

**ASD-TR-61-667  
VOLUME II**

**ELASTO-PLASTIC ANALYSIS OF STRUCTURES  
UNDER LOAD AND TWO-DIMENSIONAL  
TEMPERATURE DISTRIBUTIONS**

**VOLUME II. SUMMARY OF TEST DATA**

**TECHNICAL REPORT No. ASD-TR-61-667, VOL. II**

**APRIL 1962**

**FLIGHT DYNAMICS LABORATORY  
AERONAUTICAL SYSTEMS DIVISION  
AIR FORCE SYSTEMS COMMAND  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO**

**Project No. 1367, Task No. 136710**

**(Prepared under Contract No. AF 33(616)-7738 by  
Martin Marietta Corporation, Baltimore Division, Baltimore, Maryland.  
Authors: P. C. Huang and R. J. Edwards.)**

## FOREWORD

This report was prepared by the Baltimore Division of the Martin Marietta Corporation under Contract AF33(616)-7738. The contract was initiated under Task No. 136710, Project No. 1367, "Structural Design Criteria," and was administered under the direction of the Aeronautical Systems Division, Air Force Systems Command, with Mr. J. R. Johnson as project engineer. This report summarizes work performed during the period 15 December 1960 to 15 November 1961.

The significant contributions of the authors were:

|                   |                                                                                 |
|-------------------|---------------------------------------------------------------------------------|
| Dr. P. C. Huang   | Research Project Director.                                                      |
| Mr. R. J. Edwards | Principal Investigator, coordination and direction of the verification program. |

Other contributors of importance were:

|                                   |                                                                                                      |
|-----------------------------------|------------------------------------------------------------------------------------------------------|
| Mr. J. Mason                      | Assistant to the authors, performance of material control coupon tests, data reduction and analyses. |
| Mr. B. Josselyn<br>Mr. G. Schmidt | Facility Modification, instrumentation installation and performance of large specimen tests.         |
| Mr. E. Marsh                      | Instrumentation circuitry design, data collection for large specimen tests.                          |

The authors also wish to thank Mr. C. Swanson and Mr. E. Mead for their technical and administrative assistance.

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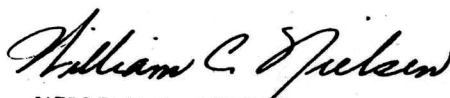
## ABSTRACT

This report describes investigations performed to determine experimentally the validity of the time-independent aspects of a time-dependent elasto-plastic stress and strain analysis method for structures exposed to complex load and two-dimensional elevated temperature environments. Experiments, consisting of tests of long flat plates subjected to uniaxial loads and temperatures which varied in two directions, are described. These were specifically designed to evaluate the accuracy of the analysis method. Magnitude and duration of the test variables were such that the strains induced by loading were in the plastic range and appreciable thermal stress systems were introduced. Significant creep strains were eliminated by short-time continuous loading. Experimental strains were compared with analytical strains calculated for conditions identical with the tests. Within the range of test parameters selected, the degree of correlation achieved indicates verification of the time-independent portion of the analysis method.

## PUBLICATION REVIEW

This report has been reviewed and is approved.

FOR THE COMMANDER:



WILLIAM C. NIELSEN

Colonel, USAF

Chief, Flight Dynamics Laboratory

TABLE 1 EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

| GAGE NO. | FIG. NO. | DATE   |             |             |
|----------|----------|--------|-------------|-------------|
| 2        | 1        | 6 29 1 |             |             |
| X (IN)   | Y (IN)   | Z (IN) | ANGLE (DEG) |             |
| 0.       | 6.00     |        | 0.          |             |
| TIME     | TEMP.    | LOAD   | STRAIN      | AVE. STRAIN |
| (SEC)    | (DEG. F) | (KIPS) | (IN/IN)     | (IN/IN)     |
| 0.0      | 443.     | 0      | -0.000280   | 0.          |
| 1.3      | 443.     | 0      | -0.000265   | 0.          |
| 2.4      | 443.     | 0      | -0.000265   | 0.          |
| 3.6      | 443.     | 0      | -0.000265   | 0.          |
| 4.8      | 443.     | 0      | -0.000250   | 0.          |
| 5.9      | 443.     | 0      | -0.000250   | 0.          |
| 75.4     | 441.     | 0      | -0.000027   | 0.          |
| 76.6     | 441.     | 0      | 0.000003    | 0.          |
| 77.8     | 441.     | 0      | -0.000027   | 0.          |
| 78.9     | 441.     | 0      | 0.000003    | 0.          |
| 80.1     | 441.     | 0      | -0.000012   | 0.          |
| 218.9    | 395.     | 0      | 0.000408    | 0.          |
| 220.2    | 395.     | 0      | 0.000451    | 0.          |
| 221.3    | 395.     | 0      | 0.000422    | 0.          |
| 222.5    | 395.     | 0      | 0.000408    | 0.          |
| 223.7    | 395.     | 0      | 0.000408    | 0.          |
| 0.0      | 406.     | 0      | 0.000347    | 0.          |
| 1.2      | 406.     | 0      | 0.000347    | 0.          |
| 2.3      | 406.     | 0      | 0.000347    | 0.          |
| 3.5      | 406.     | 0      | 0.000361    | 0.          |
| 4.7      | 406.     | 0      | 0.000376    | 0.          |
| 5.9      | 406.     | 0      | 0.000376    | 0.          |
| 7.0      | 406.     | 0      | 0.000361    | 0.          |
| 8.2      | 406.     | 0      | 0.000376    | 0.          |
| 9.4      | 406.     | 0      | 0.000361    | 0.          |
| 10.5     | 406.     | 3.4    | 0.000477    | 0.          |
| 11.7     | 406.     | 12.3   | 0.000710    | 0.          |
| 12.9     | 406.     | 21.0   | 0.000943    | 0.          |
| 14.0     | 406.     | 29.0   | 0.001190    | 0.          |
| 15.2     | 406.     | 37.5   | 0.001438    | 0.          |
| 16.4     | 406.     | 45.6   | 0.001700    | 0.          |
| 17.5     | 406.     | 53.7   | 0.001947    | 0.          |
| 18.7     | 406.     | 61.3   | 0.002136    | 0.          |
| 19.9     | 406.     | 68.5   | 0.002340    | 0.          |
| 21.0     | 406.     | 75.3   | 0.002602    | 0.          |
| 21.7     | 406.     | 79.6   | 0.002820    | 0.          |
| 23.4     | 406.     | 89.5   | 0.003024    | 0.          |
| 24.5     | 406.     | 95.5   | 0.003257    | 0.          |
| 25.7     | 406.     | 102.7  | 0.003460    | 0.          |
| 26.9     | 406.     | 108.8  | 0.003693    | 0.          |
| 28.1     | 406.     | 115.4  | 0.003955    | 0.          |
| 29.2     | 406.     | 121.2  | 0.004188    | 0.          |
| 30.4     | 406.     | 127.3  | 0.004493    | 0.          |
| 31.6     | 406.     | 133.5  | 0.004813    | 0.          |
| 32.7     | 406.     | 139.1  | 0.005163    | 0.          |
| 33.9     | 406.     | 144.6  | 0.005614    | 0.          |
| 35.1     | 406.     | 149.7  | 0.006123    | 0.          |
| 36.2     | 406.     | 153.8  | 0.006807    | 0.          |
| 37.4     | 406.     | 158.0  | 0.007694    | 0.          |
| 38.6     | 406.     | 161.5  | 0.008800    | 0.          |
| 39.7     | 406.     | 163.8  | 0.010168    | 0.          |

