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C 2 SUPPORT SYSTEM TESTS

COMPUTER PROGRAM TO REDUCE AND PLOT
 STATIC STRAIN GAGE DATA

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1. INTRODUCTION

The primary objective of the C2 tests for the NRX-A reactor support system is to survey the capabilities of the structure. This will be achieved by subjecting the support system to four major tests:

1. Imploding Pressure
2. Axial Load
3. Lateral Load
4. Thermal Gradient.

The instrumentation on these tests will consist of thermocouples, strain gages, deflection gages and pressure gages. The reduced data from the instrumentation will be stress vs. load, stress vs. radius, principle stresses vs. load, direction of principle stress vs. load, deflection vs. load and stress vs. temperature gradient.

The reduced data of stress levels and deflections will be used to evaluate the present system at design loads and will assist in defining its capabilities. The data will also be used to confirm analytical design parameters and it may also show that weight and cost savings may be realized through design modifications. A complete description of the C2 tests is given in WANL-TME-633.

The computer program described in this report is primarily concerned with reducing strain gage data taken from the axial load tests at room temperature. Additional modifications in the program will be made to eliminate the limitation of room temperature calculations and a modification will be made to fit the plotted data points with a smooth curve.

2. PROGRAM DESCRIPTION

This program is written in Fortran II for the IBM 7094 digital computer and for the General Dynamics SC 4020 cathode ray plotter. The data reduction involves calculating stress from single, right angle and rosette strain gages. The stress calculations for each gage take into account temperature variations in gage factors, apparent strain and modulus of elasticity.

The information that is processed by this program comes directly from the test in the form of multichannel printed tapes. An example of this tape is shown in Figure 1. The data from these printed tapes are keypunched onto cards along with the other required input quantities, and from these data the various types of stresses are calculated. By using the appropriate input and output quantities, graphs are then labeled and plotted via the SC 4020 onto 35 MM film. Included in the program is the facility to plot percent load versus deflection. There are no calculations involved in this routine.

2.1 INPUT

The following list of input is required in order to run the computer program:

1. Strain gage identifications.
2. Strain readings versus recorder channel as a function of load.
3. Number of strain gages used.
4. Gage factors of each gage at the test temperature.
5. Gage factor for the recording instrument.
6. Percent load for each load increment.
7. Temperature at each load increment.

In addition to the above input, deflection readings versus load may be entered into the computer program.

Figure 1

2.2 EQUATIONS

1. Modulus of elasticity for 2219 aluminum (E_{AL}) as a function of temperature in degrees Fahrenheit. Temperature range -400°F. to $+200^{\circ}\text{F.}$ ¹

$$E_{AL} = [10.7055 - 2.7302t(10^{-3}) + 4.0080t^2(10^{-6}) + 4.8810t^3(10^{-9})](10^6).$$

2. Modulus of elasticity for titanium (E_{TI}) as a function of temperature in degrees Fahrenheit. Temperature range -400°F. to $+200^{\circ}\text{F.}$ ¹

$$E_{TI} = [16.3515 - 5.4398t(10^{-3}) - 4.0937t^2(10^{-6}) + 1.2603t^3(10^{-8})](10^6).$$

3. Strain correction.²

$$\epsilon_t = \frac{K}{K_t} (\epsilon_t' - \epsilon_{At})$$

where ϵ_t = temperature corrected strain

K = recording gage factor

K_t = gage factor of individual gage at test temperature

ϵ_t' = recorded strain

ϵ_{At} = apparent strain at test temperature.

4. Single gage stress.³

$$\sigma_s = E \epsilon_t \quad \text{where } \epsilon_t = \text{temperature corrected strain} \\ \text{and } E = \text{modulus of elasticity.}$$

5. Right angle gage stresses (all strains are temperature corrected).³

$$\sigma_{\max} = \frac{E}{1-\mu^2} (\epsilon_1 + \mu \epsilon_3)$$

$$\sigma_{\min} = \frac{E}{1-\mu^2} (\epsilon_3 + \mu \epsilon_1)$$

where μ (Poisson's ratio) = .3

ϵ_1 = axial or radial strain

ϵ_3 = tangential strain.

6. Rosette gage stresses (all strains are temperature corrected).

$$\epsilon_A = \frac{1}{2}(\epsilon_1 + \epsilon_3)$$

$$\epsilon_B = \sqrt{(\epsilon_1 - \epsilon_A)^2 + (\epsilon_2 - \epsilon_A)^2}$$

$$\sigma_A = \frac{\epsilon_A^{(E)}}{1-\mu} \quad \sigma_B = \frac{\epsilon_B^{(E)}}{1+\mu}$$

For stress in tension

$$\sigma_{\max} = \sigma_A + \sigma_B \quad \sigma_{\min} = \sigma_A - \sigma_B$$

For stress in compression

$$\sigma_{\max} = \sigma_A - \sigma_B \quad \sigma_{\min} = \sigma_A + \sigma_B$$

Angle between $\sigma_{\max}$ and ϵ_1

$$\alpha = \frac{1}{2} \text{Arctan} \frac{\epsilon_2 - \epsilon_A}{\epsilon_1 - \epsilon_A}$$

where $\mu = .3$

ϵ_1 = axial or radial strain

ϵ_2 = strain at 45° from axial or radial

ϵ_3 = tangential strain.

2.3 PRINTED OUTPUT

Appendix B of this report illustrates each type of computer output.

The first page of output contains the title of the run, total number of strain gages and the recording gage factor. The complete list of strain gage identifications and strain gage factors are printed next. After this list is printed, the recorded strains are printed out for each load increment. In addition to the recorded strain, the corrected strains are printed for right angle and rosette gages. These corrected strains are printed two on a line for right angle gages and three on a line for rosette gages. Before the right angle and rosette corrected strains are printed, they are sorted

according to their direction and are then printed in the proper sequence. This type of output continues until all of the load increments have been printed. Following the recorded strains are the calculated stresses for single, right angle and rosette gages.

When plotting is requested, the printed output will include sheets labeled "SC-4020 Arguments". The important point to check in this section of output is "IERR FROM APL0TV". Successful plots are indicated whenever $IERR = 0$. When $IERR$ is non-zero, it is the number of data points that have not been plotted. When this occurs, the input to the program should be checked for errors. Each graph is checked by the program to insure that all of the points will appear on each graph.

The next section of printed output contains the deflection gage readings and the error indicator ($IERR$) for the deflection plots. This error indicator should also be checked to insure that all deflection gages have been plotted.

2.4 PLOTTED OUTPUT

In addition to the regular printed output, the program also generates data to produce plotted curves. During the 7094 computer run the plotted output is written onto magnetic tape (tape unit B6), and when the computer run is completed, this magnetic tape becomes the input tape to the SC 4020 plotter. The graphs shown in Figures 2 through 8 were produced by the SC 4020 plotter. In the plotting program the maximum and minimum of both the ordinate and abscissa are calculated from the input data, and from these values the complete grid with labels is plotted. The data points are then plotted on the graphs and vectors are drawn through these points to complete the graph. Figures 2 through 4 illustrate what can happen when there are not enough data

SUPPORT SYSTEM TEST 403 AMB. TEMP. 0-100 PERCENT AFT AXIAL LOAD 12-18-63
 LOAD VS. STRESS FOR SINGLE GAGES
 CHANNEL 1 GAGE 21151A

PAGE
 001 001

Figure 2

SUPPORT SYSTEM TEST 403 AMB. TEMP. 0-100 PERCENT AFT AXIAL LOAD 12-16-63
 LOAD VS. STRESS FOR RIGHT ANGLE GAGES
 CHANNELS 1 2 GAGES 21151A 23151A

PAGE
 049 049

Figure 3

SUPPORT SYSTEM TEST 402 AMB. TEMP. @ 100 PERCENT AFT AXIAL LOAD 12-14-63
 LOAD VS. STRESS FOR ROSETTE GAGES
 CHANNELS 23 24 25 GAGES 31236 32236 33236

PAGE
 171 17

Figure 4

SUPPORT SYSTEM TEST 401 AMB. TEMP. 0-100 PERCENT AFT AXIAL LOAD 12-12-63
 LOAD VS. STRESS FOR SINGLE GAGES
 CHANNEL 1 GAGE 10194A

PAGE
 006 001

Figure 5

SUPPORT SYSTEM TEST 401 AMB TEMP 0 100 PERCENT AFT AXIAL LOAD 12 12 63
 LOAD VS. DEFLECTION
 GAGE NUMBER 1 ZR

PAGE
 004 00

Figure 6

RUN 1 TEST NO217 REFLECTOR SUPPORT 12 CHANNEL-21LOADS 11-25-63
 LOAD VS. STRESS FOR SINGLE GAGES
 CHANNEL 1 GAGE NO. 10101 DEGREE = 3

PAGE L
 001 001

Figure 7

RUN 1 TEST NO217 REFLECTOR SUPPORT 12 CHANNEL-21LOADS 11-25-63
 LOAD VS. STRESS FOR SINGLE GAGES
 CHANNEL 1 GAGE NO. 10101 DEGREE - 0

PAGE L
 007 007

Figure 8

points to approximate a smooth curve. In order for a reasonably smooth curve to be drawn, there should be data points at approximately 2% to 5% load increments.

A plotting routine has been written to illustrate how test data can be fitted with a smooth curve. Figures 7 and 8 show the results of how a polynomial regression subroutine can be used to plot the best fit through the data points. Figure 7 illustrates a third degree polynomial; Figure 8 illustrates a ninth degree polynomial. This modification in the strain gage plotting program can be made if necessary.

2.5 LIMITATIONS

1. The strain gages must be mounted on either aluminum or titanium. Built into the program is the ability to calculate the modulus of elasticity as a function of temperature for aluminum and titanium.

2. At present the program can be run at room temperature only because C_{At} in equation 2.2-3 is set to zero. A later modification will remove this limitation.

3. In a given case the maximum number of load increments that can be handled by this program is 100 and the maximum number of strain gages is 50. However, this does not limit the number of cases that may be run in succession.

4. When right angle or rosette gages are used, they must be connected in sets using adjacent channels on the recorder. If the sets are broken up, the strain gage must be processed as a single gage.

5. Each strain gage must have a reading for every load increment. If a gage is lost during the test, the recorded values for the lost gage should be changed to zero. This will indicate in the reduced data that the gage was inoperative.

6. When deflection plots are requested, the number of deflection readings must be equal to the number of load readings taken.

7. Due to the limitation on the number of printed copies that can be produced on a roll of SC 4020 photocopy paper, the maximum number of graphs that can be processed in a given computer run is limited to 350.

3. CARD INPUT

The input for the strain gage program is described for one complete set of input cards. Additional cases may be stacked one after the other for as many cases as are needed to complete the computer run. Most of the lists described for this program have a variable number of input elements. Within each list, all elements are entered side by side according to its format, and extended onto as many cards as are necessary to complete the list. Anything remaining on a card after the list is satisfied, is ignored, and the next list is started on a new card. To clarify the input requirements a complete listing of input cards is included in this section.

In addition to the data cards, the following information must be transmitted to the digital computer facility:

1. The plotted output from this program is stored on tape unit B6. This tape should be saved and registered to the person running the problem. If this tape is to be plotted on the SC 4020, this instruction should be given to the operator.

2. The SC 4020 service bureau at Washington, D.C. must know the number of end of files on the tape and the total number of graphs between each end of file. This information can be determined from the printed output. An end of file is written on tape unit B6 after each case has been completed. When deflection readings are run through the program, this constitutes a new case.

CARD INPUT DESCRIPTION

<u>LIST</u>	<u>COLUMN</u>	<u>DESCRIPTION</u>	<u>FORMAT</u>
1	1-72	TITLE - Any alphanumeric data starting in column 1.	12A6
2	1-12	Recording gage factor.	E12.7
	17-18	Number of strain gages (50 max.)	I2
	24	Plot control - zero to plot, 1 not to plot.	I1
	28-30	Number of deflection gages.	I3
3	1-72	Strain gage factor of each gage at the test temperature - 6 factors to a card, use as many cards as necessary to complete the list.	6E12.7
4	1-72	Gage identification - 9 to a card. (see note 1)	9(2I1,A3, A1,2X)
5	1-12	Percent load.	E12.7
	13-14	Temperature in degrees F.	E12.7
	30	1 is to be punched in the last percent load card of a given case. (see note 2)	I1
6	1-72	Channel number and recorded strain - 9 to a card. (see note 2)	9(I2,F3.0, A1,I1,1X)
7	1-6	Deflection gage identification - any 6 alphanumeric characters. (see note 3)	A6
8	1-72	Deflection readings - 6 to a card. (see note 3)	6E12.7

Notes:

1. The system for strain gage identification has been established as follows:

2. The strain gage readings are to be keypunched directly from the printed tapes (Figure 1) that are supplied from the multichannel strain recorders. Each load increment and temperature should be marked on the printed tape. The load and temperature (punched according to list 5) followed by the channel numbers and recorded strains (punched according to list 6) are to be punched for all the load increments. The channel numbers are to be punched in ascending order until the next load increment is encountered. The last load that is keypunched for a given case should contain a 1 in column 30.

