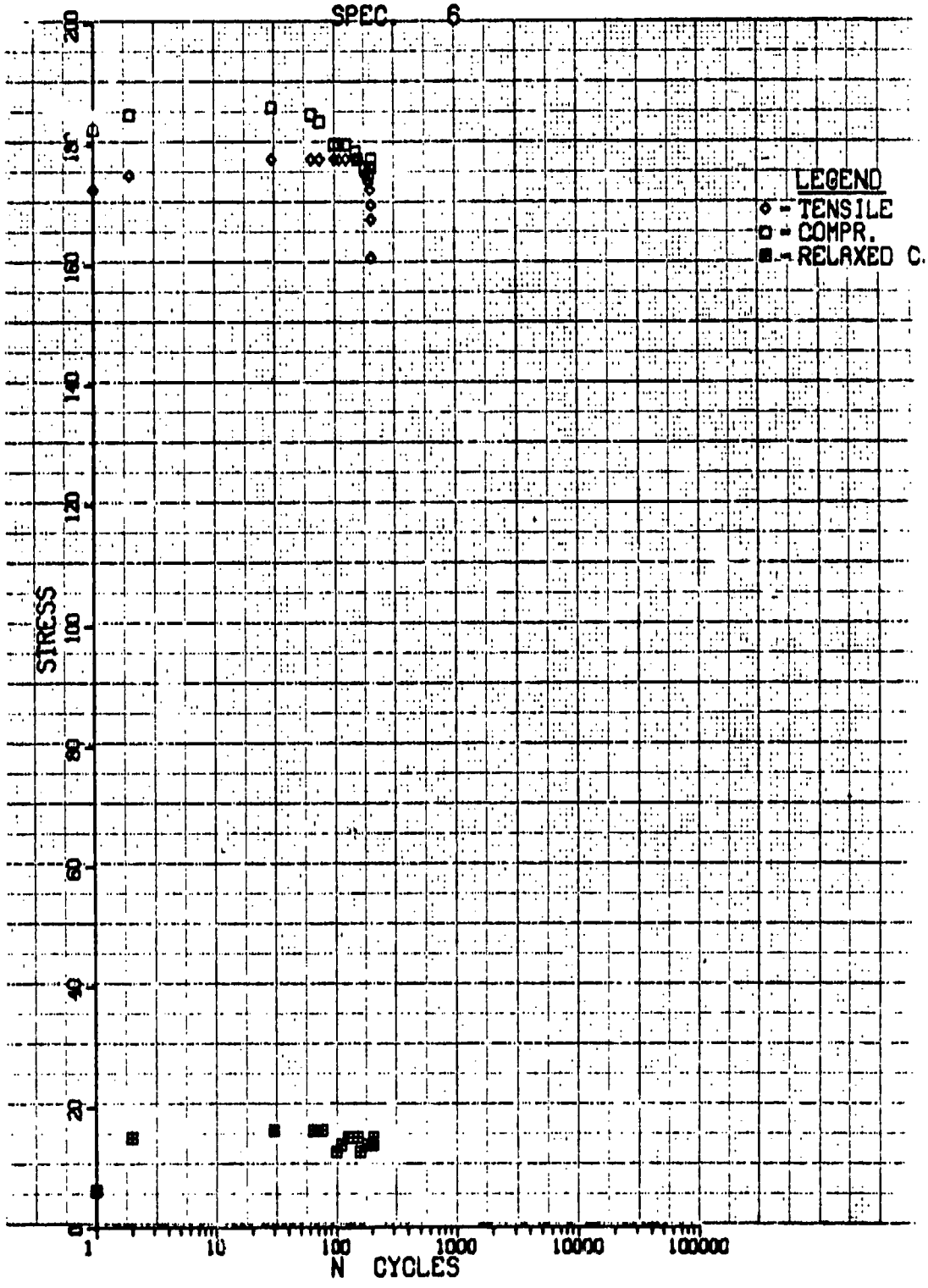

SPEC. 6
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 59.

TABLE 39

SPECIMEN 11

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 160. | 0.0 | 164. | 10.0 |
| 2 | 2. | 1. | 158. | 0.0 | 164. | 12.5 |
| 3 | 3. | 1. | 159. | 0.0 | 165. | 13.8 |
| 4 | 5. | 2. | 159. | 0.0 | 166. | 16.3 |
| 5 | 15. | 7. | 161. | 0.0 | 166. | 15.3 |
| 6 | 20. | 10. | 163. | 0.0 | 166. | 16.3 |
| 7 | 40. | 19. | 163. | 0.0 | 165. | 15.3 |
| 8 | 48. | 23. | 163. | 0.0 | 165. | 17.5 |
| 9 | 61. | 29. | 163. | 0.0 | 164. | 15.3 |
| 10 | 71. | 34. | 163. | 0.0 | 163. | 15.3 |
| 11 | 90. | 43. | 163. | 0.0 | 161. | 15.0 |
| 12 | 101. | 48. | 163. | 0.0 | 161. | 15.3 |
| 13 | 112. | 54. | 163. | 0.0 | 160. | 15.0 |
| 14 | 141. | 67. | 161. | 0.0 | 159. | 13.8 |
| 15 | 160. | 77. | 161. | 0.0 | 158. | 12.5 |
| 16 | 165. | 79. | 161. | 0.0 | 158. | 13.8 |
| 17 | 170. | 81. | 161. | 0.0 | 158. | 15.0 |
| 18 | 176. | 84. | 161. | 0.0 | 156. | 13.8 |
| 19 | 182. | 87. | 161. | 0.0 | 156. | 12.5 |

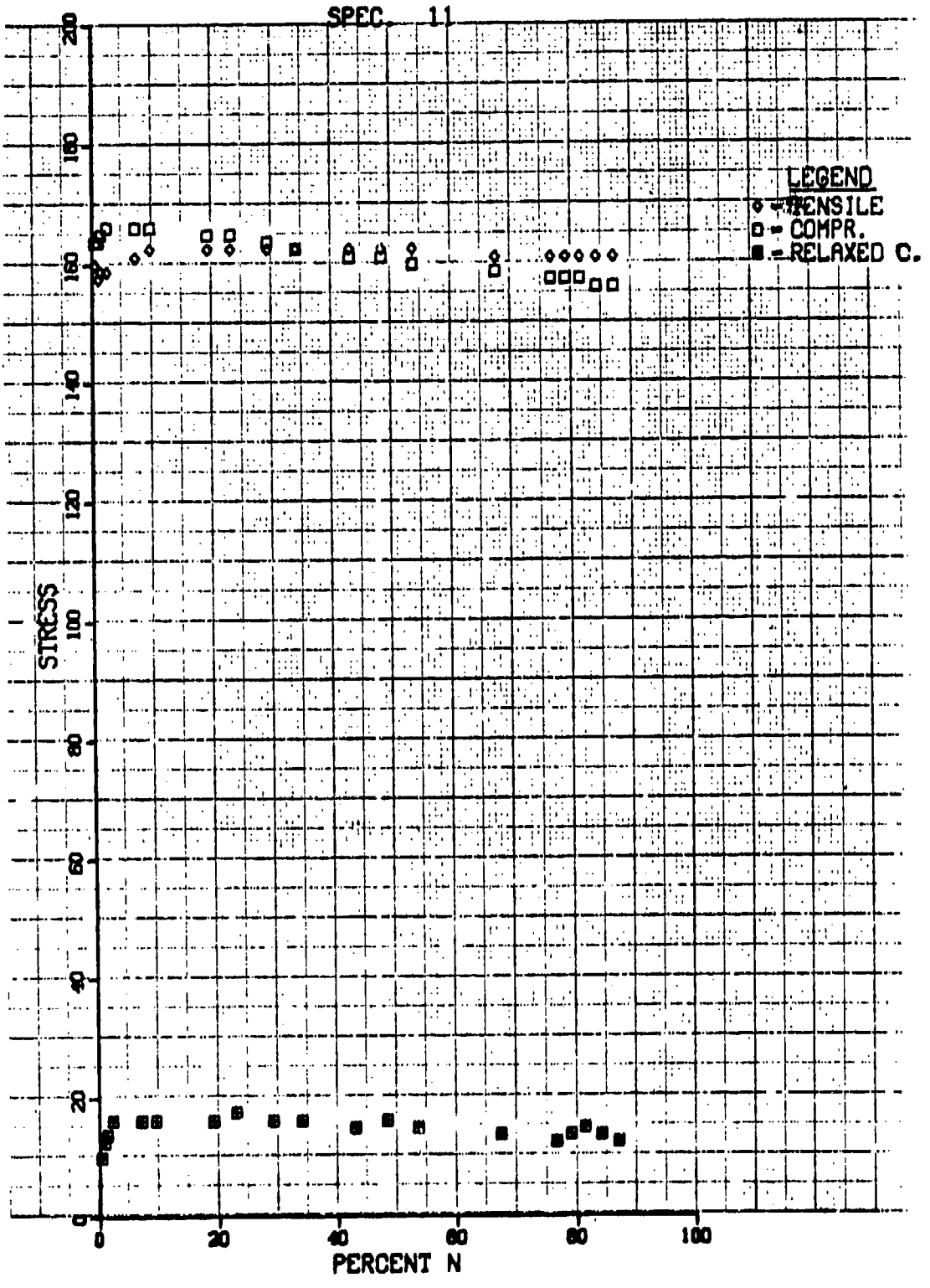

SPEC. 11
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 60.

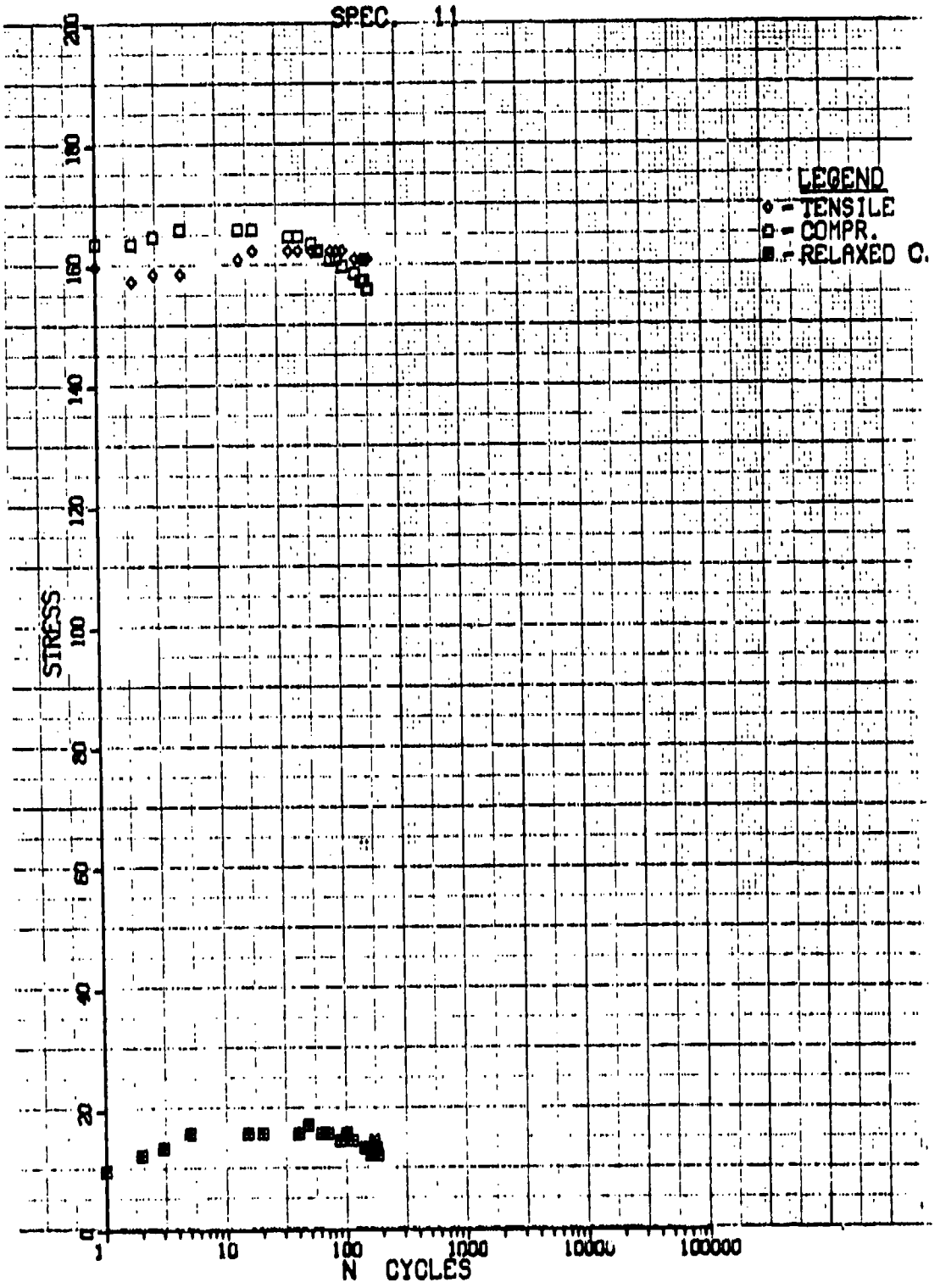

SPEC. 11
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 61.

TABLE 40

SPECIMEN 14

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 178. | 0.0 | 183. | 8.3 |
| 2 | 2. | 1. | 179. | 0.0 | 183. | 8.8 |
| 3 | 3. | 1. | 179. | 0.0 | 183. | 10.0 |
| 4 | 4. | 2. | 179. | 0.0 | 183. | 8.8 |
| 5 | 11. | 5. | 179. | 0.0 | 183. | 10.0 |
| 6 | 20. | 9. | 180. | 0.0 | 183. | 12.5 |
| 7 | 40. | 18. | 180. | 0.0 | 181. | 11.3 |
| 8 | 57. | 26. | 180. | 0.0 | 180. | 12.5 |
| 9 | 70. | 32. | 181. | 0.0 | 178. | 11.3 |
| 10 | 89. | 41. | 180. | 0.0 | 176. | 11.3 |
| 11 | 108. | 49. | 180. | 0.0 | 175. | 10.0 |
| 12 | 134. | 61. | 180. | 0.0 | 174. | 11.3 |
| 13 | 143. | 65. | 180. | 0.0 | 173. | 10.0 |
| 14 | 154. | 70. | 179. | 0.0 | 173. | 10.0 |
| 15 | 183. | 84. | 178. | 0.0 | 171. | 11.3 |
| 16 | 194. | 89. | 178. | 0.0 | 171. | 10.0 |
| 17 | 212. | 97. | 176. | 0.0 | 174. | 12.5 |

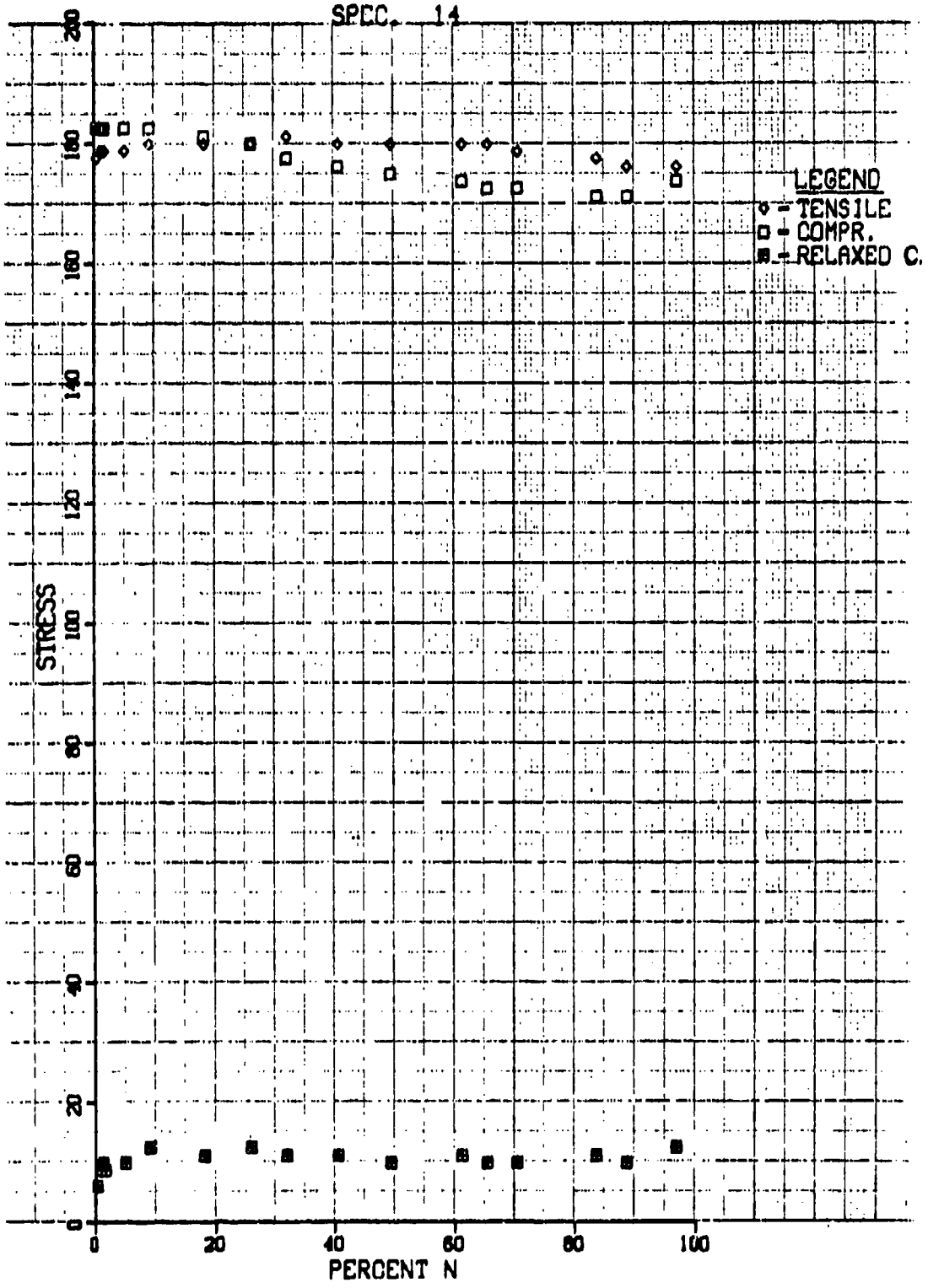

SPEC. 14
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N

Figure 62.

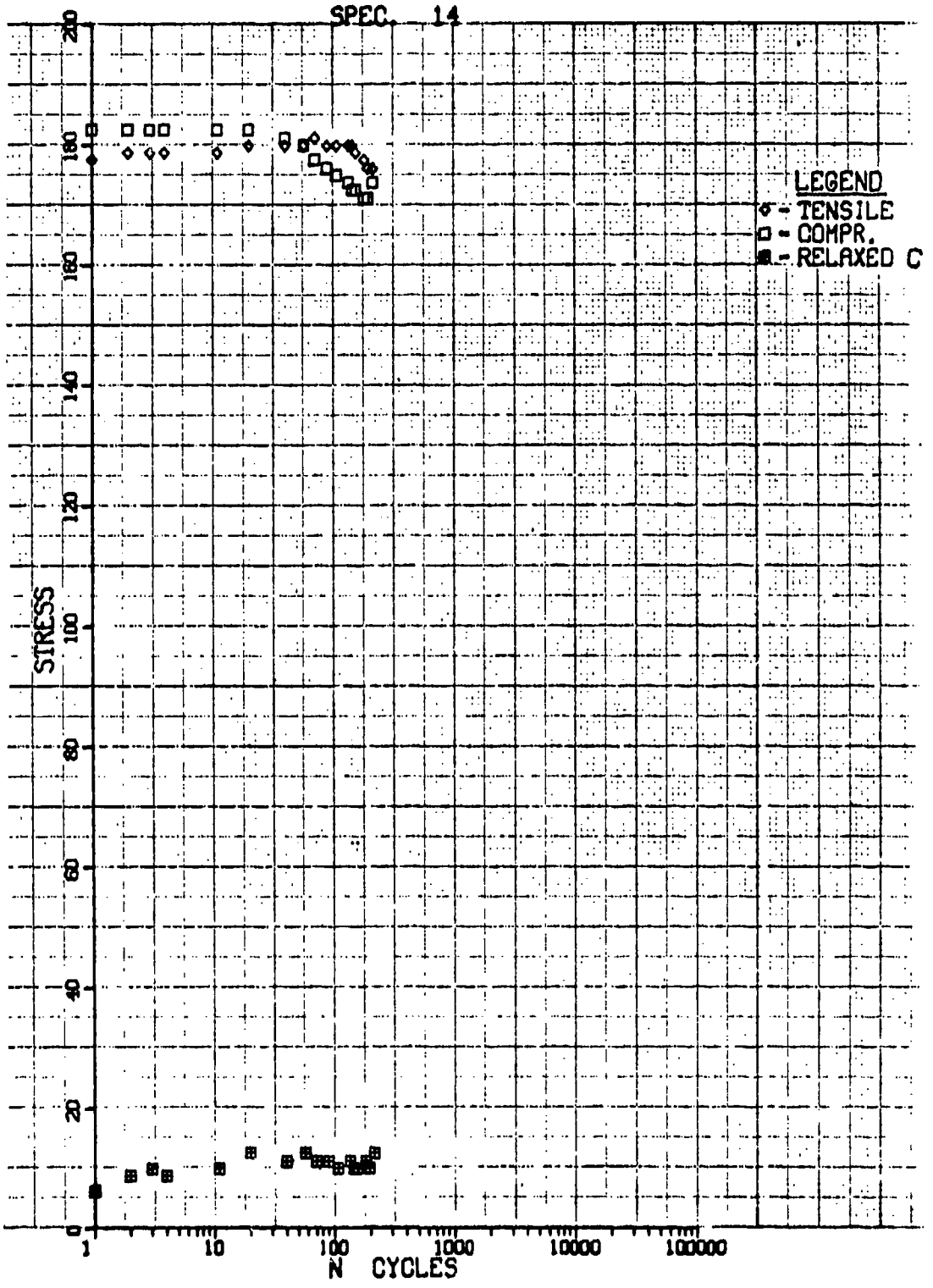

SPEC. 14
LEGEND
- TENSILE
- COMPR.
- RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 63.

TABLE 41

SPECIMEN 8

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 158. | 0.0 | | |
| 2 | 2. | 0. | 163. | 0.0 | 169. | 6.3 |
| 3 | 3. | 1. | 160. | 0.0 | 170. | 8.8 |
| 4 | 4. | 1. | 160. | 0.0 | 168. | 5.3 |
| 5 | 5. | 1. | 160. | 0.0 | 169. | 12.5 |
| 6 | 6. | 1. | 163. | 0.0 | 166. | 10.0 |
| 7 | 8. | 2. | 165. | 0.0 | 166. | 7.5 |
| 8 | 13. | 3. | 165. | 0.0 | 166. | 7.5 |
| 9 | 28. | 7. | 165. | 0.0 | 165. | 7.5 |
| 10 | 30. | 7. | 166. | 0.0 | 165. | 7.5 |
| 11 | 100. | 24. | 165. | 0.0 | 163. | 7.5 |
| 12 | 125. | 30. | 165. | 0.0 | 160. | 6.3 |
| 13 | 150. | 36. | 165. | 0.0 | 158. | 6.3 |
| 14 | 225. | 54. | 165. | 0.0 | 155. | 5.0 |
| 15 | 250. | 61. | 165. | 0.0 | 156. | 7.5 |
| 16 | 275. | 67. | 165. | 0.0 | 155. | 7.5 |
| 17 | 350. | 85. | 163. | 0.0 | 153. | 6.3 |
| 18 | 380. | 92. | 161. | 0.0 | 153. | 6.3 |
| 19 | 385. | 93. | 160. | 0.0 | 155. | 7.5 |
| 20 | 401. | 97. | 159. | 0.0 | 154. | 7.5 |
| 21 | 405. | 98. | 158. | 0.0 | 155. | 7.5 |
| 22 | 410. | 99. | 155. | 0.0 | 155. | 7.5 |
| 23 | 411. | 100. | 153. | 0.0 | 155. | 5.0 |
| 24 | 412. | 100. | 151. | 0.0 | 156. | 7.5 |
| 25 | 413. | 100. | 150. | 0.0 | 156. | 7.5 |
| 26 | 414. | 100. | 143. | 0.0 | | |

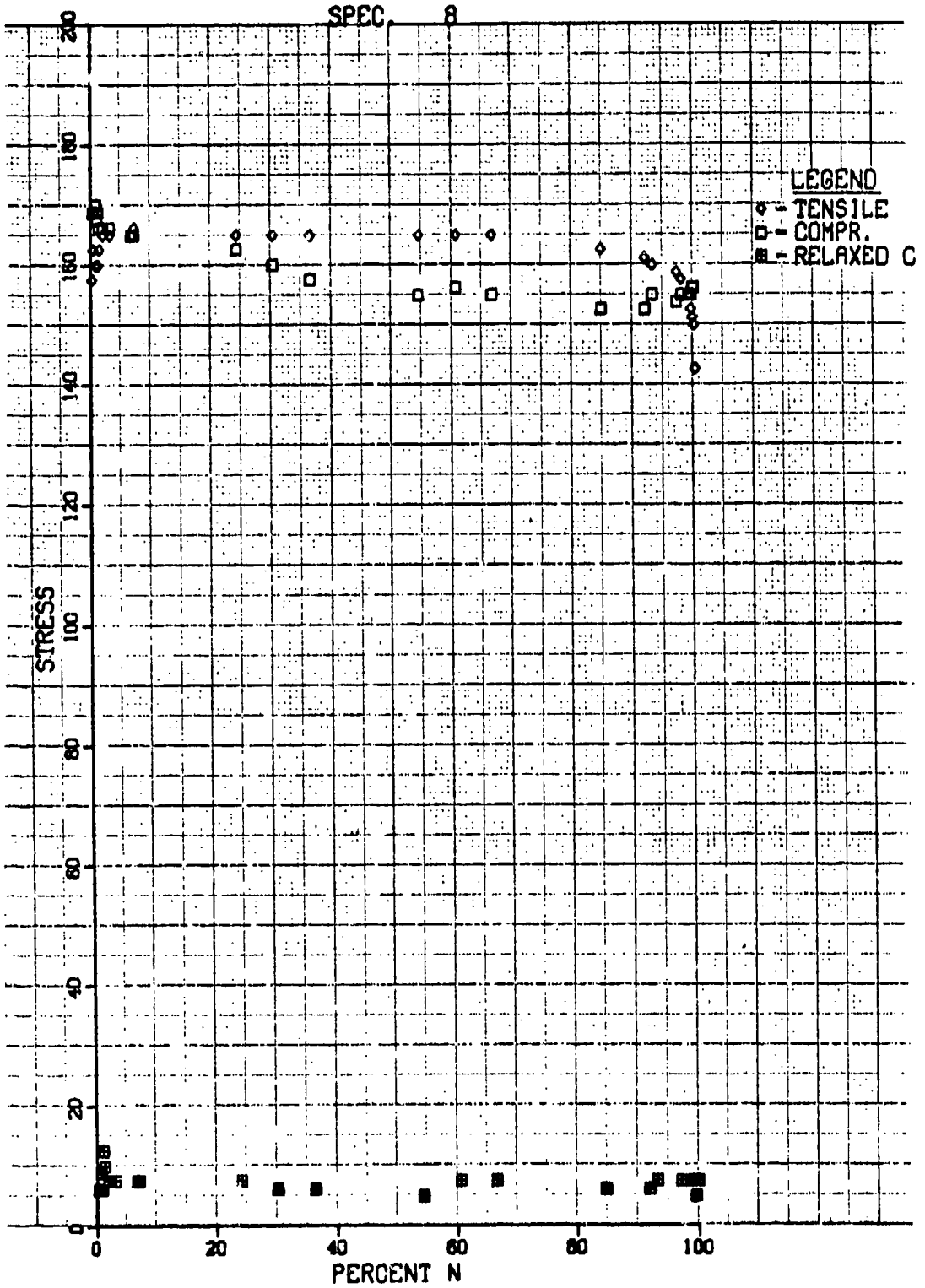

SPEC. 8
LEGEND
TENSILE
COMPR.
RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 64.

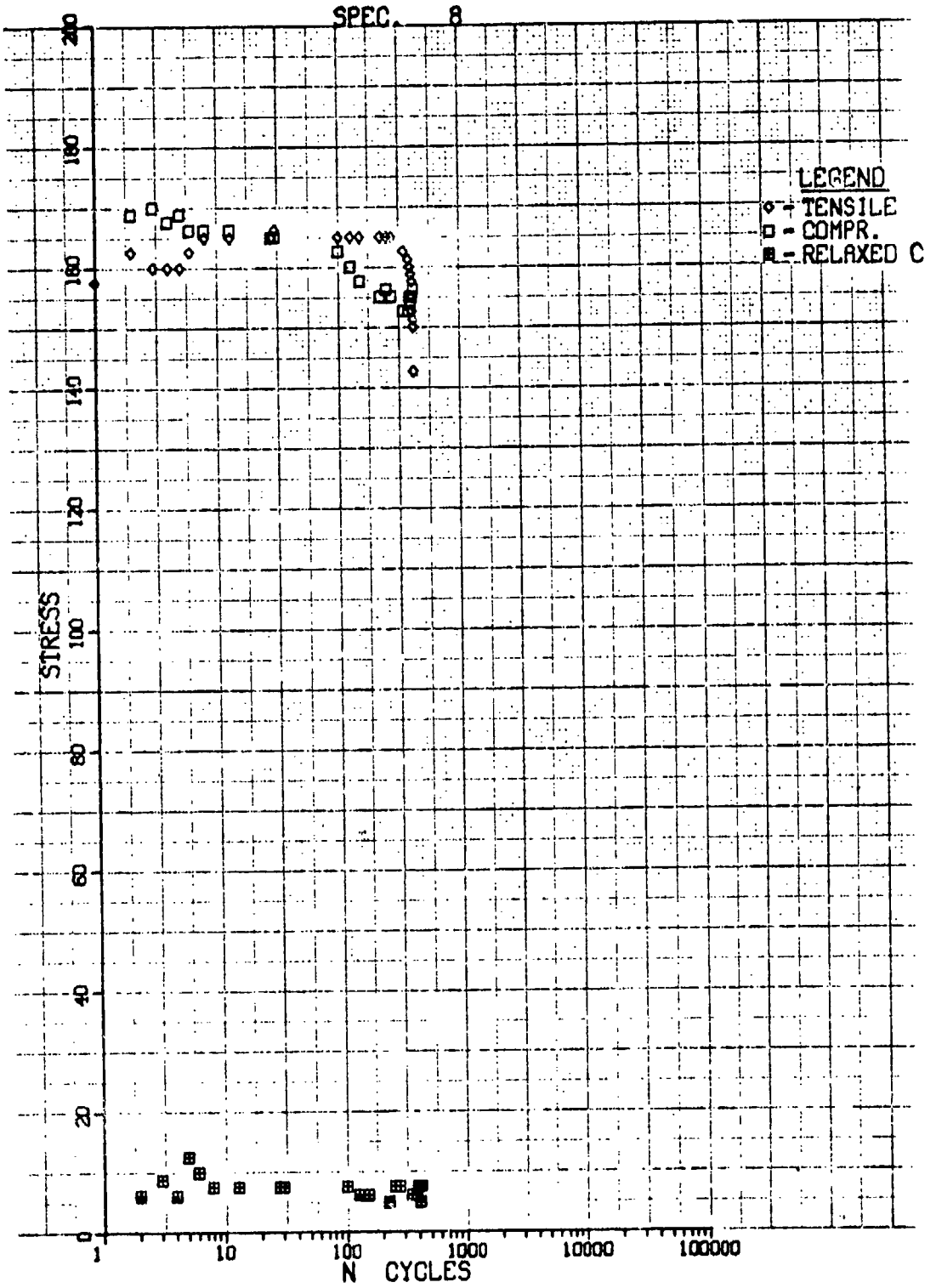

SPEC. 8
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 65.

TABLE 42

SPECIMEN 13

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 150. | 0.0 | 155. | 2.5 |
| 2 | 2. | 0. | 155. | 0.0 | 153. | 2.5 |
| 3 | 3. | 0. | 155. | 0.0 | 153. | 1.3 |
| 4 | 11. | 1. | 155. | 0.0 | 151. | 1.3 |
| 5 | 13. | 2. | 155. | 0.0 | 151. | 2.5 |
| 6 | 30. | 4. | 155. | 0.0 | 150. | 2.5 |
| 7 | 40. | 5. | 155. | 0.0 | 148. | 1.3 |
| 8 | 41. | 5. | 155. | 0.0 | 149. | 2.5 |
| 9 | 59. | 7. | 155. | 0.0 | 148. | 2.5 |
| 10 | 99. | 12. | 155. | 0.0 | 146. | 1.3 |
| 11 | 125. | 15. | 155. | 0.0 | 145. | 2.5 |
| 12 | 191. | 23. | 156. | 0.0 | 144. | 1.3 |
| 13 | 240. | 28. | 156. | 0.0 | 143. | 1.3 |
| 14 | 304. | 36. | 155. | 0.0 | 141. | 1.3 |
| 15 | 374. | 44. | 156. | 0.0 | 140. | 1.3 |
| 16 | 420. | 50. | 156. | 0.0 | 140. | 2.5 |
| 17 | 540. | 64. | 156. | 0.0 | 139. | 2.5 |
| 18 | 560. | 66. | 156. | 0.0 | 138. | 1.3 |
| 19 | 581. | 69. | 155. | 0.0 | 138. | 1.3 |
| 20 | 683. | 81. | 154. | 0.0 | 138. | 1.3 |
| 21 | 720. | 85. | 153. | 0.0 | 138. | 2.5 |
| 22 | 750. | 89. | 151. | 0.0 | 138. | 2.5 |
| 23 | 777. | 92. | 150. | 0.0 | | |
| 24 | 816. | 96. | 148. | 0.0 | 139. | 2.5 |
| 25 | 825. | 98. | 148. | 0.0 | 140. | 3.8 |
| 26 | 835. | 99. | 145. | 0.0 | 143. | 2.5 |

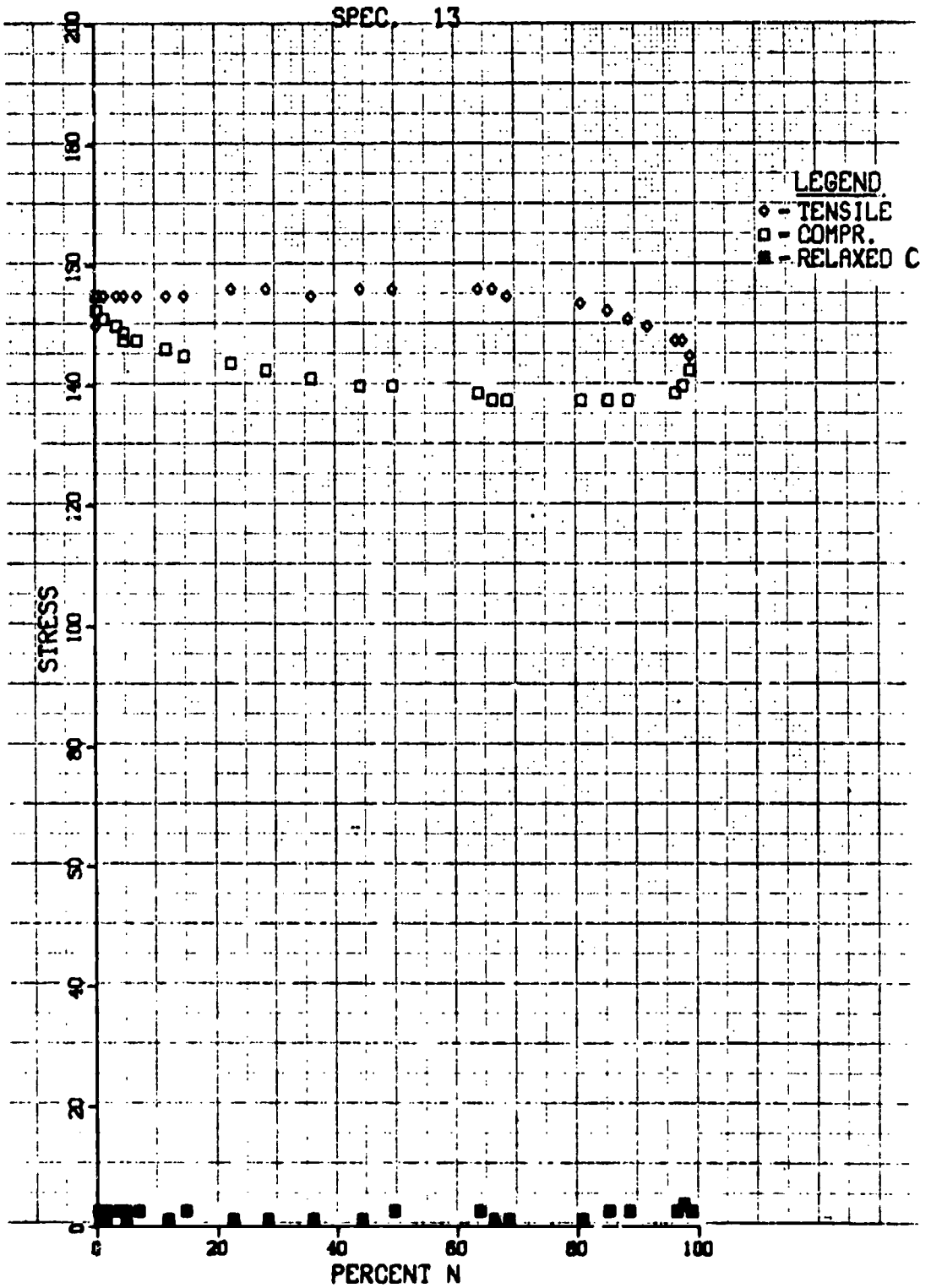

SPEC. 13
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
0
20
40
60
80
100
PERCENT N

Figure 66.