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TABLE 1 EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

|          |          |        |
|----------|----------|--------|
| GAGE NO. | FIG. NO. | DATE   |
| 3        | 2        | 6 29 1 |

|        |        |        |             |
|--------|--------|--------|-------------|
| X (IN) | Y (IN) | Z (IN) | ANGLE (DEG) |
| 0.     | 4.50   |        | 0.          |

|               |                   |                |                   |                        |
|---------------|-------------------|----------------|-------------------|------------------------|
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVG. STRAIN<br>(IN/IN) |
| 0.0           | 435.              | 0              | -0.000143         | 0.                     |
| 1.3           | 435.              | 0              | -0.000114         | 0.                     |
| 2.4           | 435.              | 0              | -0.000129         | 0.                     |
| 3.6           | 435.              | 0              | -0.000099         | 0.                     |
| 4.8           | 435.              | 0              | -0.000129         | 0.                     |
| 5.9           | 435.              | 0              | -0.000114         | 0.                     |
| 75.4          | 442.              | 0              | -0.000074         | 0.                     |
| 76.6          | 442.              | 0              | -0.000059         | 0.                     |
| 77.8          | 442.              | 0              | -0.000059         | 0.                     |
| 78.9          | 442.              | 0              | -0.000044         | 0.                     |
| 80.1          | 442.              | 0              | -0.000044         | 0.                     |
| 218.9         | 441.              | 0              | 0.000146          | 0.                     |
| 220.2         | 441.              | 0              | 0.000146          | 0.                     |
| 221.3         | 441.              | 0              | 0.000146          | 0.                     |
| 222.5         | 441.              | 0              | 0.000175          | 0.                     |
| 223.7         | 441.              | 0              | 0.000175          | 0.                     |
| 0.0           | 420.              | 0              | 0.000156          | 0.                     |
| 1.2           | 420.              | 0              | 0.000127          | 0.                     |
| 2.3           | 420.              | 0              | 0.000142          | 0.                     |
| 3.5           | 420.              | 0              | 0.000142          | 0.                     |
| 4.7           | 420.              | 0              | 0.000142          | 0.                     |
| 5.9           | 420.              | 0              | 0.000156          | 0.                     |
| 7.0           | 420.              | 0              | 0.000127          | 0.                     |
| 8.2           | 420.              | 0              | 0.000156          | 0.                     |
| 9.4           | 420.              | 0              | 0.000142          | 0.                     |
| 10.5          | 420.              | 3.4            | 0.000215          | 0.                     |
| 11.7          | 420.              | 12.3           | 0.000463          | 0.                     |
| 12.9          | 420.              | 21.0           | 0.000711          | 0.                     |
| 14.0          | 420.              | 29.0           | 0.000974          | 0.                     |
| 15.2          | 420.              | 37.5           | 0.001193          | 0.                     |
| 16.4          | 420.              | 45.6           | 0.001427          | 0.                     |
| 17.5          | 420.              | 53.7           | 0.001689          | 0.                     |
| 18.7          | 420.              | 61.3           | 0.001908          | 0.                     |
| 19.9          | 420.              | 68.5           | 0.002142          | 0.                     |
| 21.0          | 420.              | 75.3           | 0.002376          | 0.                     |
| 21.7          | 420.              | 79.6           | 0.002609          | 0.                     |
| 23.4          | 420.              | 89.5           | 0.002814          | 0.                     |
| 24.5          | 420.              | 95.6           | 0.003018          | 0.                     |
| 25.7          | 420.              | 102.7          | 0.003252          | 0.                     |
| 26.9          | 420.              | 108.8          | 0.003471          | 0.                     |
| 28.1          | 420.              | 115.4          | 0.003733          | 0.                     |
| 29.2          | 420.              | 121.2          | 0.003996          | 0.                     |
| 30.4          | 420.              | 127.3          | 0.004288          | 0.                     |
| 31.6          | 420.              | 133.5          | 0.004566          | 0.                     |
| 32.7          | 420.              | 139.1          | 0.004960          | 0.                     |
| 33.9          | 420.              | 144.6          | 0.005412          | 0.                     |
| 35.1          | 420.              | 149.7          | 0.005967          | 0.                     |
| 36.2          | 420.              | 153.8          | 0.006712          | 0.                     |
| 37.4          | 420.              | 158.0          | 0.007821          | 0.                     |
| 38.6          | 420.              | 161.5          | 0.009442          | 0.                     |
| 39.7          | 420.              | 163.8          | 0.011574          | 0.                     |

TABLE 1      EXPERIMENTAL STRAIN DATA      TEST NO. 510 -095

| GAGE NO.      | FIG. NO.          | DATE           |                   |                        |
|---------------|-------------------|----------------|-------------------|------------------------|
| 4             | 2                 | 6 29 1         |                   |                        |
| X (IN)        | Y (IN)            | Z (IN)         | ANGLE (DEG)       |                        |
| 0.            | 4.50              |                | 0.                |                        |
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
| 0.0           | 435.              | 0              | -0.000132         | -0.000138              |
| 1.3           | 435.              | 0              | -0.000102         | -0.000108              |
| 2.4           | 435.              | 0              | -0.000102         | -0.000116              |
| 3.6           | 435.              | 0              | -0.000102         | -0.000101              |
| 4.8           | 435.              | 0              | -0.000102         | -0.000116              |
| 5.9           | 435.              | 0              | -0.000117         | -0.000116              |
| 75.4          | 442.              | 0              | -0.000028         | -0.000051              |
| 76.6          | 442.              | 0              | -0.000014         | -0.000036              |
| 77.8          | 442.              | 0              | -0.000014         | -0.000036              |
| 78.9          | 442.              | 0              | 0.000016          | -0.000014              |
| 80.1          | 442.              | 0              | 0.000016          | -0.000014              |
| 218.9         | 411.              | 0              | 0.000107          | 0.000127               |
| 220.2         | 411.              | 0              | 0.000122          | 0.000134               |
| 221.3         | 411.              | 0              | 0.000122          | 0.000134               |
| 222.5         | 411.              | 0              | 0.000137          | 0.000156               |
| 223.7         | 411.              | 0              | 0.000137          | 0.000156               |
| 0.0           | 420.              | 0              | 0.000102          | 0.000129               |
| 1.2           | 420.              | 0              | 0.000102          | 0.000115               |
| 2.3           | 420.              | 0              | 0.000102          | 0.000122               |
| 3.5           | 420.              | 0              | 0.000102          | 0.000122               |
| 4.7           | 420.              | 0              | 0.000117          | 0.000129               |
| 5.9           | 420.              | 0              | 0.000117          | 0.000137               |
| 7.0           | 420.              | 0              | 0.000087          | 0.000107               |
| 8.2           | 420.              | 0              | 0.000117          | 0.000137               |
| 9.4           | 420.              | 0              | 0.000132          | 0.000137               |
| 10.5          | 420.              | 3.4            | 0.000190          | 0.000203               |
| 11.7          | 420.              | 12.3           | 0.000455          | 0.000459               |
| 12.9          | 420.              | 21.0           | 0.000705          | 0.000708               |
| 14.0          | 420.              | 29.0           | 0.000940          | 0.000957               |
| 15.2          | 420.              | 37.5           | 0.001190          | 0.001191               |
| 16.4          | 420.              | 45.6           | 0.001440          | 0.001433               |
| 17.5          | 420.              | 53.7           | 0.001660          | 0.001675               |
| 18.7          | 420.              | 61.3           | 0.001881          | 0.001895               |
| 19.9          | 420.              | 68.6           | 0.002131          | 0.002136               |
| 21.0          | 420.              | 75.3           | 0.002366          | 0.002371               |
| 21.7          | 420.              | 79.6           | 0.002601          | 0.002605               |
| 23.4          | 420.              | 89.5           | 0.002807          | 0.002810               |
| 24.5          | 420.              | 95.6           | 0.003013          | 0.003015               |
| 25.7          | 420.              | 102.7          | 0.003233          | 0.003242               |
| 26.9          | 420.              | 108.8          | 0.003468          | 0.003470               |
| 28.1          | 420.              | 115.4          | 0.003704          | 0.003719               |
| 29.2          | 420.              | 121.3          | 0.003968          | 0.003982               |
| 30.4          | 420.              | 127.3          | 0.004262          | 0.004275               |
| 31.6          | 420.              | 133.5          | 0.004615          | 0.004590               |
| 32.7          | 420.              | 139.1          | 0.004968          | 0.004964               |
| 33.9          | 420.              | 144.6          | 0.005438          | 0.005425               |
| 35.1          | 420.              | 149.7          | 0.006026          | 0.005997               |
| 36.2          | 420.              | 153.8          | 0.006805          | 0.006759               |
| 37.4          | 420.              | 158.0          | 0.007996          | 0.007909               |
| 38.6          | 420.              | 161.5          | 0.009687          | 0.009564               |
| 39.7          | 420.              | 163.8          | 0.012009          | 0.011791               |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

