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10-3-75

TECHNICAL STUDY

TITLE: Energy Absorption in the Size 24 Fig. 607 Valve Seat and Disk

ABSTRACT

A preliminary investigation of the resistance of this valve to damage from disk-seat impact was made. An elastic finite-element study of the valve body and disk showed that yielding will occur first in the valve body. A scale model test of the valve body demonstrated that plastic deformation of the seat occurs in such a way as to absorb the impact energy without loss of pressure integrity. It is concluded that this valve can safely withstand the sudden closure which would result from an instantaneous release of pressure upstream of the valve.

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KEY WORDS

Calculations; Valves, Angle; Valves, Nuclear

DISTRIBUTION

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OBJECTIVE

This study was undertaken at the request of the customer to determine whether the size 24 Figure 607 main steam isolation valves at the Three Mile Island nuclear power plant are capable of safely withstanding a sudden release of upstream pressure, such as would occur due to an instantaneous bursting of the pipe. Such a condition would cause these stop-check type valves to slam shut, the disks striking the seats at a velocity of 107 ft/sec. (33 m/s) and with an energy of 1,380,000 in.lb. (155 kJ).

Due to the limited time available, this study was to be limited to an elastic finite-element analysis, hand calculations and simple tests.

CONCLUSIONS

1. The disk impact energy due to the sudden flow reversal associated with a line break can be safely absorbed by the valve seat.

2. The type of deformation that will occur is a plastic flow of the seat shelf, downward and inward, causing a reduction in the inside diameter of the valve bore below the seat. Very little radial movement of the body shell will occur.

3. The valve disk is stronger than the seat by a factor of 2.24. Therefore most plastic deformation will occur in the valve seat. Any plastic deformation that might occur in the disk will provide further energy-absorbing capacity.

4. The deformed seat in the model was coined to an excellent finish. However, no stellite was deposited on this seat as is the case in the actual valve. Therefore, the sealing ability of the valve after this deformation has occurred cannot be predicted solely on the basis of the test. However, even though the stellite might crack, the tight mechanical engagement of disk and body would be preserved and would effectively limit the flow.

DISCUSSION

This investigation included two principal activities: an elastic finite-element stress analysis of the disk and body and an experimental study of the plastic deformation of the seat. Discussion of these activities will be presented in that order.

ELASTIC FINITE-ELEMENT ANALYSIS

The lower portion of the disk and the seat region of the body were modeled using FINEL (2), an axisymmetric finite-element program having rectangular and triangular

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[1] Numbers in parenthesis refer to references at end of paper.

elements. This program has been used extensively within Rockwell and has been verified with closed-form analyses and by comparison to NASTRAN on identical models.

Since the body loading includes both the seat loading due to impact and the internal pressure loading above the seat, it was necessary to run two cases in order to identify the seat deflection due to the impact loading alone.

Exhibit One is the computer output for the combined pressure and impact loading of the body. For a pressure load of 1000 psi (69 bar) and an impact load of 1,000,000 lbs. (4.45 MN), the maximum stress intensity occurs just below the seat, and has a magnitude of 46.2 ksi (318 MPa).

Comparing this value to the yield stress of the body material at 500F (260C), which, from Section III of the ASME Code, is 29.1 ksi (200 MPa) shows that the actual seat loading at which yield will occur is:

$$1{,}000{,}000 \left(\frac{29.1}{46.2}\right) = 630{,}000 \text{ lb. } (2.8 \text{ MN})$$

And the corresponding pressure loading would be:

$$1000 \left(\frac{29.1}{46.2}\right) = 630 \text{ psi } (44 \text{ bar})$$

which fortunately compares well with the 617 psi (43 bar) obtained by extrapolating the inlet pressure in the simulation study to the time of impact.

Exhibit Two is the analysis of the body under impact loading only. This analysis shows that the outward deflection of the seat is .004" (0.10 mm) due to impact. Applying the 0.63 yield adjustment factor as above, the adjusted deflection at a 630,000 lb. (2.8 MN) load would be 0.0026" (0.065 mm).

A calculation of the elastic energy absorbed by outward deflection of the seat yields:

$$W = \frac{1}{2} F x = \frac{1}{2} (630{,}000)(.0026) = 820 \text{ in-lb.},$$

or, in SI units,

$$\frac{1}{2} (2.8)(.065)\, 10^3 = 91 \text{ J}$$

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which is, of course, insignificant compared to the 1,380,000 in-lb (155 kJ) kinetic energy of the disk.