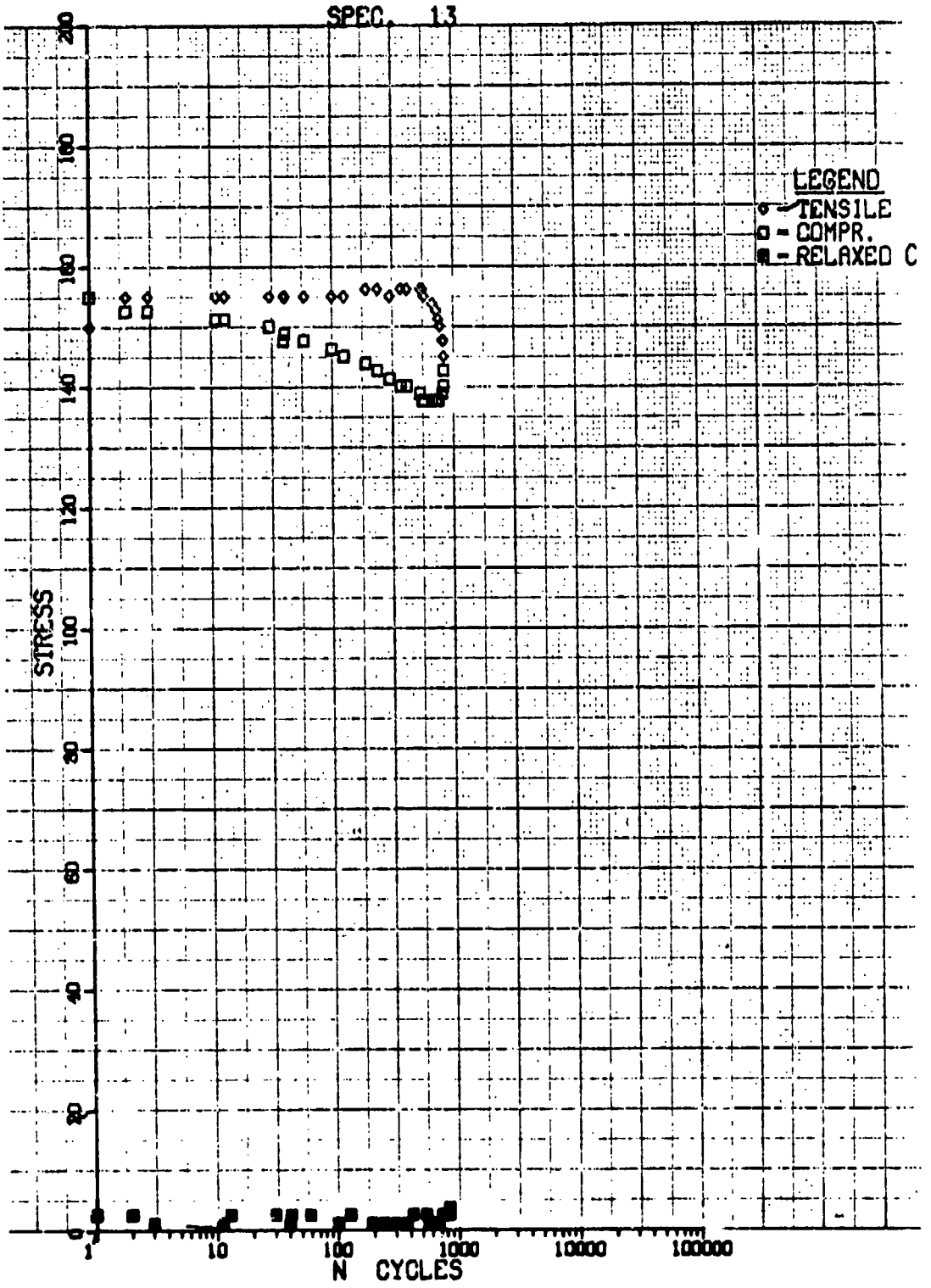

SPEC. 13
LEGEND
TENSILE
COMPR.
RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 67.

TABLE 43

SPECIMEN 16

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 121. | 0.0 | 125. | 0.0 |
| 2 | 2. | 0. | 128. | 0.0 | 121. | 0.0 |
| 3 | 3. | 0. | 128. | 0.0 | 121. | 0.0 |
| 4 | 26. | 1. | 126. | 0.0 | 123. | 0.0 |
| 5 | 70. | 2. | 125. | 0.0 | 123. | 0.0 |
| 6 | 98. | 3. | 125. | 0.0 | 124. | 0.0 |
| 7 | 320. | 10. | 124. | 0.0 | 125. | 0.0 |
| 8 | 1200. | 39. | 124. | 0.0 | 124. | 0.0 |
| 9 | 1349. | 44. | 125. | 0.0 | 124. | 0.0 |
| 10 | 1501. | 49. | 125. | 0.0 | 123. | 0.0 |
| 11 | 1716. | 55. | 125. | 0.0 | 121. | 0.0 |
| 12 | 1850. | 60. | 126. | 0.0 | 121. | 0.0 |
| 13 | 2522. | 82. | 125. | 0.0 | 121. | 0.0 |
| 14 | 2775. | 90. | 124. | 0.0 | 121. | 0.0 |
| 15 | 3028. | 98. | 124. | 0.0 | 121. | 0.0 |
| 16 | 3054. | 99. | 125. | 0.0 | 123. | 0.0 |
| 17 | 3069. | 99. | 130. | 0.0 | 125. | 0.0 |
| 18 | 3074. | 99. | 130. | 0.0 | 126. | 0.0 |
| 19 | 3083. | 100. | 133. | 0.0 | 129. | -1.3 |
| 20 | 3084. | 100. | 134. | 0.0 | 130. | 0.0 |
| 21 | 3086. | 100. | 135. | 0.0 | 131. | 0.0 |
| 22 | 3088. | 100. | 135. | 0.0 | 133. | 0.0 |
| 23 | 3089. | 100. | 135. | 0.0 | 135. | 0.0 |

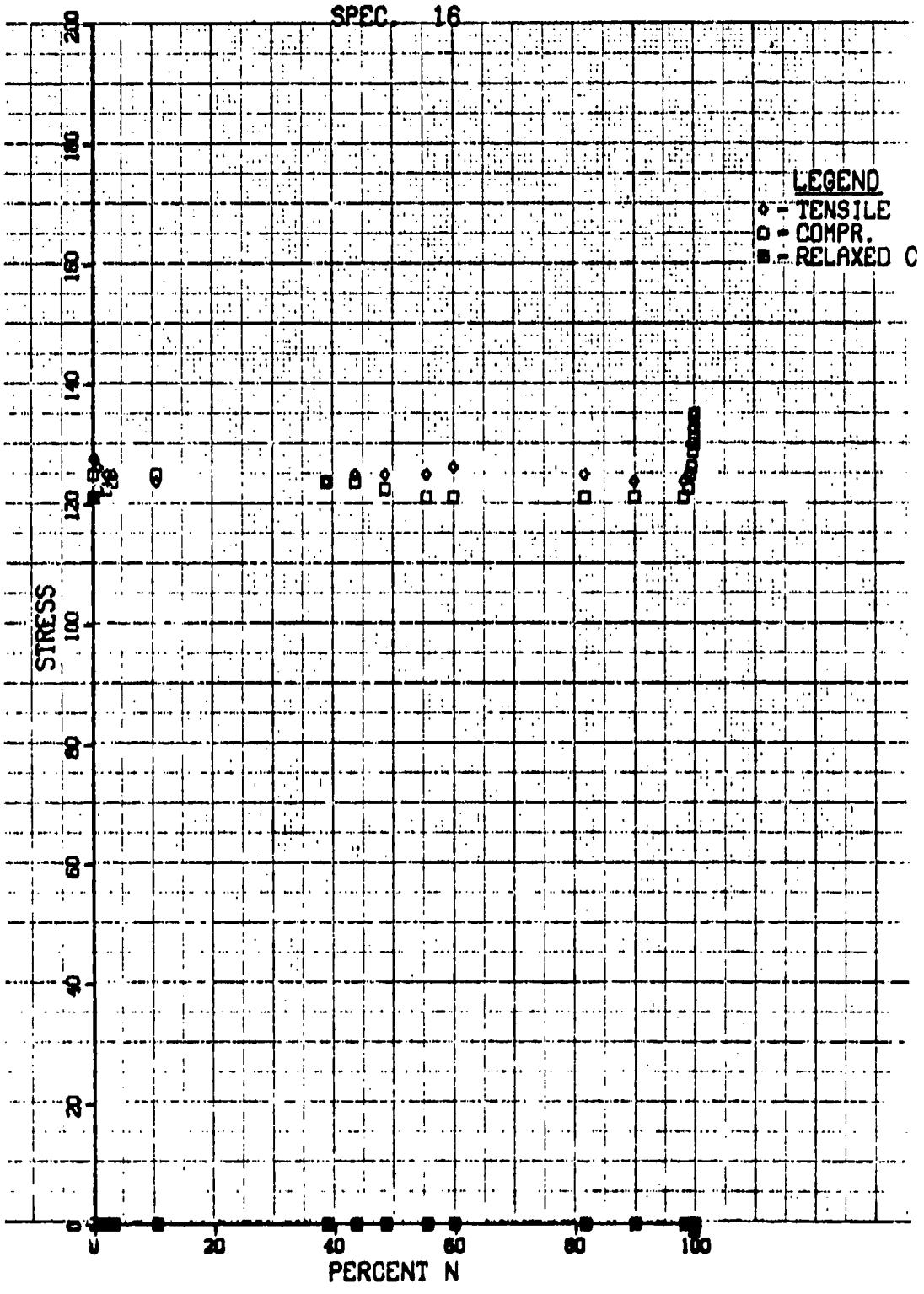

SPEC. 16
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 68.

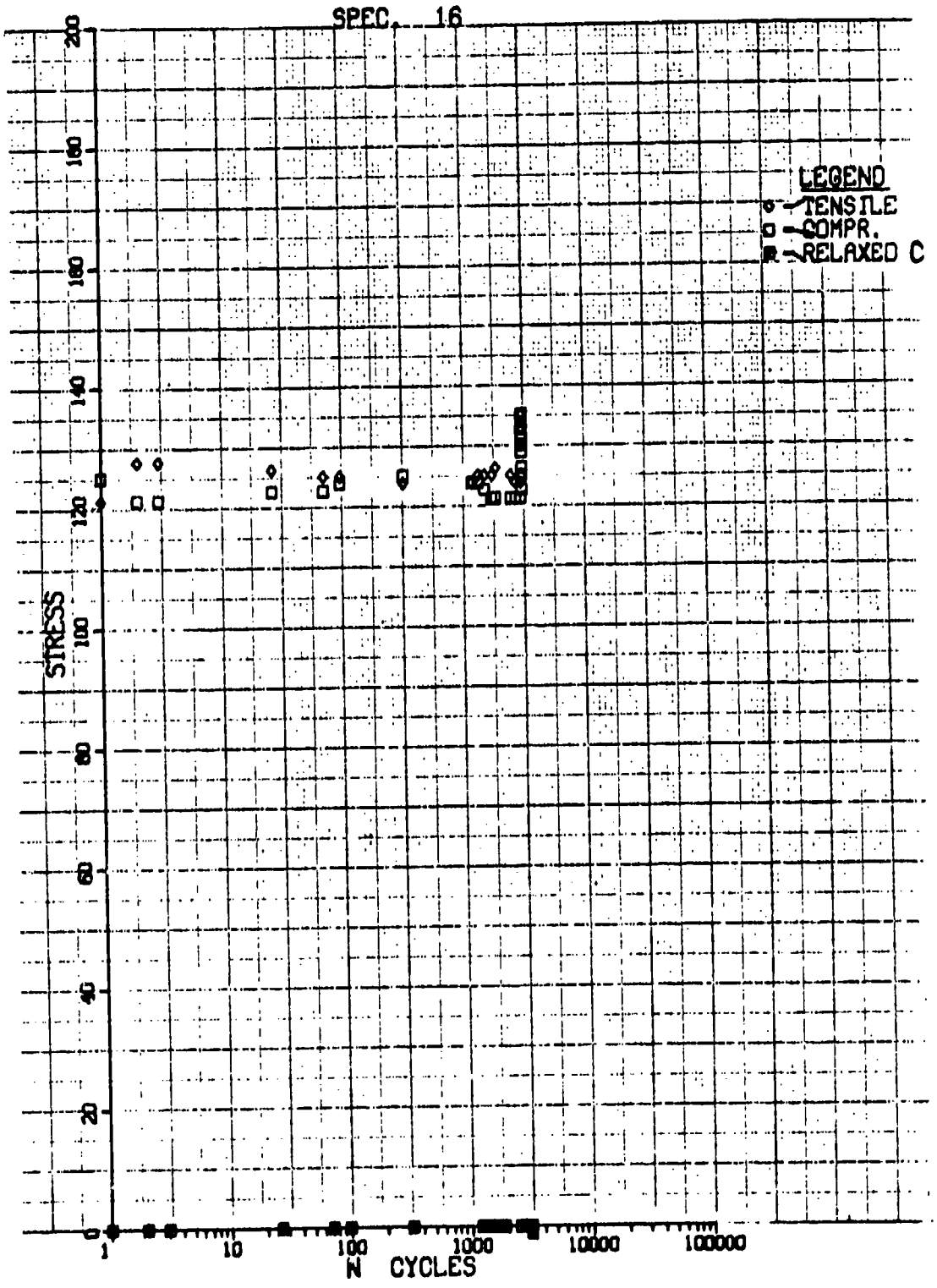

SPEC. 16
LEGEND
TENSILE
COMPR.
RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 69.

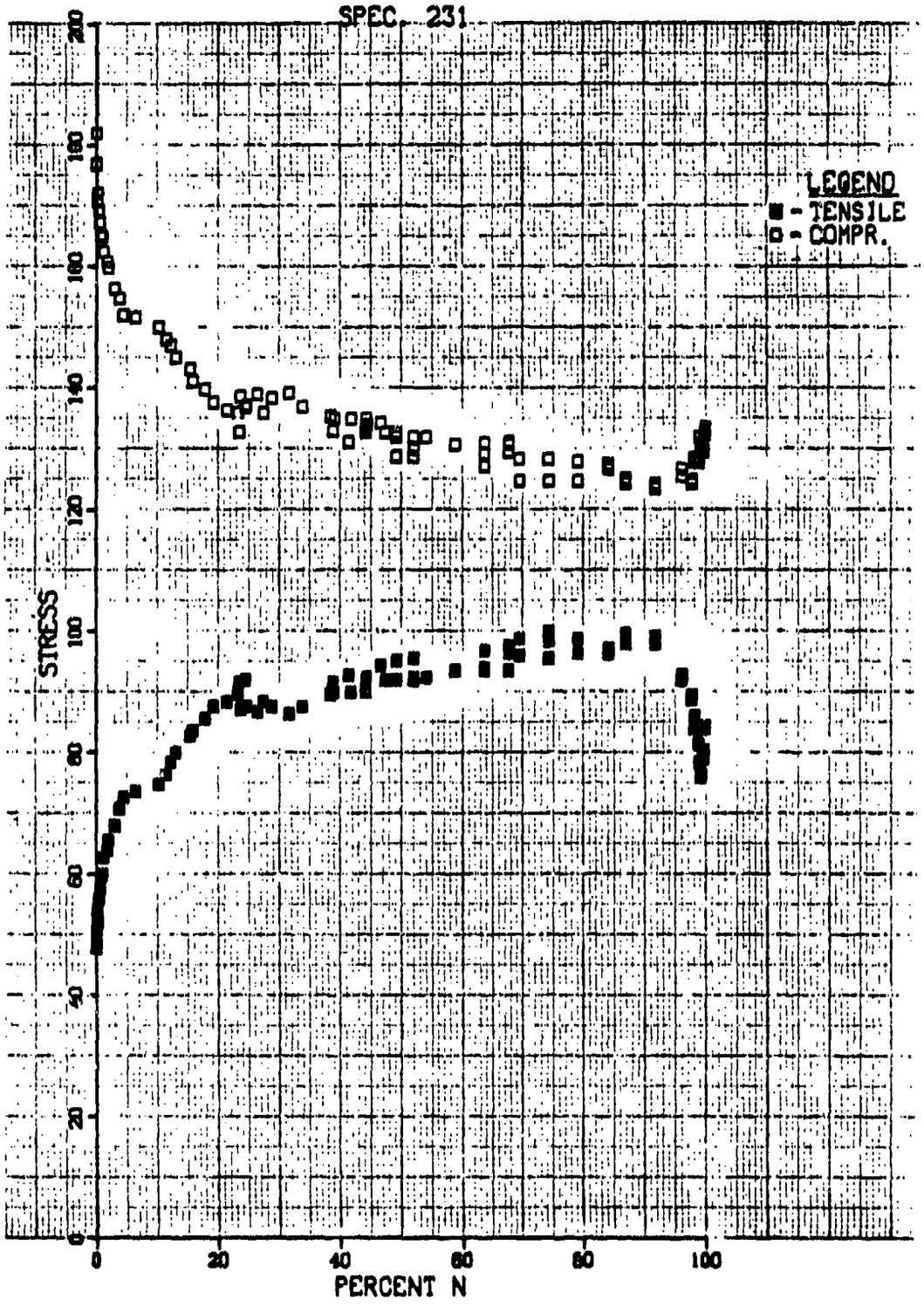

SPEC. 231
LEGEND
■ - TENSILE
□ - COMPR.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 70.

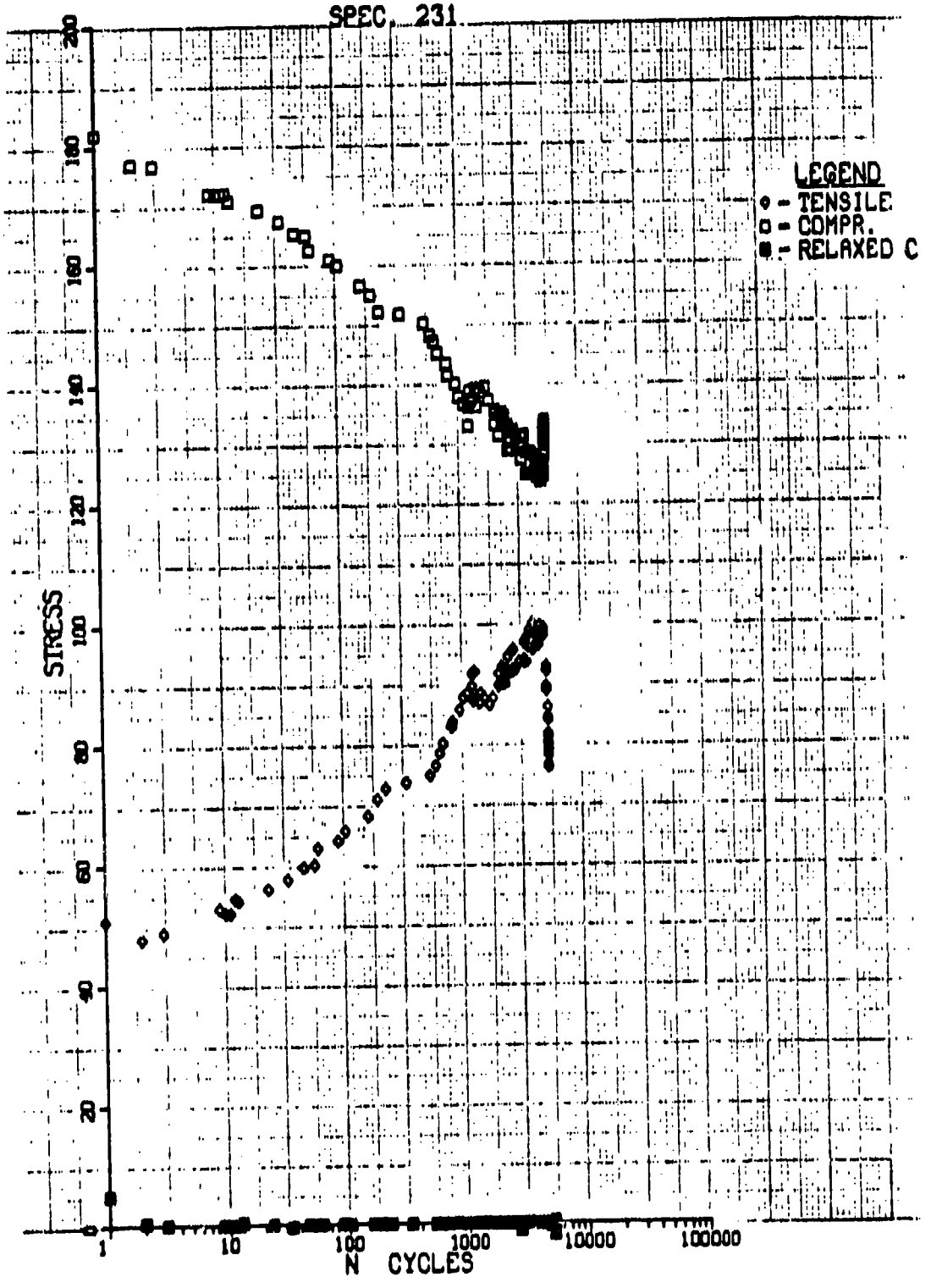

SPEC. 231
LEGEND
◇ - TENSILE
□ - COMPR.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 71.

TABLE 44

SPECIMEN 222

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 162. | 0.0 | 174. | 5.0 |
| 2 | 2. | 1. | 166. | 0.0 | 171. | 4.0 |
| 3 | 3. | 1. | | 0.0 | 172. | |
| 4 | 5. | 2. | 166. | 0.0 | 169. | 4.0 |
| 5 | 7. | 3. | 168. | 0.0 | 169. | 5.0 |
| 6 | 13. | 6. | 168. | 0.0 | 167. | 6.0 |
| 7 | 21. | 9. | 169. | 0.0 | 165. | 5.0 |
| 8 | 29. | 13. | 170. | 0.0 | 163. | 3.0 |
| 9 | 38. | 17. | 172. | 0.0 | 163. | 5.0 |
| 10 | 45. | 20. | 172. | 0.0 | 162. | 5.0 |
| 11 | 53. | 24. | 172. | 0.0 | 160. | 4.0 |
| 12 | 55. | 25. | 173. | 0.0 | 160. | 6.0 |
| 13 | 63. | 28. | 174. | 0.0 | 159. | 5.0 |
| 14 | 70. | 31. | 174. | 0.0 | 158. | 5.0 |
| 15 | 77. | 34. | 174. | 0.0 | 157. | 4.0 |
| 16 | 85. | 38. | 174. | 0.0 | 157. | 5.0 |
| 17 | 87. | 39. | 176. | 0.0 | 156. | 6.0 |
| 18 | 110. | 49. | 176. | 0.0 | 155. | 6.0 |
| 19 | 111. | 50. | 176. | 0.0 | 154. | 4.0 |
| 20 | 133. | 59. | 176. | 0.0 | 153. | 5.0 |
| 21 | 134. | 60. | 176. | 0.0 | 152. | 4.0 |
| 22 | 148. | 66. | 176. | 0.0 | 156. | 6.0 |
| 23 | 156. | 70. | 176. | 0.0 | 154. | 5.0 |
| 24 | 163. | 73. | 176. | 0.0 | 153. | 5.0 |
| 25 | 172. | 77. | 176. | 0.0 | 152. | 3.0 |
| 26 | 180. | 80. | 176. | 0.0 | 152. | 3.0 |
| 27 | 189. | 84. | 176. | 0.0 | 153. | 4.0 |
| 28 | 197. | 88. | 177. | 0.0 | 151. | 5.0 |
| 29 | 204. | 91. | 174. | 0.0 | 151. | 3.0 |
| 30 | 212. | 95. | 172. | 0.0 | 151. | 3.0 |
| 31 | 219. | 98. | 170. | 0.0 | 152. | 8.0 |
| 32 | 220. | 98. | 168. | 0.0 | 152. | 4.0 |
| 33 | 221. | 99. | 166. | 0.0 | 153. | 5.0 |
| 34 | 222. | 99. | | 0.0 | 154. | |

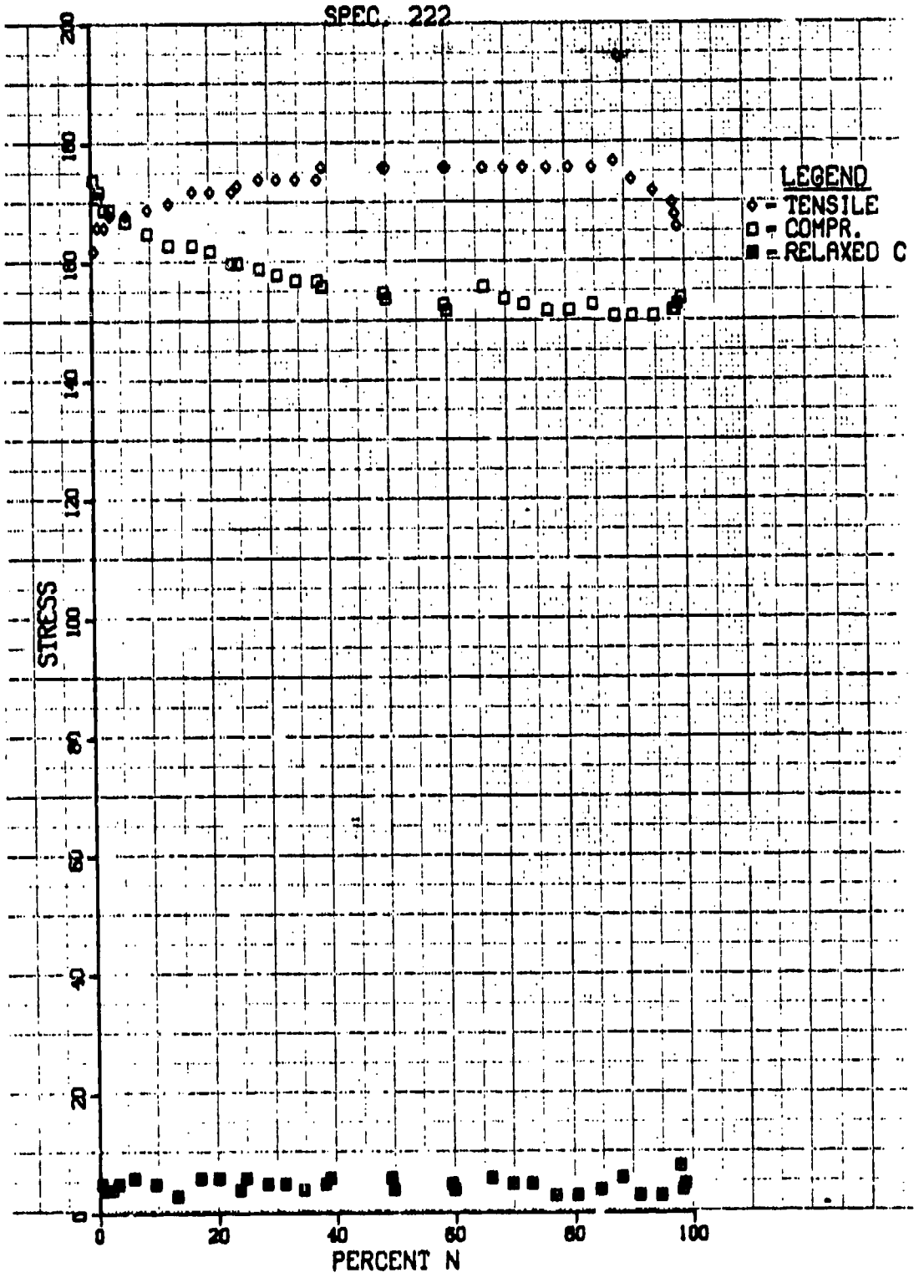

SPEC. 222
LEGEND
◇ = TENSILE
□ = COMPR.
■ = RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N

Figure 72.

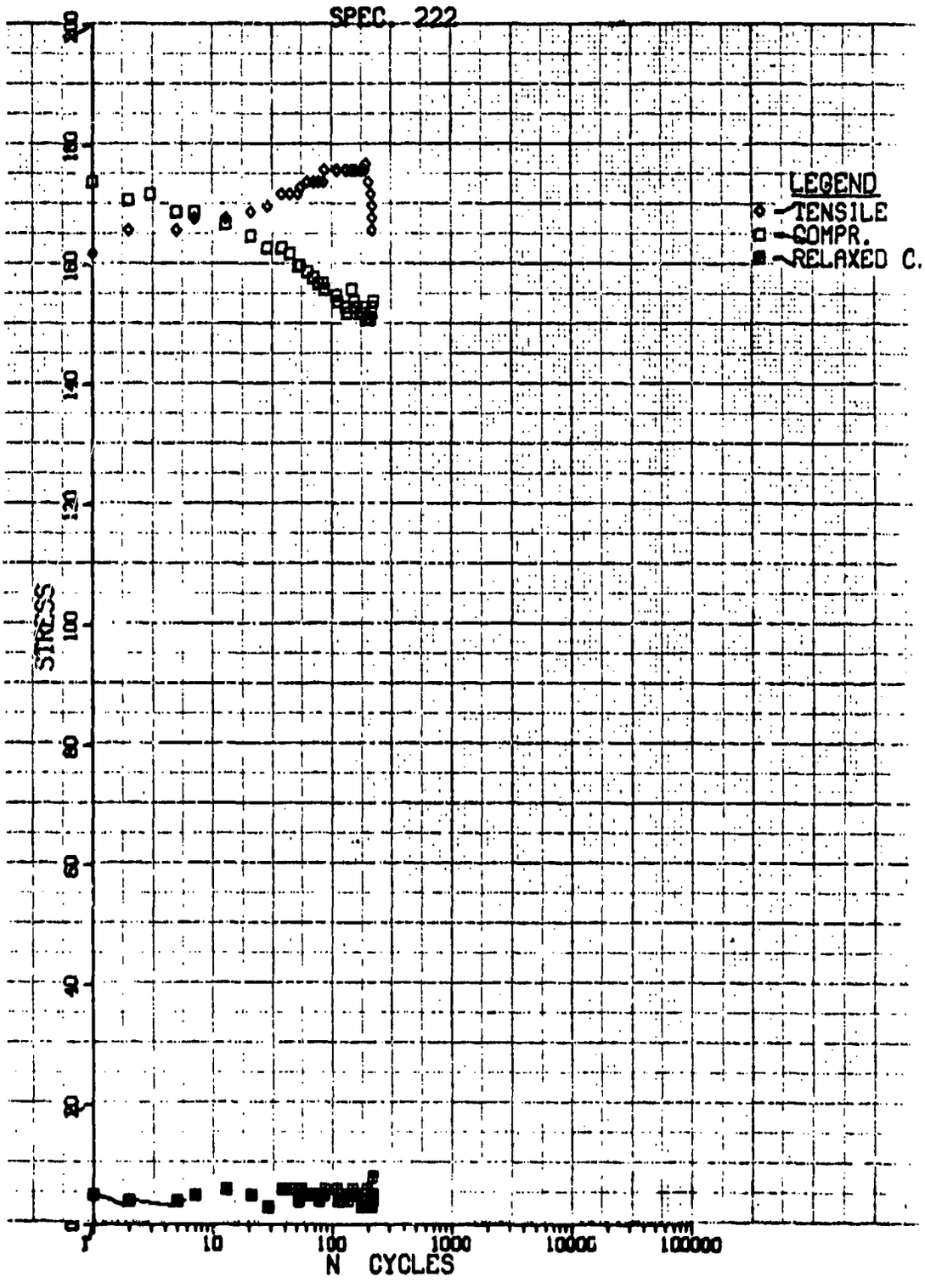

SPEC. 222
LEGEND
TENSILE
COMPR.
RELAXED C.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 73.