3. The deflection gage identification (punched according to list 6) followed by the deflection readings (punched according to list 7) must be punched for as many deflection gages or entered on list 2, columns 28-30.

LISTING OF THE
INPUT CARDS

List 1	SUPPORT SYSTEM TEST 403 AMB. TEMP. 0-100 PERCENT AFT AXIAL LOAD 12-16-63								1	
List 2	2.17	44	0	22					2	
List 3	2.28	2.28	2.28	2.28	2.20	2.20			3A	
	2.20	2.20	2.20	2.20	2.20	2.20			3B	
	2.20	2.20	2.20	2.20	2.20	2.20			3C	
	2.20	2.20	2.20	2.20	2.20	2.20			3D	
	2.20	2.20	2.14	2.14	2.14	2.14			3E	
	2.14	2.14	2.14	2.14	2.14	2.14			3F	
	2.14	2.14	2.14	2.20	2.20	2.17			3G	
	2.17	2.17							3H	
List 4	21151A	23151A	21153A	23153A	10155A	10156A	10158A	21159A	23159A	4A
	10162A	10163A	10164A	10165A	10166A	10178A	10179A	10180A	10181A	4B
	10183A	10184A	10185A	10186A	10188A	10192A	10198A	10200A	31211	4C
	32211	33211	21121	23121	21128	23128	21136	23136	21141	4D
	23141	10148	10149	10161A	10168A	10401	10402	10403		4E
List 5	0.	75.0								
List 6	01003 3	02001-3	03002-3	04001-3	05001-3	06001-3	07001-3	08002-3	09000 3	
	10002 3	11003-3	12005-3	13004-3	14003-3	15004-3	16000-3	17003-3	18004-3	
	19003-3	20003-3	21001-1	22002-3	23002-3	24002-3	25004-3	26002-3	27003-3	
	28002-3	29002-3	30005-3	31002-3	32001-3	33002-3	34000-3	35002 3	36004-3	
	37002-3	38002-3	39001-3	40001-3	41000-3	42002-3	43003-3	44004-3		
List 5	7.	75.0								
List 6	01036-3	02012-3	03038-3	04016-3	05042-3	06036 3	07037 3	08023-3	09000 3	
	10044 3	11051-3	12033 3	13042-3	14036 3	15028 3	16032-3	17019 3	18034-3	
	19051-3	20037 3	21045-3	22033 3	23040 3	24037 3	25034 3	26036 3	27007-3	
	28011-3	29005-3	30095-3	31027 3	32087-3	33017 3	34093-3	35033 3	36068-3	
	37005 3	38056-3	39066-3	40075-3	41042 3	42044-3	43010-3	44030-3		
List 5	14.	75.0								
List 6	01077-3	02021-3	03077-3	04029-3	05090-3	06077 3	07080 3	08043-3	09000 3	
	10089 3	11101-3	12073 3	13081-3	14076 3	15064 3	16065-3	17043 3	18066-3	
	19102-3	20080 3	21090-3	22071 3	23086 3	24081 3	25077 3	26082 3	27011-3	
	28014-3	29003-3	30197-3	31056 3	32173-3	33036 3	34194-3	35065 3	36135-3	
	37011 3	38113-3	39130-3	40162-3	41086 3	42095-3	43014-3	44062-3		
	21.	75.0								
	01110-3	02030-3	03106-3	04042-3	05129-3	06113 3	07118 3	08060-3	09000 3	
	10125 3	11148-3	12114 3	13113-3	14109 3	15094 3	16093-3	17062 3	18091-3	
	19151-3	20115 3	21128-3	22107 3	23124 3	24117 3	25113 3	26118 3	27012-3	
	28015-3	29001-3	30270-3	31075 3	32235-3	33051 3	34270-3	35090 3	36182-3	
	37013 3	38159-3	39175-3	40226-3	41122 3	42148-3	43007-3	44089-3		
	28.	75.0								
	01129-3	02033-3	03133-3	04055-3	05147-3	06134 3	07137 3	08075-3	09000 3	

10152 3	11171-3	12128 3	13138-3	14132 3	15115 3	16115-3	17075 3	18113-3
19174-3	20138 3	21155-3	22124 3	23147 3	24138 3	25135 3	26140 3	27013-3
28015-3	29004 3	30307-3	31088 3	32279-3	33060 3	34317-3	35105 3	36213-3
37015 3	38189-3	39203-3	40265-3	41144 3	42170-3	43007-3	44119-3	
35.	75.0							
01183-3	02043-3	03166-3	04075-3	05202-3	06177 3	07188 3	08100-3	09000 3
10212 3	11237-3	12181 3	13186-3	14182 3	15158 3	16156-3	17103 3	18153-3
19235-3	20195 3	21209-3	22169 3	23204 3	24191 3	25187 3	26192 3	27014-3
28013-3	29011 3	30380-3	31108 3	32370-3	33082 3	34405-3	35146 3	36265-3
37019 3	38247-3	39251-3	40375-3	41203 3	42240-3	43000-3	44181-3	
42.	75.0							
01197-3	02047-3	03179-3	04081-3	05214-3	06190 3	07198 3	08109-3	09000 3
10221 3	11248-3	12190 3	13196-3	14192 3	15169 3	16168-3	17112 3	18166-3
19249-3	20209 3	21223-3	22180 3	23215 3	24202 3	25197 3	26204 3	27014-3
28013-3	29013 3	30402-3	31115 3	32399-3	33088 3	34432-3	35145 3	36283-3
37019 3	38268-3	39269-3	40407-3	41216 3	42260-3	43002-3	44100-3	
49.	75.0							
01249-3	02075-3	03242-3	04097-3	05291-3	06251 3	07262 3	08137-3	09000 3
10294 3	11328-3	12256 3	13258-3	14256 3	15223 3	16218-3	17143 3	18217-3
19329-3	20264 3	21293-3	22237 3	23288 3	24269 3	25264 3	26272 3	27007 3
28008-3	29024 3	30485-3	31140 3	32512-3	33115 3	34533-3	35184 3	36343-3
37021 3	38343-3	39322-3	40510-3	41274 3	42352-3	43019-3	44293-3	
56.	75.0							
01273-3	02071-3	03246-3	04114-3	05310-3	06269 3	07280 3	08147-3	09000 3
10313 3	11351-3	12274 3	13275-3	14274 3	15236 3	16234-3	17152 3	18231-3
19350-3	20282 3	21313-3	22255 3	23308 3	24288 3	25284 3	26292 3	27010 3
28007-3	29024 3	30506-3	31145 3	32543-3	33122 3	34559-3	35191 3	36361-3
37021 3	38364-3	39340-3	40540-3	41302 3	42374-3	43021-3	44314-3	
59.5	75.0							
01305-3	02076-3	03273-3	04117-3	05342-3	06299 3	07310 3	08162-3	09000 3
10346 3	11390-3	12304 3	13305-3	14303 3	15265 3	16259-3	17169 3	18257-3
19389-3	20313 3	21347-3	22282 3	23342 3	24319 3	25315 3	26324 3	27014 3
28003-3	29030 3	30546-3	31157 3	32599-3	33145 3	34608-3	35211 3	36388-3
37022 3	38400-3	39364-3	40590-3	41324 3	42424-3	43023 3	44366-3	
63.	75.0							
01310-3	02082-3	03277-3	04120-3	05359-3	06315 3	07318 3	08164-3	09000 3
10356 3	11399-3	12312 3	13311-3	14311 3	15271 3	16265-3	17173 3	18263-3
19397-3	20320 3	21355-3	22288 3	23349 3	24326 3	25323 3	26342 3	27003 3
28003-3	29030 3	30555-3	31160 3	32611-3	33148 3	34617-3	35214 3	36395-3
37022 3	38409-3	39370-3	40601-3	41340 3	42432-3	43024 3	44375-3	
66.5	75.0							

01325-3	02088-3	03293-3	04128-3	05379-3	06334 3	07338 3	08174-3	09000 3
10378 3	11423-3	12342 3	13330-3	14337 3	15288 3	16280-3	17184 3	18278-3
19420-3	20340 3	21376-3	22306 3	23372 3	24347 3	25344 3	26353 3	27000 3
28001 3	29031 3	30578-3	31178 3	32644-3	33146 3	34644-3	35233 3	36413-3
37024 3	38440-3	39387-3	40641-3	41362 3	42454-3	43030 3	44397-3	
70.	75.0							
01339-3	02089-3	03316-3	04145-3	05377-3	06341 3	07354 3	08182-3	09000 3
10396 3	11444-3	12349 3	13346-3	14346 3	15297 3	16293-3	17193 3	18292-3
19440-3	20357 3	21394-3	22321 3	23390 3	24364 3	25361 3	26370 3	27002 3
28003 3	29032 3	30598-3	31171 3	32669-3	33152 3	34666-3	35245 3	36426-3
37024 3	38449-3	39399-3	40666-3	41368 3	42474-3	43044 3	44417-3	
73.5	75.0							
01357-3	02094-3	03334-3	04144-3	05411-3	06367 3	07373 3	08193-3	09000 3
10417 3	11468-3	12367 3	13365-3	14364 3	15317 3	16310-3	17203 3	18308-3
19464-3	20375 3	21416-3	22349 3	23411 3	24383 3	25380 3	26390 3	27002 3
28005 3	29035 3	30621-3	31180 3	32707-3	33160 3	34697-3	35256 3	36446-3
37024 3	38475-3	39418-3	40702-3	41399 3	42505-3	43037 3	44448-3	
77.	75.0							
01380-3	02100-3	03352-3	04153-3	05436-3	06380 3	07395 3	08203-3	09000 3
10441 3	11496-3	12389 3	13387-3	14387 3	15332 3	16329-3	17214 3	18327-3
19492-3	20398 3	21440-3	22359 3	23436 3	24416 3	25402 3	26413 3	27005 3
28007 3	29037 3	30649-3	31198 3	32747-3	33179 3	34731-3	35266 3	36467-3
37025 3	38501-3	39426-3	40724-3	41412 3	42542-3	43041 3	44481-3	
80.5	75.0							
01392-3	02102-3	03365-3	04159-3	05451-3	06393 3	07410 3	08210-3	09000 3
10458 3	11515-3	12404 3	13401-3	14402 3	15349 3	16340-3	17222 3	18339-3
19510-3	20423 3	21457-3	22373 3	23453 3	24421 3	25418 3	26429 3	27006 3
28009 3	29038 3	30668-3	31204 3	32774-3	33185 3	34752-3	35280 3	36480-3
37025 3	38517-3	39446-3	40757-3	41437 3	42563-3	43043 3	44500-3	
84.	75.0							
01407-3	02106-3	03385-3	04166-3	05470-3	06422 3	07428 3	08217-3	09000 3
10478 3	11536-3	12433 3	13417-3	14420 3	15365 3	16355-3	17232 3	18353-3
19540-3	20441 3	21476-3	22399 3	23473 3	24440 3	25436 3	26447 3	27008 3
28011 3	29041 3	30691-3	31212 3	32805-3	33193 3	34778-3	35287 3	36494-3
37026 3	38539-3	39451-3	40787-3	41455 3	42589-3	43046 3	44523-3	
87.5	75.0							
01413-3	02108-3	03390-3	04169-3	05476-3	06429 3	07436 3	08222-3	09000 3
10486 3	11545-3	12441 3	13424-3	14437 3	15371 3	16359-3	17236 3	18358-3
19548-3	20450 3	21484-3	22406 3	23481 3	24448 3	25445 3	26455 3	27006 3
28014 3	29042 3	30693-3	31213 3	32814-3	33195 3	34783-3	35295 3	36497-3
37028 3	38545-3	39452-3	40796-3	41467 3	42601-3	43049 3	44534-3	