Exhibit Three is the finite-element model of the disk. This disk model is loaded in proportion to the mass at each section, in the manner used in the Leonard and O'Leary study of nuclear swing check valves (3). The FINEL program is also used in this analysis.

The seat load resulting from the arbitrarily-scaled inertial loading was 212,675 lb. (.946 MN). The maximum stress intensity was 4.7 ksi (32.4 MPa) compared to a yield stress (F11 material) of 31.2 ksi (215 MPa), indicating that the disk can withstand a seat load of:

$$212{,}675 \left(\frac{31.2}{4.7}\right) = 1{,}412{,}000 \text{ lb. } (6.28 \text{ MN})$$

before yielding. Since the body will begin to yield at 630,000 lb. (2.8 MN), the disk is approximately 1,412,000/630,000 = 2.24 times as strong as the body.

By summing the products of one-half the applied forces times the deflection of the corresponding nodes, the elastic energy input to the disk was calculated to be 149.3 in-lb (16.9 J) under the loading of the model. This must be scaled up by a factor of $(630{,}000/212{,}675)^2 = 8.77$ to correspond to the body yield load, yielding an elastic energy of 1310 in-lb (148 J).

The elastic energy also would include that energy absorbed by relative motion of the disk into the conical seat. Inward deflection of the disk, adjusted for the yield load of the body, would be:

$$.00017 \left(\frac{630{,}000}{212{,}675}\right) = .0005'' \text{ } (0.012 \text{ mm})$$

Adding this to the outward deflection of the body and multiplying by half the applied force, the energy absorbed is:

$$W = \frac{1}{2} (630{,}000)(.0005 + .0026) = 977 \text{ in.lb.}$$

or, in SI units,

$$W = \frac{1}{2} (2.8)(.012 + .065)\ 10^3 = 108 \text{ J}$$

The total energy that is absorbed elastically, then, up to the point of incipient yielding, would be:

Description	Energy, in-lb (J)
Body Elastic Energy	820 (91)
Disk Elastic Energy	1310 (148)
Disk-Body Relative Motion	977 (108)
Total Elastic Energy Capacity	3107 (347)

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Thus, the elastic analysis bears out the initial opinion that the amount of energy that can be absorbed elastically is far less than that which would be supplied under the postulated line break conditions.

Nonetheless, the elastic analysis does identify the body as the likely site of plastic deformation.

EXPERIMENTAL SEAT STUDY

In order to determine the nature of the plastic deformation that would occur, it was decided to make a scale model of the valve seat, and to perform an actual deformation test, while measuring deflections and forces.

In order to make use of the 200,000 lb. (889.6 kN) test machine in the Rockwell materials laboratory, a scale factor of 0.189 was chosen.

Exhibit Four shows the test model dimensions. Clay impressions were made of the seat in the model and viewed on an optical comparator to verify that the geometry was correct. A solid disk having a 45° beveled edge and a 4.217 diameter was made of hardened AISI 4340 steel, in order to confine the deformation to the body only.

A tensile specimen was made of the same piece of material that was used for the body, and was pulled to determine the yield strength of the material. Its yield strength (0.2% offset) was 43.4 ksi (298 MPa). This is typical of the 1018 material used, and is higher than the minimum specified yield strength of the valve body material (4). Knowing the actual yield strength provides a basis for comparison of the energy absorbed in the test model to that which would be absorbed in a valve with minimum material properties. The ratio of yield strength is:

$$\frac{43.3}{29.1} = 1.487$$

Exhibit Five is the force-deflection curve obtained from this test. The area under this curve represents the amount of energy dissipated by plastic flow of the material. This area is approximately 17,000 in-lb (1.92 kJ).

The energy in the model can be scaled to the actual valve by dividing by the cube of the scale factor. This means that a geometrically similar deformation in a valve of equal material strength would absorb $17{,}000/.189^3 = 2{,}518{,}000$ in-lb (285 kJ). Adjusting for the ratio of actual yield strength of the model to the MSYS of the body material reduces this to 1,693,000 in-lb (191 kJ).