| GAGE NO.      | FIG. NO.          | DATE           |                   |                        |
|---------------|-------------------|----------------|-------------------|------------------------|
| 5             | 3                 | 6 29 1         |                   |                        |
| X (IN)        | Y (IN)            | Z (IN)         | ANGLE (DEG)       |                        |
| 0.            | 2.50              |                | 0.                |                        |
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
| 0.0           | 418.              | 0              | 0.000075          | 0.                     |
| 1.3           | 418.              | 0              | 0.000105          | 0.                     |
| 2.4           | 418.              | 0              | 0.000090          | 0.                     |
| 3.6           | 418.              | 0              | 0.000075          | 0.                     |
| 4.8           | 418.              | 0              | 0.000120          | 0.                     |
| 5.9           | 418.              | 0              | 0.000090          | 0.                     |
| 75.4          | 443.              | 0              | -0.000064         | 0.                     |
| 76.6          | 443.              | 0              | -0.000064         | 0.                     |
| 77.8          | 443.              | 0              | -0.000080         | 0.                     |
| 78.9          | 443.              | 0              | -0.000064         | 0.                     |
| 80.1          | 443.              | 0              | -0.000064         | 0.                     |
| 218.9         | 431.              | 0              | -0.000185         | 0.                     |
| 220.2         | 431.              | 0              | -0.000170         | 0.                     |
| 221.3         | 431.              | 0              | -0.000215         | 0.                     |
| 222.5         | 431.              | 0              | -0.000200         | 0.                     |
| 223.7         | 431.              | 0              | -0.000170         | 0.                     |
| 0.0           | 437.              | 0              | -0.000140         | 0.                     |
| 1.2           | 437.              | 0              | -0.000155         | 0.                     |
| 2.3           | 437.              | 0              | -0.000170         | 0.                     |
| 3.5           | 437.              | 0              | -0.000155         | 0.                     |
| 4.7           | 437.              | 0              | -0.000125         | 0.                     |
| 5.9           | 437.              | 0              | -0.000140         | 0.                     |
| 7.0           | 437.              | 0              | -0.000155         | 0.                     |
| 8.2           | 437.              | 0              | -0.000170         | 0.                     |
| 9.4           | 437.              | 0              | -0.000125         | 0.                     |
| 10.5          | 437.              | 3.4            | -0.000035         | 0.                     |
| 11.7          | 437.              | 12.3           | 0.000191          | 0.                     |
| 12.9          | 437.              | 21.0           | 0.000447          | 0.                     |
| 14.0          | 437.              | 29.1           | 0.000673          | 0.                     |
| 15.2          | 437.              | 37.5           | 0.000883          | 0.                     |
| 16.4          | 437.              | 45.6           | 0.001154          | 0.                     |
| 17.5          | 437.              | 53.7           | 0.001395          | 0.                     |
| 18.7          | 437.              | 61.3           | 0.001561          | 0.                     |
| 19.9          | 437.              | 68.6           | 0.001786          | 0.                     |
| 21.0          | 437.              | 75.4           | 0.002057          | 0.                     |
| 21.7          | 437.              | 79.6           | 0.002268          | 0.                     |
| 23.4          | 437.              | 89.5           | 0.002464          | 0.                     |
| 24.5          | 437.              | 95.6           | 0.002659          | 0.                     |
| 25.7          | 437.              | 102.7          | 0.002900          | 0.                     |
| 26.9          | 437.              | 108.8          | 0.003126          | 0.                     |
| 28.1          | 437.              | 115.4          | 0.003382          | 0.                     |
| 29.2          | 437.              | 121.3          | 0.003607          | 0.                     |
| 30.4          | 437.              | 127.3          | 0.003893          | 0.                     |
| 31.6          | 437.              | 133.5          | 0.004179          | 0.                     |
| 32.7          | 437.              | 139.2          | 0.004510          | 0.                     |
| 33.9          | 437.              | 144.6          | 0.004932          | 0.                     |
| 35.1          | 437.              | 149.7          | 0.005428          | 0.                     |
| 36.2          | 437.              | 153.8          | 0.006091          | 0.                     |
| 37.4          | 437.              | 158.0          | 0.007099          | 0.                     |
| 38.6          | 437.              | 161.5          | 0.008649          | 0.                     |
| 39.7          | 437.              | 163.8          | 0.010997          | 0.                     |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

| GAGE NO.      | FIG. NO.          | DATE           |                   |                        |
|---------------|-------------------|----------------|-------------------|------------------------|
| 6             | 3                 | 6 29 1         |                   |                        |
| X (IN)        | Y (IN)            | Z (IN)         | ANGLE (DEG)       |                        |
| 0.            | 2.50              |                | 0.                |                        |
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
| 0.0           | 418.              | 0              | 0.000094          | 0.000084               |
| 1.3           | 418.              | 0              | 0.000136          | 0.000121               |
| 2.4           | 418.              | 0              | 0.000108          | 0.000099               |
| 3.6           | 418.              | 0              | 0.000122          | 0.000098               |
| 4.8           | 418.              | 0              | 0.000108          | 0.000114               |
| 5.9           | 418.              | 0              | 0.000094          | 0.000092               |
| 75.4          | 443.              | 0              | -0.000055         | -0.000060              |
| 76.6          | 443.              | 0              | -0.000041         | -0.000053              |
| 77.8          | 443.              | 0              | -0.000055         | -0.000068              |
| 78.9          | 443.              | 0              | -0.000027         | -0.000046              |
| 80.1          | 443.              | 0              | -0.000055         | -0.000060              |
| 218.9         | 431.              | 0              | -0.000174         | -0.000180              |
| 220.2         | 431.              | 0              | -0.000202         | -0.000186              |
| 221.3         | 431.              | 0              | -0.000216         | -0.000216              |
| 222.5         | 431.              | 0              | -0.000188         | -0.000194              |
| 223.7         | 431.              | 0              | -0.000188         | -0.000179              |
| 0.0           | 437.              | 0              | -0.000146         | -0.000143              |
| 1.2           | 437.              | 0              | -0.000160         | -0.000157              |
| 2.3           | 437.              | 0              | -0.000160         | -0.000165              |
| 3.5           | 437.              | 0              | -0.000132         | -0.000143              |
| 4.7           | 437.              | 0              | -0.000146         | -0.000135              |
| 5.9           | 437.              | 0              | -0.000132         | -0.000136              |
| 7.0           | 437.              | 0              | -0.000160         | -0.000157              |
| 8.2           | 437.              | 0              | -0.000146         | -0.000158              |
| 9.4           | 437.              | 0              | -0.000146         | -0.000135              |
| 10.5          | 437.              | 3.4            | -0.000033         | -0.000034              |
| 11.7          | 437.              | 12.3           | 0.000207          | 0.000199               |
| 12.9          | 437.              | 21.1           | 0.000446          | 0.000447               |
| 14.0          | 437.              | 29.1           | 0.000686          | 0.000679               |
| 15.2          | 437.              | 37.5           | 0.000940          | 0.000912               |
| 16.4          | 437.              | 45.6           | 0.001166          | 0.001160               |
| 17.5          | 437.              | 53.7           | 0.001433          | 0.001414               |
| 18.7          | 437.              | 61.3           | 0.001617          | 0.001589               |
| 19.9          | 437.              | 68.6           | 0.001885          | 0.001836               |
| 21.0          | 437.              | 75.4           | 0.002138          | 0.002098               |
| 21.7          | 437.              | 79.6           | 0.002350          | 0.002309               |
| 23.4          | 437.              | 89.5           | 0.002576          | 0.002520               |
| 24.5          | 437.              | 95.6           | 0.002773          | 0.002716               |
| 25.7          | 437.              | 102.7          | 0.003027          | 0.002963               |
| 26.9          | 437.              | 108.9          | 0.003252          | 0.003189               |
| 28.1          | 437.              | 115.4          | 0.003520          | 0.003451               |
| 29.2          | 437.              | 121.3          | 0.003746          | 0.003677               |
| 30.4          | 437.              | 127.3          | 0.004028          | 0.003961               |
| 31.6          | 437.              | 133.5          | 0.004352          | 0.004266               |
| 32.7          | 437.              | 139.2          | 0.004705          | 0.004608               |
| 33.9          | 437.              | 144.7          | 0.005156          | 0.005044               |
| 35.1          | 437.              | 149.7          | 0.005692          | 0.005560               |
| 36.2          | 437.              | 153.8          | 0.006397          | 0.006244               |
| 37.4          | 437.              | 158.0          | 0.007539          | 0.007319               |
| 38.6          | 437.              | 161.5          | 0.009301          | 0.008975               |
| 39.7          | 437.              | 163.8          | 0.011628          | 0.011312               |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

GAGE NO.