91.	75.0								
01429-3	02114-3	03406-3	04187-3	05490-3	06447 3	07455 3	08230-3	09000 3	
10506 3	11568-3	12459 3	13442-3	14455 3	15387 3	16375-3	17245 3	18375-3	
19571-3	20467 3	21505-3	22423 3	23502 3	24466 3	25464 3	26474 3	27012 3	
28016 3	29043 3	30718-3	31220 3	32850-3	33203 3	34810-3	35305 3	36514-3	
37026 3	38567-3	39470-3	40820-3	41483 3	42629-3	43059 3	44558-3		
94.5	75.0								
01448-3	02119-3	03422-3	04185-3	05515-3	06463 3	07473 3	08239-3	09000 3	
10527 3	11591-3	12478 3	13460-3	14474 3	15402 3	16391-3	17265 3	18391-3	
19594-3	20486 3	21524-3	22440 3	23523 3	24485 3	25483 3	26494 3	27014 3	
28017 3	29045 3	30740-3	31230 3	32883-3	33216 3	34837-3	35317 3	36529-3	
37028 3	38590-3	39491-3	40840-3	41507 3	42657-3	43054 3	44583-3		
98.	75.0								
01463-3	02124-3	03427-3	04189-3	05536-3	06480 3	07489 3	08247-3	09000 3	
10545 3	11612-3	12495 3	13476-3	14490 3	15416 3	16404-3	17272 3	18403-3	
19613-3	20502 3	21542-3	22454 3	23541 3	24502 3	25500 3	26511 3	27016 3	
28022 3	29047 3	30763-3	31234 3	32913-3	33223 3	34859-3	35326 3	36545-3	
37028 3	38609-3	39500-3	40867-3	41525 3	42685-3	43066 3	44603-3		
100.	75.0								
01475-3	02128-3	03446-3	04193-3	05548-3	06491 3	07500 3	08253-3	09000 3	
10557 3	11626-3	12505 3	13487-3	14501 3	15426 3	16414-3	17278 3	18413-3	
19628-3	20514 3	21555-3	22466 3	23554 3	24514 3	25512 3	26523 3	27016 3	
28024 3	29048 3	30778-3	31240 3	32935-3	33223 3	34877-3	35327 3	36556-3	
37036 3	38623-3	39504-3	40880-3	41537 3	42702-3	43066 3	44618-3		
49.	75.0								
01383-3	02057-3	03247-3	04088-3	05265-3	06235 3	07241 3	08125-3	09000 3	
10273 3	11306-3	12240 3	13232-3	14242 3	15208 3	16207-3	17133 3	18199-3	
19301-3	20245 3	21265-3	22220 3	23270 3	24248 3	25248 3	26253 3	27016-3	
28011-3	29022 3	30489-3	31145 3	32502-3	33122 3	34583-3	35255 3	36318-3	
37025 3	38333-3	39251-3	40450-3	41263 3	42427-3	43008-3	44329-3	45063 3	
0.	75.0	1							
01029-3	02007-3	03042-3	04001-3	05011-3	06010 3	07008 3	08010-3	09000-3	
10013 3	11015-3	12007 3	13009-3	14008 3	15005 3	16013-3	17005 3	18009-3	
19011-3	20010 3	21010-3	22008 3	23009 3	24006 3	25005 3	26005 3	27024-3	
28010-3	29001-3	30094-3	31030 3	32073-3	33014 3	34069-3	35057 3	36016-3	
37003 3	38024-3	39014 3	40012 3	41010 3	42109-3	43051-3	44048-3	45001-3	

List 7	1 ZR					
List 8	.0	.003	.006	.009	.01	.012
	.014	.018	.019	.02	.021	.022
	.023	.023	.024	.025	.025	.025
	.026	.027	.027	.028		

List 7	2 CS					
List 8	.0	.0042	.0091	.0132	.0147	.0193
	.0215	.0274	.0281	.0311	.0315	.0329
	.0336	.0352	.0365	.037	.0385	.0395
	.031	.032	.033	.0337		
List 7	3 CS					
List 8	.0	.005	.009	.014	.016	.022
	.024	.031	.032	.035	.036	.037
	.039	.04	.042	.044	.045	.046
	.047	.05	.05	.052		
	4 CS					
	.0	.006	.012	.018	.02	.027
	.03	.039	.041	.044	.046	.049
	.051	.053	.056	.057	.059	.061
	.064	.066	.068	.069		
	5 CS					
	.0	.006	.013	.019	.021	.031
	.032	.041	.044	.048	.05	.052
	.054	.057	.06	.061	.064	.066
	.068	.07	.072	.074		
	6 CS					
	.0	.005	.011	.017	.02	.026
	.029	.036	.036	.041	.043	.045
	.047	.05	.052	.054	.056	.058
	.06	.062	.064	.065		
	7 CS					
	.0	.005	.009	.012	.015	.02
	.022	.027	.03	.032	.033	.034
	.036	.037	.039	.04	.041	.042
	.044	.046	.047	.048		
	8 CS					
	.0	.0035	.0071	.0105	.0128	.0172
	.0183	.0235	.0245	.027	.0275	.0286
	.0299	.0311	.0324	.0335	.0345	.0257
	.0370	.0382	.0393	.0399		
	9 ZR					
	.0	.002	.004	.006	.007	.009
	.01	.012	.014	.015	.016	.017
	.017	.018	.021	.021	.021	.021
	.022	.022	.023	.023		
	10 ZR					

.0	.002	.005	.008	.01	.013
.015	.02	.021	.023	.024	.025
.025	.026	.027	.028	.028	.029
.029	.03	.03	.031		
11 CS					
.0	.004	.009	.013	.015	.021
.022	.029	.031	.033	.034	.035
.037	.038	.04	.041	.042	.043
.044	.045	.046	.047		
12 CS					
.0	.005	.011	.015	.018	.025
.026	.031	.035	.039	.04	.041
.042	.043	.044	.046	.048	.049
.051	.052	.054	.055		
13 CS					
.0	.005	.012	.017	.021	.029
.031	.039	.042	.045	.048	.049
.051	.054	.057	.058	.06	.062
.065	.066	.068	.07		
14 CS					
.0	.005	.012	.016	.018	.025
.029	.035	.038	.042	.043	.044
.046	.048	.051	.052	.055	.056
.059	.061	.062	.064		
15 CS					
.0	.004	.008	.011	.012	.017
.02	.026	.027	.03	.031	.032
.032	.034	.035	.035	.035	.035
.036	.036	.036	.037		
16 CS					
.0	.0035	.007	.01	.0121	.0156
.0167	.021	.024	.0251	.0259	.0261
.0269	.0285	.0295	.0305	.0327	.0328
.0339	.035	.0361	.0366		
17 ZR					
.0	.002	.004	.005	.006	.008
.009	.01	.012	.013	.014	.015
.015	.016	.016	.016	.017	.018
.018	.019	.019	.02		
21 NR					
.0	-.001	-.002	-.002	-.0016	-.001

.000	.001	.001	.0017	.002	.002
.0025	.003	.0033	.0037	.0042	.0045
.0047	.005	.0053	.0055		
22 NR					
.0	-.001	-.0015	-.001	-.0005	-.0002
-.0002	.0002	.000	.0003	.0003	.0003
.0005	.0005	.0005	.0005	.0005	.0005
.0005	.0005	.0005	.000		
23 NR					
.0	.000	.0005	.001	.0013	.002
.003	.004	.0042	.0042	.004	.0039
.0037	.0033	.003	.0027	.0025	.0023
.0023	.0023	.0023	.0023		
24 NR					
.0	-.0007	-.0007	-.0009	-.0009	.000
.000	.000	.000	.000	.001	.001
.001	.0012	.0015	.0012	.0012	.0012
.0012	.0012	.0012	.0016		
25 CD					
.0	-.001	-.0015	-.0023	-.0028	-.0035
-.004	-.0053	-.0058	-.0065	-.0065	-.007
-.0072	-.0077	-.008	-.0083	-.009	-.009
-.0092	-.0092	-.0092	-.0092		

APPENDIX A
Fortran II Listings

MAIN PROGRAM

C
C
C
C CARD 1 TITLE CARD (12A6)
C CARD 2 RECORDING GAGE FACTOR IN COL. 1-12 (E12.7)
C NO. OF GAGES IN COL. 17-18 (I2) 50 MAX.
C PLOT CONTROL IN COL. 24 +1 NO PLOT, ZERO TO PLOT
C NO. OF DEFLECTION GAGES IN COL.28-30
C CARD 3 GAGE FACTORS (6E12.7)
C CARD 4 GAGE IDENTIFICATION 9(I1,I,A3,A1,2X)
C TYPE - 1=SINGLE, 2=RIGHT ANGLE, 3= ROSETTE (I1)
C ANGLE POSITION 0,1,2,OR 3 (I1)
C GAGE NO. (A3)
C MATERIAL GAGE IS MOUNTED ON. A = ALUMINUM, BLANK IF TI.
C CARD 5 PER-CENT LOAD IN COL 1-12 (E12.7)
C TEMPERATURE DEG.F. IN COL. 13-24 (E12.7)
C IEND IN COL. 30 +1 STARTS PRINT ROUTINE (I6)
C CARD 6 CHANNEL NO. (I2)
C RECORDED STRAIN (F3.0)
C SIGN (+TENSION, -COMP.) (A1)
C POWER (I1)
C CARD 6 WILL HAVE 1 BLANK SPACE BETWEEN EACH 4 ENTRYS
C FORMAT FOR CARD 6 = 9(I2,F3.0,A1,I1,1X)
C CARD 7 DEFLECTION GAGE IDENTIFICATION IN COL. 1-6 (A6)
C CARD 8 DEFLECTION READINGS (6E12.7)
C DIMENSION SET UP FOR 50 CHANNEL - 100 LOADS PER RUN
C DIMENSION NGAGE(50), FORCE(100), TEMP(100), ICHAN(50), EPSR(50)
C 1,ISIGN(50), IPOWER(50), EPST(50), STRESS(50,100)
C 2, RASTR1(25,100), RASTR2(25,100), ROSTR1(17,100), ROSTR2(17,100)
C 3, ALPHA(17,100), NTYPE(50), ICHRA1(25), ICHRA2(25), NGARA1(25)
C 4, NGARA2(25), ICHRO1(17), ICHRO2(17), ICHRO3(17), NGARO1(17)
C 5, NGARO2(17), NGARO3(17), MATL(50)
C 6, TITLE(12)
C DIMENSIONMATRA1(25), MATRA2(25), MATRO1(17), MATRO2(17)
C 1,MATRO3(17)
C 2,ID(50), IDRA1(25), IDRA2(25), IDRO1(17), IDRO2(17), IDRO3(17)
C 3, GFATT(50)
C COMMON TITLE, NOG, NORAG, NOROG, FORCE, STRESS, RASTR1, RASTR2
C 1, ROSTR1, ROSTR2, K, NTYPE, ID, NGAGE, MATL, ICHRA1, ICHRA2
C 2, KTYRA, KTYRO, IDRA1, IDRA2, NGARA1, NGARA2, MATRA1, MATRA2
C 3, ICHRO1, ICHRO2, ICHRO3, IDRO1, IDRO2, IDRO3, NGARO1, NGARO2
C 4, NGARO3, MATRO1, MATRO2, MATRO3


```
COMMON XL, XR, IPLOT2
XMU = .3
TEST= 1H-
TESTA = 1HA
EQUIVALENCE (TEST, ITEST), (TESTA, IA)
KTYRA = 2
KTYRO = 3
5 IEND = 0
IPLOT = 0
IPLOT2 = 0
K = 0
READ INPUT TAPE 5, 1000, TITLE
PRINT 1020, TITLE
READ INPUT TAPE 5, 1012, RECGF, NOG, IPLOT, IPLOT2
READ INPUT TAPE 5, 1018, (GFATT(I), I = 1, NOG)
DO 2000 I = 1, NOG
2000 ICHAN(I) = I
READ INPUT TAPE 5, 1001, (NTYPE(I), ID(I), NGAGE(I), MATL(I),
1 I = 1, NOG)
WRITE OUTPUT TAPE 6, 1004, TITLE
WRITE OUTPUT TAPE 6, 1005, NOG, RECGF, (I, NTYPE(I), ID(I),
1 NGAGE(I), MATL(I), GFATT(I), I = 1, NOG)
C SET UP GAGE TITLES FOR RIGHT ANGLE AND ROSETTE GAGES
I = 1
KRA = 0
KRO = 0
6 IF(NTYPE(I) - 2) 10, 7, 8
C STATEMENT 10 FOR SINGLE GAGES
C RIGHT ANGLE GAGES TYPE 2
7 KRA = KRA + 1
I2 = I+1
IF(NTYPE(I) - NTYPE(I2)) 2010, 2020, 2010
C ERROR IN GAGE ARRANGEMENT
2010 WRITE OUTPUT TAPE 6, 1016, I, I2
CALL EXIT
2020 IDRA1(KRA) = ID(I)
IDRA2(KRA) = ID(I2)
ICHRA1(KRA) = ICHAN(I)
ICHRA2(KRA) = ICHAN(I2)
NGARA1(KRA) = NGAGE(I)
NGARA2(KRA) = NGAGE(I2)
MATRA1(KRA) = MATL(I)
MATRA2(KRA) = MATL(I2)
```