Applying these results to the postulated event in the valve, it is estimated that to a first approximation, the impact energy would be absorbed after seat deformation and disk travel of 0.44 in. (11 mm). This disk travel will produce additional energy to be absorbed because of the unbalanced pressure force acting on the disk. This is determined to be:

$$\text{Seat area } (379 \text{ in}^2) \times \text{bonnet cavity pressure } (168 \text{ psi}) \times 0.44 \text{ in.}$$
$$= 28,000 \text{ in.lbs.}$$

Thus the total energy to be absorbed is 1,380,000 in.lbs. + 28,000 in.lbs., or 1,410,000 in.lbs. (159 kJ). Since the 1,693,000 in.lbs. (191 kJ) value calculated for a minimum yield strength body represents only the extent of deformation applied to the model and not a limiting value, it can be concluded that the safe energy absorption capacity of the body is conservatively adequate for the postulated event.

Deformation of the model is shown in Exhibit Six. The disk moved the seat downward by a plowing type action. The width of the seat was increased from .025" (.64 mm) to .082" (2.1 mm) by the "piling up" of displaced material. The diameter of the body was not significantly changed.

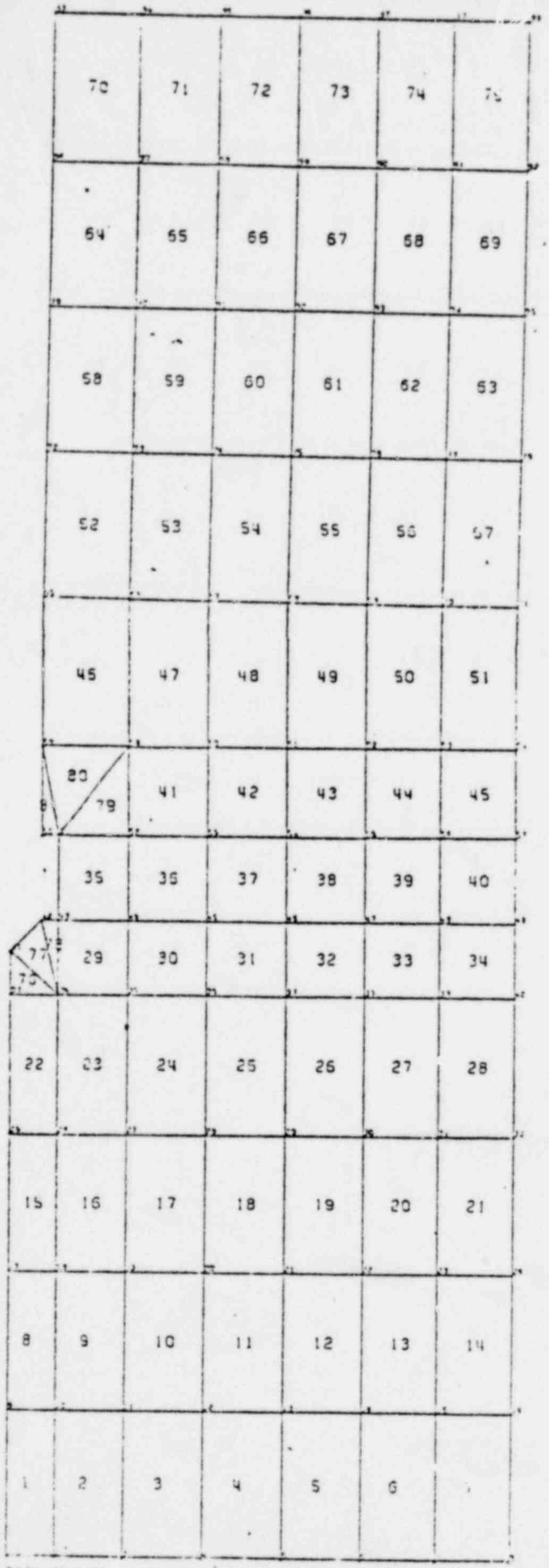

EXHIBIT ONE

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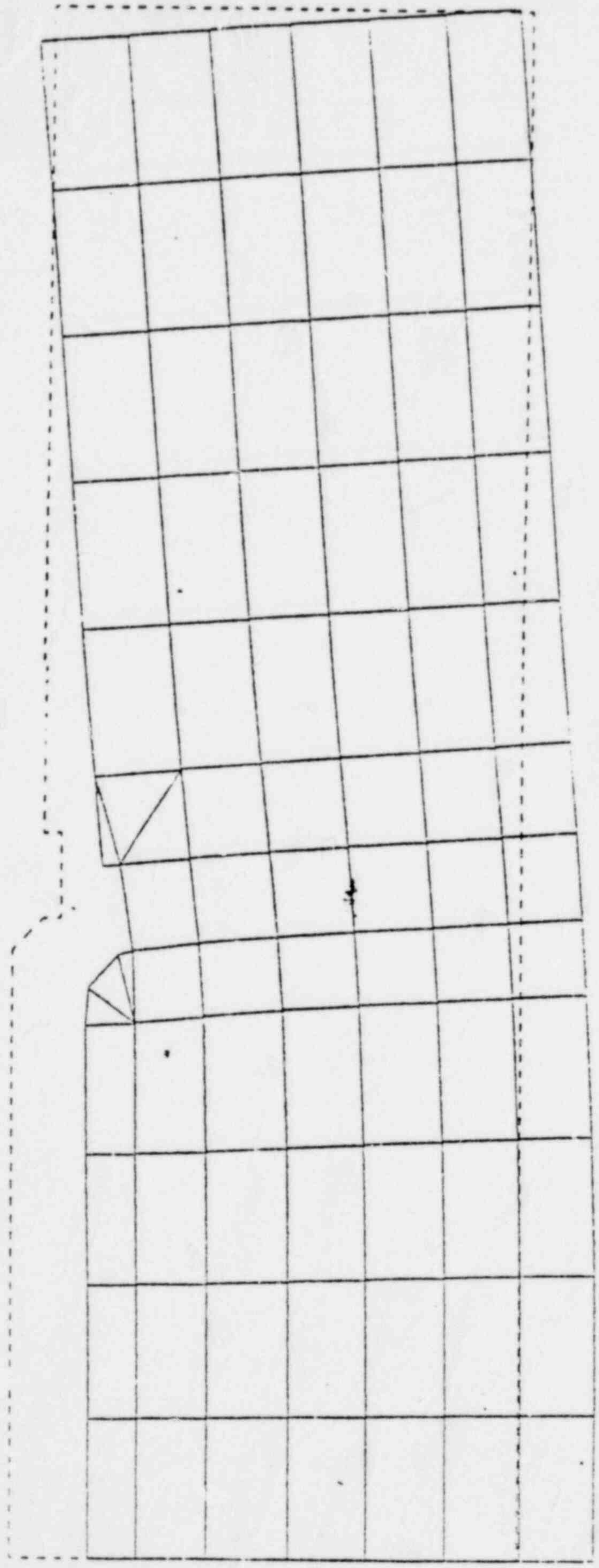

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EXHIBIT C-5

[illegible]

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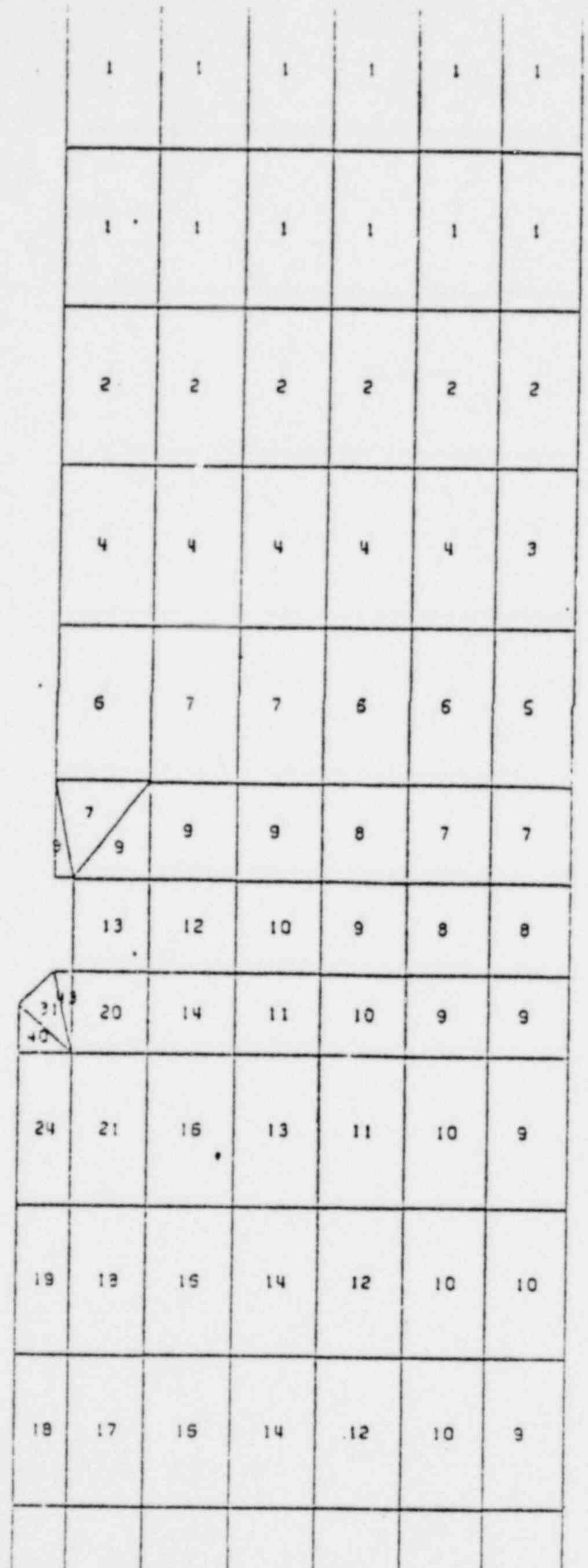