7

FIG. NO.

4

DATE

6 29 1

X (IN)

0.

Y (IN)

1.00

Z (IN)

ANGLE (DEG)

0.

| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
|---------------|-------------------|----------------|-------------------|------------------------|
| 0.0           | 407.              | 0              | 0.000264          | 0.                     |
| 1.3           | 407.              | 0              | 0.000293          | 0.                     |
| 2.4           | 407.              | 0              | 0.000308          | 0.                     |
| 3.6           | 407.              | 0              | 0.000308          | 0.                     |
| 4.8           | 407.              | 0              | 0.000322          | 0.                     |
| 5.9           | 407.              | 0              | 0.000322          | 0.                     |
| 75.4          | 445.              | 0              | -0.000050         | 0.                     |
| 76.6          | 445.              | 0              | -0.000080         | 0.                     |
| 77.8          | 445.              | 0              | -0.000080         | 0.                     |
| 78.9          | 445.              | 0              | -0.000050         | 0.                     |
| 80.1          | 445.              | 0              | -0.000080         | 0.                     |
| 218.9         | 443.              | 0              | -0.000355         | 0.                     |
| 220.2         | 443.              | 0              | -0.000340         | 0.                     |
| 221.3         | 443.              | 0              | -0.000355         | 0.                     |
| 222.5         | 443.              | 0              | -0.000370         | 0.                     |
| 223.7         | 443.              | 0              | -0.000325         | 0.                     |
| 0.0           | 447.              | 0              | -0.000260         | 0.                     |
| 1.2           | 447.              | 0              | -0.000305         | 0.                     |
| 2.3           | 447.              | 0              | -0.000275         | 0.                     |
| 3.5           | 447.              | 0              | -0.000275         | 0.                     |
| 4.7           | 447.              | 0              | -0.000275         | 0.                     |
| 5.9           | 447.              | 0              | -0.000275         | 0.                     |
| 7.0           | 447.              | 0              | -0.000290         | 0.                     |
| 8.2           | 447.              | 0              | -0.000275         | 0.                     |
| 9.4           | 447.              | 0              | -0.000260         | 0.                     |
| 10.5          | 447.              | 3.4            | -0.000155         | 0.                     |
| 11.7          | 447.              | 12.4           | 0.000085          | 0.                     |
| 12.9          | 447.              | 21.1           | 0.000310          | 0.                     |
| 14.0          | 447.              | 29.1           | 0.000580          | 0.                     |
| 15.2          | 447.              | 37.6           | 0.000820          | 0.                     |
| 16.4          | 447.              | 45.6           | 0.001060          | 0.                     |
| 17.5          | 447.              | 53.8           | 0.001315          | 0.                     |
| 18.7          | 447.              | 61.3           | 0.001540          | 0.                     |
| 19.9          | 447.              | 68.6           | 0.001765          | 0.                     |
| 21.0          | 447.              | 75.4           | 0.002005          | 0.                     |
| 21.7          | 447.              | 79.6           | 0.002245          | 0.                     |
| 23.4          | 447.              | 89.5           | 0.002470          | 0.                     |
| 24.5          | 447.              | 95.6           | 0.002635          | 0.                     |
| 25.7          | 447.              | 102.7          | 0.002935          | 0.                     |
| 26.9          | 447.              | 108.9          | 0.003145          | 0.                     |
| 28.1          | 447.              | 115.4          | 0.003400          | 0.                     |
| 29.2          | 447.              | 121.3          | 0.003670          | 0.                     |
| 30.4          | 447.              | 127.3          | 0.003910          | 0.                     |
| 31.6          | 447.              | 133.5          | 0.004255          | 0.                     |
| 32.7          | 447.              | 139.2          | 0.004585          | 0.                     |
| 33.9          | 447.              | 144.7          | 0.004990          | 0.                     |
| 35.1          | 447.              | 149.7          | 0.005485          | 0.                     |
| 36.2          | 447.              | 153.8          | 0.006160          | 0.                     |
| 37.4          | 447.              | 158.0          | 0.007150          | 0.                     |
| 38.6          | 447.              | 161.5          | 0.008725          | 0.                     |
| 39.7          | 447.              | 163.8          | 0.011110          | 0.                     |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

| GAGE NO. | FIG. NO. | DATE   |             |             |
|----------|----------|--------|-------------|-------------|
| 8        | 4        | 6 29 1 |             |             |
| X (IN)   | Y (IN)   | Z (IN) | ANGLE (DEG) |             |
| 0.       | 1.00     |        | 0.          |             |
| TIME     | TEMP.    | LOAD   | STRAIN      | AVE. STRAIN |
| (SEC)    | (DEG. F) | (KIPS) | (IN/IN)     | (IN/IN)     |
| 0.0      | 407.     | 0      | 0.000276    | 0.000270    |
| 1.3      | 407.     | 0      | 0.000276    | 0.000284    |
| 2.4      | 407.     | 0      | 0.000290    | 0.000299    |
| 3.6      | 407.     | 0      | 0.000304    | 0.000306    |
| 4.8      | 407.     | 0      | 0.000290    | 0.000306    |
| 5.9      | 407.     | 0      | 0.000290    | 0.000306    |
| 75.4     | 445.     | 0      | -0.000128   | -0.000089   |
| 76.6     | 445.     | 0      | -0.000113   | -0.000097   |
| 77.8     | 445.     | 0      | -0.000142   | -0.000111   |
| 78.9     | 445.     | 0      | -0.000128   | -0.000089   |
| 80.1     | 445.     | 0      | -0.000157   | -0.000118   |
| 218.9    | 443.     | 0      | -0.000403   | -0.000379   |
| 220.2    | 443.     | 0      | -0.000403   | -0.000372   |
| 221.3    | 443.     | 0      | -0.000403   | -0.000379   |
| 222.5    | 443.     | 0      | -0.000374   | -0.000372   |
| 223.7    | 443.     | 0      | -0.000403   | -0.000364   |
| 0.0      | 447.     | 0      | -0.000332   | -0.000296   |
| 1.2      | 447.     | 0      | -0.000332   | -0.000318   |
| 2.3      | 447.     | 0      | -0.000332   | -0.000303   |
| 3.5      | 447.     | 0      | -0.000332   | -0.000303   |
| 4.7      | 447.     | 0      | -0.000332   | -0.000303   |
| 5.9      | 447.     | 0      | -0.000332   | -0.000303   |
| 7.0      | 447.     | 0      | -0.000346   | -0.000318   |
| 8.2      | 447.     | 0      | -0.000317   | -0.000296   |
| 9.4      | 447.     | 0      | -0.000361   | -0.000310   |
| 10.5     | 447.     | 3.4    | -0.000215   | -0.000185   |
| 11.7     | 447.     | 12.4   | 0.000046    | 0.000066    |
| 12.9     | 447.     | 21.1   | 0.000279    | 0.000295    |
| 14.0     | 447.     | 29.1   | 0.000527    | 0.000553    |
| 15.2     | 447.     | 37.6   | 0.000730    | 0.000775    |
| 16.4     | 447.     | 45.6   | 0.001007    | 0.001033    |
| 17.5     | 447.     | 53.8   | 0.001269    | 0.001292    |
| 18.7     | 447.     | 61.4   | 0.001472    | 0.001506    |
| 19.9     | 447.     | 68.6   | 0.001705    | 0.001735    |
| 21.0     | 447.     | 75.4   | 0.001938    | 0.001971    |
| 21.7     | 447.     | 79.6   | 0.002171    | 0.002208    |
| 23.4     | 447.     | 89.5   | 0.002403    | 0.002437    |
| 24.5     | 447.     | 95.6   | 0.002593    | 0.002614    |
| 25.7     | 447.     | 102.7  | 0.002855    | 0.002895    |
| 26.9     | 447.     | 108.9  | 0.003087    | 0.003116    |
| 28.1     | 447.     | 115.4  | 0.003320    | 0.003360    |
| 29.2     | 447.     | 121.3  | 0.003567    | 0.003619    |
| 30.4     | 447.     | 127.3  | 0.003858    | 0.003884    |
| 31.6     | 447.     | 133.6  | 0.004120    | 0.004188    |
| 32.7     | 447.     | 139.2  | 0.004470    | 0.004527    |
| 33.9     | 447.     | 144.7  | 0.004892    | 0.004941    |
| 35.1     | 447.     | 149.7  | 0.005430    | 0.005457    |
| 36.2     | 447.     | 153.8  | 0.006070    | 0.006115    |
| 37.4     | 447.     | 158.0  | 0.007147    | 0.007148    |
| 38.6     | 447.     | 161.5  | 0.008747    | 0.008736    |
| 39.7     | 447.     | 163.8  | 0.011221    | 0.011165    |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