I = I+2
GO TO 11
C ROSETTE GAGES TYPE 3
8 I2 = I+1
I3 = I+2
KRO = KRO + 1
IF(NTYPE(I) - NTYPE(I2)) 2040,2030,2040
2030 IF(NTYPE(I3) - 3) 2040,2050,2040
C ERROR IN GAGE ARRANGEMENT
2040 WRITE OUTPUT TAPE 6, 1017, I,I2,I3
CALL EXIT
2050 IDRO1(KRO) = ID(I)
IDRO2(KRO) = ID(I2)
IDRO3(KRO) = ID(I3)
ICHRO1(KRO) = ICHAN(I)
ICHRO2(KRO) = ICHAN(I2)
ICHRO3(KRO) = ICHAN(I3)
NGARO1(KRO) = NGAGE(I)
NGARO2(KRO) = NGAGE(I2)
NGARO3(KRO) = NGAGE(I3)
MATRO1(KRO) = MATL(I)
MATRO2(KRO) = MATL(I2)
MATRO3(KRO) = MATL(I3)
I = I+3
GO TO 11
10 I = I+1
11 IF(I - NOG) 6,6,12
12 WRITE OUTPUT TAPE 6, 1013
C K = LOAD NO.
15 K = K+1
NORAG = 0
NOROG = 0
READ INPUT TAPE 5, 1002, FORCE(K), TEMP(K), IEND
20 READ INPUT TAPE 5, 1003, (IDUM, EPSR(I), ISIGN(I), IPOWER(I),
1 I = 1,NOG)
C CONVERT INPUT STRAIN READINGS AND PRINT
DO 22 I = 1,NOG
EPSR(I) = EPSR(I) * 10.0 ** (-IPOWER(I)) * 1.0E-3
IF(ISIGN(I) - ITEST) 22,21,22
21 EPSR(I) = - EPSR(I)
22 CONTINUE
WRITE OUTPUT TAPE 6, 1014, K, FORCE(K), TEMP(K)
WRITE OUTPUT TAPE 6, 1015, (EPSR(I), I=1,NOG)

C CALCULATE TEMP. CORRECTION FACTORS

EPSAT = 0.

TEMPSQ = TEMP(K)**2

TEMPCU = TEMP(K)**3

EAL = (10.705511 - 2.7301868E-3 * TEMP(K) + 4.0080510E-6 * TEMPSQ
1 + 4.8810596E-9 * TEMPCU) * 1.0E6ETI = (16.351495 - 5.4398447E-3 * TEMP(K) - 4.0937064E-6 * TEMPSQ
1 + 1.2602872E-8 * TEMPCU) * 1.0E6

CONAL = EAL / (1.0 - XMU**2)

CONTI = ETI / (1.0 - XMU**2)

C CALCULATION OF STRESS FOR SINGLE GAGES

DO 25 I = 1,NOG

EPST(I) = (EPSR(I) - EPSAT) * RECGF / GFATT(I)

IF(MATL(I) - IA)24,23,24

C MODULUS FOR AL.

23 E = EAL

GO TO 25

C MODULUS FOR TI.

24 E = ETI

25 STRESS(I,K) = E * EPST(I)

C TEST FOR GAGE TYPE

I = 1

34 IF(NTYPE(I) - 2) 49,35,45

C CALCULATION FOR RIGHT ANGLE GAGES

35 I2 = I+1

NORAG = NORAG + 1

C SORT EPST FOR R.A. GAGES

IF(ID(I) - 1) 38,38,36

36 TEMPRA = EPST(I)

EPST(I) = EPST(I2)

EPST(I2) = TEMPRA

38 IF(MATL(I) - IA) 40,41,40

C CO ST FOR TI.

40 CONST = CONTI

GO TO 43

C CONST FOR AL.

41 CONST = CONAL

43 RASTR1(NORAG,K) = CONST * (EPST(I) + XMU * EPST(I2))

WRITE OUTPUT TAPE 6, 1015, EPST(I), EPST(I2)

RASTR2(NORAG,K) = CONST * (EPST(I2) + XMU * EPST(I))

I = I+2

GO TO 50

C CALCULATION FOR ROSETTE GAGES

45 I2 = I+1
I3 = I+2
NOROG = NOROG +1
C SORT EPST FOR ROSETTE GAGES
240 IF(ID(I) - 2) 251,252,253
251 EPST1 = EPST(I)
I = I + 1
GO TO 260
252 EPST2 = EPST(I)
I = I + 1
GO TO 260
253 EPST3 = EPST(I)
I = I + 1
260 IF(I - I3) 240,240,46
46 A = .5 * (EPST1 + EPST3)
B = SQRTF((EPST1 - A)**2 + (EPST2 - A)**2)
WRITE OUTPUT TAPE 6, 1015, EPST1,EPST2,EPST3
AP = A * E / (1.0 - XMU)
BP = B * E / (1.0 + XMU)
STR1 = AP + BP
STR2 = AP - BP
IF(ABSF(STR1)- ABSF(STR2))270,270,280
270 ROSTR1(NOROG,K) = STR2
ROSTR2(NOROG,K) = STR1
GO TO 290
280 ROSTR1(NOROG,K) = STR1
ROSTR2(NOROG,K) = STR2
290 CONTINUE
ARG1 = EPST2 - A
ARG2 = EPST1 - A
ALPHA(NOROG,K) = ARTNF (ARG1, ARG2) * 28.6478895
GO TO 50
49 I = I+1
50 IF(I - NOG) 34,34,51
51 IF(IEND)15,15,100
C +1 IN COL. 30 ENDS RUN, STATEMENT 100 IS PRINT ROUTINE
C PRINT OUTPUT FOR SINGLE GAGES
100 DO 110 I = 1,NOG
WRITE OUTPUT TAPE 6, 1006, ICHAN(I), NTYPE(I), ID(I), NGAGE(I),
1 MATL(I)
WRITE OUTPUT TAPE 6, 1007, (L, FORCE(L), TEMP(L), STRESS(I,L),
1 L = 1,K)
110 CONTINUE

C PRINT OUTPUT FOR RIGHT ANGLE GAGES

IF(NORAG)124,124,115

115 DO 120 I = 1,NORAG

WRITE OUTPUT TAPE 6, 1008, ICHRA1(I), ICHRA2(I), KTYRA, IDRA1(I),

1 NGARA1(I), MATRA1(I), KTYRA, IDRA2(I), NGARA2(I), MATRA2(I)

WRITE OUTPUT TAPE 6, 1009, (L, FORCE(L), TEMP(L), RASTR1(I,L),

1 RASTR2(I,L), L = 1,K)

120 CONTINUE

C PRINT OUTPUT FOR ROSETTE GAGES

124 IF(NOROG)135,135,125

125 DO 130 I = 1,NOROG

WRITE OUTPUT TAPE 6, 1010, ICHRO1(I), ICHRO2(I), ICHRO3(I), KTYRO,

1 IDRO1(I), NGARO1(I), MATRO1(I), KTYRO, IDRO2(I), NGARO2(I),

2 MATRO2(I), KTYRO, IDRO3(I), NGARO3(I), MATRO3(I)

WRITE OUTPUT TAPE 6, 1011, (L, FORCE(L), TEMP(L), ROSTR1(I,L),

1 ROSTR2(I,L), ALPHA(I,L), L = 1,K)

130 CONTINUE

135 IF(I PLOT)150,150,160

150 CALL PLOT

152 IF(I PLOT2)160,160,154

154 CALL PLOT2

160 GO TO 5

1000 FORMAT(12A6)

1001 FORMAT(9(2I1,A3,A1,2X))

1002 FORMAT(2E12.7, I6)

1003 FORMAT(9(I2,F3.0,A1,I1,1X))

1004 FORMAT(1H1,20X12A6///)

1005 FORMAT(22X27HNO. OF GAGES FOR THIS RUN = I4 , 5X22HRECORDER GAGE

1FACTOR = F6.3 /// 22X44HCHANNEL NO. GAGE NO. GAGE FACT

2OR // (27X12, 12X2I1,A3,A1, 10XF6.3))

1006 FORMAT(1H1,38X32HLOAD VS. STRESS FOR SINGLE GAGES///10X13HCHANNEL

1NO. = I4,10X10HGAGE NO. = I3,I1,A3,A1//10X8HLOAD NO.,3X12HPERCENT

2LOAD,4X13HTEMP.(DEG.F.),6X19HSTRESS(LB./SQ.IN.) ///

1007 FORMAT(12X13,OPF15.3, 8XOPF9.3,11X1PE13.6)

1008 FORMAT(1H1,35X37HLOAD VS. STRESS FOR RIGHT ANGLE GAGES ///10X

1 14HCHANNEL NOS. = I4,3X12, 10X11HGAGE NOS. = I3,I1,A3,A1,3X2I1,A3

2,A1// 10X 40HLOAD NO. PERCENT LOAD TEMP.(DEG.F.),10X7HMAXIMUM

3 , 14X 7HMINIMUM / 54X39HSTRESS(LB./SQ.IN.) S

4TRESS(LB./SQ.IN.) ///

1009 FORMAT(12X13,OPF15.3, 8XOPF9.3, 9X1PE13.6,8X1PE13.6)

1010 FORMAT(1H1, 37X33HLOAD VS. STRESS FOR ROSETTE GAGES /// 10X

114HCHANNEL NOS. = I4,2(3X12), 10X11HGAGE NOS. =I3,I1,A3,A1,2(3X2I1

2,A3,A1), //10X 8HLOAD NO.,3X12HPERCENT LOAD,4X13HTEMP.(DEG.F.),10X

```
      3 7HMAXIMUM, 14X7HMINIMUM, 9X11HALPHA(DEG.)/54X39HSTRESS(LB./SQ.IN.)
      4  STRESS(LB./SQ.IN.) //)
1011 FORMAT(12XI3, 0PF15.3, 8X0PF9.3, 9X1PE13.6, 8X1PE13.6, 6X0PF10.5)
1012 FORMAT(E12.7, 10I6)
1013 FORMAT(1H1, 40X30HRECORDED STRAIN IN INCHES/INCH )
1014 FORMAT(1H0, 9X10HLOAD NO. = I3, 5X14HPERCENT LOAD = F9.3,
      1 5X13HTEMPERATURE = F9.3, 6H DEG.F. //)
1015 FORMAT( 7X 1P7E13.3)
1016 FORMAT(1H1, 10X30HERROR----GAGE TYPE AT CHANNELS, 2I4, 18H ARE OU
      1T OF ORDER )
1017 FORMAT(1H1, 10X30HERROR----GAGE TYPE AT CHANNELS, 3I4, 18H ARE OU
      1T OF ORDER )
1018 FORMAT(6E12.7)
1020 FORMAT(10X 12A6)
      END
```

STORAGE NOT USED BY PROGRAM

DEC OCT
3426 06542

DEC OCT
18436 44004

STORAGE LOCATIONS FOR VARIABLES APPEARING IN COMMON STATEMENTS

DEC OCT
FORCE 32546 77442
ICHRO2 18626 44302
IDRO1 18592 44240
IPLOT2 18437 44005
MATL 18895 44717
MATRO2 18473 44051
NGARA2 18718 44436
NOG 32549 77445
RASTR1 27446 65466
STRESS 32446 77276

DEC OCT
ICHRA1 18845 44635
ICHRO3 18609 44261
IDRO2 18575 44217
K 19046 45146
MATRA1 18693 44405
MATRO3 18456 44030
NGARO1 18541 44155
NORAG 32548 77444
RASTR2 24946 60562
TITLE 32561 77461

DEC OCT
ICHRA2 18820 44604
IDRA1 18793 44551
IDRO3 18558 44176
KTYRA 18795 44553
MATRA2 18668 44354
NGAGE 18945 45001
NGARO2 18524 44134
NOROG 32547 77443
ROSTR1 22446 53656
XL 18439 44007

DEC OCT
ICHRO1 18643 44323
IDRA2 18768 44520
ID 18995 45063
KTYRO 18794 44552
MATRO1 18490 44072
NGARA1 18743 44467
NGARO3 18507 44113
NTYPE 19045 45145
ROSTR2 20746 50412
XR 18438 44006

STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE STATEMENTS

DEC OCT
ALPHA 3023 05717
IA 3424 06540
ITEST 3425 06541

DEC OCT
EPSR 3273 06311
ICHAN 3323 06373
TEMP 3423 06537

DEC OCT
EPST 3123 06063
IPOWER 3173 06145
TESTA 3424 06540

DEC OCT
GFATT 3073 06001
ISIGN 3223 06227
TEST 3425 06541

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN COMMON, DIMENSION, OR EQUIVALENCE STATEMENT

DEC OCT
AP 1323 02453
BP 1319 02447
CONTI 1315 02443
EPST2 1311 02437
I2 1307 02433
IPLOT 1303 02427
L 1299 02423
TEMPCU 1295 02417