TABLE 45

SPECIMEN 41

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 150. | 0.0 | 150. | 15.0 |
| 2 | 2. | 1. | 154. | 0.0 | 145. | 17.5 |
| 3 | 3. | 1. | 151. | 0.0 | 141. | 11.3 |
| 4 | 4. | 1. | 153. | 0.0 | 143. | 15.0 |
| 5 | 5. | 2. | 154. | 0.0 | 140. | 13.8 |
| 6 | 8. | 3. | 155. | 0.0 | 135. | 12.5 |
| 7 | 11. | 4. | 156. | 0.0 | 134. | 12.5 |
| 8 | 14. | 5. | 158. | 0.0 | 133. | 15.0 |
| 9 | 17. | 6. | 158. | 0.0 | 130. | 13.8 |
| 10 | 20. | 7. | 159. | 0.0 | 129. | 13.8 |
| 11 | 26. | 9. | 160. | 0.0 | 126. | 11.3 |
| 12 | 29. | 10. | 160. | 0.0 | 126. | 13.8 |
| 13 | 38. | 13. | 160. | 0.0 | 125. | 13.8 |
| 14 | 44. | 16. | 161. | 0.0 | 124. | 13.8 |
| 15 | 56. | 20. | 163. | 0.0 | 123. | 13.8 |
| 16 | 68. | 24. | 163. | 0.0 | 121. | 13.8 |
| 17 | 78. | 28. | 164. | 0.0 | 120. | 13.8 |
| 18 | 95. | 34. | 164. | 0.0 | 119. | 12.5 |
| 19 | 122. | 43. | 165. | 0.0 | 118. | 15.0 |
| 20 | 139. | 49. | 163. | 0.0 | 119. | 13.8 |
| 21 | 148. | 52. | 165. | 0.0 | 118. | 13.8 |
| 22 | 159. | 60. | 165. | 0.0 | 116. | 15.0 |
| 23 | 220. | 78. | 165. | 0.0 | 115. | 15.0 |
| 24 | 250. | 88. | 163. | 0.0 | 115. | 15.0 |
| 25 | 265. | 94. | 161. | 0.0 | 115. | 15.0 |
| 26 | 268. | 95. | 160. | 0.0 | 115. | 15.0 |
| 27 | 274. | 97. | 158. | 0.0 | 116. | 16.3 |
| 28 | 280. | 99. | 156. | 0.0 | 119. | 18.8 |
| 29 | 283. | 100. | 155. | 0.0 | 118. | 15.0 |
| 30 | 284. | 100. | 153. | 0.0 | 120. | |
| 31 | 285. | 101. | 150. | 0.0 | | |
| 32 | 286. | 101. | 148. | 0.0 | [illegible] | 15.3 |
| 33 | 287. | 101. | | 0.0 | 123. | |

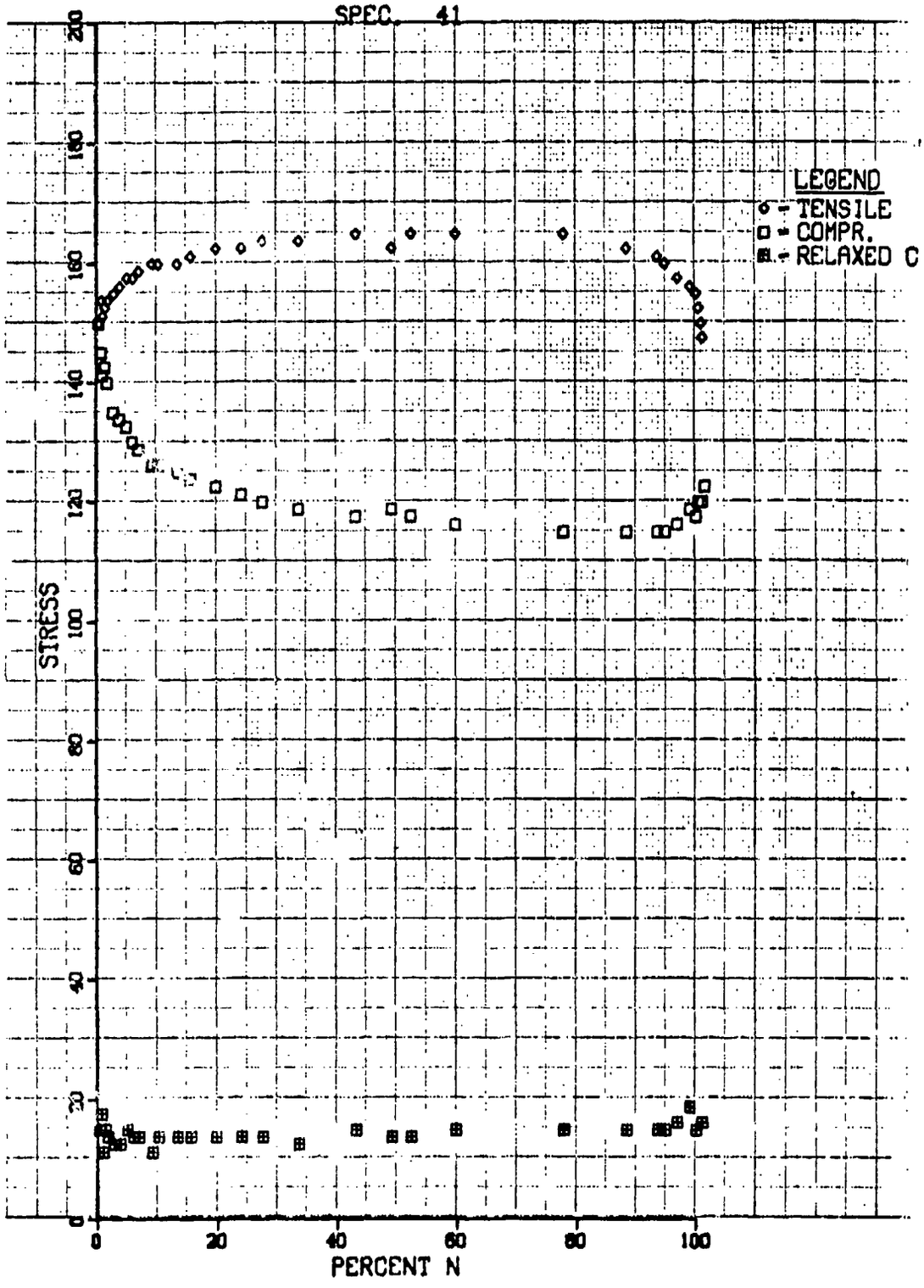

SPEC. 41
LEGEND
◇ - TENSILE
□ - COMPR.
⊞ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 74.

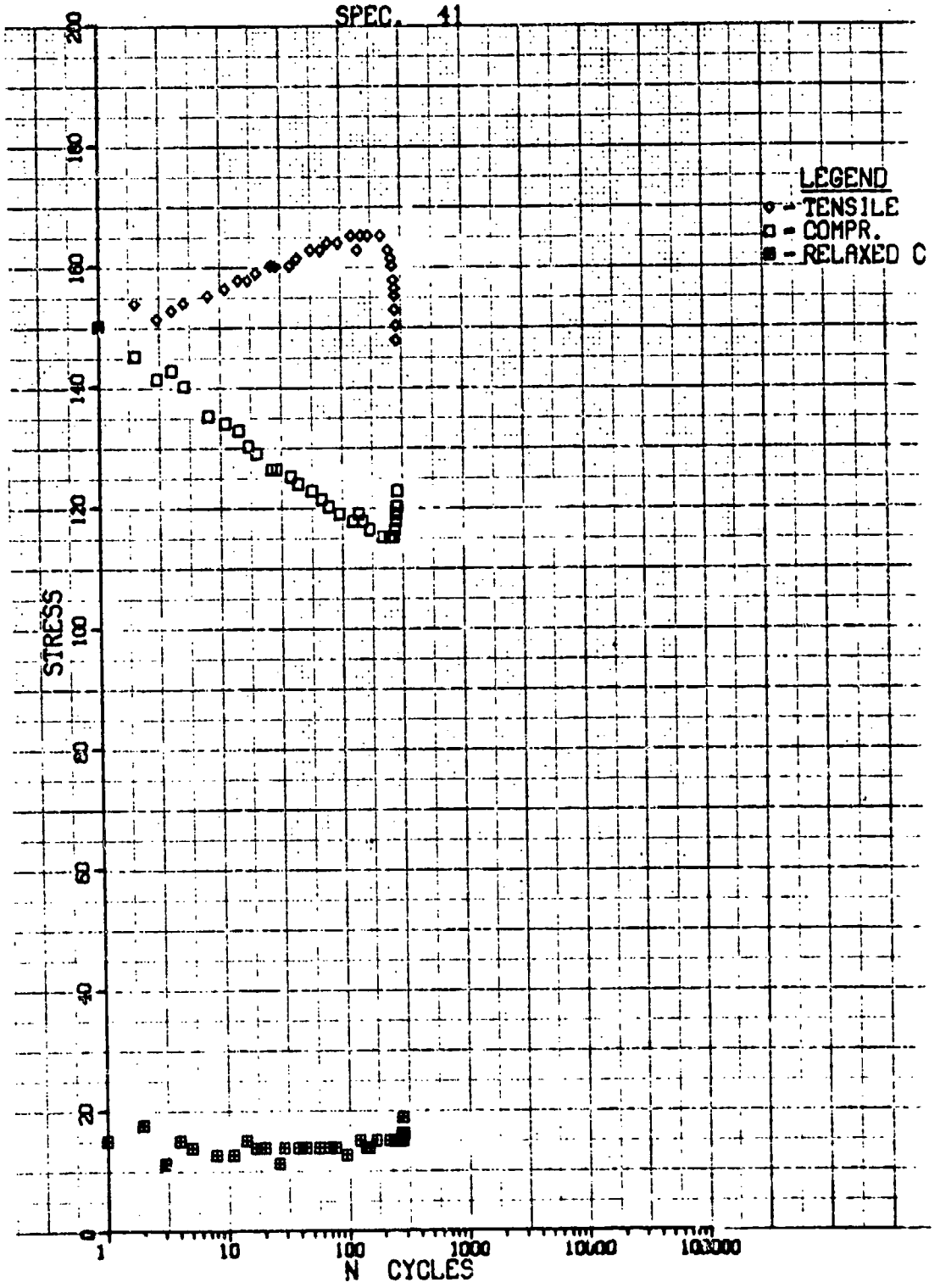

SPEC. 41
LEGEND
TENSILE
COMPR.
RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 75.

TABLE 46

SPECIMEN 247

| I | N | %N | PEAK TENSILE | HELD TENSILE | RELAXED TENSILE | PEAK COMPR. | HELD COMPR. | RELAXED COMPR. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1. | 0. | **** | 0. | 0.0 | 180. | 161. | 0.0 |
| 2 | 2. | 1. | 170. | 0. | 0.0 | 184. | 168. | 13.6 |
| 3 | 3. | 1. | 168. | 0. | 0.0 | 184. | 167. | 15.2 |
| 4 | 4. | 2. | 168. | 0. | 0.0 | 184. | 167. | 16.0 |
| 5 | 11. | 4. | 170. | 0. | 0.0 | 185. | 163. | 16.6 |
| 6 | 13. | 5. | 171. | 0. | 0.0 | 185. | 163. | 17.6 |
| 7 | 14. | 5. | 171. | 0. | 0.0 | 185. | 162. | 16.2 |
| 8 | 21. | 8. | 171. | 0. | 0.0 | 186. | 161. | 16.0 |
| 9 | 30. | 11. | 171. | 0. | 0.0 | 187. | 160. | 16.4 |
| 10 | 49. | 19. | 172. | 0. | 0.0 | 187. | 159. | 16.0 |
| 11 | 59. | 22. | 172. | 0. | 0.0 | 187. | 158. | 15.2 |
| 12 | 68. | 26. | 172. | 0. | 0.0 | 187. | 157. | 14.6 |
| 13 | 88. | 33. | 172. | 0. | 0.0 | 187. | 157. | 14.8 |
| 14 | 127. | 48. | 172. | 0. | 0.0 | 186. | 156. | 15.2 |
| 15 | 154. | 59. | 172. | 0. | 0.0 | 187. | 156. | 14.8 |
| 16 | 163. | 62. | 172. | 0. | 0.0 | 186. | 156. | 15.2 |
| 17 | 184. | 70. | 172. | 0. | 0.0 | 186. | 156. | 15.4 |
| 18 | 251. | 95. | 172. | 0. | 0.0 | 187. | 156. | 14.6 |
| 19 | 260. | 99. | 170. | 0. | 0.0 | 186. | 156. | 15.4 |
| 20 | 262. | 100. | 170. | 0. | 0.0 | 185. | 157. | 17.2 |

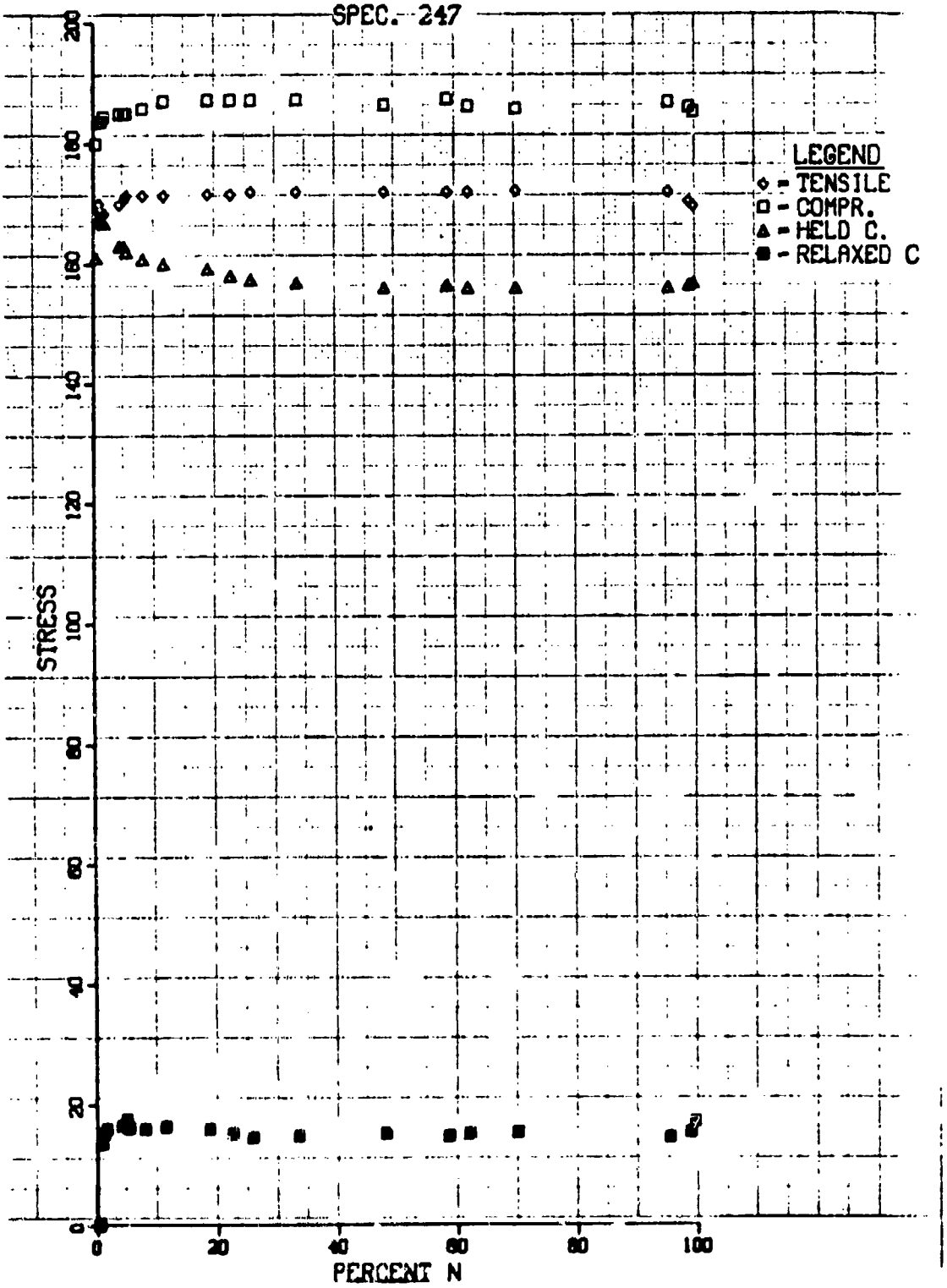

SPEC. 247
LEGEND
◇ - TENSILE
□ - COMPR.
▲ - HELD C.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 76.

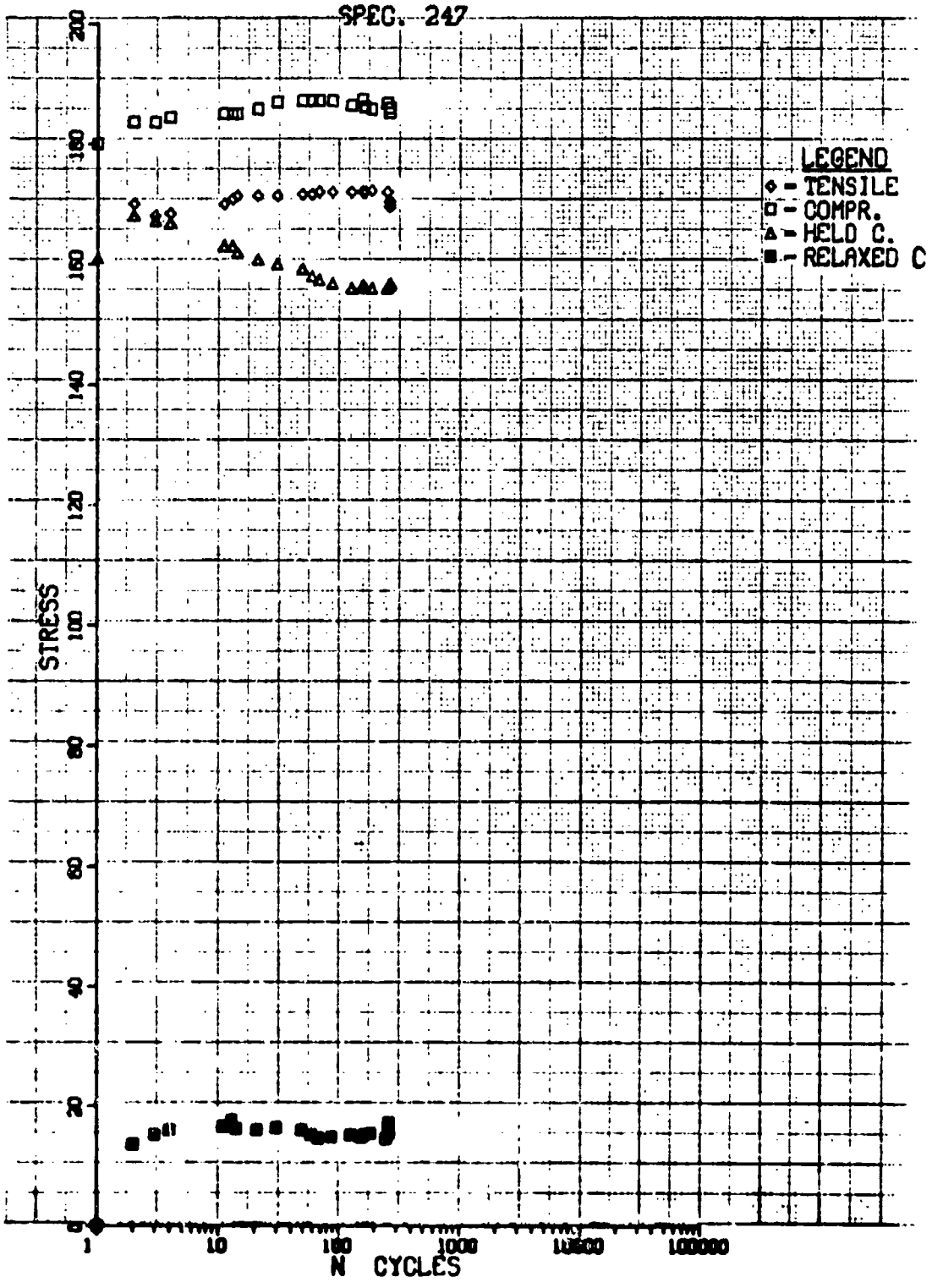

SPEC. 247
LEGEND
◇ - TENSILE
□ - COMPR.
△ - HELD C.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 77.

## SECTION 11

## RENÉ 95 TENSILE AND COMPRESSIVE STRAIN-HOLD TESTS

Tables 47 through 59 and Figures 78 through 103 present data on the tensile and compressive strain-hold tests on René 95. Equal and unequal hold periods of one and ten minutes were used.

TABLE 47

SPECIMEN 1

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 1. | 178. | 10.0 | 191. | 13.3 |
| 2 | 2. | 1. | 180. | 18.0 | 194. | 16.3 |
| 3 | 3. | 2. | 181. | 22.5 | 195. | 18.0 |
| 4 | 6. | 4. | | | 197. | 19.5 |
| 5 | 7. | 4. | 182. | 24.5 | 197. | 20.8 |
| 6 | 12. | 8. | 184. | 27.3 | 198. | 21.8 |
| 7 | 16. | 10. | 183. | 27.5 | 199. | 23.8 |
| 8 | 17. | 11. | 183. | 30.0 | 200. | 22.5 |
| 9 | 18. | 12. | 183. | 27.5 | 200. | |
| 10 | 26. | 17. | 183. | 28.0 | 198. | 21.8 |
| 11 | 36. | 23. | 183. | 27.5 | 199. | 23.8 |
| 12 | 41. | 26. | 183. | 28.8 | 199. | 18.8 |
| 13 | 46. | 29. | 183. | 31.3 | 200. | 23.8 |
| 14 | 67. | 43. | 183. | 30.5 | 198. | |
| 15 | 80. | 51. | 181. | 28.8 | 196. | 22.5 |
| 16 | 106. | 68. | 180. | 31.3 | 196. | 24.2 |
| 17 | 115. | 74. | 178. | 27.5 | 196. | 20.5 |
| 18 | 116. | 74. | 179. | 27.8 | 196. | 24.2 |
| 19 | 134. | 86. | 178. | 27.5 | 193. | 20.0 |
| 20 | 135. | 87. | 178. | 30.0 | 194. | 23.8 |
| 21 | 136. | 87. | 178. | 31.8 | 195. | |
| 22 | 140. | 90. | 176. | 27.5 | 194. | 20.0 |
| 23 | 145. | 93. | 177. | 29.0 | 193. | 22.5 |
| 24 | 150. | 96. | 176. | 31.3 | 194. | 25.0 |
| 25 | 154. | 99. | 176. | 31.0 | 195. | 25.0 |
| 26 | 155. | 99. | 176. | 31.0 | 195. | 21.3 |

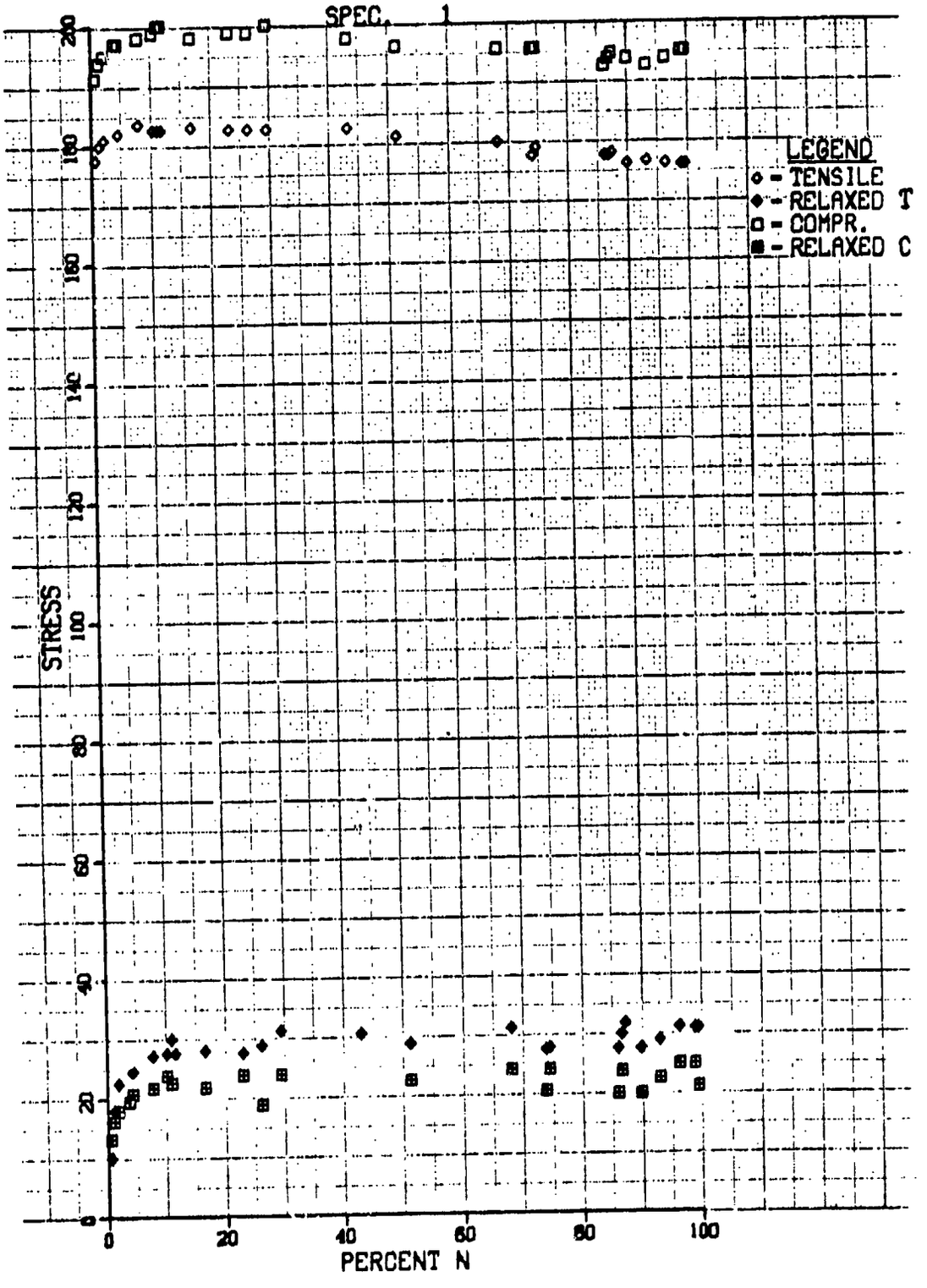

SPEC. 1
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 78.

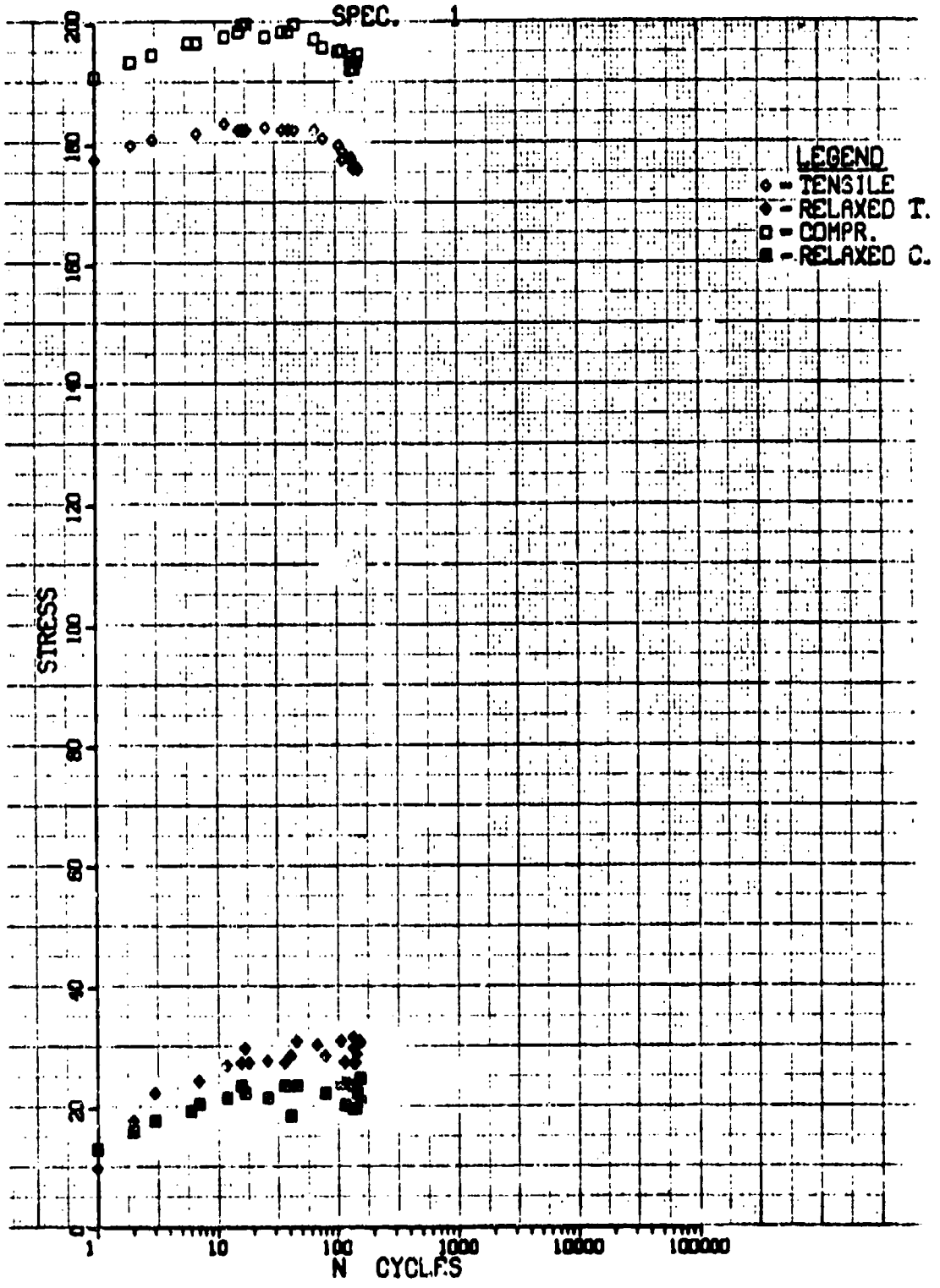

SPEC. 1
LEGEND
◇ - TENSILE
◆ - RELAXED T.
□ - COMPR.
■ - RELAXED C.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 79.

TABLE 48

SPECIMEN 2

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 173. | 6.5 | 182. | 11.5 |
| 2 | 2. | 1. | 173. | 8.8 | 180. | 6.3 |
| 3 | 3. | 1. | 174. | 12.5 | 182. | 7.7 |
| 4 | 13. | 5. | 174. | 18.8 | 186. | 13.8 |
| 5 | 24. | 10. | 174. | 20.0 | 185. | 11.3 |
| 6 | 33. | 14. | 173. | 20.0 | 187. | 12.0 |
| 7 | 49. | 21. | 173. | 17.5 | 186. | 13.0 |
| 8 | 63. | 26. | 171. | 18.8 | 188. | 16.3 |
| 9 | 107. | 45. | 170. | 18.8 | 185. | 12.5 |
| 10 | 132. | 55. | 170. | 18.8 | 183. | 12.5 |
| 11 | 147. | 62. | 169. | 18.8 | 184. | 16.3 |
| 12 | 198. | 83. | 166. | 20.0 | 183. | |
| 13 | 211. | 89. | 165. | 20.0 | 184. | 15.0 |
| 14 | 227. | 95. | 165. | 20.0 | 180. | 13.8 |
| 15 | 231. | 97. | 165. | 17.5 | 180. | 13.8 |
| 16 | 236. | 99. | 168. | 20.0 | 181. | 15.0 |

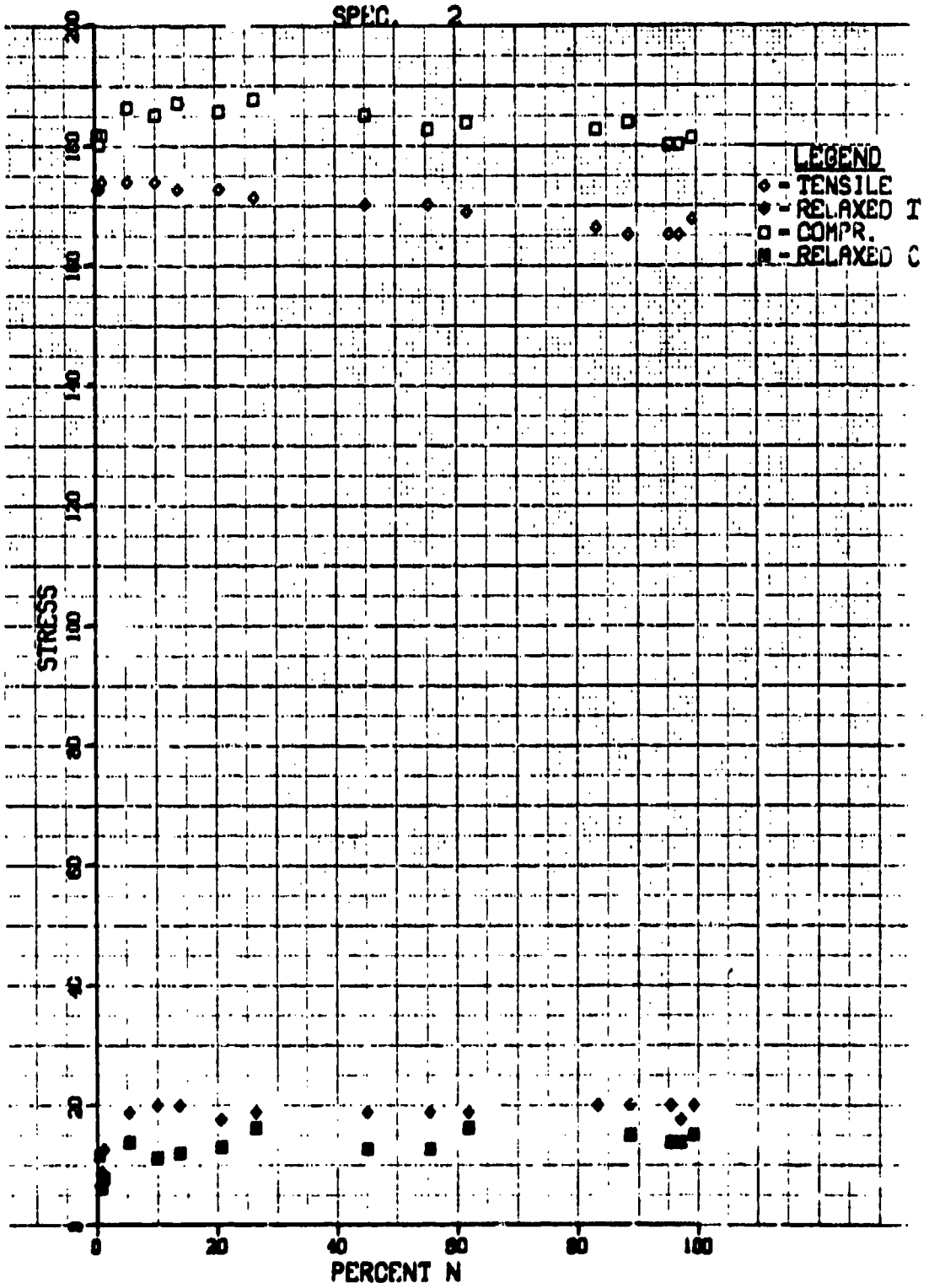

SPEC. 2
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 80.

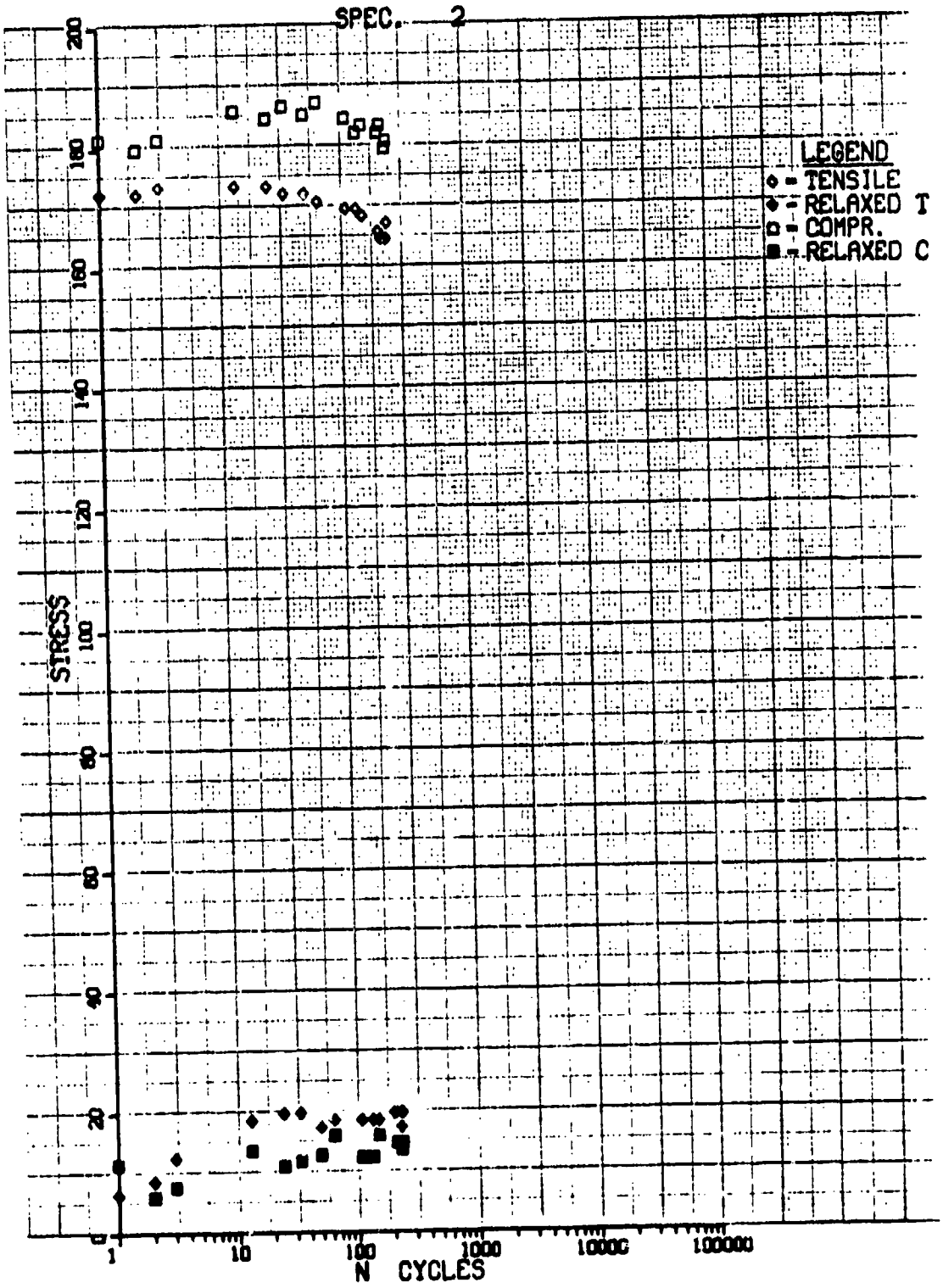

SPEC. 2
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 81.