| GAGE NO.      |                   | FIG. NO.       |                   | DATE                   |  |
|---------------|-------------------|----------------|-------------------|------------------------|--|
| 9             |                   | 5              |                   | 6'29 1                 |  |
| X (IN)        | Y (IN)            | Z (IN)         |                   | ANGLE (DEG)            |  |
| 0.            | -1.00             |                |                   | 0.                     |  |
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |  |
| 0.0           | 410.              | 0              | 0.000258          | 0.                     |  |
| 1.3           | 410.              | 0              | 0.000273          | 0.                     |  |
| 2.4           | 410.              | 0              | 0.000258          | 0.                     |  |
| 3.6           | 410.              | 0              | 0.000287          | 0.                     |  |
| 4.8           | 410.              | 0              | 0.000258          | 0.                     |  |
| 5.9           | 410.              | 0              | 0.000258          | 0.                     |  |
| 75.4          | 445.              | 0              | -0.000101         | 0.                     |  |
| 76.6          | 445.              | 0              | -0.000072         | 0.                     |  |
| 77.8          | 445.              | 0              | -0.000086         | 0.                     |  |
| 78.9          | 445.              | 0              | -0.000057         | 0.                     |  |
| 80.1          | 445.              | 0              | -0.000072         | 0.                     |  |
| 218.9         | 441.              | 0              | -0.000349         | 0.                     |  |
| 220.2         | 441.              | 0              | -0.000349         | 0.                     |  |
| 221.3         | 441.              | 0              | -0.000349         | 0.                     |  |
| 222.5         | 441.              | 0              | -0.000364         | 0.                     |  |
| 223.7         | 441.              | 0              | -0.000349         | 0.                     |  |
| 0.0           | 444.              | 0              | -0.000262         | 0.                     |  |
| 1.2           | 444.              | 0              | -0.000247         | 0.                     |  |
| 2.3           | 444.              | 0              | -0.000262         | 0.                     |  |
| 3.5           | 444.              | 0              | -0.000262         | 0.                     |  |
| 4.7           | 444.              | 0              | -0.000276         | 0.                     |  |
| 5.9           | 444.              | 0              | -0.000276         | 0.                     |  |
| 7.0           | 444.              | 0              | -0.000262         | 0.                     |  |
| 8.2           | 444.              | 0              | -0.000276         | 0.                     |  |
| 9.4           | 444.              | 0              | -0.000247         | 0.                     |  |
| 10.5          | 444.              | 3.4            | -0.000159         | 0.                     |  |
| 11.7          | 444.              | 12.4           | 0.000074          | 0.                     |  |
| 12.9          | 444.              | 21.1           | 0.000308          | 0.                     |  |
| 14.0          | 444.              | 29.1           | 0.000571          | 0.                     |  |
| 15.2          | 444.              | 37.6           | 0.000790          | 0.                     |  |
| 16.4          | 444.              | 45.6           | 0.001038          | 0.                     |  |
| 17.5          | 444.              | 53.8           | 0.001271          | 0.                     |  |
| 18.7          | 444.              | 61.4           | 0.001490          | 0.                     |  |
| 19.9          | 444.              | 68.6           | 0.001709          | 0.                     |  |
| 21.0          | 444.              | 75.4           | 0.001958          | 0.                     |  |
| 21.7          | 444.              | 79.7           | 0.002191          | 0.                     |  |
| 23.4          | 444.              | 89.5           | 0.002425          | 0.                     |  |
| 24.5          | 444.              | 95.6           | 0.002629          | 0.                     |  |
| 25.7          | 444.              | 102.7          | 0.002863          | 0.                     |  |
| 26.9          | 444.              | 108.9          | 0.003082          | 0.                     |  |
| 28.1          | 444.              | 115.5          | 0.003330          | 0.                     |  |
| 29.2          | 444.              | 121.3          | 0.003564          | 0.                     |  |
| 30.4          | 444.              | 127.4          | 0.003856          | 0.                     |  |
| 31.6          | 444.              | 133.6          | 0.004162          | 0.                     |  |
| 32.7          | 444.              | 139.2          | 0.004469          | 0.                     |  |
| 33.9          | 444.              | 144.7          | 0.004878          | 0.                     |  |
| 35.1          | 444.              | 149.7          | 0.005359          | 0.                     |  |
| 36.2          | 444.              | 153.8          | 0.006075          | 0.                     |  |
| 37.4          | 444.              | 158.0          | 0.007082          | 0.                     |  |
| 38.6          | 444.              | 161.5          | 0.008717          | 0.                     |  |
| 39.7          | 444.              | 163.8          | 0.011170          | 0.                     |  |