DEC OCT
ARG1 1322 02452
B 1318 02446
EAL 1314 02442
EPST3 1310 02436
I3 1306 02432
I 1302 02426
RECGF 1298 02422
TEMPRA 1294 02416

DEC OCT
ARG2 1321 02451
CONAL 1317 02445
EPSAT 1313 02441
E 1309 02435
IDUM 1305 02431
KRA 1301 02425
STR1 1297 02421
TEMPSQ 1293 02415

DEC OCT
A 1320 02450
CONST 1316 02444
EPST1 1312 02440
ETI 1308 02434
IEND 1304 02430
KRO 1300 02424
STR2 1296 02420
XMU 1292 02414

SYMBOLS AND LOCATIONS FOR SOURCE PROGRAM FORMAT STATEMENTS

	EFN	LOC		EFN	LOC		EFN	LOC		EFN	LOC
8)VB	1000	02375	8)V9	1001	02374	8)VA	1002	02371	8)VB	1003	02367
8)VC	1004	02363	8)VD	1005	02360	8)VE	1006	02324	8)VF	1007	02266
8)VG	1008	02260	8)VH	1009	02201	8)VI	1010	02171	8)VJ	1011	02111
8)VK	1012	02077	8)VL	1013	02074	8)VM	1014	02064	8)VN	1015	02043
8)VO	1016	02040	8)VP	1017	02024	8)VQ	1018	02010	8)VS	1020	02006

LOCATIONS FOR OTHER SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
1)	1278	02376	2)	995	01743	3)	1008	01760	4)	32767	77777
6)	1024	02000	A)101	969	01711	A)102	982	01726	B)	1004	01754
C)10	1282	02402	C)G1	1283	02403	C)G2	1284	02404	C)G3	1285	02405
C)G4	1286	02406	C)G5	1287	02407	C)101	1288	02410	C)102	1289	02411
C)104	1290	02412	C)105	1291	02413	D)10A	167	00247	D)10F	243	00363
D)10G	247	00367	D)10H	266	00412	D)40J	310	00466	D)413	515	01003
D)41L	734	01336	D)41T	808	01450	D)423	883	01563	D)50A	166	00246
D)50J	309	00465	D)51T	807	01447	D)523	882	01562	D)70J	308	00464
E)15	537	01031	E)18	551	01047	E)1G	634	01172	E)1K	727	01327
E)1M	740	01344									

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
ARTN	11	00013	EXIT	8	00010	EXP(2	9	00011	PLOT2	13	00015
PLOT	12	00014	SQRT	10	00012	(FIL)	6	00006	(FPT)	0	00000
(RTN)	3	00003	(SLI)	2	00002	(SLO)	5	00005	(SPH)	4	00004
(STH)	7	00007	(TSH)	1	00001						

ENTRY POINTS TO SUBROUTINES NOT OUTPUT FROM LIBRARY

ARTN	EXIT	EXP(2	PLOT2	PLOT	SQRT	(FIL)	(FPT)
(RTN)	(SLI)	(SLO)	(SPH)	(STH)	(TSH)		

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN
5	32	00041	2000	48	00140	6	65	00250	7	66	00255	
2010	69	00272	2020	72	00311	8	82	00337	2030	86	00364	
2040	87	00370	2050	90	00413	10	104	00456	11	105	00467	
12	106	00474	15	107	00502	20	112	00543	21	120	00615	
22	121	00617	23	139	00764	24	141	00767	25	142	00771	
34	144	01004	35	145	01011	36	148	01033	38	151	01041	
40	152	01044	41	154	01051	43	155	01053	45	161	01112	
240	164	01134	251	165	01140	252	168	01150	253	171	01157	
260	173	01165	46	174	01173	270	183	01275	280	186	01302	
290	188	01306	49	193	01330	50	194	01337	51	195	01346	
100	196	01352	110	204	01426	115	206	01435	120	214	01541	
124	215	01544	125	216	01550	130	224	01670	135	225	01673	
150	226	01676	152	227	01701	154	228	01705	160	229	01710	

SUBROUTINE PLOT

```
SUBROUTINE PLOT
  DIMENSION FORCE(100), STRESS(50,100), RASTR1(25,100), RASTR2(25,100)
  1, ROSTR1(17,100), ROSTR2(17,100), ID(50), NGAGE(50), MATL(50)
  2, ICHRA1(25), ICHRA2(25), IDRA1(25), IDRA2(25), NGARA1(25)
  3, NGARA2(25), MATRA1(25), MATRA2(25), ICHRO1(17), ICHRO2(17)
  4, ICHRO3(17), IDRO1(17), IDRO2(17), IDRO3(17), NGARO1(17)
  5, NGARO2(17), NGARO3(17), MATRO1(17), MATRO2(17), MATRO3(17)
  6, TITLE(12), NTYPE(50)
  COMMON TITLE, NOG, NORAG, NOROG, FORCE, STRESS, RASTR1, RASTR2
  1, ROSTR1, ROSTR2, K, NTYPE, ID, NGAGE, MATL, ICHRA1, ICHRA2
  2, KTYRA, KTYRO, IDRA1, IDRA2, NGARA1, NGARA2, MATRA1, MATRA2
  3, ICHRO1, ICHRO2, ICHRO3, IDRO1, IDRO2, IDRO3, NGARO1, NGARO2
  4, NGARO3, MATRO1, MATRO2, MATRO3
  COMMON XL, XR, IPLOT2
  IOUT = 6
  WRITE OUTPUT TAPE IOUT, 2000
  K17 = K * 17
  K25 = K * 25
  K50 = K * 50
  CALL CAMRAV(1)
  XL = FORCE(1)
  XR = XL
  DO 50 I = 2, K
    XL = MIN1F(XL, FORCE(I))
    XR = MAX1F(XR, FORCE(I))
  50 CONTINUE
  DIF = (XR - XL) * .05
  XL = XL - DIF
  XR = XR + DIF
C PLOT STRESS FOR SINGLE GAGES
  DO 200 I = 1, NOG
    CALL SETMIV (24,100,24,48)
    YB = STRESS(I,1)
    YT = YB
    DO 100 M = 2, K
      YB = MIN1F(YB, STRESS(I,M))
      YT = MAX1F(YT, STRESS(I,M))
    100 CONTINUE
    DIF = (YT - YB) * .05
    YB = YB - DIF
    YT = YT + DIF
    CALL DXDYV(1, XL, XR, DX, N1, I1, NX, 10.0, IERR1)
```

```
CALL DXDYV(2, YB, YT, DY, M1, J1, NY, 10.0, IERR2)
NY = -3
WRITE OUTPUT TAPE IOUT, 2001, I, XL, XR, YB, YT, DX, DY, N1, M1,
1 I1, J1, NX, NY, IERR1, IERR2
CALL GRIDIV(1, XL, XR, YB, YT, DX, DY, N1, M1, -I1, -J1, NX, NY)
CALL PRINTV(72, TITLE, 130, 1015)
CALL PRINTV(-32, 32HLOAD VS. STRESS FOR SINGLE GAGES, 130, 999)
CALL PRINTV(-7, 7HCHANNEL, 130, 983)
XI = I
CALL LABLV(XI, 170, 983, 6, 1, 6)
CALL PRINTV(-4, 4HGAGE, 290, 983)
CALL PLOTV(346, 983, NTYPE(I))
CALL PLOTV(354, 983, ID(I))
CALL PRINTV(3, NGAGE(I), 362, 983)
CALL PRINTV(1, MATL(I), 386, 983)
CALL APRNTV(0, -12, -32, 32HSTRESS IN POUNDS PER SQUARE INCH, 4, 600)
CALL PRINTV(-12, 12HPERCENT LOAD, 400, 4)
DO 110 KOUNT = 1, 2
CALL APLTV(K50, FORCE(1), STRESS(I, 1), 1, 50, 1, 38, IERR)
110 CONTINUE
WRITE OUTPUT TAPE IOUT, 2002, IERR
C PLOT VECTORS FOR SINGLE GAGES
IX1 = NXV(FORCE(1))
IY1 = NYV(STRESS(I, 1))
DO 150 I2 = 2, K
IX2 = NXV(FORCE(I2))
IY2 = NYV(STRESS(I, I2))
DO 125 KOUNT = 1, 3
CALL LINEV(IX1, IY1, IX2, IY2)
125 CONTINUE
IX1 = IX2
150 IY1 = IY2
200 CONTINUE
C PLOT RIGHT ANGLE GAGES - MAX. AND MIN. STRESS ON ONE PLOT
IF(NORAG) 415, 415, 225
225 DO 400 I = 1, NORAG
CALL SETMIV(24, 100, 24, 48)
YT = RASTR1(I, 1)
YB = RASTR2(I, 1)
DO 300 M = 2, K
YB = MIN1F(YB, RASTR1(I, M))
YT = MAX1F(YT, RASTR1(I, M))
YB = MIN1F(YB, RASTR2(I, M))
```

YT = MAX1F(YT, RASTR2(I,M))
300 CONTINUE
DIF = (YT - YB) * .05
YB = YB - DIF
YT = YT + DIF
CALL DXDYV(1, XL, XR, DX, N1, I1, NX, 10.0, IERR1)
CALL DXDYV(2, YB, YT, DY, M1, J1, NY, 10.0, IERR2)
WRITE OUTPUT TAPE IOUT, 2012, ICHRA1(I), ICHRA2(I), XL, XR, YB,
1 YT, DX, DY, N1, M1, I1, J1, NX, NY, IERR1, IERR2
NY = -3
CALL GRID1V(1, XL, XR, YB, YT, DX, DY, N1, M1, -I1, -J1, NX, NY)
CALL PRINTV(72, TITLE, 130, 1015)
CALL PRINTV(-37, 37HLOAD VS. STRESS FOR RIGHT ANGLE GAGES, 130, 999)
CALL PRINTV(-8, 8HCHANNELS, 130, 983)
XI1 = ICHRA1(I)
XI2 = ICHRA2(I)
CALL LABLV(XI1, 170, 983, 6, 1, 6)
CALL LABLV(XI2, 200, 983, 6, 1, 6)
CALL PRINTV(-5, 5HGAGES, 290, 983)
CALL PLOTV(346, 983, KTYRA)
CALL PLOTV(354, 983, IDRA1(I))
CALL PRINTV(3, NGARA1(I), 362, 983)
CALL PRINTV(1, MATRA1(I), 386, 983)
CALL PLOTV(410, 983, KTYRA)
CALL PLOTV(418, 983, IDRA2(I))
CALL PRINTV(3, NGARA2(I), 426, 983)
CALL PRINTV(1, MATRA2(I), 450, 983)
CALL APRNTV(0, -12, -32, 32HSTRESS IN POUNDS PER SQUARE INCH, 4, 600)
CALL PRINTV(-12, 12HPERCENT LOAD, 400, 4)
DO 305 KOUNT = 1, 2
CALL APLOTV(K25, FORCE(1), RASTR1(I, 1), 1, 25, 1, 38, IERR)
305 CONTINUE
WRITE OUTPUT TAPE IOUT, 2003, IERR
DO 308 KOUNT = 1, 2
CALL APLOTV(K25, FORCE(1), RASTR2(I, 1), 1, 25, 1, 16, IERR)
308 CONTINUE
WRITE OUTPUT TAPE IOUT, 2004, IERR
C PLOT VECTORS FOR MAX. AND MIN. STRESS OF RIGHT ANGLE GAGES
IX1 = NXV(FORCE(1))
IY1 = NYV(RASTR1(I, 1))
DO 325 I2 = 2, K
IX2 = NXV(FORCE(I2))
IY2 = NYV(RASTR1(I, I2))

DO 310 KOUNT = 1,3
CALL LINEV(IX1,IY1,IX2,IY2)
310 CONTINUE
IX1 = IX2
325 IY1 = IY2
IX1 = NXV(FORCE(1))
IY1 = NYV(RASTR2(I,1))
DO 350 I2 = 2,K
IX2 = NXV(FORCE(I2))
IY2 = NYV(RASTR2(I,I2))
DO 340 KOUNT = 1,3
CALL LINEV(IX1,IY1,IX2,IY2)
340 CONTINUE
IX1 = IX2
350 IY1 = IY2
400 CONTINUE
C PLOT ROSETTE GAGES - MAX. AND MIN. STRESS ON ONE PLOT
415 IF(NOROG)650,650,425
425 DO 600 I = 1, NOROG
CALL SETMIV (24,100,24,48)
YT = ROSTR1(I,1)
YB = ROSTR2(I,1)
DO 450 M = 2,K
YT = MAX1F(YT, ROSTR1(I,M))
YB = MIN1F(YB, ROSTR1(I,M))
YT = MAX1F(YT, ROSTR2(I,M))
YB = MIN1F(YB, ROSTR2(I,M))
450 CONTINUE
DIF = (YT - YB) * .05
YB = YB - DIF
YT = YT + DIF
CALL DXDYV(1, XL, XR, DX, N1, I1, NX, 10.0, IERR1)
CALL DXDYV(2, YB, YT, DY, M1, J1, NY, 10.0, IERR2)
NY = -3
WRITE OUTPUT TAPE IOUT, 2013, ICHRO1(I), ICHRO2(I), ICHRO3(I),
1 XL, XR, YB, YT, DX, DY, N1, M1, I1, J1, NX, NY, IERR1, IERR2
CALL GRIDIV(1, XL, XR, YB, YT, DX, DY, N1, M1, -I1, -J1, NX, NY)
CALL PRINTV(72, TITLE,130, 1015)
CALL PRINTV(-33,33HLOAD VS. STRESS FOR ROSETTE GAGES,130, 999)
CALL PRINTV(-8,8HCHANNELS,130, 983)
XI1 = ICHRO1(I)
XI2 = ICHRO2(I)
XI3 = ICHRO3(I)