TABLE 49

SPECIMEN 32

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 165. | 8.8 | 166. | 0.0 |
| 2 | 2. | 1. | 161. | 3.8 | 170. | 3.8 |
| 3 | 3. | 1. | 163. | 6.3 | 169. | 2.5 |
| 4 | 4. | 1. | 161. | 7.5 | 171. | 2.5 |
| 5 | 5. | 1. | 160. | 7.5 | 173. | 6.3 |
| 6 | 8. | 2. | 159. | 6.3 | 171. | 6.3 |
| 7 | 10. | 3. | 161. | 8.8 | 170. | 3.8 |
| 8 | 18. | 5. | 160. | 8.8 | 171. | 7.5 |
| 9 | 23. | 6. | 158. | 7.5 | 173. | 7.5 |
| 10 | 28. | 8. | 159. | 10.0 | 174. | 5.0 |
| 11 | 47. | 13. | 156. | 10.0 | 174. | 5.0 |
| 12 | 48. | 13. | 156. | 6.3 | 173. | |
| 13 | 52. | 15. | 158. | 8.8 | 171. | 6.3 |
| 14 | 53. | 15. | 156. | 11.3 | 174. | 5.0 |
| 15 | 112. | 31. | 156. | 10.0 | 169. | 7.5 |
| 16 | 126. | 35. | 153. | 7.5 | 169. | 6.3 |
| 17 | 131. | 37. | 155. | 8.8 | 169. | 3.8 |
| 18 | 141. | 39. | 151. | 10.0 | 173. | 7.5 |
| 19 | 146. | 41. | 155. | 10.0 | 173. | 11.3 |
| 20 | 150. | 42. | 151. | 10.0 | 171. | 6.3 |
| 21 | 156. | 44. | 155. | 11.3 | 168. | 7.5 |
| 22 | 160. | 45. | 151. | 10.0 | 173. | 7.5 |
| 23 | 200. | 56. | 151. | 10.0 | 170. | 7.5 |
| 24 | 249. | 70. | 150. | 10.0 | 166. | 8.8 |
| 25 | 259. | 72. | 149. | 8.8 | 168. | 8.8 |
| 26 | 269. | 75. | 148. | 8.8 | 168. | 6.3 |
| 27 | 279. | 78. | 150. | 12.5 | 166. | 8.8 |
| 28 | 303. | 85. | 146. | 6.3 | 165. | 8.8 |
| 29 | 308. | 86. | 145. | 3.8 | 166. | 7.5 |
| 30 | 318. | 89. | 148. | 12.5 | 166. | 7.5 |
| 31 | 319. | 89. | 145. | 10.0 | 168. | 10.0 |
| 32 | 342. | 96. | 144. | 10.0 | 164. | 6.3 |
| 33 | 343. | 96. | 143. | 10.0 | 165. | 7.5 |
| 34 | 348. | 97. | 140. | 8.8 | 165. | 7.5 |
| 35 | 352. | 98. | 138. | 10.0 | 166. | 7.5 |
| 36 | 357. | 100. | 130. | 10.0 | 165. | 5.0 |
| 37 | 358. | 100. | 125. | 12.5 | 168. | |

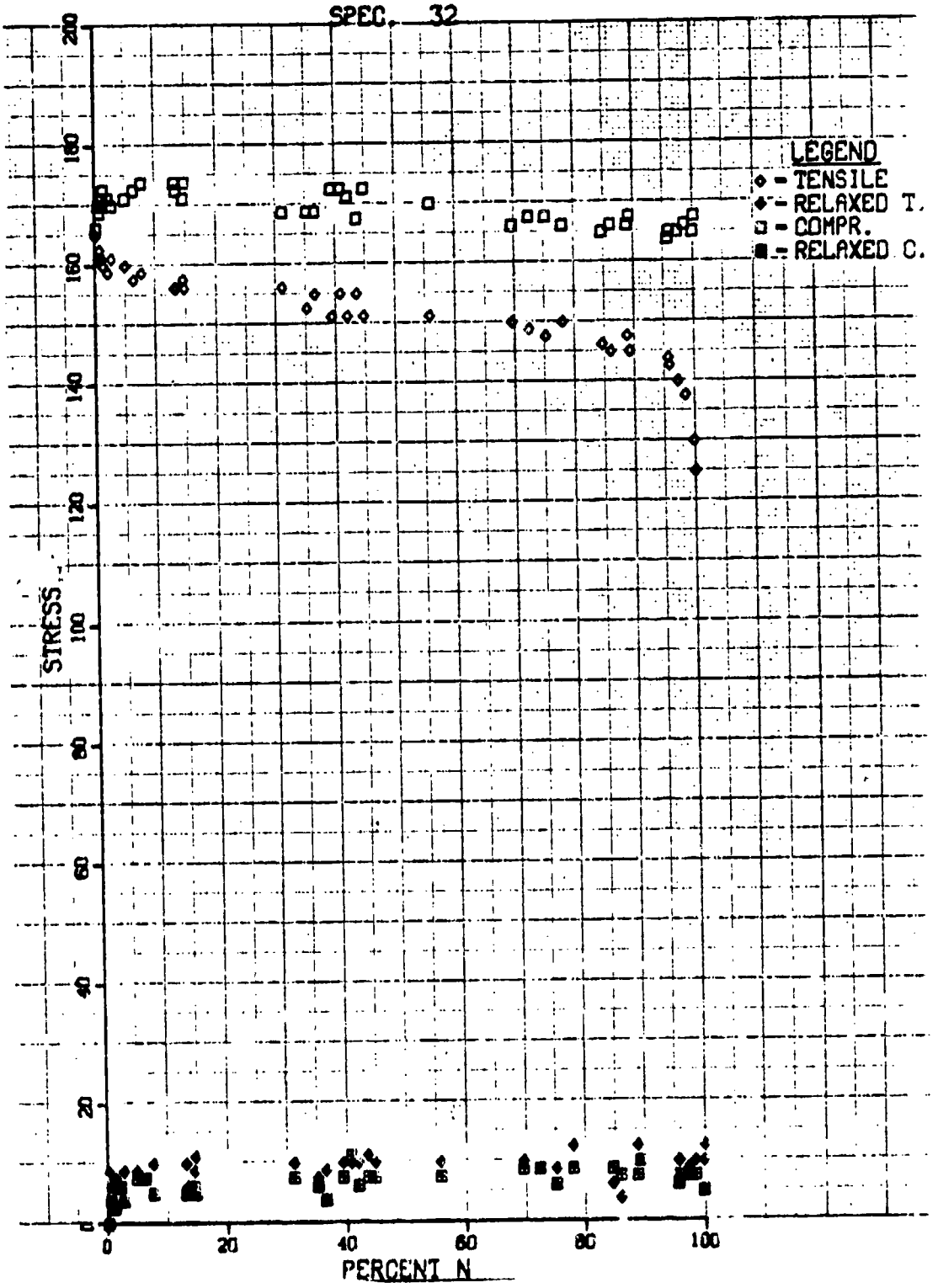

SPEC. 32
LEGEND
◇ - TENSILE
◆ - RELAXED T.
□ - COMPR.
■ - RELAXED C.
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 82.

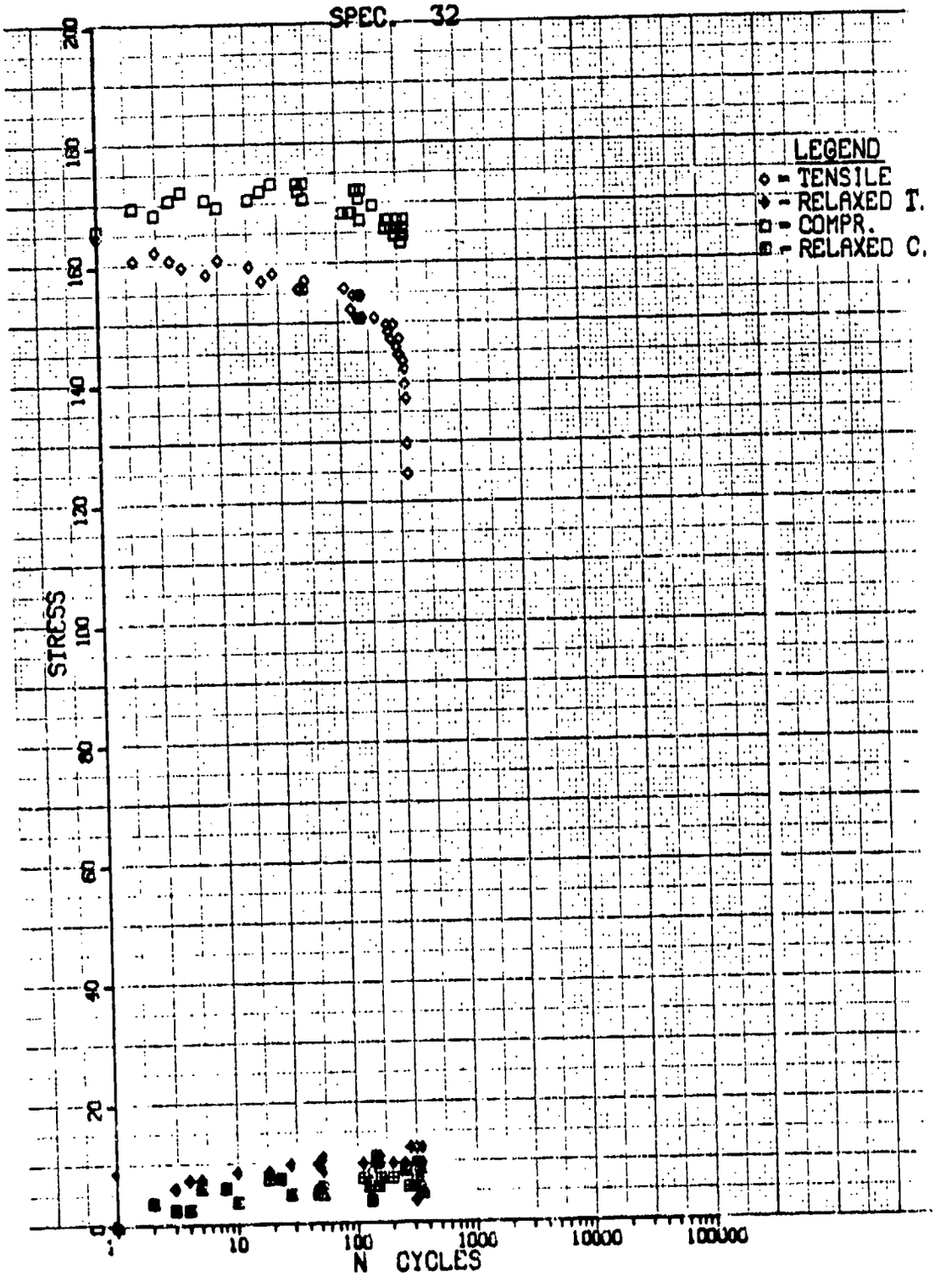

SPEC. 32
LEGEND
◇ - TENSILE
◆ - RELAXED T.
□ - COMPR.
■ - RELAXED C.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 83.

TABLE 50

SPECIMEN 9

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 145. | 2.5 | 154. | 0.0 |
| 2 | 2. | 0. | 143. | 1.3 | 154. | 1.3 |
| 3 | 3. | 0. | 143. | 2.5 | 155. | 3.8 |
| 4 | 4. | 0. | 144. | 3.8 | 153. | 1.3 |
| 5 | 10. | 1. | 141. | 5.0 | 156. | 2.5 |
| 6 | 18. | 2. | 141. | 6.3 | 158. | 2.5 |
| 7 | 20. | 2. | 138. | 3.8 | 158. | 2.5 |
| 8 | 25. | 3. | 140. | 7.5 | 158. | 2.5 |
| 9 | 26. | 3. | 136. | 5.0 | 160. | 3.8 |
| 10 | 40. | 4. | 135. | 2.5 | 159. | 3.8 |
| 11 | 100. | 10. | 135. | 6.3 | 160. | 5.0 |
| 12 | 150. | 16. | 138. | 7.5 | 156. | 5.0 |
| 13 | 173. | 18. | 135. | 8.8 | 161. | 6.3 |
| 14 | 188. | 20. | 138. | 7.5 | 158. | 6.3 |
| 15 | 219. | 23. | 135. | 7.5 | 159. | 6.3 |
| 16 | 350. | 36. | 134. | 6.3 | 155. | 2.5 |
| 17 | 475. | 50. | 135. | 8.8 | 155. | 6.3 |
| 18 | 549. | 57. | 133. | 5.0 | 153. | 3.8 |
| 19 | 675. | 70. | 130. | 5.0 | 153. | 2.5 |
| 20 | 725. | 76. | 133. | 7.5 | 150. | 5.0 |
| 21 | 770. | 80. | 130. | 6.3 | 150. | 5.0 |
| 22 | 800. | 83. | 130. | 8.8 | 151. | 3.8 |
| 23 | 830. | 87. | 128. | 6.3 | 150. | 2.5 |
| 24 | 845. | 88. | 125. | 5.0 | 153. | 5.0 |
| 25 | 875. | 91. | 125. | 8.8 | 153. | 5.0 |
| 26 | 897. | 94. | 125. | 7.5 | 149. | 5.0 |
| 27 | 925. | 96. | 120. | 7.5 | 150. | 6.3 |
| 28 | 932. | 97. | 120. | 10.0 | 150. | 7.5 |
| 29 | 940. | 98. | 115. | 6.3 | 150. | 7.5 |
| 30 | 947. | 99. | 108. | 7.5 | 153. | 7.5 |
| 31 | 948. | 99. | 108. | 8.8 | 151. | 6.3 |
| 32 | 949. | 99. | 106. | 7.5 | 150. | 7.5 |
| 33 | 953. | 99. | 94. | 8.8 | 148. | 7.5 |

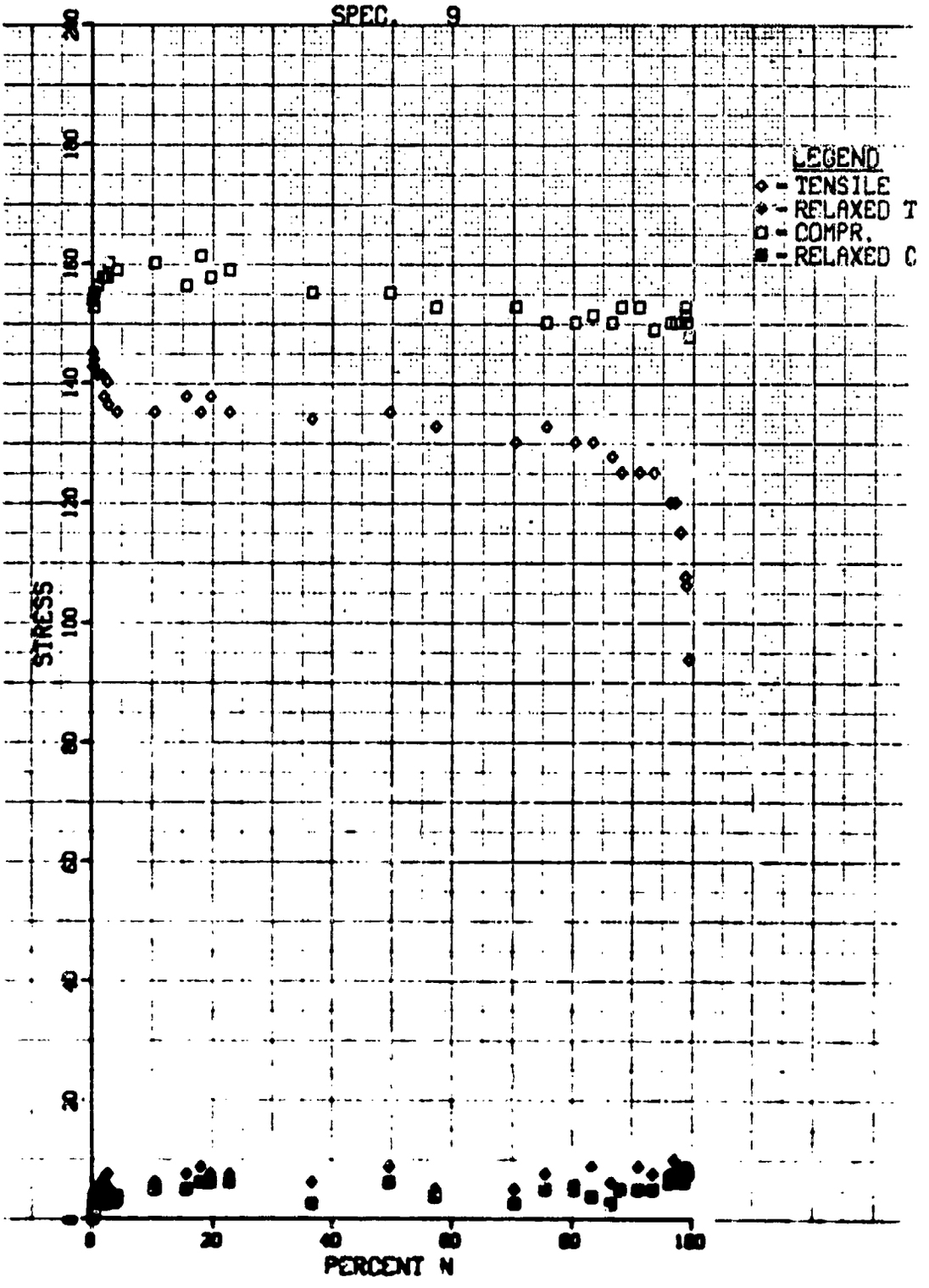

SPEC. 9
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 84.

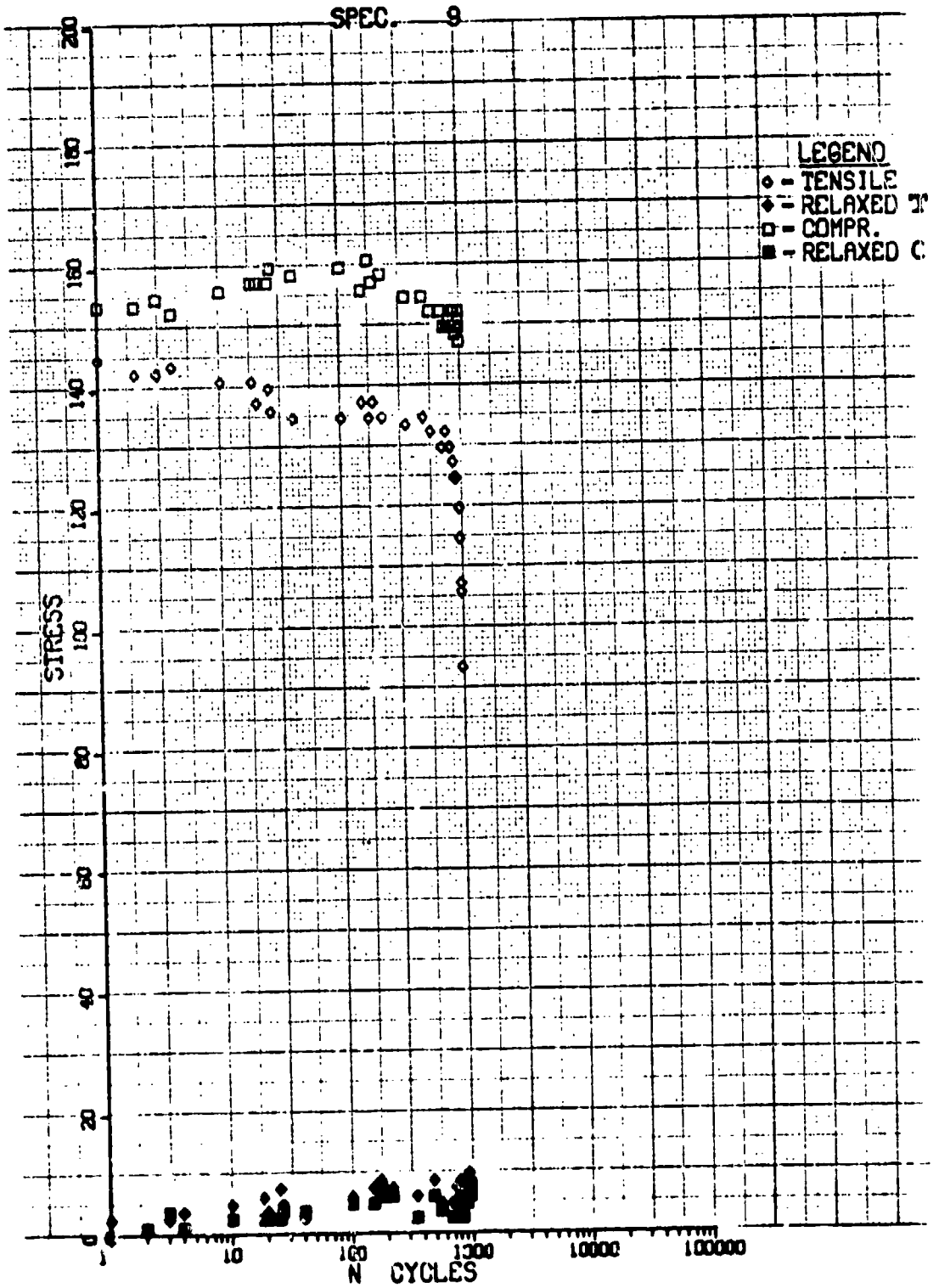

SPEC. 9
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 85.

TABLE 51

SPECIMEN 4

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 133. | 3.8 | 131. | 0.0 |
| 2 | 2. | 0. | 132. | 3.2 | 133. | 2.5 |
| 3 | 3. | 0. | 133. | 5.0 | 134. | 4.0 |
| 4 | 4. | 0. | 133. | 6.3 | 135. | 5.0 |
| 5 | 7. | 1. | 130. | 3.8 | 135. | 5.0 |
| 6 | 15. | 1. | 128. | 5.0 | 135. | 5.0 |
| 7 | 24. | 2. | 126. | 5.0 | 135. | 3.8 |
| 8 | 46. | 4. | 125. | 5.0 | 137. | 4.0 |
| 9 | 103. | 8. | 124. | 6.3 | 138. | 6.3 |
| 10 | 220. | 18. | 123. | 6.3 | 138. | 6.3 |
| 11 | 305. | 25. | 121. | 6.3 | 136. | 5.0 |
| 12 | 436. | 36. | 120. | 6.0 | 136. | 7.3 |
| 13 | 525. | 43. | 120. | 6.3 | 135. | 7.5 |
| 14 | 600. | 49. | 120. | 7.5 | 135. | 7.5 |
| 15 | 690. | 57. | 119. | 7.5 | 135. | 7.5 |
| 16 | 755. | 62. | 118. | 6.3 | 134. | 7.5 |
| 17 | 805. | 66. | 118. | 7.5 | 134. | 7.5 |
| 18 | 850. | 70. | 118. | 7.5 | 133. | 7.5 |
| 19 | 915. | 75. | 116. | 6.3 | 133. | 7.5 |
| 20 | 945. | 78. | 116. | 7.5 | 133. | 7.5 |
| 21 | 995. | 82. | 116. | 8.8 | 133. | 8.8 |
| 22 | 1049. | 86. | 115. | 7.5 | 131. | 7.5 |
| 23 | 1075. | 88. | 115. | 8.8 | 131. | 7.5 |
| 24 | 1115. | 92. | 114. | 7.5 | 130. | 7.5 |
| 25 | 1123. | 92. | 113. | 7.5 | 130. | 7.5 |
| 26 | 1145. | 94. | 111. | 8.8 | 130. | 8.8 |
| 27 | 1153. | 95. | 110. | 8.8 | 130. | 8.8 |
| 28 | 1165. | 96. | 108. | 7.5 | 130. | 8.8 |
| 29 | 1173. | 97. | 106. | 7.5 | 130. | 8.8 |
| 30 | 1180. | 97. | 105. | 7.5 | 130. | 8.8 |
| 31 | 1182. | 97. | 104. | 7.5 | 130. | 8.8 |
| 32 | 1188. | 98. | 101. | 7.3 | 130. | 8.8 |
| 33 | 1195. | 98. | 100. | 8.8 | 130. | 8.8 |
| 34 | 1197. | 99. | 98. | 7.5 | 130. | 8.8 |
| 35 | 1202. | 99. | 95. | 7.5 | 130. | 8.8 |
| 36 | 1205. | 99. | 91. | 6.3 | 129. | 7.5 |
| 37 | 1212. | 100. | 85. | 6.3 | 130. | 8.8 |

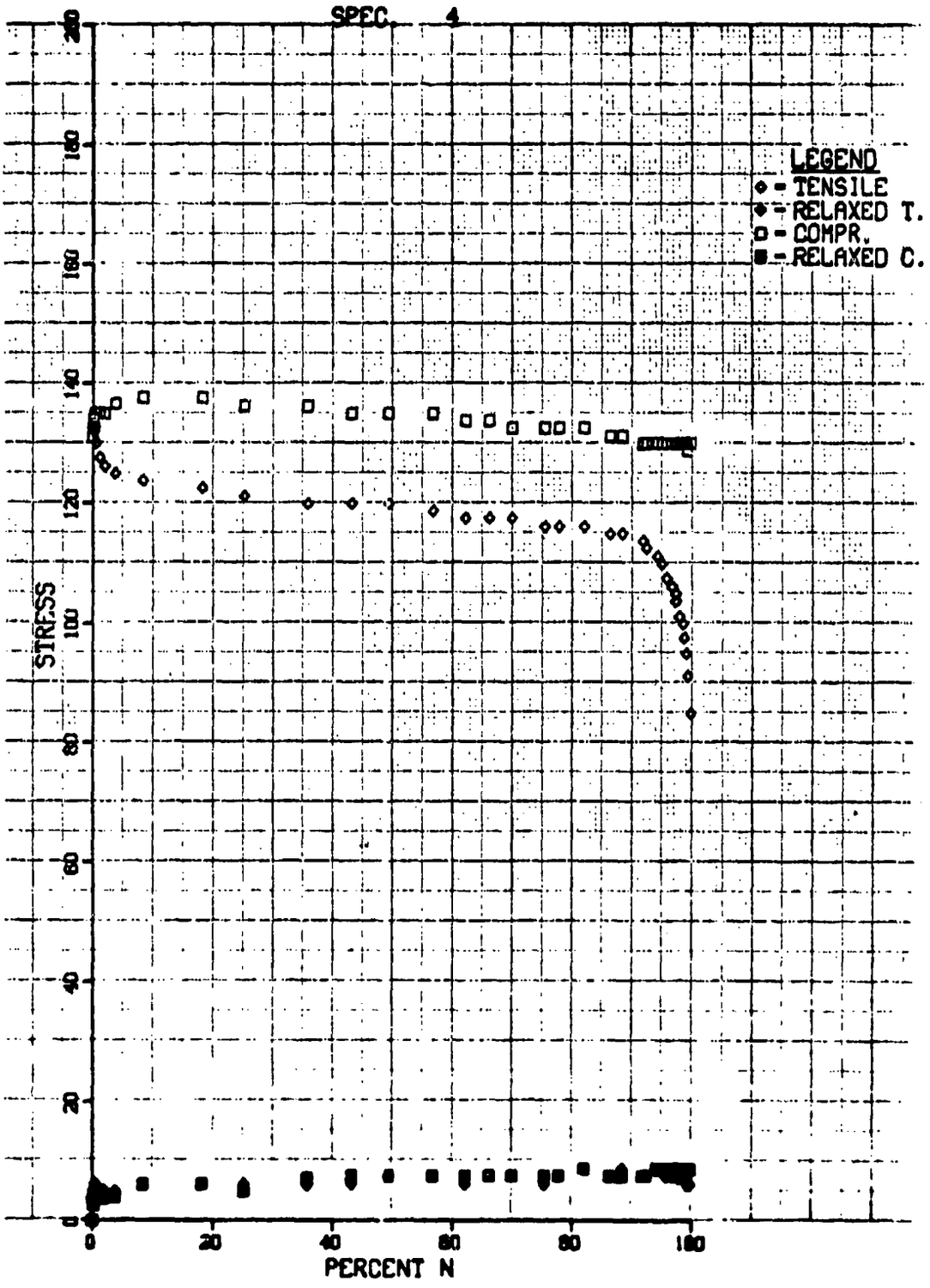

SPEC. 4
LEGEND
◇ - TENSILE
◆ - RELAXED T.
□ - COMPR.
■ - RELAXED C.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 86.

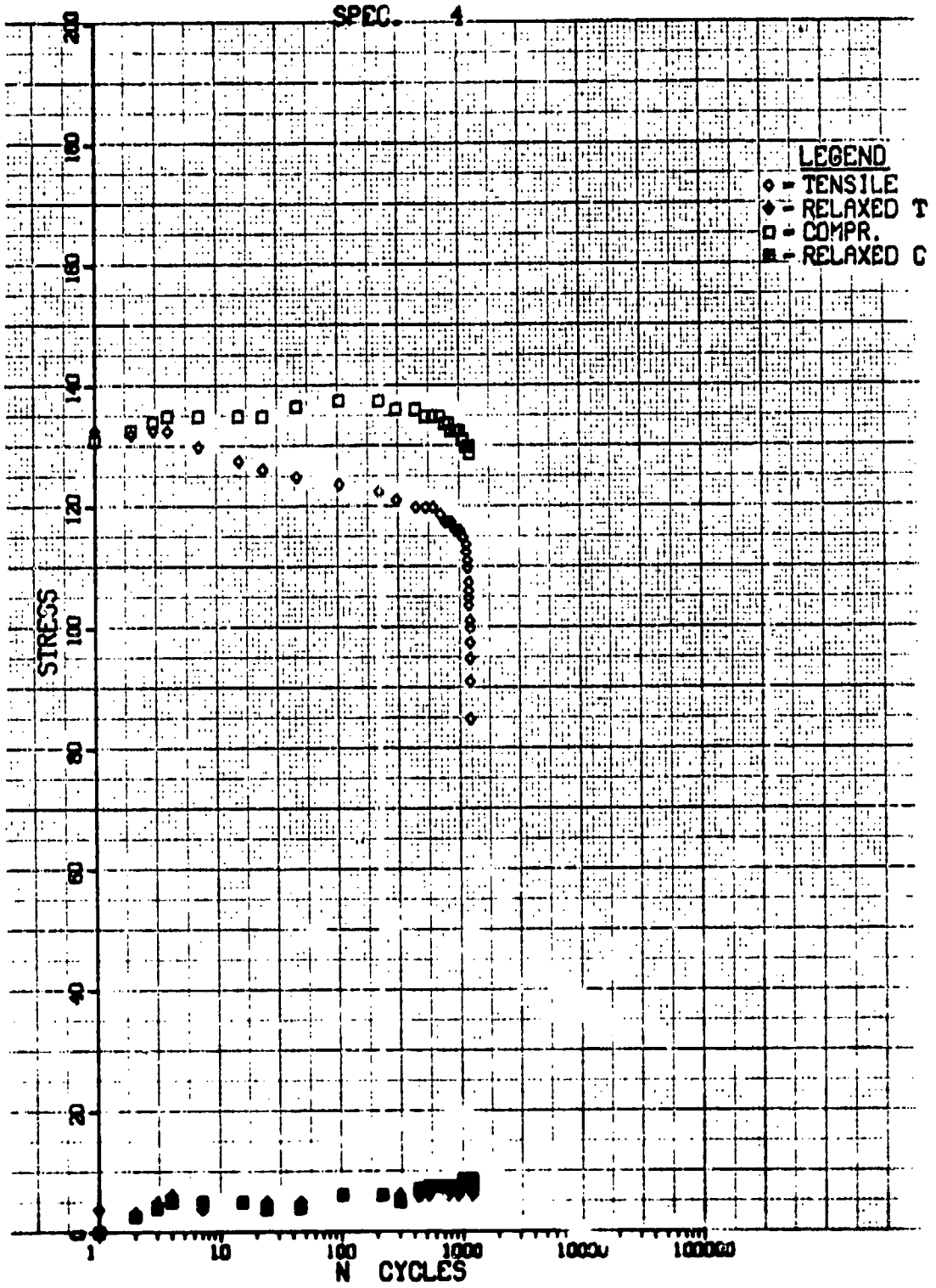

SPEC. 4
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 87.