| TABLE 1       |                   | EXPERIMENTAL STRAIN DATA |                   | TEST NO. 510 -095      |  |
|---------------|-------------------|--------------------------|-------------------|------------------------|--|
| GAGE NO.      |                   | FIG. NO.                 |                   | DATE                   |  |
| 10            |                   | 5                        |                   | 6 29 1                 |  |
| X (IN)        |                   | Y (IN)                   |                   | Z (IN)                 |  |
| 0.            |                   | -1.00                    |                   | 0.                     |  |
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS)           | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |  |
| 0.0           | 410.              | 0                        | 0.000276          | 0.000267               |  |
| 1.3           | 410.              | 0                        | 0.000291          | 0.000282               |  |
| 2.4           | 410.              | 0                        | 0.000276          | 0.000267               |  |
| 3.6           | 410.              | 0                        | 0.000276          | 0.000282               |  |
| 4.8           | 410.              | 0                        | 0.000305          | 0.000282               |  |
| 5.9           | 410.              | 0                        | 0.000276          | 0.000267               |  |
| 75.4          | 445.              | 0                        | -0.000088         | -0.000094              |  |
| 76.6          | 445.              | 0                        | -0.000102         | -0.000087              |  |
| 77.8          | 445.              | 0                        | -0.000116         | -0.000101              |  |
| 78.9          | 445.              | 0                        | -0.000102         | -0.000080              |  |
| 80.1          | 445.              | 0                        | -0.000102         | -0.000087              |  |
| 218.9         | 441.              | 0                        | -0.000371         | -0.000360              |  |
| 220.2         | 441.              | 0                        | -0.000342         | -0.000346              |  |
| 221.3         | 441.              | 0                        | -0.000357         | -0.000353              |  |
| 222.5         | 441.              | 0                        | -0.000357         | -0.000360              |  |
| 223.7         | 441.              | 0                        | -0.000357         | -0.000353              |  |
| 0.0           | 444.              | 0                        | -0.000333         | -0.000297              |  |
| 1.2           | 444.              | 0                        | -0.000319         | -0.000283              |  |
| 2.3           | 444.              | 0                        | -0.000319         | -0.000290              |  |
| 3.5           | 444.              | 0                        | -0.000290         | -0.000276              |  |
| 4.7           | 444.              | 0                        | -0.000319         | -0.000297              |  |
| 5.9           | 444.              | 0                        | -0.000304         | -0.00029.              |  |
| 7.0           | 444.              | 0                        | -0.000333         | -0.000297              |  |
| 8.2           | 444.              | 0                        | -0.000319         | -0.000297              |  |
| 9.4           | 444.              | 0                        | -0.000304         | -0.000276              |  |
| 10.5          | 444.              | 3.4                      | -0.000203         | -0.000181              |  |
| 11.7          | 444.              | 12.4                     | 0.000028          | 0.000051               |  |
| 12.9          | 444.              | 21.1                     | 0.000288          | 0.000298               |  |
| 14.0          | 444.              | 29.1                     | 0.000548          | 0.000559               |  |
| 15.2          | 444.              | 37.6                     | 0.000779          | 0.000784               |  |
| 16.4          | 444.              | 45.7                     | 0.000996          | 0.001017               |  |
| 17.5          | 444.              | 53.8                     | 0.001242          | 0.001257               |  |
| 18.7          | 444.              | 61.4                     | 0.001473          | 0.001482               |  |
| 19.9          | 444.              | 68.6                     | 0.001704          | 0.001707               |  |
| 21.0          | 444.              | 75.4                     | 0.001964          | 0.001961               |  |
| 21.7          | 444.              | 79.7                     | 0.002181          | 0.002186               |  |
| 23.4          | 444.              | 89.5                     | 0.002398          | 0.002411               |  |
| 24.5          | 444.              | 95.6                     | 0.002615          | 0.002622               |  |
| 25.7          | 444.              | 102.8                    | 0.002860          | 0.002861               |  |
| 26.9          | 444.              | 108.9                    | 0.003106          | 0.003094               |  |
| 28.1          | 444.              | 115.5                    | 0.003351          | 0.003341               |  |
| 29.2          | 444.              | 121.3                    | 0.003583          | 0.003573               |  |
| 30.4          | 444.              | 127.4                    | 0.003872          | 0.003864               |  |
| 31.6          | 444.              | 133.6                    | 0.004175          | 0.004169               |  |
| 32.7          | 444.              | 139.2                    | 0.004551          | 0.004510               |  |
| 33.9          | 444.              | 144.7                    | 0.004941          | 0.004909               |  |
| 35.1          | 444.              | 149.7                    | 0.005432          | 0.005396               |  |
| 36.2          | 444.              | 153.8                    | 0.006083          | 0.006079               |  |
| 37.4          | 444.              | 158.1                    | 0.007166          | 0.007124               |  |
| 38.6          | 444.              | 161.5                    | 0.008770          | 0.008744               |  |
| 39.7          | 444.              | 163.8                    | 0.011285          | 0.011227               |  |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

GAGE NO.  
11FIG. NO.  
6DATE  
6 29 1

| X (IN) | Y (IN) | Z (IN) | ANGLE (DEG) |
|--------|--------|--------|-------------|
| 0.     | -6.00  |        | 0.          |

| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
|---------------|-------------------|----------------|-------------------|------------------------|
| 0.0           | 444.              | 0              | -0.000245         | 0.                     |
| 1.3           | 444.              | 0              | -0.000215         | 0.                     |
| 2.4           | 444.              | 0              | -0.000215         | 0.                     |
| 3.6           | 444.              | 0              | -0.000274         | 0.                     |
| 4.8           | 444.              | 0              | -0.000245         | 0.                     |
| 5.9           | 444.              | 0              | -0.000215         | 0.                     |
| 75.4          | 442.              | 0              | -0.000020         | 0.                     |
| 76.6          | 442.              | 0              | -0.000020         | 0.                     |
| 77.8          | 442.              | 0              | 0.000010          | 0.                     |
| 78.9          | 442.              | 0              | -0.000005         | 0.                     |
| 80.1          | 442.              | 0              | 0.000025          | 0.                     |
| 218.9         | 395.              | 0              | 0.000370          | 0.                     |
| 220.2         | 395.              | 0              | 0.000355          | 0.                     |
| 221.3         | 395.              | 0              | 0.000400          | 0.                     |
| 222.5         | 395.              | 0              | 0.000355          | 0.                     |
| 223.7         | 395.              | 0              | 0.000355          | 0.                     |
| 0.0           | 397.              | 0              | 0.000400          | 0.                     |
| 1.2           | 397.              | 0              | 0.000400          | 0.                     |
| 2.3           | 397.              | 0              | 0.000445          | 0.                     |
| 3.5           | 397.              | 0              | 0.000400          | 0.                     |
| 4.7           | 397.              | 0              | 0.000400          | 0.                     |
| 5.9           | 397.              | 0              | 0.000430          | 0.                     |
| 7.0           | 397.              | 0              | 0.000430          | 0.                     |
| 8.2           | 397.              | 0              | 0.000430          | 0.                     |
| 9.4           | 397.              | 0              | 0.000445          | 0.                     |
| 10.5          | 397.              | 3.4            | 0.000549          | 0.                     |
| 11.7          | 397.              | 12.4           | 0.000771          | 0.                     |
| 12.9          | 397.              | 21.1           | 0.000994          | 0.                     |
| 14.0          | 397.              | 29.1           | 0.001261          | 0.                     |
| 15.2          | 397.              | 37.6           | 0.001469          | 0.                     |
| 16.4          | 397.              | 45.7           | 0.001737          | 0.                     |
| 17.5          | 397.              | 53.8           | 0.001974          | 0.                     |
| 18.7          | 397.              | 61.4           | 0.002212          | 0.                     |
| 19.9          | 397.              | 68.6           | 0.002464          | 0.                     |
| 21.0          | 397.              | 75.4           | 0.002672          | 0.                     |
| 21.7          | 397.              | 79.7           | 0.002910          | 0.                     |
| 23.4          | 397.              | 89.6           | 0.003132          | 0.                     |
| 24.5          | 397.              | 95.6           | 0.003325          | 0.                     |
| 25.7          | 397.              | 102.8          | 0.003578          | 0.                     |
| 26.9          | 397.              | 108.9          | 0.003771          | 0.                     |
| 28.1          | 397.              | 115.5          | 0.004083          | 0.                     |
| 29.2          | 397.              | 121.3          | 0.004320          | 0.                     |
| 30.4          | 397.              | 127.4          | 0.004617          | 0.                     |
| 31.6          | 397.              | 133.6          | 0.004929          | 0.                     |
| 32.7          | 397.              | 139.2          | 0.005286          | 0.                     |
| 33.9          | 397.              | 144.7          | 0.005701          | 0.                     |
| 35.1          | 397.              | 149.8          | 0.006221          | 0.                     |
| 36.2          | 397.              | 153.8          | 0.006910          | 0.                     |
| 37.4          | 397.              | 158.1          | 0.007855          | 0.                     |
| 38.6          | 397.              | 161.5          | 0.009117          | 0.                     |
| 39.7          | 397.              | 163.8          | 0.010765          | 0.                     |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

GAGE NO.  
12FIG. NO.  
6DATE  
6 29 1X (IN)  
0.Y (IN)  
-6.00

Z (IN)

ANGLE (DEG)  
0.

| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
|---------------|-------------------|----------------|-------------------|------------------------|
| 0.0           | 444.              | 0              | -0.000257         | -0.000251              |
| 1.3           | 444.              | 0              | -0.000257         | -0.000236              |
| 2.4           | 444.              | 0              | -0.000286         | -0.000250              |
| 3.6           | 444.              | 0              | -0.000271         | -0.000273              |
| 4.8           | 444.              | 0              | -0.000271         | -0.000258              |
| 5.9           | 444.              | 0              | -0.000257         | -0.000236              |
| 75.4          | 442.              | 0              | -0.000173         | -0.000096              |
| 76.6          | 442.              | 0              | -0.000173         | -0.000096              |
| 77.8          | 442.              | 0              | -0.000173         | -0.000081              |
| 78.9          | 442.              | 0              | -0.000173         | -0.000089              |
| 80.1          | 442.              | 0              | -0.000173         | -0.000074              |
| 218.9         | 395.              | 0              | 0.000352          | 0.000361               |
| 220.2         | 395.              | 0              | 0.000380          | 0.000368               |
| 221.3         | 395.              | 0              | 0.000366          | 0.000383               |
| 222.5         | 395.              | 0              | 0.000338          | 0.000347               |
| 223.7         | 395.              | 0              | 0.000366          | 0.000361               |
| 0.0           | 397.              | 0              | 0.000394          | 0.000397               |
| 1.2           | 397.              | 0              | 0.000409          | 0.000404               |
| 2.3           | 397.              | 0              | 0.000409          | 0.000427               |
| 3.5           | 397.              | 0              | 0.000409          | 0.000404               |
| 4.7           | 397.              | 0              | 0.000394          | 0.000397               |
| 5.9           | 397.              | 0              | 0.000394          | 0.000412               |
| 7.0           | 397.              | 0              | 0.000409          | 0.000419               |
| 8.2           | 397.              | 0              | 0.000394          | 0.000412               |
| 9.4           | 397.              | 0              | 0.000394          | 0.000420               |
| 10.5          | 397.              | 3.5            | 0.000493          | 0.000521               |
| 11.7          | 397.              | 12.4           | 0.000719          | 0.000745               |
| 12.9          | 397.              | 21.1           | 0.000973          | 0.000983               |
| 14.0          | 397.              | 29.2           | 0.001184          | 0.001223               |
| 15.2          | 397.              | 37.6           | 0.001424          | 0.001447               |
| 16.4          | 397.              | 45.7           | 0.001678          | 0.001707               |
| 17.5          | 397.              | 53.8           | 0.001931          | 0.001953               |
| 18.7          | 397.              | 61.4           | 0.002129          | 0.002170               |
| 19.9          | 397.              | 68.6           | 0.002383          | 0.002423               |
| 21.0          | 397.              | 75.4           | 0.002608          | 0.002640               |
| 21.7          | 397.              | 79.7           | 0.002806          | 0.002858               |
| 23.4          | 397.              | 89.6           | 0.003031          | 0.003082               |
| 24.5          | 397.              | 95.7           | 0.003229          | 0.003277               |
| 25.7          | 397.              | 102.8          | 0.003468          | 0.003523               |
| 26.9          | 397.              | 108.9          | 0.003680          | 0.003725               |
| 28.1          | 397.              | 115.5          | 0.003919          | 0.004001               |
| 29.2          | 397.              | 121.3          | 0.004201          | 0.004261               |
| 30.4          | 397.              | 127.4          | 0.004483          | 0.004550               |
| 31.6          | 397.              | 133.6          | 0.004751          | 0.004840               |
| 32.7          | 397.              | 139.2          | 0.005118          | 0.005202               |
| 33.9          | 397.              | 144.7          | 0.005527          | 0.005614               |
| 35.1          | 397.              | 149.8          | 0.006063          | 0.006142               |
| 36.2          | 397.              | 153.8          | 0.006683          | 0.006801               |
| 37.4          | 397.              | 158.1          | 0.007628          | 0.007741               |
| 38.6          | 397.              | 161.5          | 0.008854          | 0.008986               |
| 39.7          | 397.              | 163.8          | 0.010504          | 0.010635               |

TABLE 1

## EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

GAGE NO.

13

FIG. NO.

7

DATE

6 29 1

X (IN)

9.00

Y (IN)

6.00

Z (IN)

ANGLE (DEG)

0.

| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
|---------------|-------------------|----------------|-------------------|------------------------|
| 0.0           | 389.              | 0              | -0.000361         | 0.                     |
| 1.3           | 389.              | 0              | -0.000331         | 0.                     |
| 2.4           | 389.              | 0              | -0.000391         | 0.                     |
| 3.6           | 389.              | 0              | -0.000361         | 0.                     |
| 4.8           | 389.              | 0              | -0.000376         | 0.                     |
| 5.9           | 389.              | 0              | -0.000346         | 0.                     |
| 75.4          | 397.              | 0              | -0.000104         | 0.                     |
| 76.6          | 397.              | 0              | -0.000089         | 0.                     |
| 77.8          | 397.              | 0              | -0.000089         | 0.                     |
| 78.9          | 397.              | 0              | -0.000059         | 0.                     |
| 80.1          | 397.              | 0              | -0.000089         | 0.                     |
| 218.9         | 363.              | 0              | 0.000239          | 0.                     |
| 220.2         | 363.              | 0              | 0.000254          | 0.                     |
| 221.3         | 363.              | 0              | 0.000254          | 0.                     |
| 222.5         | 363.              | 0              | 0.000254          | 0.                     |
| 223.7         | 363.              | 0              | 0.000254          | 0.                     |
| 0.0           | 364.              | 0              | 0.000239          | 0.                     |
| 1.2           | 364.              | 0              | 0.000209          | 0.                     |
| 2.3           | 364.              | 0              | 0.000239          | 0.                     |
| 3.5           | 364.              | 0              | 0.000224          | 0.                     |
| 4.7           | 364.              | 0              | 0.000224          | 0.                     |
| 5.9           | 364.              | 0              | 0.000224          | 0.                     |
| 7.0           | 364.              | 0              | 0.000224          | 0.                     |
| 8.2           | 364.              | 0              | 0.000224          | 0.                     |
| 9.4           | 364.              | 0              | 0.000224          | 0.                     |
| 10.5          | 364.              | 3.5            | 0.000298          | 0.                     |
| 11.7          | 364.              | 12.5           | 0.000538          | 0.                     |
| 12.9          | 364.              | 21.2           | 0.000807          | 0.                     |
| 14.0          | 364.              | 29.2           | 0.001031          | 0.                     |
| 15.2          | 364.              | 37.6           | 0.001285          | 0.                     |
| 16.4          | 364.              | 45.7           | 0.001464          | 0.                     |
| 17.5          | 364.              | 53.9           | 0.001734          | 0.                     |
| 18.7          | 364.              | 61.4           | 0.001913          | 0.                     |
| 19.9          | 364.              | 68.7           | 0.002167          | 0.                     |
| 21.0          | 364.              | 75.5           | 0.002361          | 0.                     |
| 21.7          | 364.              | 79.7           | 0.002556          | 0.                     |
| 23.4          | 364.              | 89.6           | 0.002735          | 0.                     |
| 24.5          | 364.              | 95.7           | 0.002959          | 0.                     |
| 25.7          | 364.              | 102.8          | 0.003169          | 0.                     |
| 26.9          | 364.              | 108.9          | 0.003333          | 0.                     |
| 28.1          | 364.              | 115.5          | 0.003543          | 0.                     |
| 29.2          | 364.              | 121.3          | 0.003737          | 0.                     |
| 30.4          | 364.              | 127.4          | 0.003916          | 0.                     |
| 31.6          | 364.              | 133.6          | 0.004096          | 0.                     |
| 32.7          | 364.              | 139.2          | 0.004320          | 0.                     |
| 33.9          | 364.              | 144.7          | 0.004529          | 0.                     |
| 35.1          | 364.              | 149.8          | 0.004709          | 0.                     |
| 36.2          | 364.              | 153.8          | 0.004903          | 0.                     |
| 37.4          | 364.              | 158.1          | 0.005127          | 0.                     |
| 38.6          | 364.              | 161.6          | 0.005322          | 0.                     |
| 39.7          | 364.              | 163.8          | 0.005561          | 0.                     |