CALL LABLV(XI1, 170, 983, 6,1,6)
CALL LABLV(XI2, 200, 983, 6,1,6)
CALL LABLV(XI3, 230, 983, 6,1,6)
CALL PRINTV(-5, 5HGAGES, 322, 983)
CALL PLOTV(378, 983, KTYRO)
CALL PLOTV(386, 983, IDRO1(I))
CALL PRINTV(3, NGARO1(I), 394, 983)
CALL PRINTV(1, MATRO1(I), 418, 983)
CALL PLOTV(442, 983, KTYRO)
CALL PLOTV(450, 983, IDRO2(I))
CALL PRINTV(3, NGARO2(I), 458, 983)
CALL PRINTV(1, MATRO2(I), 482, 983)
CALL PLOTV(506, 983, KTYRO)
CALL PLOTV(514, 983, IDRO3(I))
CALL PRINTV(3, NGARO3(I), 522, 983)
CALL PRINTV(1, MATRO3(I), 546, 983)
CALL APRNTV(0,-12,-32,32HSTRESS IN POUNDS PER SQUARE INCH,4,600)
CALL PRINTV(-12, 12HPERCENT LOAD, 400, 4)
DO 460 KOUNT = 1,2
CALL APLOTV(K17, FORCE(1), ROSTR1(I,1), 1, 17, 1, 38, IERR)
460 CONTINUE
WRITE OUTPUT TAPE IOUT, 2005, IERR
DO 470 KOUNT = 1,2
CALL APLOTV(K17, FORCE(1), ROSTR2(I,1), 1, 17, 1, 16, IERR)
470 CONTINUE
WRITE OUTPUT TAPE IOUT, 2006, IERR
C PLOT VECTORS FOR MAX. AND MIN. STRESS OF ROSETTE GAGES
IX1 = NXV(FORCE(1))
IY1 = NYV(ROSTR1(I,1))
DO 500 I2 = 2,K
IX2 = NXV(FORCE(I2))
IY2 = NYV(ROSTR1(I,I2))
DO 475 KOUNT = 1,3
CALL LINEV(IX1,IY1,IX2,IY2)
475 CONTINUE
IX1 = IX2
500 IY1 = IY2
IX1 = NXV(FORCE(1))
IY1 = NYV(ROSTR2(I,1))
DO 550 I2 = 2,K
IX2 = NXV(FORCE(I2))
IY2 = NYV(ROSTR2(I,I2))
DO 525 KOUNT = 1,3

CALL LINEV(IX1,IY1,IX2,IY2)
525 CONTINUE
IX1 = IX2
550 IY1 = IY2
600 CONTINUE
650 CALL FRAMEV
CALL PRINTV(-18,18HTHIS JOB COMPLETED,300,600)
CALL PRINTV(-44,44HSEND TO WESTINGHOUSE ASTRONUCLEAR LABORATORY,
1 300,550)
CALL PRINTV(-41,41HPOST OFFICE BOX 10864, PITTSBURGH 36, PA., 300,
1 500)
CALL PRINTV(-44,44HATTENTION DIGITAL COMPUTER FACILITY BLDG. 5 ,
1 300,450)
CALL FRAMEV
END FILE 12
RETURN
2000 FORMAT(1H1, 40X17HSC-4020 ARGUMENTS //)
2001 FORMAT(1H0, 10X31HVALUES FOR GRID1V---CHANNEL NO. 14 //10X
1 1P6E16.6 /10X 8I10)
2002 FORMAT(1H0, 10X30HIERR FROM APLOTV SINGLE GAGE = I6)
2003 FORMAT(1H0, 10X25HIERR FROM APLOTV RASTR1 = I6)
2004 FORMAT(1H0, 10X25HIERR FROM APLOTV RASTR2 = I6)
2005 FORMAT(1H0, 10X25HIERR FROM APLOTV ROSTR1 = I6)
2006 FORMAT(1H0, 10X25HIERR FROM APLOTV ROSTR2 = I6)
2012 FORMAT(1H0, 10X31HVALUES FOR GRID1V---CHANNEL NO.214 //10X
1 1P6E16.6 /10X 8I10)
2013 FORMAT(1H0, 10X31HVALUES FOR GRID1V---CHANNEL NO.314 //10X
1 1P6E16.6 /10X 8I10)
END

STORAGE NOT USED BY PROGRAM

DEC OCT
1951 03637

DEC OCT
18436 44004

STORAGE LOCATIONS FOR VARIABLES APPEARING IN COMMON STATEMENTS

DEC OCT
FORCE 32546 77442
ICHRO2 18626 44302
IDRO1 18592 44240
IPLOT2 18437 44005
MATL 18895 44717
MATRO2 18473 44051
NGARA2 18718 44436
NOG 32549 77445
RASTR1 27446 65466
STRESS 32446 77276

DEC OCT
ICHRA1 18845 44635
ICHRO3 18609 44261
IDRO2 18575 44217
K 19046 45146
MATRA1 18693 44405
MATRO3 18456 44030
NGARO1 18541 44155
NORAG 32548 77444
RASTR2 24946 60562
TITLE 32561 77461

DEC OCT
ICHRA2 18820 44604
IDRA1 18793 44551
IDRO3 18558 44176
KTYRA 18795 44553
MATRA2 18668 44354
NGAGE 18945 45001
NGARO2 18524 44134
NOROG 32547 77443
ROSTR1 22446 53656
XL 18439 44007

DEC OCT
ICHRO1 18643 44323
IDRA2 18768 44520
ID 18995 45063
KTYRO 18794 44552
MATRO1 18490 44072
NGARA1 18743 44467
NGARO3 18507 44113
NTYPE 19045 45145
ROSTR2 20746 50412
XR 18438 44006

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN COMMON, DIMENSION, OR EQUIVALENCE STATEMEN

DEC OCT
DIF 1950 03636
IERR1 1946 03632
I 1942 03626
IY2 1938 03622
K50 1934 03616
NY 1930 03612
XI 1926 03606

DEC OCT
DX 1949 03635
IERR2 1945 03631
IX1 1941 03625
J1 1937 03621
M1 1933 03615
XI1 1929 03611
YB 1925 03605

DEC OCT
DY 1948 03634
IERR 1944 03630
IX2 1940 03624
K17 1936 03620
N1 1932 03614
XI2 1928 03610
YT 1924 03604

DEC OCT
I1 1947 03633
IOUT 1943 03627
IY1 1939 03623
K25 1935 03617
NX 1931 03613
XI3 1927 03607

SYMBOLS AND LOCATIONS FOR SOURCE PROGRAM FORMAT STATEMENTS

EFN LOC
8)1UG 2000 03555
8)1UK 2004 03512
8)1UT 2013 03447

EFN LOC
8)1UH 2001 03547
8)1UL 2005 03503

EFN LOC
8)1UI 2002 03531
8)1UM 2006 03474

EFN LOC
8)1UJ 2003 03521
8)1US 2012 03465

LOCATIONS FOR OTHER SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
1)	1902	03556	2)	1656	03170	3)	1811	03423	6)	1813	03425
8)	1714	03262	C)G1	1906	03562	C)G2	1907	03563	C)100	1908	03564
C)101	1909	03565	C)102	1910	03566	C)103	1911	03567	C)104	1912	03570
C)105	1913	03571	C)106	1914	03572	C)107	1915	03573	C)108	1916	03574
C)201	1917	03575	C)204	1918	03576	C)205	1919	03577	C)206	1920	03600
C)209	1921	03601	C)20A	1922	03602	C)20B	1923	03603	D)117	1496	02730
D)208	414	00636	D)20L	895	01577	D)20P	956	01674	D)21B	1557	03025
D)308	413	00635	D)30P	955	01673	D)31B	1556	03024	E)106	365	00555
E)10H	827	01473	E)10J	854	01526	E)113	1428	02624	E)115	1455	02657

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
APLOTV	10	00012	APRNTV	9	00011	CAMRAV	2	00002	DXDYV	4	00004
FRAM V	14	00016	GRID1V	5	00005	LABLV	7	00007	LINEV	13	00015
NXV	11	00013	NYV	12	00014	PLOTV	8	00010	PRINTV	6	00006
SETMIV	3	00003	(EFT)	15	00017	(FIL)	1	00001	(STH)	0	00000

ENTRY POINTS TO SUBROUTINES NOT OUTPUT FROM LIBRARY

APLOTV	APRNTV	CAMRAV	DXDYV	FRAMEV	GRID1V	LABLV	LINEV
NXV	NYV	PLOTV	PRINTV	SETMIV	(EFT)	(FIL)	(STH)

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN
50	27	00077	100	39	00204	110	78	00576	125	93	00671	
150	95	00675	200	96	00703	225	98	00723	300	108	01036	
305	158	01514	308	164	01547	310	179	01636	325	181	01642	
340	194	01727	350	196	01733	400	197	01741	415	198	01757	
425	199	01763	450	209	02076	460	270	02645	470	276	02700	
475	291	02767	500	293	02773	525	306	03060	550	308	03064	
600	309	03072	650	310	03110							

SUBROUTINE PLOT2

SUBROUTINE PLOT2

```
DIMENSION FORCE(100), STRESS(50,100), RASTR1(25,100), RASTR2(25,100)
```

```
1, ROSTR1(17,100), ROSTR2(17,100), ID(50), NGAGE(50), MATL(50)
```

```
2, ICHRA1(25), ICHRA2(25), IDRA1(25), IDRA2(25), NGARA1(25)
```

```
3, NGARA2(25), MATRA1(25), MATRA2(25), ICHRO1(17), ICHRO2(17)
```

```
4, ICHRO3(17), IDRO1(17), IDRO2(17), IDRO3(17), NGARO1(17)
```

```
5, NGARO2(17), NGARO3(17), MATRO1(17), MATRO2(17), MATRO3(17)
```

```
6, TITLE(12), NTYPE(50), DEFLE(100)
```

```
COMMON TITLE, NOG, NORAG, NOROG, FORCE, STRESS, RASTR1, RASTR2
```

```
1, ROSTR1, ROSTR2, K, NTYPE, ID, NGAGE, MATL, ICHRA1, ICHRA2
```

```
2, KTYRA, KTYRO, IDRA1, IDRA2, NGARA1, NGARA2, MATRA1, MATRA2
```

```
3, ICHRO1, ICHRO2, ICHRO3, IDRO1, IDRO2, IDRO3, NGARO1, NGARO2
```

```
4, NGARO3, MATRO1, MATRO2, MATRO3
```

```
COMMON XL, XR, IPLOT2
```

```
IDOUT = 6
```

```
WRITE OUTPUT TAPE 6, 1005
```

```
DO 500 I5 = 1, IPLOT2
```

```
READ INPUT TAPE 5, 1000, GAGE
```

```
READ INPUT TAPE 5, 1001, (DEFLE(I), I = 1, K)
```

```
WRITE OUTPUT TAPE 6, 1006, GAGE
```

```
WRITE OUTPUT TAPE 6, 1007, (DEFLE(I), I = 1, K)
```

```
YB = DEFLE(1)
```

```
YT = YB
```

```
DO 100 I = 2, K
```

```
YB = MIN1F(YB, DEFLE(I))
```

```
YT = MAX1F(YT, DEFLE(I))
```

```
100 CONTINUE
```

```
DIF = (YT - YB) * .05
```

```
YB = YB - DIF
```

```
YT = YT + DIF
```

```
CALL DXDYV(1, XL, XR, DX, N1, I1, NX, 10.0, IERR1)
```

```
CALL DXDYV(2, YB, YT, DY, M1, J1, NY, 10.0, IERR2)
```

```
NY = -3
```

```
WRITE OUTPUT TAPE IDOUT, 1004, GAGE, XL, XR, YB, YT, DX, DY, N1, M1,
```

```
1 I1, J1, NX, NY, IERR1, IERR2
```

```
CALL GRID1V(1, XL, XR, YB, YT, DX, DY, N1, M1, -I1, -J1, NX, NY)
```

```
CALL PRINTV(72, TITLE, 130, 1015)
```

```
CALL PRINTV(-19, 19HLOAD VS. DEFLECTION, 130, 999)
```

```
CALL PRINTV(-11, 11HGAGE NUMBER, 130, 983)
```

```
CALL PRINTV(6, GAGE, 226, 983)
```

```
CALL APRNTV(0, -12, -20, 20HDEFLECTION IN INCHES, 4, 600)
```

```
CALL PRINTV(-12, 12HPERCENT LOAD, 400, 4)
```