TABLE 52

SPECIMEN 15

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 128. | 1.3 | 138. | 11.3 |
| 2 | 2. | 0. | 130. | 3.8 | 129. | 2.5 |
| 3 | 3. | 0. | 130. | 3.8 | 129. | 2.5 |
| 4 | 9. | 1. | 125. | 3.8 | 133. | 2.5 |
| 5 | 10. | 1. | 125. | 2.5 | 133. | 2.5 |
| 6 | 11. | 1. | 125. | 3.8 | 133. | 2.5 |
| 7 | 18. | 1. | 125. | 5.0 | 135. | 3.8 |
| 8 | 31. | 2. | 110. | 0.0 | 125. | 0.0 |
| 9 | 39. | 3. | 124. | 6.3 | 135. | 2.5 |
| 10 | 75. | 6. | 123. | 6.3 | 136. | 3.8 |
| 11 | 105. | 8. | 121. | 5.0 | 136. | 3.8 |
| 12 | 112. | 9. | 120. | 3.8 | 135. | 2.5 |
| 13 | 140. | 11. | 120. | 3.8 | 136. | 2.5 |
| 14 | 173. | 13. | 120. | 5.0 | 136. | 3.8 |
| 15 | 370. | 29. | 119. | 6.3 | 138. | 3.8 |
| 16 | 410. | 32. | 118. | 5.0 | 136. | 3.8 |
| 17 | 420. | 33. | 120. | 6.3 | 136. | 3.8 |
| 18 | 498. | 39. | 119. | 6.3 | 136. | 5.0 |
| 19 | 563. | 44. | 118. | 5.0 | 136. | 3.8 |
| 20 | 569. | 44. | 119. | 7.5 | 136. | 5.0 |
| 21 | 725. | 56. | 118. | 6.3 | 136. | 6.3 |
| 22 | 745. | 58. | 119. | 7.5 | 135. | 5.0 |
| 23 | 974. | 76. | 118. | 7.5 | 134. | 5.0 |
| 24 | 1000. | 78. | 116. | 6.3 | 135. | 6.3 |
| 25 | 1025. | 80. | 118. | 7.5 | 135. | 7.5 |
| 26 | 1095. | 85. | 119. | 8.8 | 134. | 7.5 |
| 27 | 1240. | 96. | 120. | 9.8 | 135. | 8.8 |
| 28 | 1270. | 99. | 120. | 8.8 | 136. | 6.3 |
| 29 | 1278. | 99. | 120. | 10.0 | 138. | 7.5 |

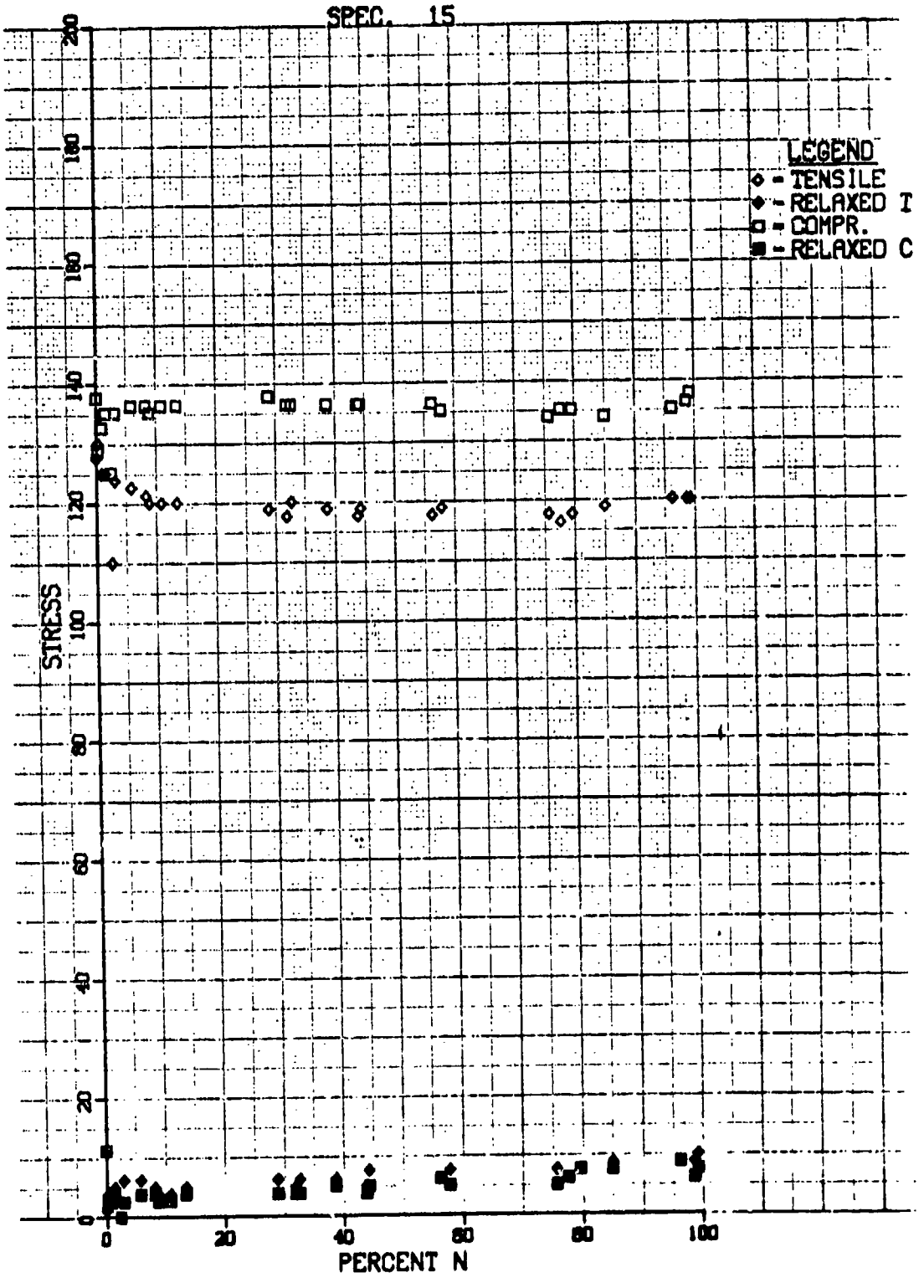

SPEC. 15
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 88.

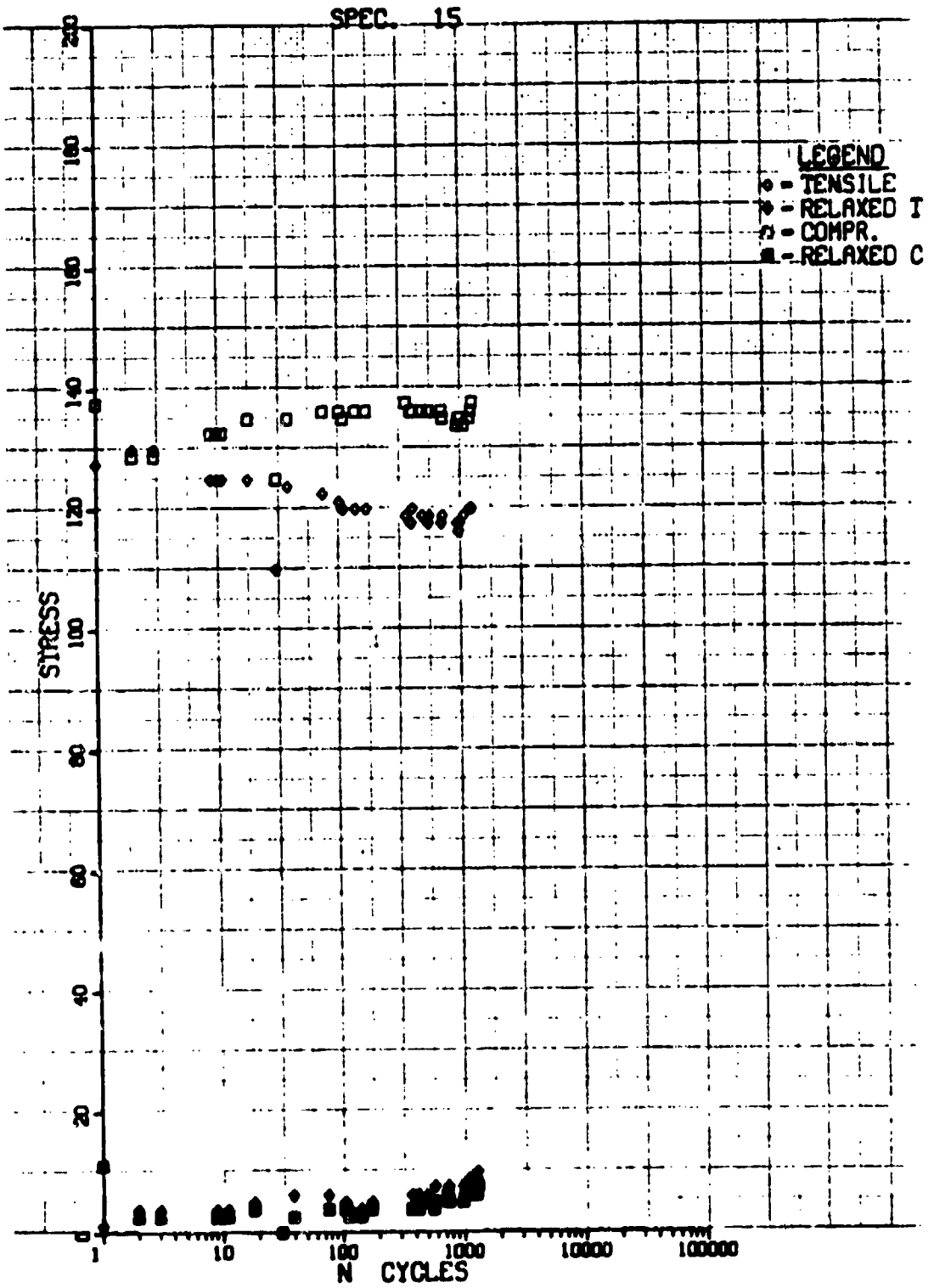

SPEC. 15
LEGEND
- TENSILE
- RELAXED T
- COMPR.
- RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 89.

TABLE 53

SPECIMEN 229

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 108. | 0.0 | **** | **** |
| 2 | 2. | 0. | 105. | -1.0 | 109. | -2.0 |
| 3 | 3. | 0. | 105. | 0.0 | 111. | -2.0 |
| 4 | 4. | 0. | 104. | -1.0 | 113. | -2.0 |
| 5 | 5. | 0. | 108. | -2.0 | 116. | -1.0 |
| 6 | 6. | 0. | 108. | -2.0 | 116. | -1.0 |
| 7 | 13. | 0. | 109. | 0.0 | 117. | -1.0 |
| 8 | 14. | 0. | 107. | 0.0 | 118. | 0.0 |
| 9 | 15. | 0. | 108. | 0.0 | 116. | -1.0 |
| 10 | 23. | 0. | 108. | 0.0 | 117. | -1.0 |
| 11 | 33. | 1. | 107. | 0.0 | 118. | -2.0 |
| 12 | 34. | 1. | 106. | 0.0 | 119. | -1.0 |
| 13 | 35. | 1. | 105. | 0.0 | 120. | 0.0 |
| 14 | 43. | 1. | 107. | 0.0 | 118. | -2.0 |
| 15 | 52. | 1. | 104. | 0.0 | 120. | 0.0 |
| 16 | 72. | 1. | 104. | 0.0 | 121. | 0.0 |
| 17 | 131. | 2. | 102. | 0.0 | 122. | -1.0 |
| 18 | 202. | 4. | 102. | 0.0 | 123. | 0.0 |
| 19 | 391. | 6. | 101. | 0.0 | 124. | 0.0 |
| 20 | 460. | 9. | 100. | 0.0 | 125. | 0.0 |
| 21 | 580. | 11. | 99. | 0.0 | 122. | 0.0 |
| 22 | 1235. | 23. | 98. | 0.0 | 124. | 0.0 |
| 23 | 1236. | 23. | 96. | 0.0 | 124. | 0.0 |
| 24 | 1255. | 24. | 98. | 0.0 | 124. | 0.0 |
| 25 | 1512. | 29. | 100. | 0.0 | 126. | 0.0 |
| 26 | 1695. | 32. | 105. | 0.0 | 120. | 0.0 |
| 27 | 1701. | 32. | 99. | 0.0 | 125. | 0.0 |
| 28 | 2160. | 41. | 98. | 0.0 | 126. | 0.0 |
| 29 | 2177. | 41. | 97. | 0.0 | 127. | 0.0 |
| 30 | 2199. | 42. | 99. | 0.0 | 125. | 0.0 |
| 31 | 2435. | 46. | 102. | 0.0 | 121. | 0.0 |
| 32 | 2505. | 47. | 103. | 0.0 | 120. | 0.0 |
| 33 | 2552. | 48. | 100. | 0.0 | 124. | 0.0 |
| 34 | 2575. | 49. | 96. | 0.0 | 128. | 0.0 |
| 35 | 2577. | 49. | 101. | 0.0 | 127. | 0.0 |
| 36 | 2525. | 50. | 94. | 0.0 | 129. | 0.0 |
| 37 | 3820. | 72. | 96. | 0.0 | 126. | 0.0 |
| 38 | 4101. | 78. | 96. | 0.0 | 128. | 0.0 |
| 39 | 4122. | 78. | 93. | 0.0 | 129. | 0.0 |
| 40 | 4123. | 78. | 92. | 0.0 | 130. | 0.0 |
| 41 | 4150. | 79. | 94. | 0.0 | 128. | 0.0 |
| 42 | 4649. | 88. | 91. | 0.0 | 130. | 0.0 |
| 43 | 4748. | 90. | 92. | 0.0 | 128. | 0.0 |
| 44 | 4755. | 90. | 90. | 0.0 | 131. | 0.0 |
| 45 | 4905. | 91. | 90. | 0.0 | 130. | 0.0 |
| 46 | 4934. | 93. | 89. | 0.0 | 129. | 0.0 |
| 47 | 4951. | 94. | 88. | 0.0 | 132. | 0.0 |
| 48 | 5075. | 96. | 87. | 0.0 | 132. | 0.0 |
| 49 | 5151. | 98. | 86. | 0.0 | 132. | 0.0 |
| 50 | 5183. | 98. | 88. | 1.0 | 132. | 1.0 |
| 51 | 5214. | 99. | 85. | 1.0 | 132. | 0.0 |
| 52 | 5225. | 99. | 84. | 0.0 | 133. | 0.0 |
| 53 | 5240. | 99. | 88. | 0.0 | 131. | 0.0 |
| 54 | 5249. | 99. | 93. | 0.0 | 132. | 0.0 |
| 55 | 5258. | 100. | 103. | 0.0 | 132. | 0.0 |
| 56 | 5259. | 100. | 104. | 0.0 | 132. | 0.0 |
| 57 | 5260. | 100. | 105. | 2.0 | 134. | 0.0 |
| 58 | 5261. | 100. | 107. | 0.0 | **** | **** |
| 59 | 5269. | 100. | 117. | 5.0 | 145. | 3.0 |

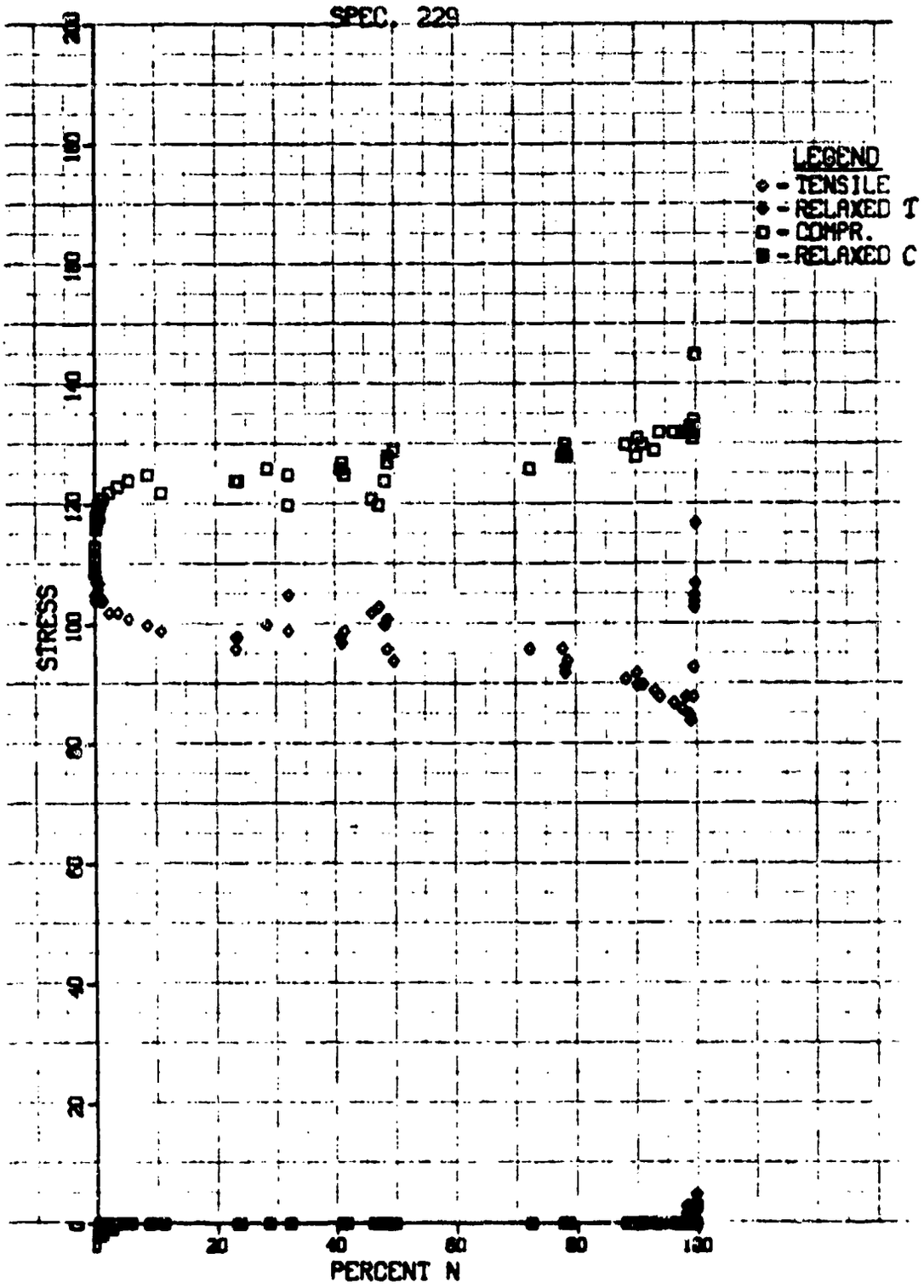

SPEC. 229
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200
0
20
40
60
80
100

Figure 90.

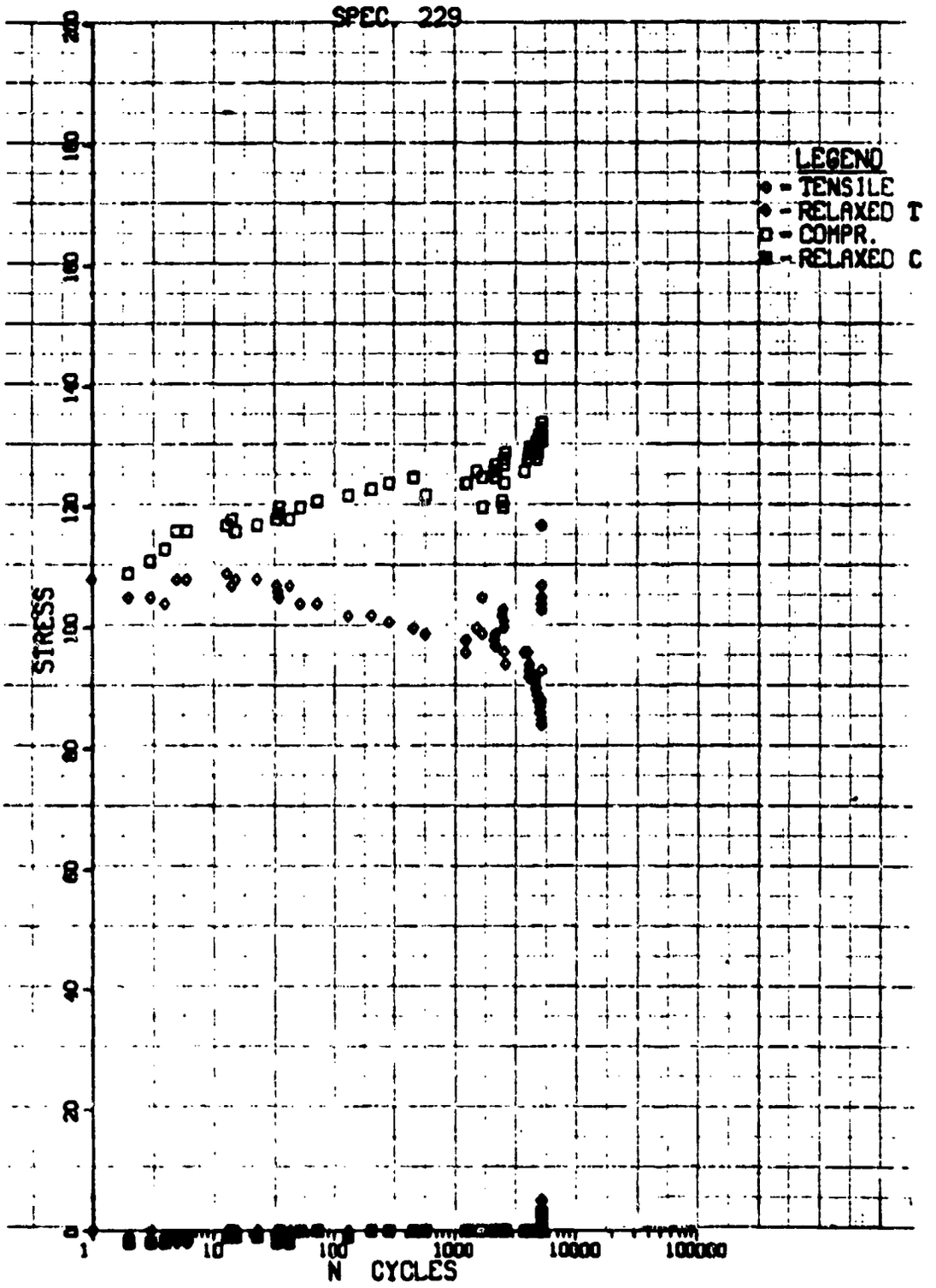

SPEC 229
LEGEND
- TENSILE
- RELAXED T
- COMPR.
- RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 91.

TABLE 54

SPECIMEN 28

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 1. | 173. | 27.5 | 185. | 31.0 |
| 2 | 2. | 2. | 179. | 40.0 | 188. | 36.3 |
| 3 | 3. | 3. | 176. | 43.6 | 189. | 38.8 |
| 4 | 4. | 3. | 178. | 45.0 | 190. | 41.3 |
| 5 | 5. | 4. | 178. | 45.0 | 190. | 42.5 |
| 6 | 6. | 5. | 180. | 48.8 | 191. | 43.8 |
| 7 | 7. | 6. | 179. | 47.5 | 191. | 45.0 |
| 8 | 8. | 7. | 180. | 50.0 | 191. | 46.3 |
| 9 | 9. | 8. | 180. | 50.0 | 191. | 45.0 |
| 10 | 10. | 9. | 180. | 50.0 | 191. | 45.0 |
| 11 | 11. | 10. | 180. | 51.3 | 193. | 47.5 |
| 12 | 12. | 10. | 180. | 52.5 | 193. | 45.3 |
| 13 | 17. | 15. | 190. | 52.5 | 194. | 46.3 |
| 14 | 18. | 16. | | | 195. | 51.3 |
| 15 | 20. | 17. | 180. | 55.0 | 195. | 48.8 |
| 16 | 21. | 15. | 180. | 55.0 | 195. | 50.0 |
| 17 | 34. | 30. | 180. | 55.0 | 194. | 51.3 |
| 18 | 44. | 38. | 180. | 55.0 | 194. | 48.8 |
| 19 | 52. | 45. | 179. | 53.8 | 193. | 47.5 |
| 20 | 66. | 57. | 179. | 56.3 | 193. | 51.3 |
| 21 | 70. | 61. | 178. | 57.5 | 191. | 51.3 |
| 22 | 83. | 72. | 176. | 56.3 | 190. | 50.0 |
| 23 | 86. | 75. | 176. | 56.3 | 190. | 52.5 |
| 24 | 87. | 76. | 176. | 57.5 | 190. | 51.3 |
| 25 | 90. | 78. | 176. | 58.8 | 190. | 52.5 |
| 26 | 92. | 80. | 175. | 57.5 | 190. | 50.0 |
| 27 | 100. | 87. | 175. | 60.0 | 190. | 52.5 |
| 28 | 113. | 98. | 173. | 60.0 | 190. | 45.0 |
| 29 | 114. | 99. | 173. | 55.0 | 190. | 47.5 |
| 30 | 115. | 100. | 173. | 55.0 | 190. | 47.5 |

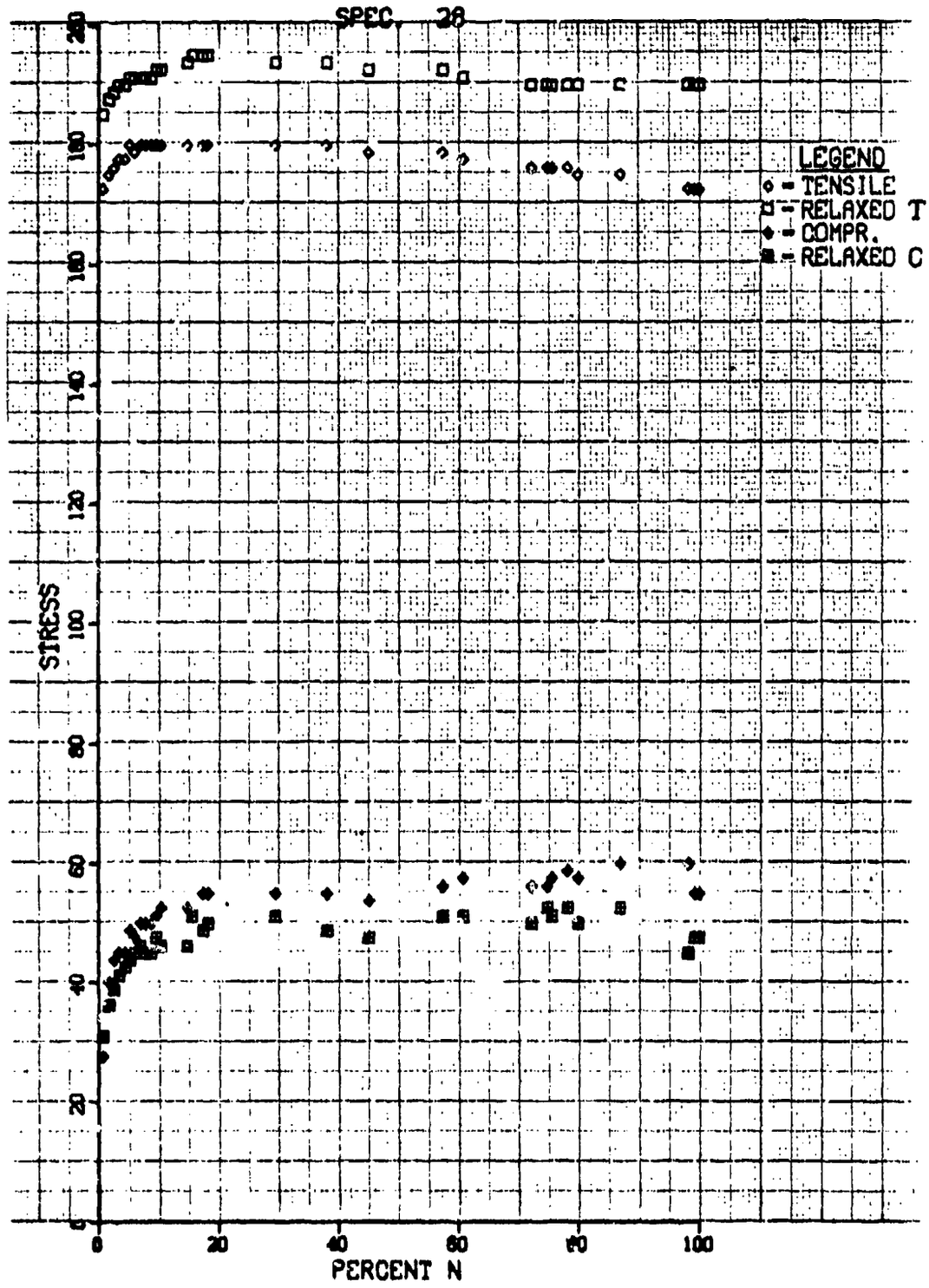

SPEC. 28
LEGEND
◇ - TENSILE
□ - RELAXED T
◆ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 92.

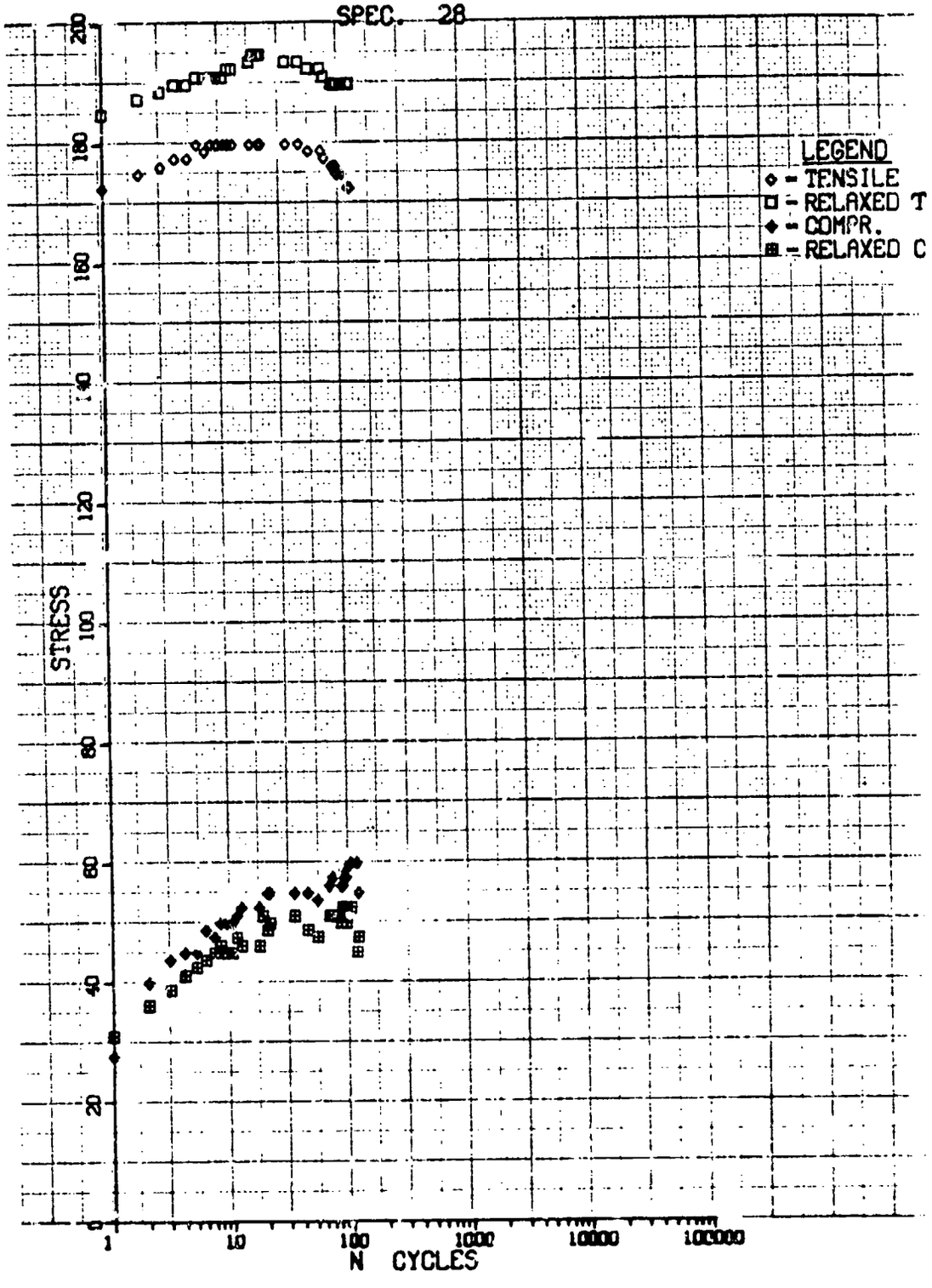

SPEC. 28
LEGEND
◇ - TENSILE
□ - RELAXED T
◆ - COMPR.
⊞ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 93.

TABLE 55

SPECIMEN 31

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 1. | 158. | 28.8 | 168. | 30.0 |
| 2 | 2. | 1. | 159. | 38.8 | 165. | 30.0 |
| 3 | 3. | 2. | 158. | 40.0 | 170. | 35.0 |
| 4 | 4. | 2. | 158. | 42.5 | 171. | 37.5 |
| 5 | 9. | 5. | 158. | 45.0 | 173. | 40.0 |
| 6 | 13. | 7. | 158. | 45.0 | 173. | 42.5 |
| 7 | 21. | 11. | 160. | 48.8 | 173. | 42.5 |
| 8 | 28. | 14. | 159. | 48.8 | 173. | 45.0 |
| 9 | 40. | 20. | 159. | 48.8 | 173. | 41.3 |
| 10 | 50. | 25. | 159. | 48.8 | 173. | 40.0 |
| 11 | 55. | 28. | 160. | 50.0 | 170. | 43.8 |
| 12 | 58. | 29. | 159. | 48.8 | 171. | 45.0 |
| 13 | 70. | 35. | 158. | 50.0 | 173. | 46.3 |
| 14 | 73. | 37. | 159. | 48.8 | 169. | 42.5 |
| 15 | 75. | 38. | 158. | 47.5 | 170. | 36.3 |
| 16 | 80. | 40. | 160. | 50.0 | 171. | 45.0 |
| 17 | 90. | 45. | 159. | 48.8 | 170. | 42.5 |
| 18 | 115. | 58. | 160. | 51.3 | 170. | 45.0 |
| 19 | 120. | 60. | 158. | 47.5 | 170. | 43.8 |
| 20 | 127. | 64. | 159. | 51.3 | 170. | 46.3 |
| 21 | 135. | 68. | 158. | 51.3 | 170. | 45.0 |
| 22 | 140. | 70. | 156. | 51.3 | 170. | 45.0 |
| 23 | 172. | 86. | 158. | 52.5 | 170. | 47.5 |
| 24 | 180. | 90. | 159. | 51.3 | 170. | 46.3 |
| 25 | 183. | 92. | 160. | 57.5 | 170. | 50.0 |
| 26 | 190. | 95. | 158. | 56.3 | 171. | 50.0 |
| 27 | 195. | 98. | 158. | 57.5 | 173. | 50.0 |
| 28 | 196. | 98. | 158. | 61.3 | 175. | 55.0 |
| 29 | 197. | 99. | 155. | 60.0 | 175. | 51.3 |

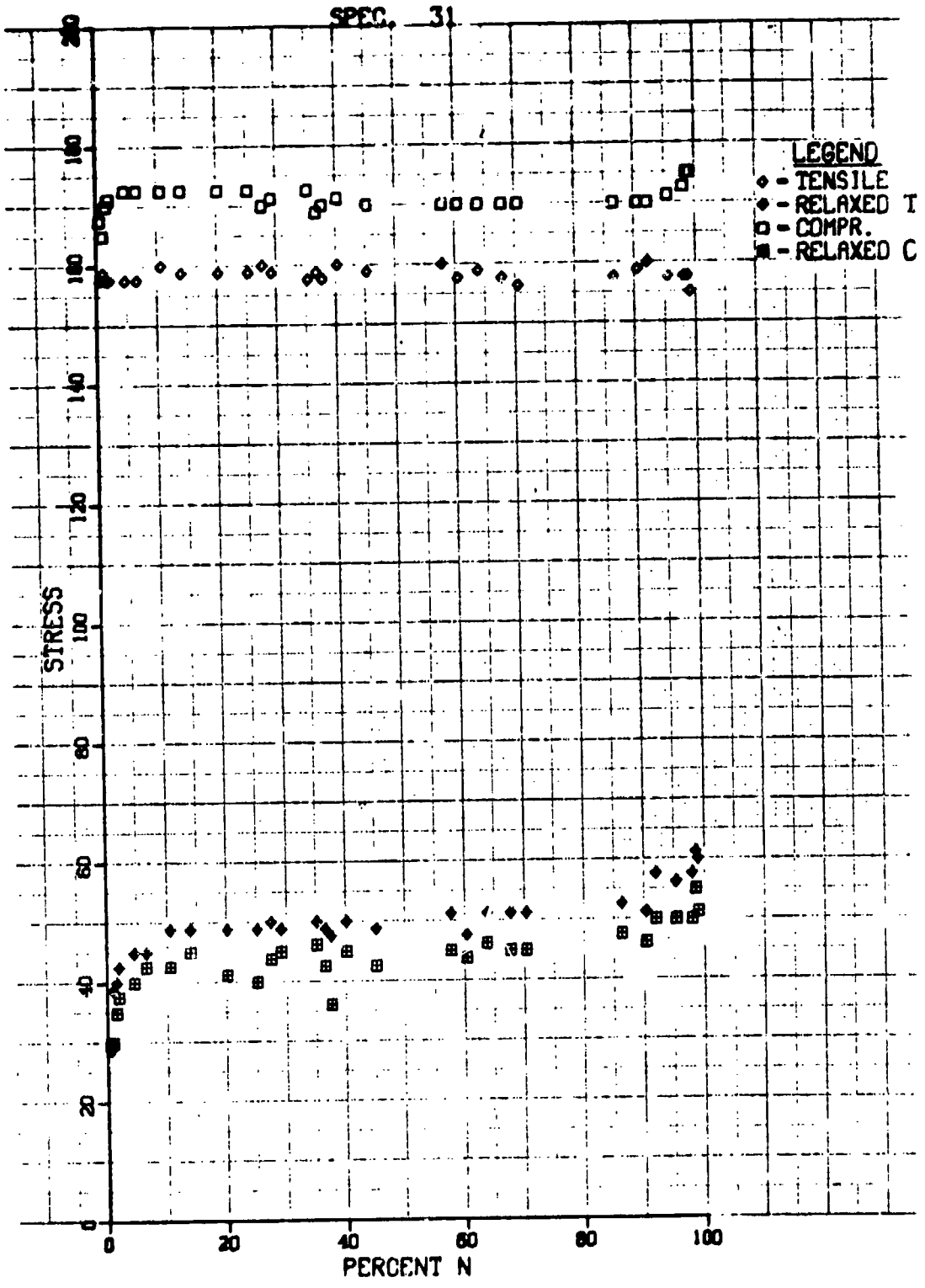

SPEC. 31
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 94.