TABLE 1      EXPERIMENTAL STRAIN DATA      TEST NO. 510 -095

| GAGE NO.      | FIG. NO.          | DATE           |                   |                        |
|---------------|-------------------|----------------|-------------------|------------------------|
| 14            | 7                 | 6 29 1         |                   |                        |
| X (IN)        | Y (IN)            | Z (IN)         | ANGLE (DEG)       |                        |
| 9.00          | 6.00              |                | 0.                |                        |
| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
| 0.0           | 389.              | 0              | -0.000357         | -0.000359              |
| 1.3           | 389.              | 0              | -0.000342         | -0.000336              |
| 2.4           | 389.              | 0              | -0.000388         | -0.000389              |
| 3.6           | 389.              | 0              | -0.000372         | -0.000367              |
| 4.8           | 389.              | 0              | -0.000342         | -0.000359              |
| 5.9           | 389.              | 0              | -0.000372         | -0.000359              |
| 75.4          | 397.              | 0              | -0.000018         | -0.000061              |
| 76.6          | 397.              | 0              | -0.000018         | -0.000054              |
| 77.8          | 397.              | 0              | -0.000018         | -0.000054              |
| 78.9          | 397.              | 0              | -0.000003         | -0.000031              |
| 80.1          | 397.              | 0              | -0.000018         | -0.000054              |
| 218.9         | 363.              | 0              | 0.000243          | 0.000241               |
| 220.2         | 363.              | 0              | 0.000258          | 0.000256               |
| 221.3         | 363.              | 0              | 0.000258          | 0.000256               |
| 222.5         | 363.              | 0              | 0.000274          | 0.000264               |
| 223.7         | 363.              | 0              | 0.000274          | 0.000264               |
| 0.0           | 364.              | 0              | 0.000258          | 0.000249               |
| 1.2           | 364.              | 0              | 0.000243          | 0.000226               |
| 2.3           | 364.              | 0              | 0.000243          | 0.000241               |
| 3.5           | 364.              | 0              | 0.000258          | 0.000241               |
| 4.7           | 364.              | 0              | 0.000274          | 0.000249               |
| 5.9           | 364.              | 0              | 0.000258          | 0.000241               |
| 7.0           | 364.              | 0              | 0.000243          | 0.000233               |
| 8.2           | 364.              | 0              | 0.000258          | 0.000241               |
| 9.4           | 364.              | 0              | 0.000258          | 0.000241               |
| 10.5          | 364.              | 3.5            | 0.000380          | 0.000339               |
| 11.7          | 364.              | 12.5           | 0.000609          | 0.000573               |
| 12.9          | 364.              | 21.2           | 0.000868          | 0.000838               |
| 14.0          | 364.              | 29.2           | 0.001097          | 0.001064               |
| 15.2          | 364.              | 37.6           | 0.001326          | 0.001306               |
| 16.4          | 364.              | 45.7           | 0.001570          | 0.001517               |
| 17.5          | 364.              | 53.9           | 0.001814          | 0.001774               |
| 18.7          | 364.              | 61.4           | 0.001997          | 0.001955               |
| 19.9          | 364.              | 68.7           | 0.002271          | 0.002219               |
| 21.0          | 364.              | 75.5           | 0.002470          | 0.002416               |
| 21.7          | 364.              | 79.7           | 0.002668          | 0.002612               |
| 23.4          | 364.              | 89.6           | 0.002866          | 0.002801               |
| 24.5          | 364.              | 95.7           | 0.003080          | 0.003020               |
| 25.7          | 364.              | 102.8          | 0.003247          | 0.003208               |
| 26.9          | 364.              | 108.9          | 0.003446          | 0.003389               |
| 28.1          | 364.              | 115.5          | 0.003629          | 0.003586               |
| 29.2          | 364.              | 121.4          | 0.003827          | 0.003782               |
| 30.4          | 364.              | 127.4          | 0.004040          | 0.003978               |
| 31.6          | 364.              | 133.6          | 0.004208          | 0.004152               |
| 32.7          | 364.              | 139.2          | 0.004422          | 0.004371               |
| 33.9          | 364.              | 144.7          | 0.004605          | 0.004567               |
| 35.1          | 364.              | 149.8          | 0.004788          | 0.004748               |
| 36.2          | 364.              | 153.8          | 0.005016          | 0.004960               |
| 37.4          | 364.              | 158.1          | 0.005245          | 0.005186               |
| 38.6          | 364.              | 161.6          | 0.005428          | 0.005375               |
| 39.7          | 364.              | 163.9          | 0.005457          | 0.005609               |

TABLE 1 EXPERIMENTAL STRAIN DATA

TEST NO. 510 -095

| GAGE NO. | FIG. NO. | DATE   |
|----------|----------|--------|
| 15       | 8        | 6 29 1 |

| X (IN) | Y (IN) | Z (IN) | ANGLE (DEG) |
|--------|--------|--------|-------------|
| 9.00   | 4.50   |        | 0.          |

| TIME<br>(SEC) | TEMP.<br>(DEG. F) | LOAD<br>(KIPS) | STRAIN<br>(IN/IN) | AVE. STRAIN<br>(IN/IN) |
|---------------|-------------------|----------------|-------------------|------------------------|
| 0.0           | 374.              | 0              | -0.000111         | 0.                     |
| 1.3           | 374.              | 0              | -0.000097         | 0.                     |
| 2.4           | 374.              | 0              | -0.000111         | 0.                     |
| 3.6           | 374.              | 0              | -0.000111         | 0.                     |
| 4.8           | 374.              | 0              | -0.000097         | 0.                     |
| 5.9           | 374.              | 0              | -0.000097         | 0.                     |
| 75.4          | 393.              | 0              | -0.000045         | 0.                     |
| 76.6          | 393.              | 0              | -0.000016         | 0.                     |
| 77.8          | 393.              | 0              | -0.000030         | 0.                     |
| 78.9          | 393.              | 0              | -0.000016         | 0.                     |
| 80.1          | 393.              | 0              | -0.000016         | 0.                     |
| 218.9         | 368.              | 0              | 0.000117          | 0.                     |
| 220.2         | 368.              | 0              | 0.000146          | 0.                     |
| 221.3         | 368.              | 0              | 0.000160          | 0.                     |
| 222.5         | 368.              | 0              | 0.000146          | 0.                     |
| 223.7         | 368.              | 0              | 0.000132          | 0.                     |
| 0.0           | 370.              | 0              | 0.000132          | 0.                     |
| 1.2           | 370.              | 0              | 0.000132          | 0.                     |
| 2.3           | 370.              | 0              | 0.000117          | 0.                     |
| 3.5           | 370.              | 0              | 0.000146          | 0.                     |
| 4.7           | 370.              | 0              | 0.000132          | 0.                     |
| 5.9           | 370.              | 0              | 0.000132          | 0.                     |
| 7.0           | 370.              | 0              | 0.000146          | 0.                     |
| 8.2           | 370.              | 0              | 0.000117          | 0.                     |
| 9.4           | 370.              | 0              | 0.000132          | 0.                     |
| 10.5          | 370.              | 3.5            | 0.000217          | 0.                     |
| 11.7          | 370.              | 12.5           | 0.000432          | 0.                     |
| 12.9          | 370.              | 21.2           | 0.000675          | 0.                     |
| 14.0          | 370.              | 29.2           | 0.000904          | 0.                     |
| 15.2          | 370.              | 37.7           | 0.001147          | 0.                     |
| 16.4          | 370.              | 45.7           | 0.001376          | 0.                     |
| 17.5          | 370.              | 53.9           | 0.001590          | 0.                     |
| 18.7          | 370.              | 61.4           | 0.001790          | 0.                     |
| 19.9          | 370.              | 68.7           | 0.002019          | 0.                     |
| 21.0          | 370.              | 75.5           | 0.002234          | 0.                     |
| 21.7          | 370.              | 79.7           | 0.002420          | 0.                     |
| 23.4          | 370.              | 89.6           | 0.002620          | 0.                     |
| 24.5          | 370.              | 95.7           | 0.002820          | 0.                     |
| 25.7          | 370.              | 102.8          | 0.003020          | 0.                     |
| 26.9          | 370.              | 108.9          | 0.003192          | 0.                     |
| 28.1          | 370.              | 115.5          | 0.003392          | 0.                     |
| 29.2          | 370.              | 121.4          | 0.003564          | 0.                     |
| 30.4          | 370.              | 127.4          | 0.003778          | 0.                     |
| 31.6          | 370.              | 133.6          | 0.003978          | 0.                     |
| 32.7          | 370.              | 139.3          | 0.004150          | 0.                     |
| 33.9          | 370.              | 144.7          | 0.004364          | 0.                     |
| 35.1          | 370.              | 149.8          | 0.004507          | 0.                     |
| 36.2          | 370.              | 153.9          | 0.004736          | 0.                     |
| 37.4          | 370.              | 158.1          | 0.004922          | 0.                     |
| 38.6          | 370.              | 161.6          | 0.005108          | 0.                     |
| 39.7          | 370.              | 163.9          | 0.005280          | 0.                     |