DO 110 KOUNT = 1,2
CALL APL0TV(K, FORCE(1), DEFLE(1), 1, 1, 1, 38, IERR)
110 CONTINUE
WRITE OUTPUT TAPE 6, 1002, IERR
C PLOT VECTORS
IX1 = NXV(FORCE(1))
IY1 = NYV(DEFLE(1))
DO 200 I2 = 2, K
IX2 = NXV(FORCE(I2))
IY2 = NYV(DEFLE(I2))
DO 225 KOUNT = 1, 3
CALL LINEV(IX1, IY1, IX2, IY2)
225 CONTINUE
IX1 = IX2
IY1 = IY2
200 CONTINUE
500 CONTINUE
650 CALL FRAMEV
CALL PRINTV(-18, 18, THIS JOB COMPLETED, 300, 600)
CALL PRINTV(-44, 44, SEND TO WESTINGHOUSE ASTRONUCLEAR LABORATORY,
1 300, 550)
CALL PRINTV(-41, 41, POST OFFICE BOX 10864, PITTSBURGH 36, PA., 300,
1 500)
CALL PRINTV(-44, 44, ATTENTION DIGITAL COMPUTER FACILITY BLDG. 5 ,
1 300, 450)
CALL FRAMEV
END FILE 12
RETURN
1000 FORMAT(A6)
1001 FORMAT(6E12.7)
1002 FORMAT(1H0, 10X24HIERR FROM APL0TV DEFLE = I6)
1004 FORMAT(1H0, 10X32HVALUES FOR GRID1V-----GAGE NO. A6 //10X
1 1P6E16.6 /10X 8I10)
1005 FORMAT(1H1, 40X21HDEFLECTION GAGE INPUT)
1006 FORMAT(1H0, 9X14HGAGE NUMBER = A6 //)
1007 FORMAT(7X 1P7E13.4)
END

STORAGE NOT USED BY PROGRAM

DEC OCT
588 01114

DEC OCT
18436 44004

STORAGE LOCATIONS FOR VARIABLES APPEARING IN COMMON STATEMENTS

DEC OCT
FORCE 32546 77442
ICHRO2 18626 44302
IDRO1 18592 44240
IPLOT2 18437 44005
MATL 18895 44717
MATRO2 18473 44051
NGARA2 18718 44436
NOG 32549 77445
RASTR1 27446 65466
STRE S 32446 77276

DEC OCT
ICHRA1 18845 44635
ICHRO3 18609 44261
IDRO2 18575 44217
K 19046 45146
MATRA1 18693 44405
MATRO3 18456 44030
NGARD1 18541 44155
NORAG 32548 77444
RASTR2 24946 60562
TITLE 32561 77461

DEC OCT
ICHRA2 18820 44604
IDRA1 18793 44551
IDRO3 18558 44176
KTYRA 18795 44553
MATRA2 18668 44354
NGAGE 18945 45001
NGARD2 18524 44134
NOROG 32547 77443
ROSTR1 22446 53656
XL 18439 44007

DEC OCT
ICHRO1 18643 44323
IDRA2 18768 44520
ID 18995 45063
KTYRO 18794 44552
MATRO1 18490 44072
NGARA1 18743 44467
NGARO3 18507 44113
NTYPE 19045 45145
ROSTR2 20746 50412
XR 18438 44006

STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE STATEMENTS

DEC OCT
DEFLE 587 01113

DEC OCT

DEC OCT

DEC OCT

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN COMMON, DIMENSION, OR EQUIVALENCE STATEMENTS

DEC OCT
DIF 487 00747
I1 483 00743
IOUT 479 00737
IY2 475 00733
NX 471 00727

DEC OCT
DX 486 00746
IERR1 482 00742
IX1 478 00736
J1 474 00732
NY 470 00726

DEC OCT
DY 485 00745
IERR2 481 00741
IX2 477 00735
M1 473 00731
YB 469 00725

DEC OCT
GAGE 484 00744
IERR 480 00740
IY1 476 00734
N1 472 00730
YT 468 00724

SYMBOLS AND LOCATIONS FOR SOURCE PROGRAM FORMAT STATEMENTS

EFN LOC
8)V8 1000 00720
8)VD 1005 00670

EFN LOC
8)V9 1001 00717
8)VE 1006 00662

EFN LOC
8)VA 1002 00715
8)VF 1007 00654

EFN LOC
8)VC 1004 00706

LOCATIONS FOR OTHER SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
1)	465	00721	2)	346	00532	3)	419	00643	6)	421	00645
)	373	00565									

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
APLOTV	8	00010	APRNTV	7	00007	DXDYV	4	00004	FRAMEV	12	00014
GRIDIV	5	00005	LINEV	11	00013	NXV	9	00011	NYV	10	00012
PRIN V	6	00006	(EFT)	13	00015	(FIL)	1	00001	(RTN)	3	00003
(STH)	0	00000	(TSH)	2	00002						

ENTRY POINTS TO SUBROUTINES NOT OUTPUT FROM LIBRARY

APLOTV	APRNTV	DXDYV	FRAMEV	GRIDIV	LINEV	NXV	NYV
PRINTV	(EFT)	(FIL)	(RTN)	(STH)	(TSH)		

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN
1 0	35	00122	110	63	00361	225	78	00440	200	81	00446	
5 0	82	00450	650	83	00452							

BEGIN LOAD TIME 11.044

ENTRY POINTS TO SUBROUTINES REQUESTED FROM LIBRARY,

(IOS)	(WRS)	(WTC)	(RCH)	(TES)	(WER)	(TCO)	LOG	EXP(2
(TSHM)	(SLI)	(RTN)	(SPH)	(SLO)	(FIL)	(STHM)	EXIT	SQRT
(EFT)								

SUBROUTINE ENTRY POINTS AND STARTING LOCATIONS

UPPER PROGRAM 31512

LOWER COMMON 44004

ENTRY	START	ENTRY	START	ENTRY	START	ENTRY	START
TPNUMV	00230 00144	(JBN..	00241	(CTJ..	00233	(P..4)	00223
NOFRV	00233	(4020)	00225	(CLEAN	00166	(PLOT)	00155
FORMV	01305 01160	RESETV	01302	FRAMEV	01167	CAMRAV	01317
YAXISV	01415 01407	XAXISV	01413	GRIDIV	01465 01442	LINRV	02415 02404
NONLNV	03223 03210	DXDYV	03642 03635	ERRLNV	04446 04443	ERRNLV	04533 04530
ERMKV	04624 04621	APRNTV	04646 04640	LINEV	04763 04760	APLOTV	05127 05117
POINTV	05347 05342	PRINTV	05502 05477	PLOTV	05650 05645	(XXXX)	06172 05677
SERREV	06113	SERSAV	06106	SCERRV	06101	UYV	06125
UXV	06122	NYV	06030	NXV	06025	YSCALV	05706
XSCALV	05703	IYV	06075	IXV	06072	RESCLV	06145
SCLSAV	06137	(YYYY)	06171	(SMYV)	06240 06210	(SMXV)	06230
MSXYV	06223	SMXYV	06216	YMODV	06253 06250	XMODV	06253
STOPTV	06260 06255	FAINTV	06273 06266	BRITEV	06271	LABLV	06331 06325
HOLLV	06620 06616	SIG6V	06661 06657	SIG6	06661	BNBCDV	07023 07021
BINBCD	07023	SETMOV	07251 07241	SETMIV	07243	SETCOV	07275 07265
SETCIV	07267	HOLDIV	07314 07307	HOLDIV	07311	RITXYV	07344 07320
RITSTV	07326	RITE2V	07356	RTSIZV	07574 07564	VCHARV	07601
CHSIZV	07567	TABLIV	10356 10035	TABL2V	10475 10360	TABL3V	10607 10477
MAIN-P	10627 10611	PLOT	17377 17353	PLOT2	23232 23212	EXP(2	24206 24203
NLOG	24265 24262	LOG	24265	SQRT	24363 24360	ATAN	24457 24435
ARTN	24435	ANYER	25237 24566	SBRER	25235	OVFLW	25230
UNFLW	25233	BRCDE	25215	EPMDE	25206	(SVN)	24573
(SIX)	24572	(FPT)	24574	ERROR	24723	ERTRP	25247
ERSIN	25241	EXIT	25271 25267	(TSHM)	25313 25303	(TSH)	25313
(EFT)	25360 25354	(BLOK)	25766 25373	(STHD)	25406	(STHM)	25403
(STH)	25403	(SPH)	26034 26030	(SLO)	26266 26266	(SLI)	26303 26303
(WTC)	26371 26320	(WER)	26332	(RDC)	26450 26417	(RER)	26426
(RTN)	27315 26464	(FIL)	27304	(IOH)	27445	(TCO)	30500 30371
(TEF)	30477	(RCH)	30476	(ETT)	30475	(REW)	30474
(WEF)	30473	(BSR)	30472	(WRS)	30471	(RDS)	30470
(IOS)	30374	STCH)	30512	(TCN)	30511	(LCH)	30510
(CHR)	30507	(RUN)	30506	(BSF)	30505	(SDL)	30504
(SDH)	30503	(BTT)	30502	(TRC)	30501	(IOU)	30536 30533
(FT)	30562 30554	(EXEM)	30563	(EXE)	30563	(TES)	31511 31511

EXECUTION TIME 11.046

APPENDIX B

Sample Output

NO. OF GAGES FOR THIS RUN = 44

RECORDER GAGE FACTOR = 2.170

CHANNEL NO.	GAGE NO.	GAGE FACTOR
1	21151A	2.280
2	23151A	2.280
3	21153A	2.280
4	23153A	2.280
5	10155A	2.200
6	10156A	2.200
7	10158A	2.200
8	21159A	2.200
9	23159A	2.200
10	10162A	2.200
11	10163A	2.200
12	10164A	2.200
13	10165A	2.200
14	10166A	2.200
15	10178A	2.200
16	10179A	2.200
17	10180A	2.200
18	10181A	2.200
19	10183A	2.200
20	10184A	2.200
21	10185A	2.200
22	10186A	2.200
23	10188A	2.200
24	10192A	2.200
25	10198A	2.200
26	10200A	2.200
27	31211	2.140
28	32211	2.140
29	33211	2.140
30	21121	2.140
31	23121	2.140
32	21128	2.140
33	23128	2.140
34	21136	2.140
35	23136	2.140
36	21141	2.140
37	23141	2.140
38	10148	2.140
39	10149	2.140
40	10161A	2.200

RECORDED STRAIN IN INCHES/INCH

LOAD NO. = 1 PERCENT LOAD = 0. TEMPERATURE = 75.000 DEG.F

3.000E-06	-10.000E-07	-2.000E-06	-10.000E-07	-10.000E-07	-10.000E-07	-10.000E-07
-2.000E-06	0.	2.000E-06	-3.000E-06	-5.000E-06	-4.000E-06	-3.000E-06
-4.000E-06	-0.	-3.000E-06	-4.000E-06	-3.000E-06	-3.000E-06	-10.000E-05
-2.000E-06	-2.000E-06	-2.000E-06	-4.000E-06	-2.000E-06	-3.000E-06	-2.000E-06
-2.000E-06	-5.000E-06	-2.000E-06	-10.000E-07	-2.000E-06	-0.	2.000E-06
-4.000E-06	-2.000E-06	-2.000E-06	-10.000E-07	-10.000E-07	-0.	-2.000E-06
-3.000E-06	-4.000E-06					
2.855E-06	-9.518E-07					
-1.904E-06	-9.518E-07					
-1.973E-06	0.					
-3.042E-06	-2.028E-06	-2.028E-06				
-5.070E-06	-2.028E-06					
-1.014E-06	-2.028E-06					
-0.	2.028E-06					
-4.056E-06	-2.028E-06					