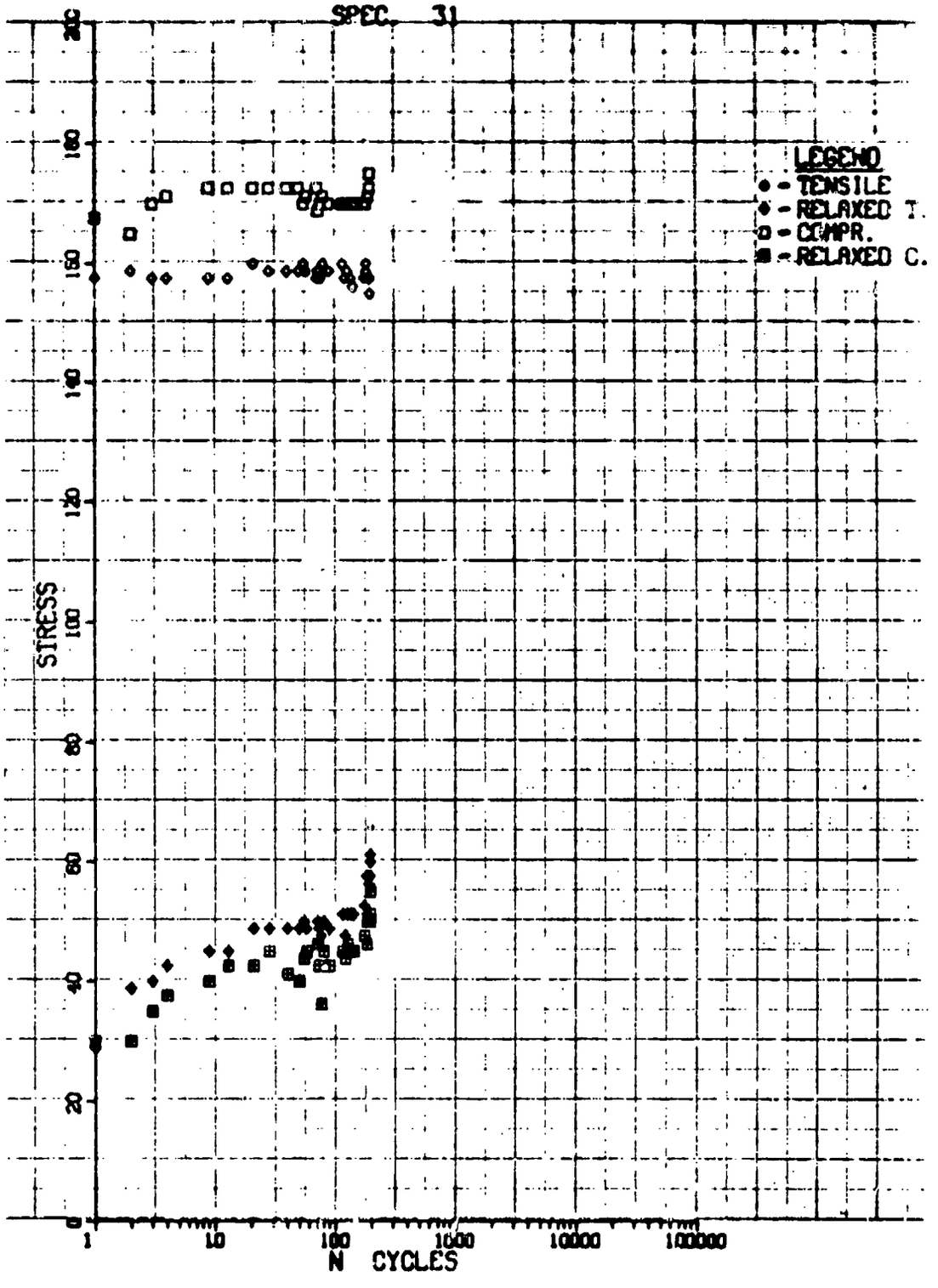

SPEC. 31
LEGEND
● - TENSILE
◆ - RELAXED T.
□ - COMPR.
■ - RELAXED C.
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 95.

TABLE 56

SPECIMEN 227

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 160. | 12.0 | 164. | 4.0 |
| 2 | 2. | 0. | 160. | 16.0 | 166. | 5.0 |
| 3 | 3. | 1. | 159. | 18.0 | 167. | 6.0 |
| 4 | 4. | 1. | 160. | 23.0 | 169. | 9.0 |
| 5 | 5. | 1. | 160. | 23.0 | 169. | 9.0 |
| 6 | 9. | 2. | 158. | 22.0 | 169. | 8.0 |
| 7 | 15. | 3. | 154. | 22.0 | 172. | 10.0 |
| 8 | 20. | 4. | 153. | 23.0 | 174. | 13.0 |
| 9 | 26. | 6. | 152. | 22.0 | 174. | 11.0 |
| 10 | 31. | 7. | 152. | 22.0 | 175. | 11.0 |
| 11 | 42. | 9. | 151. | 23.0 | 175. | 13.0 |
| 12 | 53. | 12. | 150. | 22.0 | 174. | 10.0 |
| 13 | 59. | 13. | 150. | 22.0 | 174. | 13.0 |
| 14 | 80. | 18. | 149. | 21.0 | 174. | 11.0 |
| 15 | 91. | 20. | 152. | 24.0 | 174. | 14.0 |
| 16 | 97. | 21. | 148. | 21.0 | 174. | 11.0 |
| 17 | 103. | 23. | 150. | 24.0 | 174. | 13.0 |
| 18 | 108. | 24. | 149. | 24.0 | 174. | 12.0 |
| 19 | 120. | 26. | 149. | 24.0 | 175. | 15.0 |
| 20 | 125. | 27. | 147. | 23.0 | 176. | 14.0 |
| 21 | 141. | 31. | 146. | 23.0 | 176. | 13.0 |
| 22 | 152. | 33. | 146. | 24.0 | 176. | 12.0 |
| 23 | 163. | 36. | 145. | 24.0 | 176. | 12.0 |
| 24 | 173. | 38. | 144. | 24.0 | 178. | 16.0 |
| 25 | 222. | 49. | 144. | 24.0 | 176. | 14.0 |
| 26 | 244. | 54. | 143. | 23.0 | 176. | 14.0 |
| 27 | 256. | 56. | 142. | 23.0 | 176. | 14.0 |
| 28 | 266. | 58. | 141. | 23.0 | 177. | 14.0 |
| 29 | 320. | 70. | 140. | 24.0 | 176. | 15.0 |
| 30 | 359. | 79. | 139. | 24.0 | 175. | 15.0 |
| 31 | 364. | 80. | 140. | 26.0 | 176. | 16.0 |
| 32 | 391. | 86. | 139. | 27.0 | 176. | 15.0 |
| 33 | 402. | 88. | 136. | 24.0 | 176. | 16.0 |
| 34 | 408. | 90. | 136. | 25.0 | 176. | 16.0 |
| 35 | 418. | 92. | 135. | 24.0 | 174. | 14.0 |
| 36 | 423. | 93. | 133. | 23.0 | 174. | 16.0 |
| 37 | 423. | 94. | 132. | 24.0 | 174. | 15.0 |
| 38 | 434. | 95. | 130. | 26.0 | 174. | 14.0 |
| 39 | 435. | 96. | 128. | | 174. | 14.0 |
| 40 | 440. | 97. | 124. | | 174. | 16.0 |
| 41 | 445. | 98. | 118. | 22.0 | 173. | 14.0 |
| 42 | 446. | 98. | 117. | 23.0 | 172. | 14.0 |
| 43 | 451. | 99. | 96. | 16.0 | 172. | 15.0 |
| 44 | 452. | 99. | 92. | | | |

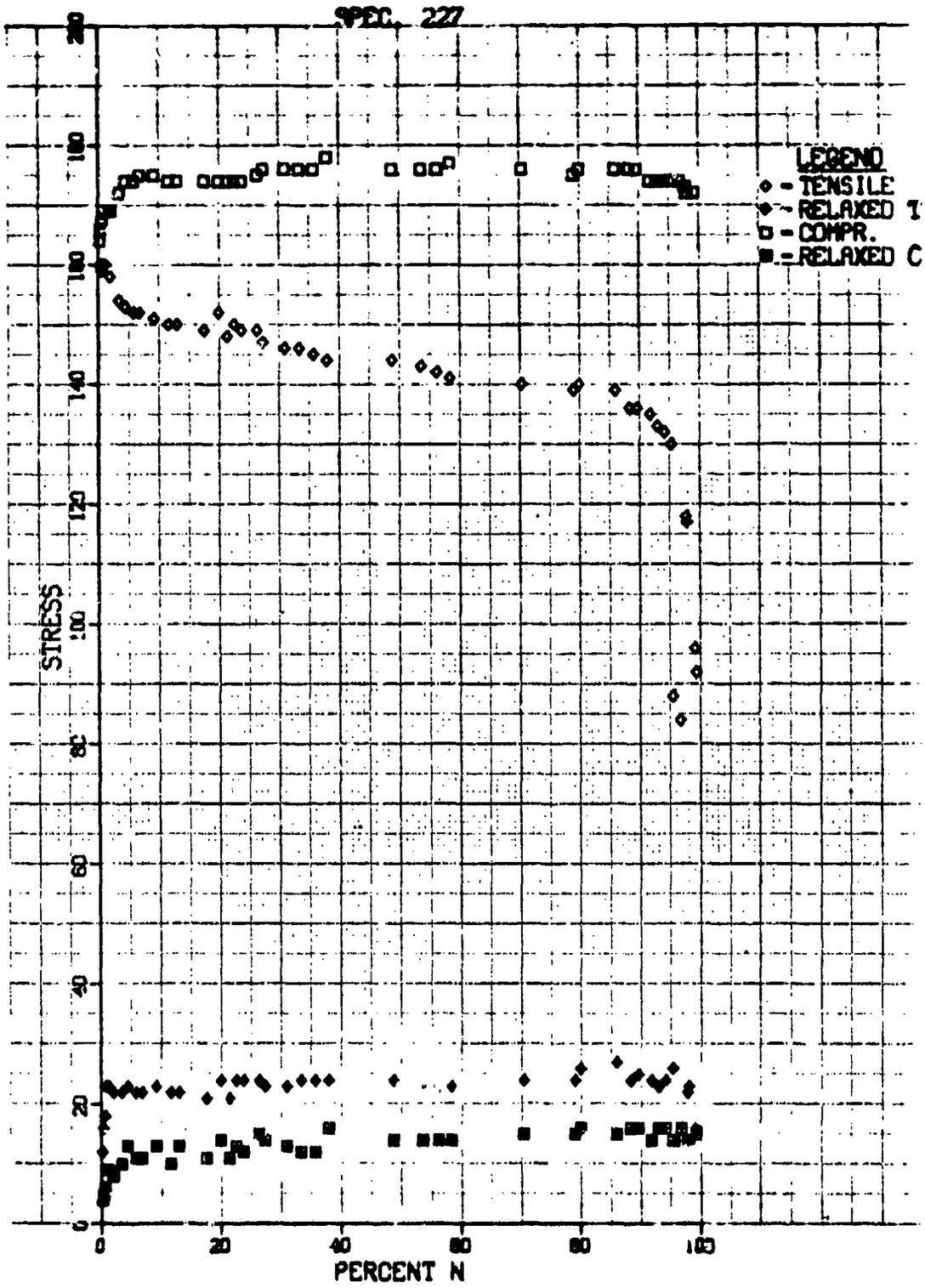

SPEC. 227
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 96.

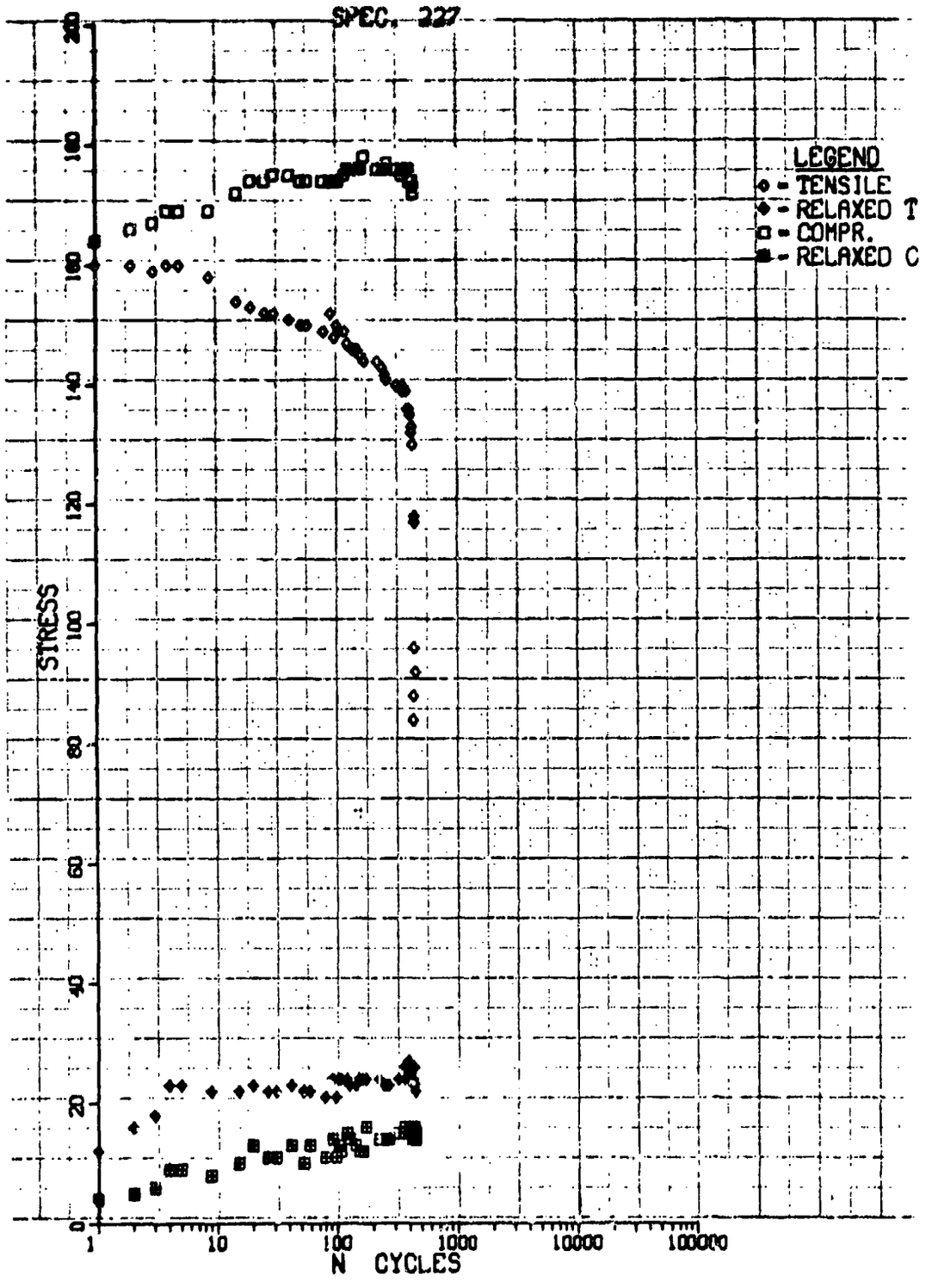

SPEC. 227
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
0
20
40
60
80
100
120
140
160
180
200
1
10
100
1000
10000
100000
N CYCLES

Figure 97.

TABLE 57

SPECIMEN 223

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 150. | 7.0 | 144. | -2.0 |
| 2 | 2. | 0. | 146. | 6.0 | 145. | 0.0 |
| 3 | 3. | 0. | 145. | 5.0 | 145. | 0.0 |
| 4 | 4. | 0. | 144. | 6.0 | 146. | 0.0 |
| 5 | 5. | 1. | 144. | 8.0 | 148. | 0.0 |
| 6 | 9. | 1 | 140. | 6.0 | 149. | 0.0 |
| 7 | 10. | 1. | 140. | 7.0 | 150. | 0.0 |
| 8 | 11. | 1. | 140. | 10.0 | 152. | 0.0 |
| 9 | 12. | 1. | 138. | 6.0 | 152. | 0.0 |
| 10 | 20. | 2. | 136. | 8.0 | 153. | 0.0 |
| 11 | 21. | 2. | 134. | 6.0 | 153. | 0.0 |
| 12 | 31. | 3. | 133. | 6.0 | 154. | 1.0 |
| 13 | 33. | 3. | 132. | 6.0 | 154. | 0.0 |
| 14 | 45. | 5. | 131. | 6.0 | 155. | 1.0 |
| 15 | 54. | 6. | 130. | 7.0 | 157. | 1.0 |
| 16 | 74. | 8. | 128. | 8.0 | 158. | 2.0 |
| 17 | 85. | 9. | 127. | 8.0 | 159. | 2.0 |
| 18 | 107. | 11. | 126. | 8.0 | 160. | 3.0 |
| 19 | 111. | 12. | 125. | 6.0 | 160. | 3.0 |
| 20 | 184. | 19. | 124. | 9.0 | 160. | 3.0 |
| 21 | 195. | 21. | 123. | 8.0 | 161. | 4.0 |
| 22 | 206. | 22. | 122. | 8.0 | 162. | 5.0 |
| 23 | 221. | 23. | 124. | 8.0 | 160. | |
| 24 | 252. | 27. | 123. | 10.0 | 162. | 5.0 |
| 25 | 282. | 30. | 124. | 12.0 | 161. | 5.0 |
| 26 | 314. | 33. | 121. | 11.0 | 163. | 5.0 |
| 27 | 316. | 33. | 120. | 8.0 | 161. | 4.0 |
| 28 | 371. | 38. | 118. | 8.0 | 163. | 5.0 |
| 29 | 439. | 46. | 120. | 12.0 | 164. | 6.0 |
| 30 | 467. | 49. | 120. | 12.0 | 163. | 5.0 |
| 31 | 522. | 55. | 117. | 11.0 | 164. | 7.0 |
| 32 | 591. | 63. | 116. | 11.0 | 164. | 4.0 |
| 33 | 620. | 66. | 116. | 12.0 | 164. | 6.0 |
| 34 | 585. | 72. | 116. | 13.0 | 164. | 6.0 |
| 35 | 607. | 73. | 116. | 14.0 | 165. | 6.0 |
| 36 | 740. | 78. | 115. | 13.0 | 165. | 7.0 |
| 37 | 742. | 79. | 114. | 12.0 | 165. | 7.0 |
| 38 | 751. | 79. | 114. | 12.0 | 164. | 6.0 |
| 39 | 763. | 81. | 116. | 15.0 | 164. | 8.0 |
| 40 | 787. | 83. | 114. | 14.0 | 165. | 8.0 |
| 41 | 849. | 90. | 116. | 16.0 | 163. | 7.0 |
| 42 | 893. | 94. | 114. | 14.0 | 161. | 8.0 |
| 43 | 914. | 97. | 112. | 15.0 | 162. | 5.0 |
| 44 | 916. | 97. | 112. | 14.0 | 163. | 8.0 |
| 45 | 925. | 98. | 111. | 16.0 | 163. | 9.0 |
| 46 | 926. | 98. | 110. | 15.0 | 162. | 7.0 |
| 47 | 927. | 98. | 109. | 15.0 | 162. | 7.0 |
| 48 | 936. | 99. | 104. | 14.0 | 161. | 8.0 |
| 49 | 936. | 99. | 102. | 14.0 | 161. | 8.0 |
| 50 | 940. | 99. | 100. | 14.0 | 160. | 7.0 |

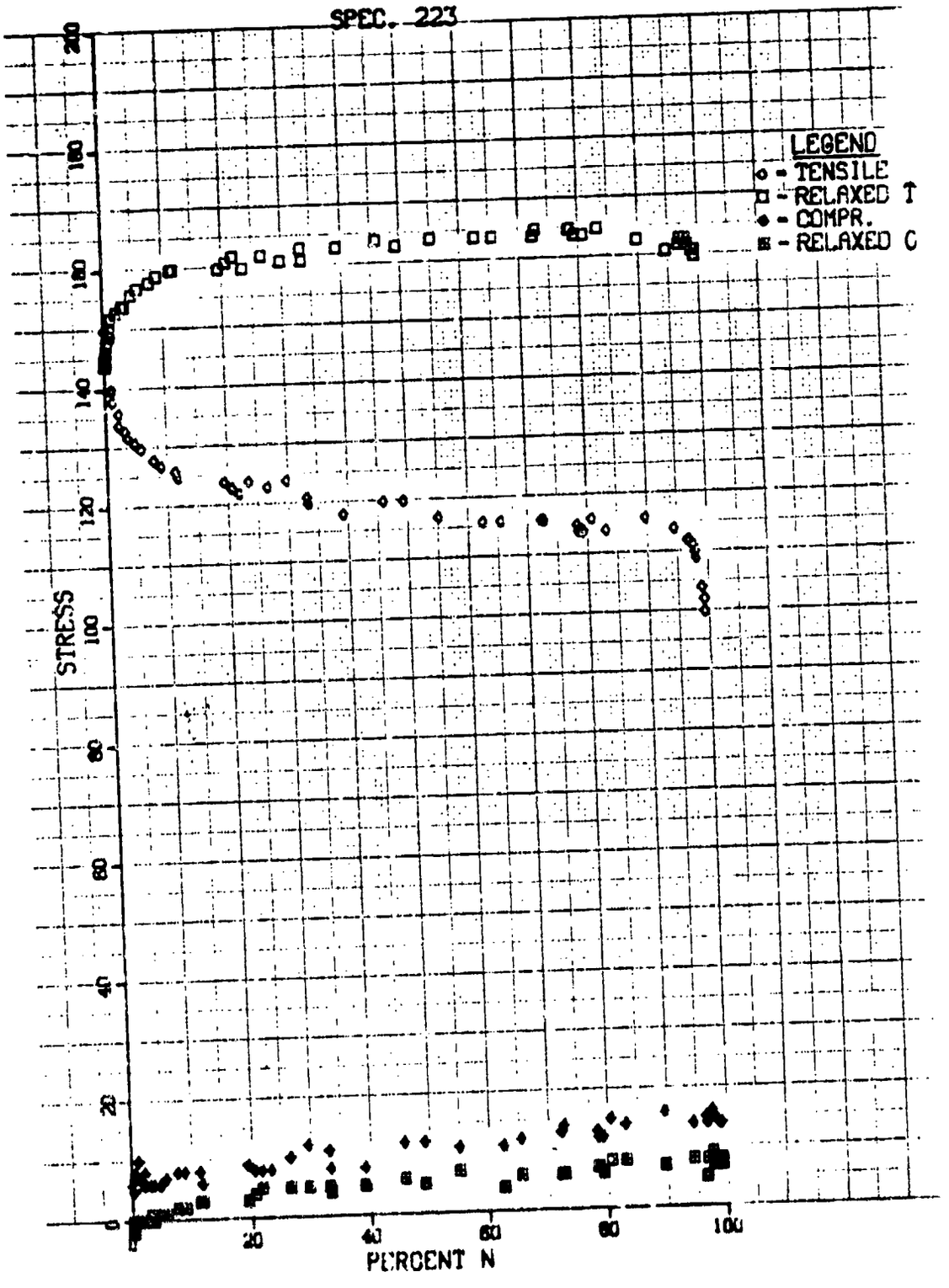

SPEC. 223
LEGEND
- TENSILE
- RELAXED T
- COMPR.
- RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 98.

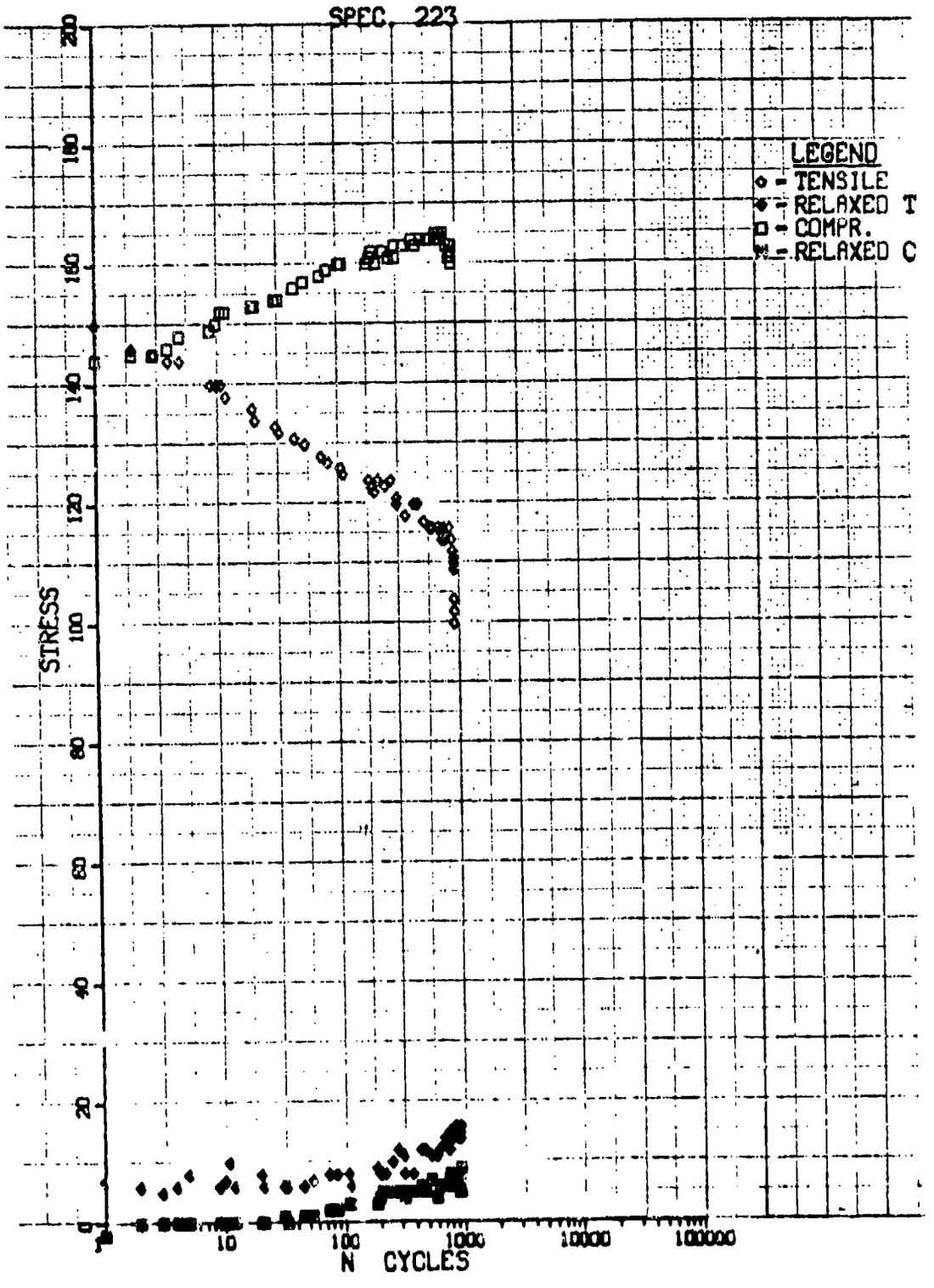

SPEC. 223
LEGEND
◇ - TENSILE
◆ - RELAXED T
□ - COMPR.
■ - RELAXED C
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 99.

TABLE 58

SPECIMEN 226

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | 166. | 5.0 | 165. | 5.0 |
| 2 | 2. | 1. | 164. | 7.0 | 168. | 10.0 |
| 3 | 3. | 1. | 165. | 9.0 | 168. | 12.0 |
| 4 | 4. | 1. | 165. | 9.0 | 168. | 10.0 |
| 5 | 5. | 1. | 164. | 8.0 | 168. | |
| 6 | 8. | 2. | 165. | 11.0 | 167. | 11.0 |
| 7 | 14. | 4. | 166. | 10.0 | 166. | 10.0 |
| 8 | 19. | 5. | 165. | 11.0 | 166. | 13.0 |
| 9 | 25. | 7. | 165. | 12.0 | 166. | 13.0 |
| 10 | 31. | 9. | 166. | 12.0 | 165. | 12.0 |
| 11 | 36. | 10. | 167. | 13.0 | 165. | 12.0 |
| 12 | 41. | 12. | 166. | 13.0 | 165. | 13.0 |
| 13 | 46. | 13. | 165. | 12.0 | 164. | 12.0 |
| 14 | 64. | 18. | 166. | 14.0 | 164. | |
| 15 | 68. | 19. | 166. | 14.0 | 164. | 13.0 |
| 16 | 69. | 20. | 165. | 13.0 | 164. | 14.0 |
| 17 | 85. | 24. | 165. | 14.0 | 162. | 13.0 |
| 18 | 95. | 27. | 168. | 16.0 | 161. | 12.0 |
| 19 | 118. | 34. | 167. | 15.0 | 160. | 12.0 |
| 20 | 123. | 35. | 167. | 15.0 | 161. | 15.0 |
| 21 | 128. | 37. | 169. | 16.0 | 160. | 15.0 |
| 22 | 133. | 38. | 168. | 16.0 | 160. | 16.0 |
| 23 | 161. | 46. | 166. | 16.0 | 160. | 13.0 |
| 24 | 166. | 48. | 165. | 17.0 | 161. | 13.0 |
| 25 | 176. | 51. | 164. | 15.0 | 160. | 13.0 |
| 26 | 210. | 60. | 168. | 17.0 | 158. | 15.0 |
| 27 | 220. | 63. | 168. | 16.0 | 156. | 15.0 |
| 28 | 248. | 71. | 168. | 18.0 | 156. | 14.0 |
| 29 | 253. | 72. | 168. | 17.0 | 155. | 15.0 |
| 30 | 259. | 74. | 168. | 20.0 | 156. | 16.0 |
| 31 | 270. | 77. | 165. | 16.0 | 156. | 14.0 |
| 32 | 280. | 80. | 164. | 16.0 | 157. | 16.0 |
| 33 | 291. | 83. | 163. | 16.0 | 157. | 15.0 |
| 34 | 302. | 87. | 162. | 16.0 | 157. | 16.0 |
| 35 | 313. | 90. | 162. | 17.0 | 157. | 16.0 |
| 36 | 324. | 93. | 162. | 15.0 | 154. | 16.0 |
| 37 | 335. | 96. | 164. | 17.0 | 154. | 17.0 |
| 38 | 341. | 98. | 164. | 18.0 | 154. | 18.0 |
| 39 | 345. | 99. | | | | |
| 40 | 346. | 99. | 159. | 19.0 | 156. | 16.0 |
| 41 | 347. | 99. | 150. | 17.0 | 156. | |

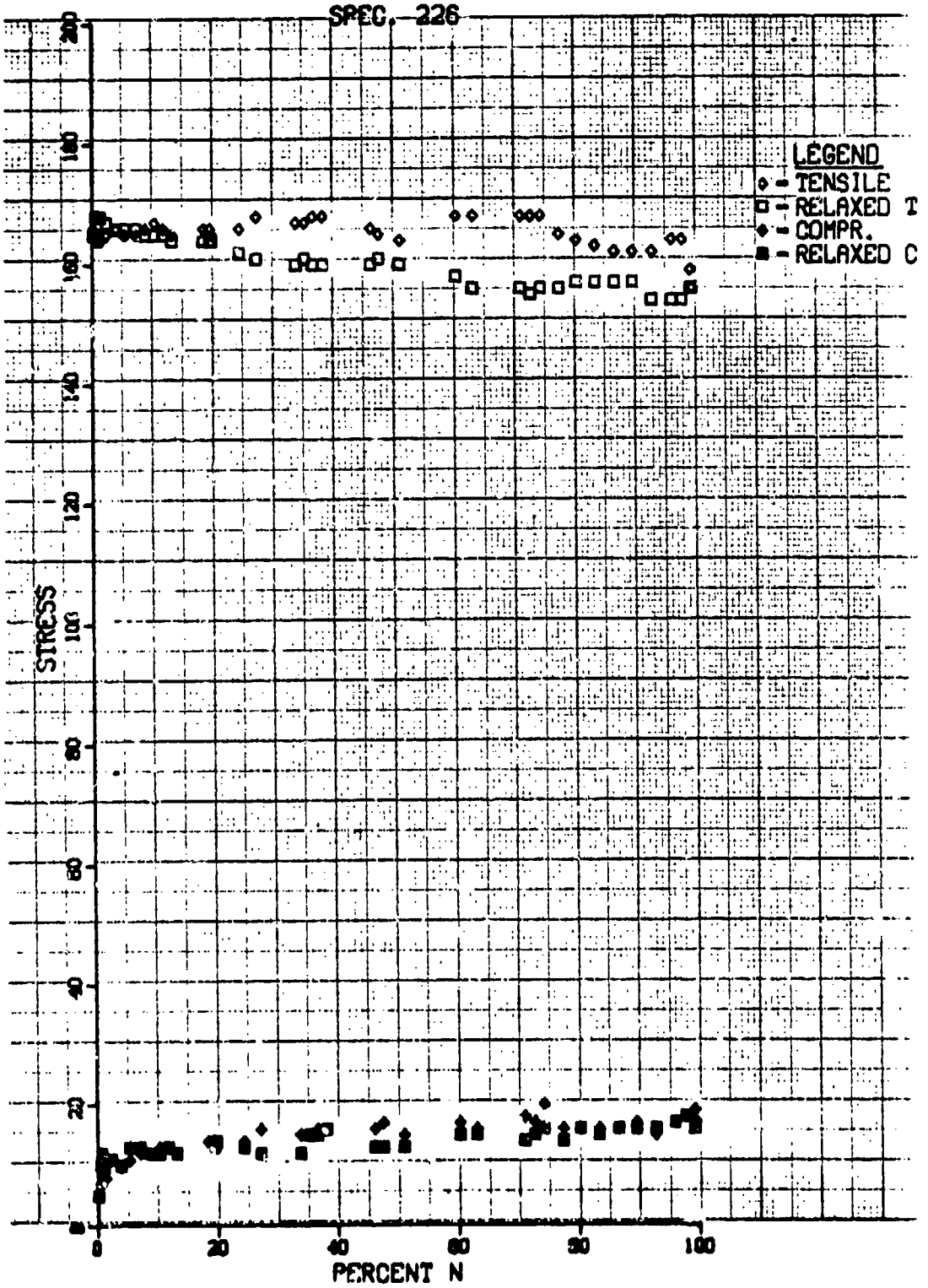

SPEC. 226
LEGEND
◇ - TENSILE
□ - RELAXED T
◆ - COMPR.
■ - RELAXED C
STRESS
PERCENT N
0
20
40
60
80
100
120
140
160
180
200

Figure 100.