LOAD NO. = 2 PERCENT LOAD = 7.000 TEMPERATURE = 75.000 DEG.F

-3.600E-05	-1.200E-05	-3.800E-05	-1.600E-05	-4.200E-05	3.600E-05	3.700E-05
-2.300E-05	0.	4.400E-05	-5.100E-05	3.300E-05	-4.200E-05	3.600E-05
2.800E-05	-3.200E-05	1.900E-05	-3.400E-05	-5.100E-05	3.700E-05	-4.500E-05
3.300E-05	4.000E-05	3.700E-05	3.400E-05	3.600E-05	-7.000E-06	-1.100E-05
-5.000E-06	-9.500E-05	2.700E-05	-8.700E-05	1.700E-05	-9.300E-05	3.300E-05
-6.800E-05	5.000E-06	-5.600E-05	-6.600E-05	-7.500E-05	4.200E-05	-4.400E-05
-10.000E-06	-3.000E-05					
-3.426E-05	-1.142E-05					
-3.617E-05	-1.523E-05					
-2.269E-05	0.					
-7.098E-06	-1.115E-05	-5.070E-06				
-9.633E-05	2.738E-05					
-8.822E-05	1.724E-05					
-9.430E-05	3.346E-05					
-6.895E-05	5.070E-06					

LOAD NO. = 3 PERCENT LOAD = 14.000 TEMPERATURE = 75.000 DEG.F

-7.700E-05	-2.100E-05	-7.700E-05	-2.900E-05	-9.000E-05	7.700E-05	8.000E-05
-4.300E-05	0.	8.900E-05	-1.010E-04	7.300E-05	-8.100E-05	7.600E-05
6.400E-05	-6.500E-05	4.300E-05	-6.600E-05	-1.020E-04	8.000E-05	-9.000E-05
7.100E-05	8.600E-05	8.100E-05	7.700E-05	8.200E-05	-1.100E-05	-1.400E-05
-3.000E-06	-1.970E-04	5.600E-05	-1.730E-04	3.600E-05	-1.940E-04	6.500E-05
-1.350E-04	1.100E-05	-1.130E-04	-1.300E-04	-1.620E-04	8.600E-05	-9.500E-05
-1.400E-05	-6.200E-05					
-7.329E-05	-1.999E-05					

LOAD VS. STRESS FOR SINGLE GAGES

CHANNEL NO. = 1

GAGE NO. = 21151A

LOAD NO.	PERCENT LOAD	TEMP.(DEG.F.)	STRESS(LB./SQ.IN.)
1	0.	75.000	3.005265E 01
2	7.000	75.000	-3.606318E 02
3	14.000	75.000	-7.713513E 02
4	21.000	75.000	-1.101930E 03
5	28.000	75.000	-1.292264E 03
6	35.000	75.000	-1.833211E 03
7	42.000	75.000	-1.973457E 03
8	49.000	75.000	-2.494370E 03
9	56.000	75.000	-2.734791E 03
10	59.500	75.000	-3.055352E 03
11	63.000	75.000	-3.105440E 03
12	66.500	75.000	-3.255703E 03
13	70.000	75.000	-3.395949E 03
14	73.500	75.000	-3.576265E 03
15	77.000	75.000	-3.806669E 03
16	80.500	75.000	-3.926879E 03
17	84.000	75.000	-4.077142E 03
18	87.500	75.000	-4.137248E 03
19	91.000	75.000	-4.297528E 03
20	94.500	75.000	-4.487862E 03
21	98.000	75.000	-4.638125E 03
22	100.000	75.000	-4.758336E 03
23	49.000	75.000	-3.836721E 03
24	0.	75.000	-2.905089E 02

LOAD VS. STRESS FOR RIGHT ANGLE GAGES

CHANNEL NOS. = 1 2

GAGE NOS. = 21151A 23151A

LOAD NO.	PERCENT LOAD	TEMP.(DEG.F.)	MAXIMUM STRESS(LB./SQ.IN.)	MINIMUM STRESS(LB./SQ.IN.)
1	0.	75.000	2.972240E 01	-1.100830E 00
2	7.000	75.000	-4.359285E 02	-2.509891E 02
3	14.000	75.000	-9.169910E 02	-4.854658E 02
4	21.000	75.000	-1.309987E 03	-6.935226E 02
5	28.000	75.000	-1.529052E 03	-7.892948E 02
6	35.000	75.000	-2.156525E 03	-1.077712E 03
7	42.000	75.000	-2.323851E 03	-1.167980E 03
8	49.000	75.000	-2.988752E 03	-1.647942E 03
9	56.000	75.000	-3.239741E 03	-1.683168E 03
10	59.500	75.000	-3.608519E 03	-1.843889E 03
11	63.000	75.000	-3.683376E 03	-1.926452E 03
12	66.500	75.000	-3.868315E 03	-2.042039E 03
13	70.000	75.000	-4.025734E 03	-2.099282E 03
14	73.500	75.000	-4.240395E 03	-2.213768E 03
15	77.000	75.000	-4.513401E 03	-2.355775E 03
16	80.500	75.000	-4.652106E 03	-2.417422E 03
17	84.000	75.000	-4.830440E 03	-2.510992E 03
18	87.500	75.000	-4.903095E 03	-2.552824E 03
19	91.000	75.000	-5.099042E 03	-2.671713E 03
20	94.500	75.000	-5.324712E 03	-2.789502E 03
21	98.000	75.000	-5.506349E 03	-2.894081E 03
22	100.000	75.000	-5.651659E 03	-2.977744E 03
23	49.000	75.000	-4.404419E 03	-1.892326E 03
24	0.	75.000	-3.423580E 02	-1.728302E 02

LOAD VS. STRESS FOR ROSETTE GAGES

CHANNEL NOS. = 27 28 29

GAGE NOS. = 31211 32211 33211

LOAD NO.	PERCENT LOAD	TEMP.(DEG.F.)	MAXIMUM STRESS(LB./SQ.IN.)	MINIMUM STRESS(LB./SQ.IN.)	ALPHA(DEG.)
1	0.	75.000	-6.645912E 01	-4.889126E 01	67.50000
2	7.000	75.000	-2.017623E 02	-7.507866E 01	-50.65497
3	14.000	75.000	-2.616427E 02	-6.133836E 01	-59.87244
4	21.000	75.000	-2.757222E 02	-2.418880E 01	-61.45262
5	28.000	75.000	-2.716320E 02	6.400135E 01	-64.49549
6	35.000	75.000	-2.456023E 02	1.763921E 02	-68.69297
7	42.000	75.000	-2.400860E 02	2.170159E 02	-68.60130
8	49.000	75.000	6.680207E 02	4.715172E 01	-54.94258
9	56.000	75.000	7.027500E 02	8.163258E 01	-53.13010
10	59.500	75.000	8.336136E 02	1.814698E 02	-53.87234
11	63.000	75.000	6.752781E 02	8.603440E 01	-62.34758
12	66.500	75.000	6.212504E 02	9.392201E 01	-68.45457
13	70.000	75.000	6.470766E 02	1.373060E 02	-68.48747
14	73.500	75.000	6.916285E 02	1.619643E 02	-70.35530
15	77.000	75.000	7.485744E 02	2.203689E 02	-69.40704
16	80.500	75.000	7.636350E 02	2.514484E 02	-70.45307
17	84.000	75.000	8.300490E 02	3.003848E 02	-70.35530
18	87.500	75.000	8.094736E 02	2.978900E 02	-75.47270
19	91.000	75.000	8.741817E 02	3.946726E 02	-71.71348
20	94.500	75.000	9.279249E 02	4.332096E 02	-70.55775
21	98.000	75.000	9.525415E 02	5.008733E 02	-74.24787
22	100.000	75.000	9.604602E 02	5.160247E 02	-76.71747
23	49.000	75.000	3.623882E 02	-2.239677E 02	-71.80782
24	0.	75.000	-4.345696E 02	-1.421823E 02	83.86761

SC-4020 ARGUMENTS

VALUES FOR GRIDIV---CHANNEL NO. 1

-5.000000E 00	1.050000E 02	-4.997755E 03	2.694721E 02	2.000000E 00	1.000000E 02
5	5	10	3	0	0

IERR FROM APLOTV SINGLE GAGE = 0

VALUES FOR GRIDIV---CHANNEL NO. 2

-5.000000E 00	1.050000E 02	-1.345858E 03	5.359388E 01	2.000000E 00	2.000000E 01
5	5	10	3	0	0

IERR FROM APLOTV SINGLE GAGE = 0

VALUES FOR GRIDIV---CHANNEL NO. 3

-5.000000E 00	1.050000E 02	-4.690216E 03	2.023545E 02	2.000000E 00	1.000000E 02
5	5	10	3	0	0

IERR FROM APLOTV SINGLE GAGE = 0

VALUES FOR GRIDIV---CHANNEL NO. 4

-5.000000E 00	1.050000E 02	-2.029555E 03	8.615092E 01	2.000000E 00	5.000000E 01
5	4	4	3	0	0

IERR FROM APLOTV SINGLE GAGE = 0

VALUES FOR GRIDIV---CHANNEL NO. 5

-5.000000E 00	1.050000E 02	-5.973182E 03	2.735610E 02	2.000000E 00	1.000000E 02
5	5	10	3	0	0

IERR FROM APLOTV SINGLE GAGE = 0

VALUES FOR GRIDIV---CHANNEL NO. 6

-5.000000E 00	1.050000E 02	-2.657747E 02	5.352868E 03	2.000000E 00	1.000000E 02
5	5	10	3	0	0

IERR FROM APLOTV SINGLE GAGE = 0

VALUES FOR GRIDIV---CHANNEL NO. 7

-5.000000E 00	1.050000E 02	-2.704465E 02	5.450976E 03	2.000000E 00	1.000000E 02
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DEFLECTION GAGE INPUT

GAGE NUMBER = 1 ZR

-0.	3.0000E-03	6.0000E-03	9.0000E-03	10.0000E-03	1.2000E-02	1.4000E-02
1.8000E-02	1.9000E-02	2.0000E-02	2.1000E-02	2.2000E-02	2.3000E-02	2.3000E-02
2.4000E-02	2.5000E-02	2.5000E-02	2.5000E-02	2.6000E-02	2.7000E-02	2.7000E-02
2.8000E-02	-0.	-0.				

VALUES FOR GRID1V-----GAGE NO. 1 ZR

-5.000000E 00	1.050000E 02	-1.400000E-03	2.940000E-02	2.000000E 00	5.000000E-04
5	4	5	8	3	-3
				0	0

IERR FROM APLOTV DEFLE = 0

GAGE NUMBER = 2 CS

-0.	4.2000E-03	9.1000E-03	1.3200E-02	1.4700E-02	1.9300E-02	2.1500E-02
2.7400E-02	2.8100E-02	3.1100E-02	3.1500E-02	3.2900E-02	3.3600E-02	3.5200E-02
3.6500E-02	3.7000E-02	3.8500E-02	3.9500E-02	3.1000E-02	3.2000E-02	3.3000E-02
3.3700E-02	-0.	-0.				

VALUES FOR GRID1V-----GAGE NO. 2 CS

-5.000000E 00	1.050000E 02	-1.975000E-03	4.147500E-02	2.000000E 00	10.000000E-04
5	5	5	10	3	-3
				0	0

IERR FROM APLOTV DEFLE = 0

GAGE NUMBER = 3 CS

-0.	5.0000E-03	9.0000E-03	1.4000E-02	1.6000E-02	2.2000E-02	2.4000E-02
3.1000E-02	3.2000E-02	3.5000E-02	3.6000E-02	3.7000E-02	3.9000E-02	4.0000E-02
4.2000E-02	4.4000E-02	4.5000E-02	4.6000E-02	4.7000E-02	5.0000E-02	5.0000E-02
5.2000E-02	-0.	-0.				

VALUES FOR GRID1V-----GAGE NO. 3 CS

-5.000000E 00	1.050000E 02	-2.600000E-03	5.460000E-02	2.000000E 00	10.000000E-04
5	5	5	10	3	-3
				0	0

IERR FROM APLOTV DEFLE = 0

GAGE NUMBER = 4 CS

-0.	6.0000E-03	1.2000E-02	1.8000E-02	2.0000E-02	2.7000E-02	3.0000E-02
3.9000E-02	4.1000E-02	4.4000E-02	4.6000E-02	4.9000E-02	5.1000E-02	5.3000E-02

APPENDIX C
Flow Diagrams

MAIN PROGRAM

SUBROUTINE PLOT

This Subroutine Plots Percent Load Vs. Stress

SUBROUTINE PLOT2

This Subroutine Plots Percent Load Vs. Deflection

5. REFERENCES

1. Equations 1 and 2 were formulated by fitting a third degree polynomial to data taken from WANL Materials Manual. Equation 1 was fitted to curve number 537457-1 and equation 2 was fitted to curve number 553846.
2. O. L. Gillette, "The Use of Strain Gages in Cryogenic Test Programs", Instrument Society of America, 18th Annual ISA Conference and Exhibit (September 9-12, 1963; Preprint No. 38.1.63).
3. Perry and Lissner, The Strain Gage Primer, 2nd ed., p. 147, McGraw-Hill Book Company, Inc., New York, 1962.