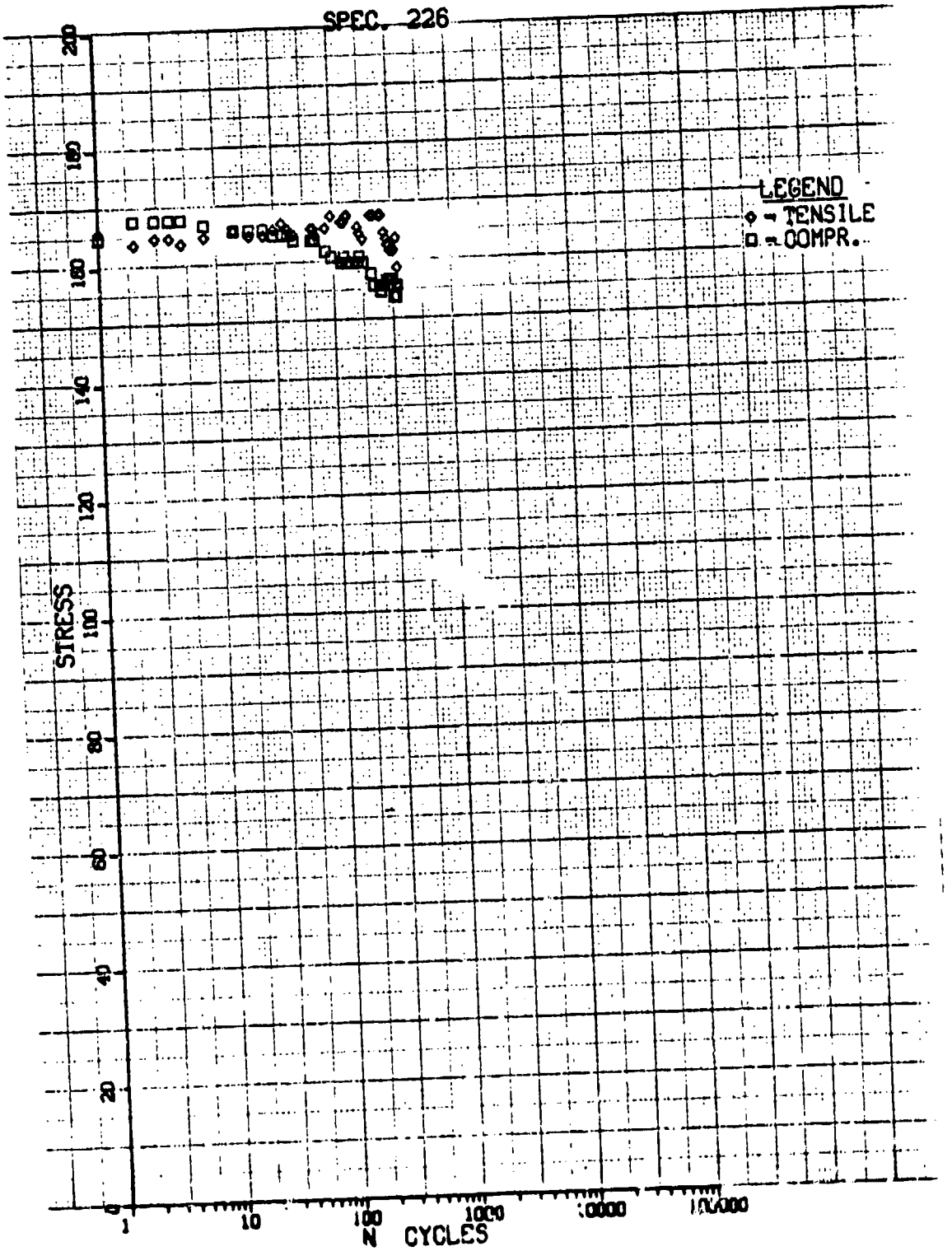

SPEC. 226
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 101.

TABLE 59

SPECIMEN 225

| I | N | %N | STRESSES TENSILE | RELAXED | COMPR. | RELAXED |
|---|---|---|---|---|---|---|
| 1 | 1. | 0. | | | | |
| 2 | 2. | 0. | 146. | 2.0 | 148. | 2.0 |
| 3 | 4. | 1. | 147. | 3.0 | 148. | 3.0 |
| 4 | 8. | 2. | 148. | 4.0 | 140. | 5.0 |
| 5 | 14. | 3. | 148. | 5.0 | 147. | 5.0 |
| 6 | 20. | 4. | 148. | 5.0 | 146. | 6.0 |
| 7 | 25. | 5. | 148. | 6.0 | 145. | 5.0 |
| 8 | 30. | 6. | 148. | 6.0 | 145. | 8.0 |
| 9 | 35. | 8. | 148. | 6.0 | 144. | 5.0 |
| 10 | 41. | 9. | 150. | 8.0 | 144. | 7.0 |
| 11 | 52. | 11. | 150. | 8.0 | 142. | 6.0 |
| 12 | 68. | 15. | 150. | 9.0 | 143. | 7.0 |
| 13 | 84. | 18. | 150. | 8.0 | 141. | 6.0 |
| 14 | 90. | 19. | 150. | 10.0 | 142. | 8.0 |
| 15 | 117. | 25. | 148. | 10.0 | 143. | 6.0 |
| 16 | 122. | 26. | 148. | 10.0 | 144. | 8.0 |
| 17 | 139. | 30. | 150. | 10.0 | 142. | 8.0 |
| 18 | 155. | 33. | 149. | 11.0 | 142. | 9.0 |
| 19 | 177. | 38. | 150. | 10.0 | 140. | 8.0 |
| 20 | 182. | 39. | 152. | 11.0 | 140. | 7.0 |
| 21 | 199. | 43. | 150. | 11.0 | 141. | 12.0 |
| 22 | 204. | 44. | 152. | 12.0 | 140. | 8.0 |
| 23 | 221. | 48. | 149. | 11.0 | 141. | 11.0 |
| 24 | 231. | 50. | 151. | 12.0 | 140. | 10.0 |
| 25 | 254. | 55. | 150. | 12.0 | 140. | 11.0 |
| 26 | 280. | 60. | 150. | 11.0 | 139. | 11.0 |
| 27 | 313. | 67. | 150. | 11.0 | 137. | 9.0 |
| 28 | 373. | 80. | 149. | 13.0 | 140. | 13.0 |
| 29 | 383. | 83. | 148. | 13.0 | 139. | 14.0 |
| 30 | 394. | 85. | 149. | 13.0 | 137. | 11.0 |
| 31 | 411. | 89. | 149. | 13.0 | 138. | 10.0 |
| 32 | 422. | 91. | 148. | 14.0 | 138. | 13.0 |
| 33 | 433. | 93. | 146. | 14.0 | 138. | 13.0 |
| 34 | 443. | 95. | 144. | 12.0 | 138. | 13.0 |
| 35 | 449. | 97. | 142. | 14.0 | 138. | 13.0 |
| 36 | 454. | 98. | 140. | 13.0 | 138. | 13.0 |
| 37 | 456. | 98. | 138. | 14.0 | 139. | |
| 38 | 460. | 99. | 128. | 14.0 | 141. | 13.0 |
| 39 | 461. | 99. | 124. | 12.0 | 141. | |

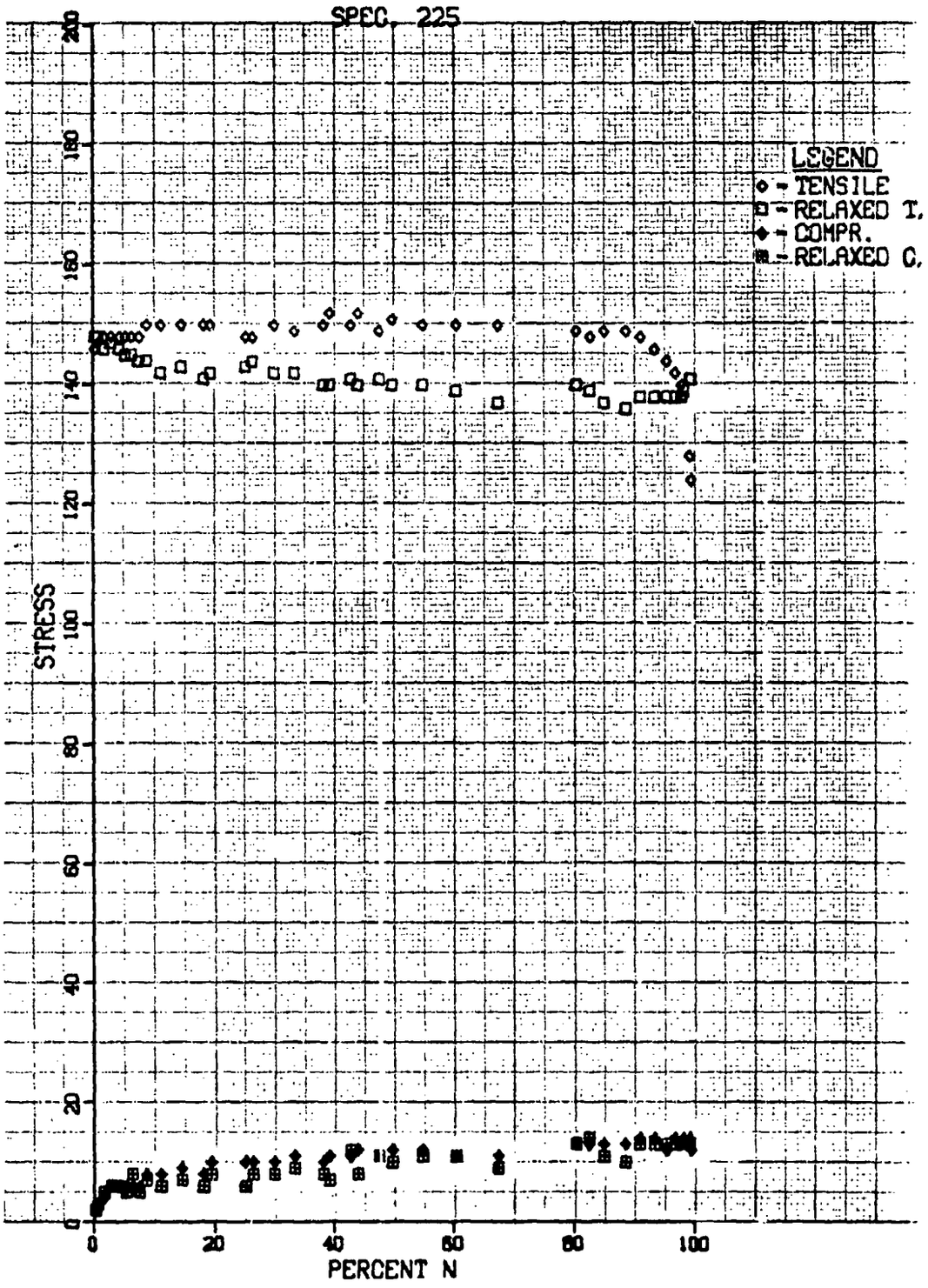

SPEC. 225
LEGEND
◇ - TENSILE
□ - RELAXED T.
◆ - COMPR.
■ - RELAXED C.
STRESS
0
20
40
60
80
100
120
140
160
180
200
PERCENT N
0
20
40
60
80
100

Figure 102.

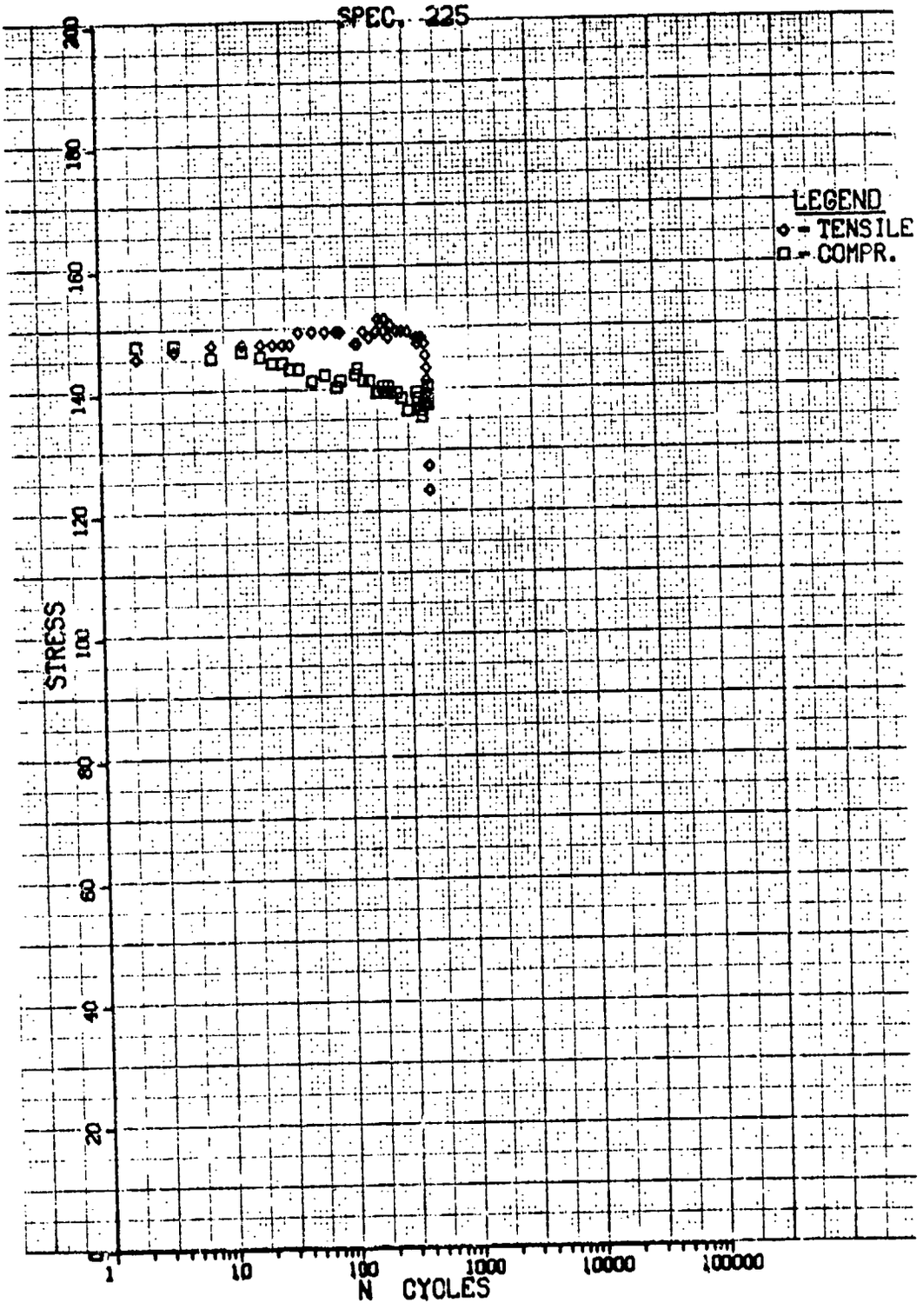

SPEC. 225
LEGEND
◇ - TENSILE
□ - COMPR.
STRESS
200
180
160
140
120
100
80
60
40
20
0
1
10
100
1000
10000
100000
N CYCLES

Figure 103.

## SECTION 12
## AF-115 DATA

This section contains data for AF-115. The data are given in Tables 60 through 65.

TABLE 60

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-1 | 40 | 139.92 | -81.84 |
| | 60 | 138.92 | -83.83 |
| | 100 | 137.52 | -84.13 |
| | 180 | 137.13 | -85.43 |
| | 260 | 137.01 | -85.40 |
| | 340 | 137.72 | -85.03 |
| | 420 | 136.81 | -85.83 |
| | 500 | 138.52 | -84.59 |
| | 580 | 137.76 | -84.23 |
| | 660 | 137.60 | -84.20 |
| | 740 | 136.53 | -85.03 |
| | 820 | 132.93 | -87.62 |
| | 860 | 123.75 | -90.62 |
| (Failure) | 883 | - | - |

TABLE 61

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-2 | 30 | 136.00 | -36.40 |
| | 64 | 134.80 | -39.20 |
| | 104 | 134.00 | -39.96 |
| | 184 | 133.40 | -40.00 |
| | 264 | 133.00 | -40.04 |
| | 344 | 132.80 | -40.40 |
| | 424 | 132.84 | -40.20 |
| | 504 | 132.68 | -40.50 |
| | 584 | 132.72 | -40.32 |
| | 664 | 133.40 | -40.38 |
| | 744 | 132.60 | -40.80 |
| | 824 | 132.64 | -40.52 |
| | 904 | 132.40 | -40.40 |
| | 984 | 133.20 | -40.08 |
| | 1064 | 133.80 | -40.00 |
| | 1144 | 134.80 | -39.60 |
| | 1224 | 135.48 | -38.80 |
| | 1304 | 135.80 | -38.92 |
| | 1384 | 136.00 | -38.32 |
| | 1464 | 135.60 | -39.40 |
| | 1544 | 135.52 | -39.80 |
| | 1624 | 135.60 | -39.83 |
| | 1704 | 134.60 | -40.01 |
| | 1784 | 134.00 | -40.36 |
| | 1864 | 133.20 | -40.12 |
| | 1944 | 132.40 | -40.39 |
| | 2024 | 132.00 | -41.60 |
| | 2104 | 130.80 | -42.32 |
| | 2144 | 129.20 | -43.60 |
| (Failure) | 2153 | - | - |

TABLE 62

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 5-2 | 40 | 152.59 | -83.63 |
| | 108 | 151.39 | -84.26 |
| | 168 | 151.20 | -85.06 |
| | 248 | 151.08 | -85.26 |
| | 328 | 151.39 | -85.66 |
| | 408 | 151.31 | -85.98 |
| | 488 | 151.08 | -86.06 |
| | 568 | 150.60 | -86.65 |
| | 648 | 149.80 | -87.25 |
| | 728 | 150.08 | -87.05 |
| | 808 | 150.20 | -87.25 |
| | 888 | 149.48 | -86.85 |
| | 968 | 149.08 | -87.25 |
| | 1048 | 147.81 | -87.65 |
| | 1088 | 146.81 | -88.25 |
| | 1128 | 143.35 | -90.12 |
| (Failure) | 1172 | - | - |

TABLE 63

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 5-5 | 40 | 137.85 | -13.15 |
| | 93 | 136.06 | -14.34 |
| | 253 | 135.86 | -15.14 |
| | 413 | 135.58 | -15.54 |
| | 573 | 135.52 | -15.16 |
| | 733 | 135.84 | -15.14 |
| | 893 | 136.41 | -13.94 |
| | 1453 | 136.25 | -14.74 |
| | 1213 | 136.30 | -14.14 |
| | 1373 | 135.86 | -14.74 |
| | 1533 | 136.45 | -14.34 |
| | 1693 | 136.06 | -14.50 |
| | 1853 | 137.45 | -13.55 |
| | 2013 | 137.33 | -13.75 |
| | 2173 | 137.05 | -13.94 |
| | 2333 | 137.65 | -13.75 |
| | 2493 | 137.85 | -13.55 |
| | 2653 | 136.65 | -14.34 |
| | 2813 | 137.05 | -13.55 |
| | 2973 | 136.45 | -13.94 |
| | 3133 | 138.25 | -12.95 |
| | 3293 | 138.45 | -12.35 |
| | 3453 | 138.65 | -13.15 |
| | 3613 | 138.84 | -12.35 |
| | 3773 | 139.12 | -12.15 |
| | 3933 | 139.04 | -12.13 |
| | 4093 | 139.20 | -11.95 |
| | 4253 | 139.32 | -11.99 |
| | 4413 | 139.04 | -12.35 |
| | 4573 | 138.92 | -12.41 |
| | 4733 | 139.00 | -13.15 |
| | 4893 | 139.20 | -12.17 |
| | 5053 | 138.25 | -12.75 |
| | 5213 | 138.65 | -12.55 |
| | 5373 | 139.32 | -12.03 |
| | 5533 | 138.45 | -12.35 |
| | 5693 | 139.32 | -11.91 |
| | 5853 | 138.92 | -12.03 |
| | 6013 | 138.84 | -12.55 |
| | 6173 | 138.73 | -12.35 |
| | 6333 | 139.12 | -11.99 |
| | 6493 | 139.16 | -11.95 |
| | 6653 | 139.22 | -11.97 |
| | 6813 | 139.28 | -11.75 |

TABLE 63 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 5-5 Cont'd | 6973 | 138.25 | -12.35 |
| | 7133 | 139.12 | -12.15 |
| | 7293 | 139.16 | -11.95 |
| | 7453 | 138.84 | -12.13 |
| | 7613 | 139.32 | -11.99 |
| | 7773 | 139.14 | -11.96 |
| | 7933 | 138.65 | -12.55 |
| | 8093 | 138.92 | -12.25 |
| | 8253 | 138.87 | -11.97 |
| | 8413 | 139.32 | -11.95 |
| | 8573 | 138.65 | -12.05 |
| | 8733 | 138.84 | -12.02 |
| | 8893 | 138.25 | -12.65 |
| | 9053 | 138.65 | -12.07 |
| | 9213 | 138.05 | -12.35 |
| | 9373 | 138.65 | -12.03 |
| | 9533 | 138.92 | -11.97 |
| | 9693 | 138.65 | -11.95 |
| | 9853 | 138.60 | -12.35 |
| | 10013 | 137.45 | -12.27 |
| | 10173 | 138.25 | -12.15 |
| | 10333 | 138.27 | -12.27 |
| | 10493 | 137.85 | -12.35 |
| | 10653 | 138.45 | -12.07 |
| | 10813 | 138.25 | -12.27 |
| | 10973 | 138.27 | -12.35 |
| | 11133 | 139.04 | -11.91 |
| | 11293 | 138.84 | -12.07 |
| | 11453 | 139.04 | -12.15 |
| | 11613 | 139.06 | -11.95 |
| | 11773 | 137.53 | -12.55 |
| | 11933 | 138.25 | -12.27 |
| | 12093 | 138.69 | -12.08 |
| | 12253 | 139.18 | -11.75 |
| | 12413 | 139.07 | -11.96 |
| | 12573 | 139.04 | -11.95 |
| | 12733 | 139.05 | -11.97 |
| | 12893 | 139.12 | -11.92 |
| | 13053 | 139.23 | -11.94 |
| | 13213 | 138.65 | -12.27 |
| | 13373 | 138.96 | -12.75 |
| | 13533 | 139.02 | -11.99 |
| | 13693 | 139.32 | -11.97 |
| | 13853 | 139.12 | -11.95 |
| | 14013 | 139.40 | -11.94 |

TABLE 6: Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 5-5 Cont'd | 14173 | 139.32 | -11.95 |
| | 14333 | 139.35 | -11.93 |
| | 14493 | 139.38 | -11.92 |
| | 14653 | 138.65 | -12.35 |
| | 14813 | 139.04 | -11.90 |
| | 14973 | 139.40 | -11.98 |
| | 15133 | 139.12 | -12.06 |
| | 15293 | 139.44 | -11.55 |
| | 15453 | 139.47 | -11.97 |
| | 15613 | 139.32 | -12.02 |
| | 15773 | 139.40 | -12.00 |
| | 15933 | 139.44 | -11.95 |
| | 16093 | 139.42 | -11.97 |
| | 16253 | 139.39 | -12.01 |
| | 16413 | 139.47 | -11.93 |
| | 16573 | 139.36 | -11.94 |
| | 16733 | 139.12 | -11.97 |
| | 16893 | 139.45 | -11.90 |
| | 17053 | 139.47 | -11.92 |
| | 17133 | 139.50 | -12.02 |
| | 17213 | 139.49 | -11.95 |
| | 17293 | 140.24 | -11.55 |
| | 17333 | 141.43 | -11.35 |
| | 17413 | 143.43 | -9.56 |
| (Failure) | 17433 | - | - |

TABLE 64

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 5-7 | 35 | 141.95 | -80.52 |
| | 98 | 139.56 | -83.54 |
| | 138 | 139.64 | -83.50 |
| | 178 | 139.58 | -83.52 |
| | 218 | 139.62 | -83.50 |
| | 258 | 139.63 | -83.50 |
| | 298 | 139.72 | -83.18 |
| | 338 | 139.92 | -82.78 |
| | 378 | 140.99 | -81.91 |
| | 418 | 141.07 | -82.50 |
| | 458 | 141.55 | -82.70 |
| | 498 | 141.25 | -82.55 |
| | 538 | 141.15 | -82.31 |
| | 578 | 141.55 | -81.51 |
| | 618 | 139.96 | -82.70 |
| | 658 | 140.24 | -83.10 |
| | 698 | 140.29 | -83.10 |
| | 738 | 143.02 | -81.51 |
| (Failure) | 763 | - | - |

TABLE 65

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 5-8 | 32 | 142.25 | -55.38 |
| | 70 | 140.71 | -57.71 |
| | 110 | 140.51 | -58.02 |
| | 150 | 140.68 | -58.10 |
| | 190 | 141.90 | -57.31 |
| | 230 | 141.98 | -57.23 |
| | 270 | 141.93 | -56.92 |
| | 310 | 142.29 | -56.84 |
| | 350 | 141.78 | -56.56 |
| | 390 | 142.29 | -56.32 |
| | 430 | 142.33 | -56.90 |
| | 470 | 142.69 | -56.13 |
| | 510 | 142.30 | -56.05 |
| | 550 | 142.33 | -56.32 |
| | 590 | 142.70 | -55.93 |
| | 630 | 142.71 | -56.45 |

No more data measured.

## SECTION 13

## AF2-1DA DATA

Fatigue data for AF2-1DA are presented in Tables 66 through 85.

TABLE 66

| 20 cpm SAMPLE | 1400°F CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-2 | 33 | 142.84 | -140.55 |
| | 71 | 142.25 | -140.11 |
| | 109 | 142.4 | -144.9 |
| | 170 | 141.47 | -144.9 |
| | 194 | 141.38 | -144.18 |
| | 228 | 141.67 | -144.19 |
| | 262 | 141.06 | -144.23 |
| (Failure) | 285 | 127.88 | 2.760 |

TABLE 67

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| B1-22 | 40 | 134.79 | -122.07 |
| | 80 | 133.60 | -123.86 |
| | 120 | 132.41 | -124.06 |
| | 160 | 131.61 | -124.45 |
| | 200 | 130.64 | -124.06 |
| | 240 | 131.61 | -123.98 |
| | 280 | 131.62 | -123.66 |
| | 320 | 131.21 | -123.26 |
| | 360 | 131.21 | -123.26 |
| | 400 | 131.23 | -123.25 |
| | 440 | 131.59 | -122.86 |
| | 480 | 131.19 | -122.66 |
| | 520 | 130.42 | -122.39 |
| | 560 | 129.22 | -122.36 |
| | 600 | 127.63 | -123.26 |
| | 640 | 124.25 | -123.28 |
| | 680 | 109.34 | -123.26 |
| (Failure) | 688 | 91.45 | 3.98 |

TABLE 68

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-8 | 40 | 129.22 | -114.12 |
| | 90 | 128.43 | -115.31 |
| | 140 | 127.44 | -113.55 |
| | 180 | 127.24 | -114.53 |
| | 220 | 127.32 | -115.71 |
| | 260 | 127.04 | -116.50 |
| | 300 | 126.84 | -114.52 |
| | 340 | 126.80 | -115.90 |
| | 380 | 126.44 | -116.10 |
| | 420 | 126.84 | -116.10 |
| | 460 | 125.65 | -116.03 |
| | 500 | 125.84 | -116.10 |
| | 540 | 125.25 | -116.30 |
| | 580 | 124.25 | -115.90 |
| | 620 | 123.26 | -115.83 |
| | 660 | 117.30 | -115.88 |
| | 700 | 111.33 | -116.70 |
| (Failure) | 732 | - | - |

TABLE 69

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-19 | 40 | 131.21 | -95.63 |
| | 110 | 128.83 | -96.90 |
| | 190 | 30.02 | -97.61 |
| | 270 | 128.43 | -98.21 |
| | 350 | 128.03 | -98.81 |
| | 430 | 127.63 | -99.20 |
| | 510 | 127.83 | -99.40 |
| | 590 | 127.44 | -99.25 |
| | 670 | 127.51 | -99.42 |
| | 750 | 127.24 | -99.44 |
| | 830 | 127.71 | -98.61 |
| | 910 | 127.08 | -99.43 |
| | 990 | 126.72 | -99.45 |
| | 1070 | 126.64 | -99.40 |
| | 1150 | 125.65 | -99.50 |
| | 1230 | 125.84 | -99.40 |
| | 1310 | 125.05 | -99.52 |
| | 1390 | 124.45 | -99.96 |
| | 1470 | 123.22 | -100.60 |
| | 1550 | 120.48 | -100.99 |
| | 1630 | 108.55 | - |
| (Failure) | 1640 | | |

TABLE 70

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-7 | 40 | 131.21 | -64.02 |
| | 106 | 130.42 | -69.98 |
| | 186 | 124.65 | -71.17 |
| | 266 | 123.86 | -71.65 |
| | 346 | 123.84 | -72.17 |
| | 426 | 124.06 | -71.61 |
| | 506 | 123.26 | -72.56 |
| | 586 | 122.70 | -73.76 |
| | 666 | 122.64 | -73.96 |
| | 746 | 122.07 | -73.96 |
| | 826 | 125.25 | -74.35 |
| | 906 | 121.27 | -74.55 |
| | 986 | 121.47 | -75.15 |
| | 1066 | 120.48 | -75.55 |
| | 1146 | 121.07 | -75.15 |
| | 1226 | 120.87 | -74.95 |
| | 1306 | 120.68 | -74.16 |
| | 1386 | 120.60 | -74.75 |
| | 1466 | 119.88 | -75.55 |
| | 1546 | 119.48 | -75.52 |
| | 1626 | 119.68 | -75.75 |
| | 1706 | 121.27 | -74.79 |
| | 1786 | 119.70 | -75.54 |
| | 1866 | 119.28 | -75.57 |
| | 1946 | 119.56 | -75.15 |
| | 2026 | 119.36 | -75.13 |
| | 2106 | 119.32 | -75.55 |
| | 2186 | 119.70 | -74.75 |
| | 2266 | 119.22 | -75.60 |
| | 2346 | 118.89 | -75.75 |
| | 2426 | 118.69 | -75.59 |
| | 2506 | 115.31 | -77.53 |
| | 2586 | 111.33 | -79.20 |
| (Failure) | 2666 | 81.51 | -85.49 |

TABLE 71

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-24 | 40 | 130.42 | -54.8 |
| | 147 | 127.28 | -56.46 |
| | 227 | 127.24 | -57.65 |
| | 301 | 126.84 | -58.25 |
| | 387 | 126.44 | -58.85 |
| | 467 | 126.24 | -59.24 |
| | 547 | 126.04 | -59.17 |
| | 627 | 126.02 | -58.85 |
| | 707 | 126.00 | -59.05 |
| | 787 | 125.84 | -58.89 |
| | 867 | 125.84 | -59.40 |
| | 947 | 125.65 | -59.05 |
| | 1027 | 125.63 | -59.52 |
| | 1107 | 125.45 | -58.85 |
| | 1187 | 125.25 | -58.65 |
| | 1267 | 125.25 | -59.56 |
| | 1347 | 125.13 | -59.48 |
| | 1427 | 125.05 | -59.05 |
| | 1507 | 125.25 | -59.61 |
| | 1587 | 125.21 | -59.48 |
| | 1667 | 124.45 | -59.64 |
| | 1747 | 124.29 | -59.65 |
| | 1827 | 124.25 | -59.72 |
| | 1907 | 124.06 | -59.56 |
| | 1987 | 124.06 | -59.64 |
| | 2067 | 124.05 | -59.63 |
| | 2147 | 123.98 | -59.65 |
| | 2227 | 124.33 | -59.60 |
| | 2307 | 123.90 | -59.63 |
| | 2387 | 124.06 | -59.61 |
| | 2467 | 124.45 | -59.48 |
| | 2547 | 124.33 | -59.62 |
| | 2627 | 124.07 | -59.72 |
| | 2707 | 123.66 | -59.64 |
| | 2787 | 123.76 | -59.63 |
| | 2867 | 123.82 | -59.65 |
| | 2947 | 123.74 | -59.60 |
| | 3027 | 123.46 | -59.72 |
| | 3107 | 123.34 | -59.80 |
| | 3187 | 124.06 | -59.54 |
| | 3267 | 123.46 | -59.96 |
| | 3347 | 123.26 | -60.44 |
| | 3427 | 117.22 | -66.09 |
| (Failure) | | | |

TABLE 72

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-25 | 40 | 123.26 | -63.62 |
| | 80 | 123.66 | -63.82 |
| | 130 | 123.65 | -64.24 |
| | 210 | 123.26 | -65.21 |
| | 290 | 123.06 | -64.89 |
| | 370 | 122.86 | -64.81 |
| | 450 | 123.66 | -64.02 |
| | 530 | 123.14 | -64.93 |
| | 610 | 122.47 | -65.01 |
| | 690 | 122.66 | -65.21 |
| | 770 | 122.72 | -64.51 |
| | 850 | 122.94 | -64.81 |
| | 930 | 122.66 | -65.01 |
| | 1010 | 121.47 | -65.73 |
| | 1090 | 121.67 | -66.00 |
| | 1170 | 122.15 | -65.69 |
| | 1250 | 122.47 | -65.21 |
| | 1330 | 121.67 | -65.41 |
| | 1410 | 121.27 | -66.60 |
| | 1490 | 122.07 | -67.61 |
| | 1570 | 122.66 | -65.41 |
| | 1650 | 123.26 | -64.73 |
| | 1730 | 123.25 | -64.33 |
| | 1810 | 123.27 | -64.81 |
| | 1890 | 123.46 | -64.21 |
| | 1970 | 123.52 | -64.22 |
| | 2050 | 123.43 | -64.77 |
| | 2130 | 123.18 | -65.37 |
| | 2210 | 122.74 | -65.69 |
| | 2290 | 123.06 | -65.21 |
| | 2370 | 123.18 | -65.01 |
| | 2450 | 123.26 | -64.41 |
| | 2530 | 123.18 | -65.33 |
| | 2610 | 122.82 | -65.41 |
| | 2690 | 123.24 | -65.21 |
| | 2770 | 123.26 | -64.41 |
| | 2850 | 123.46 | -69.33 |
| | 2930 | 123.44 | -64.61 |
| | 3010 | 122.94 | -65.37 |
| | 3090 | 123.14 | -65.21 |
| | 3170 | 123.13 | -65.21 |
| | 3250 | 123.26 | -65.10 |
| | 3330 | 122.47 | -65.81 |
| | 3370 | 119.28 | -70.78 |
| (Failure) | 3385 | | |

TABLE 73

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-1 | 40 | 126.44 | -51.89 |
| | 116 | 125.05 | -53.68 |
| | 196 | 124.53 | -54.27 |
| | 356 | 123.66 | -55.27 |
| | 516 | 124.21 | -54.87 |
| | 676 | 123.58 | -55.63 |
| | 836 | 123.06 | -56.25 |
| | 996 | 122.86 | -55.47 |
| | 1156 | 122.66 | 56.96 |
| | 1316 | 122.07 | -53.48 |
| | 1476 | 123.14 | -56.46 |
| | 1636 | 121.47 | -57.85 |
| | 1796 | 122.47 | -57.42 |
| | 1956 | 122.94 | -56.26 |
| | 2116 | 121.67 | -58.45 |
| | 2276 | 122.27 | -57.65 |
| | 2436 | 122.66 | -57.65 |
| | 2596 | 122.86 | -56.86 |
| | 2756 | 123.26 | -55.98 |
| | 2916 | 123.26 | -56.47 |
| | 3078 | 123.28 | -56.10 |
| | 3236 | 122.94 | -57.65 |
| | 3396 | 123.22 | -56.46 |
| | 3556 | 123.06 | -57.26 |
| | 3716 | 122.66 | -57.46 |
| | 3876 | 123.26 | -56.06 |
| | 4036 | 122.43 | -57.06 |
| | 4196 | 123.06 | -56.06 |
| | 4356 | 123.24 | -56.18 |
| | 4516 | 123.06 | -57.65 |
| | 5676 | 123.26 | -56.46 |
| | 4836 | 127.96 | -57.26 |
| | 4996 | 123.24 | -56.26 |
| | 5156 | 122.47 | -56.86 |
| | 5316 | 122.15 | -58.17 |
| | 5476 | 123.06 | -57.06 |
| | 5636 | 123.26 | -56.38 |
| | 5796 | 121.47 | -57.85 |
| | 5956 | 122.66 | -57.26 |
| | 6116 | 123.06 | -57.06 |
| | 6276 | 121.67 | -58.25 |
| | 6436 | 123.26 | -56.46 |
| | 6595 | 123.27 | -56.62 |
| | 6756 | 123.24 | -57.26 |
| | 6916 | 123.14 | -57.65 |
| | 6996 | 123.86 | -57.34 |
| (Failure) | 7041 | 127.44 | -54.87 |

TABLE 74

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-15 | 54 | 123.83 | -37.38 |
| | 92 | 124.06 | -38.77 |
| | 212 | 123.46 | -39.66 |
| | 332 | 123.06 | -39.76 |
| | 572 | 122.86 | -39.77 |
| | 812 | 122.07 | -40.36 |
| | 1052 | 121.87 | -40.56 |
| | 1292 | 122.58 | -39.76 |
| | 1532 | 122.50 | -39.96 |
| | 1772 | 122.66 | -39.76 |
| | 2012 | 122.47 | -39.80 |
| | 2252 | 122.27 | -39.88 |
| | 2492 | 122.66 | -40.08 |
| | 2732 | 122.47 | -39.76 |
| | 2972 | 123.22 | -39.75 |
| | 3212 | 121.67 | -40.36 |
| | 3452 | 122.47 | -39.76 |
| | 3692 | 122.67 | -39.72 |
| | 3932 | 123.06 | -39.56 |
| | 4172 | 122.90 | -39.84 |
| | 4412 | 122.86 | -39.74 |
| | 4652 | 122.39 | -39.80 |
| | 4892 | 122.66 | -39.70 |
| | 5132 | 122.87 | -39.72 |
| | 5372 | 123.06 | -39.84 |
| | 5612 | 123.22 | -39.88 |
| | 5852 | 122.94 | -39.76 |
| | 6092 | 123.25 | -39.44 |
| | 6332 | 123.26 | -39.74 |
| | 6572 | 123.14 | -39.68 |
| | 6812 | 123.27 | -39.76 |
| | 7052 | 123.04 | -39.72 |
| | 7292 | 123.26 | -38.97 |
| | 7532 | 123.22 | -39.56 |
| | 7772 | 123.26 | 38.97 |
| | 8012 | 122.86 | -39.36 |
| | 8252 | 122.66 | -39.56 |
| | 8492 | 123.06 | -38.56 |
| | 8732 | 123.07 | -39.17 |
| | 8972 | 123.26 | -38.97 |
| | 9212 | 122.86 | -39.36 |
| | 9452 | 123.26 | -38.77 |
| | 9692 | 123.24 | -38.77 |
| | 9932 | 124.06 | -36.98 |
| | 10172 | 123.46 | -37.97 |
| | 10292 | 122.66 | -39.76 |
| | 10332 | 118.89 | -44.53 |
| (Failure) | 10352 | | |

TABLE 75

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-11 | 40 | 119.32 | -43.74 |
| | 100 | 119.28 | -43.94 |
| | 140 | 119.32 | -44.14 |
| | 220 | 119.28 | -43.94 |
| | 460 | 118.89 | -44.53 |
| | 620 | 119.09 | -44.14 |
| | 940 | 119.68 | -43.76 |
| | 1260 | 119.20 | -44.73 |
| | 1580 | 118.81 | -45.53 |
| | 1900 | 118.89 | -45.33 |
| | 2220 | 119.28 | -44.33 |
| | 2540 | 119.09 | -44.53 |
| | 2860 | 117.38 | -45.81 |
| | 3180 | 117.89 | -46.12 |
| | 3500 | 118.53 | -45.33 |
| | 3820 | 118.89 | -45.05 |
| | 4140 | 117.69 | -45.73 |
| | 4460 | 117.46 | -46.32 |
| | 4780 | 117.69 | -46.12 |
| | 5100 | 118.[illegible]9 | -45.92 |
| | 5420 | 118.69 | -45.73 |
| | 5740 | 117.69 | -46.04 |
| | 6060 | 118.09 | -45.84 |
| | 6380 | 117.89 | -45.69 |
| | 6700 | 119.09 | -45.33 |
| | 7020 | 118.69 | -45.65 |
| | 7340 | 117.89 | -46.12 |
| | 7660 | 117.10 | -46.24 |
| | 7980 | 117.97 | -45.73 |
| | 4300 | 118.89 | -44.73 |
| | 8620 | 118.69 | -45.13 |
| | 8940 | 117.69 | -46.52 |
| | 9260 | 118.09 | -46.12 |
| | 9580 | 118.69 | -45.33 |
| | 9900 | 118.09 | -44.93 |
| | 10220 | 117.30 | -47.32 |
| | 10540 | 117.32 | -50.89 |
| | 10860 | 118.49 | -45.65 |
| | 11180 | 118.89 | -45.73 |
| | 11500 | 118.49 | -46.12 |
| | 11820 | 117.22 | -46.12 |
| | 12140 | 118.49 | -45.33 |
| | 12460 | 117.69 | -46.52 |
| | 12780 | 117.24 | -46.32 |
| | 12940 | 115.27 | -47.71 |
| | 13100 | 111.29 | -48.91 |
| | 13180 | 97.42 | -54.67 |
| (Failure) | 13190 | | |

TABLE 76

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| B1-21 | 46 | 113.32 | -41.55 |
| | 172 | 109.93 | -44.85 |
| | 253 | 109.15 | -45.65 |
| | 373 | 109.10 | -46.22 |
| | 533 | 108.55 | -47.12 |
| | 853 | 108.59 | -47.67 |
| | 1173 | 108.75 | -47.65 |
| | 1493 | 108.57 | -47.64 |
| | 1813 | 107.75 | -47.71 |
| | 2133 | 109.52 | -45.73 |
| | 2453 | 108.55 | -47.32 |
| | 2773 | 108.79 | -47.12 |
| | 3093 | 108.55 | -47.51 |
| | 3413 | 108.19 | -47.71 |
| | 3733 | 108.11 | -47.75 |
| | 4053 | 108.21 | -47.72 |
| | 4373 | 108.52 | -47.30 |
| | 4693 | 108.61 | -47.15 |
| | 5013 | 108.55 | -47.25 |
| | 5333 | 109.02 | -47.12 |
| | 5653 | 109.38 | -47.91 |
| | 5973 | 109.34 | -47.32 |
| | 6293 | 108.95 | -47.48 |
| | 6613 | 109.22 | -47.67 |
| | 6933 | 109.94 | -46.72 |
| | 7253 | 110.54 | -45.92 |
| | 7573 | 110.74 | -45.73 |
| | 7933 | 109.74 | -46.12 |
| | 8213 | 111.33 | -45.05 |
| | 8533 | 110.54 | -46.12 |
| | 8853 | 110.56 | -46.84 |
| | 9173 | 109.94 | -47.32 |
| | 9493 | 109.74 | -47.24 |
| | 9813 | 110.34 | -46.92 |
| | 10133 | 110.54 | -45.92 |
| | 10453 | 110.74 | -46.52 |
| | 10773 | 110.75 | -46.53 |
| | 11093 | 110.73 | -46.42 |
| | 11413 | 110.74 | -46.52 |
| | 11733 | 110.54 | -47.08 |
| | 12053 | 110.82 | -47.20 |
| | 12373 | 110.93 | -46.88 |
| | 12693 | 110.95 | -46.72 |
| | 13013 | 111.25 | -46.84 |
| | 13333 | 110.85 | -47.00 |
| | 13653 | 111.33 | -46.64 |

TABLE 76 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| B1-21 Cont'd | 13973 | 110.89 | -47.04 |
| | 14293 | 111.01 | -47.24 |
| | 14613 | 111.33 | -46.92 |
| | 14773 | 112.33 | -46.12 |
| | 14813 | 113.32 | -47.73 |
| (Failure) | 14849 | | |

TABLE 77

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-23 | 40 | 122.86 | -33.00 |
| | 100 | 120.64 | -35.79 |
| | 140 | 119.76 | -36.66 |
| | 180 | 119.28 | -37.97 |
| | 260 | 118.49 | -39.09 |
| | 420 | 117.10 | -39.76 |
| | 580 | 115.31 | -40.56 |
| | 900 | 114.71 | -42.74 |
| | 1220 | 114.70 | -42.15 |
| | 1540 | 114.12 | -42.15 |
| | 1860 | 113.72 | -42.16 |
| | 2180 | 113.80 | -42.54 |
| | 2506 | 112.60 | -43.74 |
| | 2820 | 113.94 | -43.34 |
| | 3140 | 113.72 | -43.14 |
| | 3400 | 114.51 | -42.54 |
| | 3780 | 113.52 | -43.06 |
| | 4140 | 113.60 | -43.34 |
| | 4420 | 113.72 | -43.32 |
| | 4740 | 114.19 | -42.94 |
| | 5060 | 114.51 | -42.54 |
| | 5380 | 113.72 | -43.06 |
| | 5700 | 114.43 | -43.26 |
| | 6020 | 114.59 | -42.23 |
| | 6340 | 113.52 | -43.54 |
| | 6660 | 114.31 | -43.34 |
| | 6980 | 114.47 | -42.94 |
| | 7300 | 113.72 | -43.14 |
| | 7620 | 113.72 | -43.42 |
| | 7940 | 114.12 | -43.14 |
| | 8260 | 114.71 | -43.10 |
| | 8580 | 114.87 | -42.54 |
| | 8900 | 114.51 | -42.56 |
| | 9220 | 114.91 | -42.74 |
| | 9540 | 114.52 | -42.94 |
| | 9860 | 114.71 | -43.14 |
| | 10180 | 114.91 | -42.50 |
| | 10500 | 114.91 | -42.62 |
| | 10820 | 114.71 | -43.14 |
| | 11140 | 114.75 | -42.50 |
| | 11460 | 114.79 | -43.02 |
| | 11780 | 114.59 | -42.90 |
| | 12100 | 114.51 | -43.34 |
| | 12420 | 114.75 | -43.26 |

TABLE 77 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-23 Cont'd | 12740 | 114.60 | -43.02 |
| | 13060 | 114.91 | -42.94 |
| | 13380 | 114.59 | -42.90 |
| | 13700 | 113.24 | -43.66 |
| | 14020 | 114.95 | -43.34 |
| | 14340 | 114.83 | -42.88 |
| | 14660 | 113.72 | -43.54 |
| | 14980 | 113.32 | -43.74 |
| | 15300 | 113.56 | -47.67 |
| | 15460 | 113.36 | -43.74 |
| | 15624 | 114.71 | -43.62 |
| | 15780 | 113.32 | -43.34 |
| | 15860 | 112.13 | -43.82 |
| | 15900 | 111.93 | -44.14 |
| | 15990 | 108.95 | -47.32 |
| (Failure) | 15952 | | |

TABLE 78

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-21 | 20 | 116.90 | -25.84 |
| | 60 | 115.35 | -27.83 |
| | 100 | 115.11 | -27.87 |
| | 300 | 112.13 | -29.94 |
| | 500 | 112.17 | -30.30 |
| | 700 | 111.65 | -30.82 |
| | 1100 | 112.41 | -30.62 |
| | 1580 | 112.92 | -29.98 |
| | 2060 | 111.81 | -30.62 |
| | 2540 | [illegible].12 | -29.82 |
| | 3020 | [illegible].84 | -29.80 |
| | 3500 | 111.93 | -31.01 |
| | 3980 | 112.01 | -30.62 |
| | 4460 | 111.81 | -30.22 |
| | 4940 | 112.33 | -30.62 |
| | 5420 | 111.97 | -30.42 |
| | 5900 | 112.25 | -29.98 |
| | 6380 | 111.93 | -31.01 |
| | 6860 | 112.09 | -31.13 |
| | 7340 | 111.81 | -30.70 |
| | 7820 | 112.33 | -30.78 |
| | 8300 | 112.45 | -29.90 |
| | 8780 | 113.00 | -29.82 |
| | 9260 | 112.92 | -30.93 |
| | 9740 | 112.37 | -30.70 |
| | 10220 | 112.52 | -30.62 |
| | 10700 | 112.72 | -30.97 |
| | 11180 | 112.94 | -29.94 |
| | 11660 | 113.32 | -29.62 |
| | 12140 | 112.13 | -30.58 |
| | 12620 | 111.97 | -30.62 |
| | 13100 | 112.01 | -30.78 |
| | 13580 | 112.05 | -30.89 |
| | 14060 | 112.33 | -30.62 |
| | 14540 | 113.32 | -29.70 |
| | 15020 | 112.72 | -30.22 |
| | 15500 | 113.12 | -29.70 |
| | 15980 | 113.72 | -29.22 |
| | 16460 | 112.52 | -29.90 |
| | 16940 | 112.54 | -30.02 |
| | 17420 | 113.40 | -29.22 |
| | 17900 | 113.32 | -29.78 |
| | 18380 | 113.12 | -29.42 |
| | 18860 | 113.20 | -29.90 |
| | 19340 | 112.56 | -30.22 |

TABLE 78 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-21 Cont'd | 19820 | 112.52 | -30.42 |
| | 20300 | 113.36 | -29.82 |
| | 20780 | 113.72 | -30.02 |
| | 21260 | 112.72 | -29.86 |
| | 21740 | 112.56 | -29.82 |
| | 22220 | 111.93 | -31.41 |
| | 22700 | 111.92 | -31.01 |
| | 23180 | 112.72 | -30.62 |
| | 23660 | 111.53 | -31.47 |
| | 24140 | 112.13 | -31.15 |
| | 24620 | 113.20 | -30.34 |
| | 25100 | 112.03 | -31.53 |
| | 25580 | 112.17 | -30.85 |
| | 26060 | 113.92 | -29.42 |
| | 26540 | 113.24 | -30.22 |
| | 27020 | 112.33 | -29.62 |
| | 27500 | 112.13 | -30.34 |
| | 27980 | 112.92 | -29.74 |
| | 28460 | 113.12 | -30.38 |
| | 28940 | 111.73 | -31.41 |
| | 29420 | 111.70 | -31.17 |
| | 29900 | 112.72 | -30.62 |
| | 30380 | 112.05 | -30.82 |
| | 30860 | 112.13 | -31.41 |
| | 31340 | 112.05 | -31.17 |
| | 31820 | 112.52 | -30.62 |
| | 32300 | 112.92 | -30.60 |
| | 32780 | 111.73 | -31.49 |
| | 33260 | 111.77 | -31.61 |
| | 33740 | 113.00 | -30.62 |
| | 34220 | 111.93 | -31.41 |
| | 34700 | 111.73 | -31.61 |
| | 35180 | 112.17 | -31.01 |
| | 35660 | 111.97 | -30.85 |
| | 36140 | 111.73 | -31.61 |
| | 36620 | 111.53 | -31.73 |
| | 37100 | 111.73 | -31.45 |
| | 37580 | 111.93 | -31.09 |
| | 38060 | 112.13 | -31.69 |
| | 38540 | 111.57 | -31.73 |
| | 39020 | 111.73 | -31.49 |
| | 39500 | 112.92 | -30.62 |
| | 39980 | 111.93 | -31.41 |
| | 40460 | 111.73 | -31.72 |
| | 40940 | 112.29 | -31.33 |

TABLE 78 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-21 Cont'd | 41420 | 112.13 | -31.41 |
| | 41900 | 111.45 | -31.81 |
| | 42380 | 111.57 | -31.77 |
| | 42860 | 112.13 | -31.33 |
| | 43340 | 111.73 | -31.61 |
| | 43820 | 111.65 | -31.76 |
| | 44300 | 111.41 | -31.41 |
| | 44780 | 111.93 | -31.31 |
| | 45260 | 112.09 | -31.41 |
| | 45740 | 111.33 | -31.69 |
| | 46220 | 111.53 | -31.80 |
| | 46700 | 112.45 | -30.97 |
| | 47180 | 111.41 | -31.73 |
| | 47660 | 111.35 | -31.69 |
| | 48140 | 112.33 | -30.97 |
| | 48620 | 112.41 | -30.77 |
| | 49100 | 111.81 | -31.21 |
| | 49580 | 111.33 | -31.41 |
| | 49780 | 111.30 | -31.21 |
| | 49940 | 108.15 | -32.01 |
| | 49980 | 107.36 | -31.93 |
| | 50020 | 106.84 | -32.25 |
| | 50060 | 106.37 | -33.00 |
| | 50100 | 103.38 | -34.39 |
| | 50140 | 99.01 | -35.79 |
| (Failure) | 50162 | | |

TABLE 79

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-5 | 40 | 115.63 | -19.56 |
| | 90 | 114.59 | -19.96 |
| | 130 | 114.51 | -20.28 |
| | 170 | 113.32 | -21.47 |
| | 330 | 111.33 | -23.82 |
| | 530 | 111.93 | -22.74 |
| | 930 | 112.41 | -23.06 |
| | 1330 | 110.74 | -24.25 |
| | 1730 | 109.94 | -25.65 |
| | 2330 | 110.54 | -24.45 |
| | 2930 | 109.54 | -24.25 |
| | 3530 | 111.32 | -23.86 |
| | 4130 | 110.74 | -24.21 |
| | 4730 | 111.37 | -23.84 |
| | 5330 | 110.62 | -23.94 |
| | 5930 | 111.34 | -23.38 |
| | 6530 | 110.79 | -23.86 |
| | 7130 | 111.65 | -22.35 |
| | 7730 | 111.17 | -23.82 |
| | 8330 | 111.65 | -22.58 |
| | 8930 | 111.93 | -23.78 |
| | 9530 | 111.45 | -22.47 |
| | 10130 | 111.25 | -23.76 |
| | 10730 | 111.33 | -22.86 |
| | 11330 | 111.32 | -23.34 |
| | 11930 | 111.45 | -23.77 |
| | 12530 | 111.85 | -22.27 |
| | 13130 | 111.30 | -23.06 |
| | 13730 | 112.13 | -21.79 |
| | 14330 | 112.14 | -21.75 |
| | 14930 | 111.73 | -22.74 |
| | 15530 | 111.75 | -22.98 |
| | 16130 | 111.94 | -23.23 |
| | 16730 | 111.93 | -22.07 |
| | 17330 | 111.28 | -23.78 |
| | 17930 | 110.74 | -24.17 |
| | 18530 | 111.01 | -23.89 |
| | 19130 | 111.34 | -23.82 |
| | 19730 | 111.37 | -23.26 |
| | 20330 | 112.05 | -22.66 |
| | 20930 | 112.33 | -22.07 |
| | 21530 | 112.17 | -21.87 |
| | 22130 | 110.93 | -23.86 |
| | 22730 | 111.13 | -23.90 |
| | 23330 | 111.32 | -23.66 |

TABLE 79 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-5 Cont'd | 23930 | 111.25 | -23.84 |
| | 24530 | 111.01 | -24.06 |
| | 25130 | 111.13 | -24.05 |
| | 25730 | 110.94 | -23.94 |
| | 26330 | 110.74 | -23.86 |
| | 26930 | 111.54 | -23.90 |
| | 27530 | 111.30 | -23.06 |
| | 28130 | 111.33 | -22.86 |
| | 28730 | 111.31 | -22.95 |
| | 29330 | 111.25 | -23.26 |
| | 29930 | 110.22 | -23.84 |
| | 30530 | 111.30 | -23.38 |
| | 31130 | 111.33 | -22.66 |
| | 31730 | 110.54 | -23.22 |
| | 32330 | 110.74 | -23.16 |
| | 32930 | 111.31 | -23.74 |
| | 33530 | 111.73 | -23.18 |
| | 34130 | 113.37 | -20.68 |
| | 34730 | 112.72 | -20.28 |
| | 35330 | 112.41 | -21.07 |
| | 35930 | 113.72 | -20.48 |
| | 36530 | 114.51 | -20.08 |
| | 37130 | 114.59 | -20.06 |
| | 37730 | 114.12 | -20.28 |
| | 38330 | 113.72 | -20.32 |
| | 38930 | 113.40 | -20.36 |
| | 39530 | 113.72 | -20.28 |
| | 40130 | 113.92 | -19.96 |
| | 40730 | 114.12 | -20.28 |
| | 41330 | 114.51 | -19.92 |
| | 41930 | 115.11 | -19.84 |
| | 42530 | 115.15 | -19.68 |
| | 43130 | 114.35 | -20.08 |
| | 43730 | 114.12 | -20.26 |
| | 44330 | 114.71 | -19.87 |
| | 44930 | 115.31 | -19.56 |
| | 45530 | 114.51 | -20.04 |
| | 46130 | 114.71 | -19.88 |
| | 46730 | 113.72 | -20.48 |
| | 47330 | 114.91 | -19.92 |
| | 47930 | 114.59 | -19.96 |
| | 48530 | 114.99 | -19.89 |
| | 49130 | 114.67 | -19.96 |
| | 49730 | 114.79 | -19.92 |
| | 50330 | 114.83 | -19.84 |

TABLE 79 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-5 Cont'd | 50930 | 115.27 | -19.68 |
| | 51530 | 114.55 | -19.96 |
| | 52130 | 113.72 | -20.28 |
| | 52330 | 114.12 | -20.24 |
| | 53330 | 114.12 | -19.90 |
| | 53930 | 114.31 | -20.28 |
| | 54530 | 113.12 | -20.86 |
| | 54690 | 113.72 | -19.96 |
| | 55290 | 113.70 | -19.92 |
| | 55890 | 114.31 | -19.90 |
| | 56490 | 114.12 | -19.94 |
| | 57090 | 112.33 | -21.47 |
| | 57690 | 113.24 | -20.20 |
| | 58290 | 112.13 | -20.99 |
| | 58890 | 112.10 | -20.28 |
| | 59490 | 111.93 | -20.40 |
| | 60090 | 111.85 | -20.68 |
| | 60690 | 112.01 | -20.60 |
| | 61290 | 112.12 | -20.06 |
| | 61890 | 113.20 | -19.88 |
| | 62490 | 111.73 | -20.48 |
| | 62490-77240 - No data. | | |
| | 77240 | 113.32 | -20.04 |
| | 77320 | 112.92 | -20.44 |
| | 77920 | 114.51 | -19.95 |
| | 78520 | 114.75 | -19.87 |
| | 79120 | 112.52 | -21.87 |
| | 79720 | 110.93 | -23.82 |
| | 80320 | 111.32 | -23.34 |
| | 80920 | 111.57 | -23.06 |
| | 81520 | 111.35 | -23.26 |
| | 82120 | 111.73 | -22.74 |
| | 82720 | 111.70 | -22.27 |
| | 83320 | 110.14 | -23.86 |
| | 83520 | 108.15 | -24.65 |
| | 83720 | 107.15 | -25.69 |
| | 83800 | 104.37 | -27.51 |
| | 83880 | 102.98 | -28.43 |
| | 83920 | 101.59 | -29.82 |
| | 83960 | 99.40 | -31.41 |
| | (Failure) 83964 | | |

TABLE 80

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-31 | 1 | 131.01 | -108.15 |
| | 4 | 135.19 | -118.49 |
| | 8 | 134.39 | -119.60 |
| | 15 | 134.19 | -121.67 |
| | 21 | 132.60 | -123.18 |
| | 27 | 131.61 | -123.26 |
| | 34 | 134.39 | -123.24 |
| | 48 | 134.41 | -123.30 |
| | 63 | 131.01 | -123.58 |
| | 75 | 130.89 | -123.60 |
| | 88 | 130.02 | -123.78 |
| | 104 | 129.78 | -123.66 |
| | 117 | 129.26 | -123.70 |
| | 130 | 129.07 | -123.58 |
| | 144 | 127.83 | -124.10 |
| | 159 | 127.63 | -123.69 |
| | 171 | 127.44 | -124.25 |
| | 184 | 127.83 | -123.65 |
| | 200 | 127.24 | -123.98 |
| | 213 | 127.51 | -123.28 |
| | 226 | 127.20 | -123.58 |
| | 240 | 127.22 | -123.46 |
| | 255 | 126.64 | -124.25 |
| | 267 | 127.04 | -123.70 |
| | 280 | 126.52 | -124.06 |
| | 296 | 126.16 | -123.66 |
| | 309 | 124.85 | -123.98 |
| | 322 | 123.86 | -123.66 |
| | 336 | 123.66 | -123.64 |
| | 349 | 123.26 | -124.06 |
| | 351 | 123.04 | -124.45 |
| | 356 | 122.86 | -124.06 |
| | 357 | 122.66 | -124.16 |
| | (Failure) 358 | | -124.10 |

TABLE 81

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-32 | 1 | 121.27 | -91.65 |
| | 3 | 123.26 | -102.39 |
| | 8 | 121.07 | -107.32 |
| | 16 | 119.68 | -109.34 |
| | 32 | 119.26 | -110.70 |
| | 56 | 118.09 | -111.01 |
| | 80 | 116.50 | -111.29 |
| | 104 | 115.71 | -111.33 |
| | 128 | 115.59 | -111.34 |
| | 152 | 115.71 | -111.35 |
| | 176 | 115.31 | -111.33 |
| | 200 | 115.30 | -111.34 |
| | 224 | 115.29 | -111.33 |
| | 248 | 114.59 | -111.53 |
| | 272 | 114.71 | -111.52 |
| | 296 | 113.92 | -111.65 |
| | 320 | 113.52 | -111.41 |
| | 344 | 113.72 | -111.31 |
| | 348 | 112.92 | -111.53 |
| | 392 | 113.72 | -111.41 |
| | 416 | 112.55 | -111.53 |
| | 440 | 112.13 | -111.34 |
| | 464 | 111.73 | -111.35 |
| | 488 | 111.65 | -111.30 |
| | 512 | 111.33 | -111.32 |
| | 536 | 109.74 | -111.35 |
| | 560 | 107.58 | -111.53 |
| | 584 | 103.98 | -111.73 |
| | 600 | 100.60 | -111.41 |
| | 607 | 96.62 | -111.93 |
| | (Failure) 608 | 92.25 | |

TABLE 82

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-4 | 14 | 127.24 | -113.72 |
| | 37 | 126.24 | -115.11 |
| | 75 | 123.26 | -117.30 |
| | 112 | 123.46 | -115.71 |
| | 146 | 120.68 | -118.05 |
| | 181 | 119.28 | -117.65 |
| | 214 | 119.29 | -116.30 |
| | 250 | 117.69 | -118.49 |
| | 286 | 119.48 | -115.31 |
| | 322 | 119.28 | -115.39 |
| | 358 | 119.48 | -115.31 |
| | 394 | 116.30 | -116.90 |
| | 430 | 117.10 | -115.43 |
| | 466 | 116.10 | -115.35 |
| | 502 | 115.35 | -115.27 |
| | 538 | 115.15 | -115.22 |
| | 574 | 112.13 | -115.43 |
| | 610 | 110.74 | -117.10 |
| | 622 | 108.15 | -116.90 |
| | 633 | 106.76 | -118.49 |
| | (Failure) 634 | 103.18 | |

TABLE 83

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-33 | 1 | 120.08 | -75.55 |
| | 2 | 119.88 | -83.30 |
| | 8 | 114.51 | -91.41 |
| | 14 | 113.12 | -92.25 |
| | 20 | 111.93 | -93.84 |
| | 38 | 107.55 | -95.03 |
| | 62 | 111.35 | -93.92 |
| | 86 | 111.33 | -93.44 |
| | 110 | 111.73 | -92.05 |
| | 134 | 111.70 | -91.85 |
| | 158 | 111.75 | -91.45 |
| | 182 | 111.93 | -91.53 |
| | 206 | 111.89 | -91.41 |
| | 230 | 112.05 | -91.13 |
| | 254 | 111.33 | -91.45 |
| | 278 | 110.74 | -92.25 |
| | 302 | 110.67 | -92.84 |
| | 326 | 110.60 | -91.85 |
| | 350 | 111.32 | -91.05 |
| | 374 | 111.73 | -90.62 |
| | 398 | 118.49 | -89.07 |
| | 422 | 115.11 | -89.54 |
| | 446 | 111.73 | -89.86 |
| | 470 | 112.13 | -89.07 |
| | 494 | 112.33 | -88.35 |
| | 518 | 111.65 | -89.46 |
| | 543 | 111.29 | -91.41 |
| | 569 | 110.54 | -91.49 |
| | 595 | 109.94 | -91.85 |
| | 621 | 110.34 | -91.45 |
| | 647 | 111.32 | -90.46 |
| | 673 | 111.73 | -88.07 |
| | 699 | 112.13 | -87.67 |
| | 725 | 114.23 | -91.53 |
| | 751 | 113.72 | -87.08 |
| | 777 | 113.32 | -87.12 |
| | 803 | 113.72 | -90.66 |
| | 829 | 112.13 | -87.08 |
| | 855 | 111.33 | -88.27 |
| | 881 | 111.30 | -89.08 |
| | 907 | 110.54 | -89.86 |
| | 933 | 110.74 | -89.86 |
| | 959 | 111.01 | -88.47 |
| | 950 | 110.83 | -88.27 |

TABLE 83 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-33 Cont'd | 985 | 124.06 | -86.28 |
| | 1011 | 121.27 | -87.45 |
| | 1037 | 110.74 | -88.87 |
| | 1061 | 110.14 | -87.87 |
| | 1085 | 108.07 | -88.65 |
| | 1109 | 107.36 | -90.06 |
| | 1133 | 109.17 | -91.49 |
| | 1158 | 101.59 | -92.25 |
| | 1164 | 99.80 | -93.44 |
| | 1171 | 95.43 | -94.83 |
| | (Failure) 1174 | | |

TABLE 84

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-10 | 1 | 120.78 | -58.25 |
| | 2 | 119.60 | -66.90 |
| | 8 | 113.32 | -73.56 |
| | 14 | 112.13 | -74.52 |
| | 20 | 111.37 | -75.94 |
| | 38 | 111.13 | -78.53 |
| | 68 | 109.34 | -78.73 |
| | 98 | 108.09 | -79.52 |
| | 128 | 107.83 | -79.32 |
| | 158 | 107.67 | -79.56 |
| | 188 | 107.28 | -79.60 |
| | 218 | 107.36 | -79.84 |
| | 248 | 106.96 | -79.72 |
| | 278 | 106.90 | -79.88 |
| | 308 | 106.16 | -80.12 |
| | 338 | 106.56 | -79.92 |
| | 368 | 106.54 | -79.64 |
| | 398 | 106.96 | -79.84 |
| | 428 | 105.96 | -80.12 |
| | 458 | 106.88 | -79.60 |
| | 488 | 105.61 | -79.52 |
| | 518 | 105.45 | -79.54 |
| | 548 | 105.84 | -79.52 |
| | 578 | 105.37 | -79.54 |
| | 608 | 105.41 | -79.60 |
| | 638 | 104.73 | -80.00 |
| | 668 | 104.17 | -80.24 |
| | 698 | 104.15 | -80.20 |
| | 728 | 104.57 | -80.72 |
| | 758 | 104.10 | -80.99 |
| | 788 | 104.14 | -81.51 |
| | 818 | 103.78 | -81.31 |
| | 848 | 103.38 | -81.59 |
| | 878 | 103.42 | -80.91 |
| | 908 | 103.37 | -79.90 |
| | 938 | 103.90 | -80.12 |
| | 968 | 103.38 | -80.72 |
| | 998 | 103.36 | -81.19 |
| | 1028 | 103.30 | -81.11 |
| | 1058 | 103.32 | -81.51 |
| | 1088 | 103.37 | -81.71 |
| | 1118 | 103.34 | -81.63 |
| | 1148 | 103.34 | -81.55 |
| | 1178 | 103.42 | -80.20 |
| | 1208 | 103.22 | -81.11 |

TABLE 84 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 2-10 Cont'd | 1238 | 103.38 | -80.80 |
| | 1268 | 102.78 | -81.71 |
| | 1298 | 102.98 | -81.83 |
| | 1328 | 103.26 | -81.91 |
| | 1358 | 103.18 | -82.07 |
| | 1388 | 102.76 | -81.82 |
| | 1418 | 103.28 | -82.31 |
| | 1448 | 102.98 | -81.67 |
| | 1478 | 102.90 | -81.47 |
| | 1508 | 102.94 | -81.52 |
| | 1538 | 102.39 | -81.61 |
| | 1568 | 101.89 | -81.51 |
| | 1598 | 102.41 | -81.50 |
| | 1628 | 101.79 | -81.11 |
| | 1658 | 101.19 | -80.91 |
| | 1688 | 101.93 | -80.52 |
| | 1718 | 101.39 | -81.12 |
| | 1748 | 101.87 | -79.92 |
| | 1778 | 101.79 | -79.88 |
| | 1808 | 101.07 | -80.04 |
| | 1838 | 101.59 | -80.12 |
| | 1868 | 101.49 | -80.32 |
| | 1898 | 101.19 | -80.30 |
| | 1928 | 101.20 | -80.31 |
| | 1958 | 100.20 | -80.00 |
| | 1988 | 100.24 | -80.32 |
| | 2018 | 99.80 | -80.32 |
| | 2048 | 99.44 | -81.11 |
| | 2078 | 99.40 | -81.31 |
| | 2108 | 99.36 | -82.13 |
| | 2138 | 98.81 | -82.90 |
| | 2168 | 97.89 | -82.91 |
| | 2198 | 96.82 | -83.50 |
| | 2228 | 95.83 | -83.54 |
| | 2258 | 95.39 | -83.53 |
| | 2288 | 94.83 | -83.62 |
| | 2318 | 99.44 | -85.49 |
| | 2336 | 86.88 | -89.07 |
| | 2341 | 75.67 | -89.66 |
| | 2342 | 73.56 | -89.86 |
| | (Failure) 2346 | | |

TABLE 85

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-28 | 1 | 117.30 | -40.32 |
| | 2 | 113.92 | -46.92 |
| | 5 | 108.15 | -54.47 |
| | 10 | 106.16 | -55.86 |
| | 16 | 104.77 | -56.86 |
| | 28 | 100.20 | -58.05 |
| | 47 | 103.78 | -58.05 |
| | 102 | 103.98 | -58.45 |
| | 157 | 103.75 | -58.05 |
| | 212 | 103.58 | -58.53 |
| | 267 | 103.38 | -59.60 |
| | 322 | 103.36 | -59.64 |
| | 377 | 103.22 | -59.60 |
| | 432 | 99.20 | -59.24 |
| | 487 | 99.01 | -59.32 |
| | 542 | 102.39 | -58.85 |
| | 597 | 102.58 | -59.59 |
| | 652 | 101.79 | -59.66 |
| | 707 | 101.55 | -59.84 |
| | 762 | 100.99 | -60.04 |
| | 817 | 99.01 | -60.24 |
| | 872 | 97.61 | -61.23 |
| | 927 | 99.36 | -60.03 |
| | 982 | 99.40 | -59.66 |
| | 1037 | 99.42 | -59.67 |
| | 1092 | 98.81 | -60.64 |
| | 1147 | 98.41 | -60.20 |
| | 1202 | 98.21 | -60.83 |
| | 1257 | 99.20 | -60.04 |
| | 1312 | 99.05 | -61.19 |
| | 1367 | 98.97 | -60.44 |
| | 1422 | 98.93 | -60.04 |
| | 1477 | 97.89 | -60.83 |
| | 1532 | 98.21 | -60.44 |
| | 1587 | 97.73 | -57.57 |
| | 1642 | 97.42 | -62.03 |
| | 1697 | 98.61 | -60.16 |
| | 1752 | 97.88 | -60.02 |
| | 1809 | 97.42 | -60.64 |
| | 1864 | 98.01 | -60.44 |
| | 1919 | 98.21 | -59.84 |
| | 1974 | 98.81 | -59.64 |
| | 2029 | 99.38 | -59.60 |
| | 2084 | 98.85 | -59.64 |
| | 2139 | 99.24 | -59.62 |

TABLE 85 Continued

| SAMPLE | CYCLES | TENSILE STRESS (KSI) | COMPRESSIVE STRESS (KSI) |
|---|---|---|---|
| 3-28 Cont'd | 2194 | 99.20 | -59.24 |
| | 2249 | 99.36 | -59.64 |
| | 2304 | 99.39 | -59.62 |
| | 2359 | 98.61 | -60.04 |
| | 2414 | 100.20 | -58.85 |
| | 2469 | 99.41 | -59.62 |
| | 2524 | 99.24 | -59.68 |
| | 2577 | 99.20 | -59.72 |
| | 2632 | 96.22 | -61.23 |
| | 2687 | 95.63 | -63.22 |
| | 2742 | 97.65 | -61.43 |
| | 2797 | 97.50 | -61.63 |
| | 2852 | 97.42 | -62.03 |
| | 2907 | 96.70 | -62.03 |
| | 2962 | 95.83 | -63.42 |
| | 3017 | 95.83 | -61.23 |
| | 3072 | 97.10 | -62.03 |
| | 3120 | 96.42 | -62.43 |
| | 3182 | 96.22 | -63.02 |
| | 3237 | 95.63 | -63.62 |
| | 3292 | 95.35 | -63.94 |
| | 3347 | 96.14 | -63.50 |
| | 3402 | 100.12 | -61.27 |
| | 3426 | 103.38 | -60.40 |
| | 3432 | 103.46 | -60.42 |
| | 3438 | 106.64 | -60.40 |
| (Failure) | 3442 | | |

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