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EXHIBIT ONE

EXHIBIT ONE

1

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

NT	NOREGT	NR	NZ	NPR	NPZ	NF	NSUPP	IBPL	MAXITS	NPLOT	NTRI	NCOUP
99	75	9	14	2	3	0	8	22	1000	1.	6	0

NGRIDS
5

CC	BETA	E	MU
.16000E-07	.0	.30000E+08	.30000

GRID 1 -- 7 X 4 -- 1 8 40 33

GRID 2 -- 6 X 1 -- 34 40 49 43

GRID 3 -- 6 X 1 -- 43 49 57 51

GRID 4 -- 5 X 1 -- 52 57 64 59

GRID 5 -- 6 X 5 -- 58 64 99 93

RECTANGULAR ELEMENTS

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

TRIANGULAR ELEMENTS

34	41	33	0	34	42	41	0	34	43	42	0	52	59	51	0	51	59	58	0
51	58	50	0																

R LATTICE

10.970	11.170	11.280	11.720	12.230	12.730
13.230	13.710	14.180			

Z LATTICE

.0	.93000	1.8500	2.7400	3.6400	3.9200
4.1200	4.6700	5.2500	6.1800	7.1300	8.0700
9.0100	9.9700				

POOR ORIGINAL

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SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

NODAL LATTICE POSITIONS

1	1	1
2	3	1
3	4	1
4	5	1
5	6	1
6	7	1
7	8	1
8	9	1
9	1	2
10	3	2
11	4	2
12	5	2
13	6	2
14	7	2
15	8	2
16	9	2
17	1	3
18	3	3
19	4	3
20	5	3
21	6	3
22	7	3
23	8	3
24	9	3
25	1	4
26	3	4
27	4	4
28	5	4
29	6	4
30	7	4
31	8	4
32	9	4
33	1	5
34	3	5
35	4	5
36	5	5
37	6	5
38	7	5
39	8	5
40	9	5
41	1	6
42	2	7
43	3	7
44	4	7
45	5	7
46	6	7
47	7	7
48	8	7
49	9	7
50	2	8

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SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

NODAL LATTICE POSITIONS

51	3	8
52	4	8
53	5	8
54	6	8
55	7	8
56	8	8
57	9	8
58	2	9
59	4	9
60	5	9
61	6	9
62	7	9
63	8	9
64	9	9
65	2	10
66	4	10
67	5	10
68	6	10
69	7	10
70	8	10
71	9	10
72	2	11
73	4	11
74	5	11
75	6	11
76	7	11
77	8	11
78	9	11
79	2	12
80	4	12
81	5	12
82	6	12
83	7	12
84	8	12
85	9	12
86	2	13
87	4	13
88	5	13
89	6	13
90	7	13
91	8	13
92	9	13
93	2	14
94	4	14
95	5	14
96	6	14
97	7	14
98	8	14
99	9	14

POOR ORIGINAL

1411 321

ROCKWELL INTERNATIONAL
FLO CONTROL DIVISION
PROGRAM NO. NCCESR26

SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

PICTORIAL REPRESENTATION

0	93	0	94	95	56	57	98	99
0	86	0	87	88	89	90	91	92
0	79	0	80	81	82	83	84	85
0	72	0	73	74	75	76	77	78
0	65	0	66	67	68	69	70	71
0	58	0	59	60	61	62	63	64
0	50	51	52	53	54	55	56	57
0	42	43	44	45	46	47	48	49
41	0	0	0	0	0	0	0	0
33	0	34	35	36	37	38	39	40
25	0	26	27	28	29	30	31	32
17	0	18	19	20	21	22	23	24
9	0	10	11	12	13	14	15	16
1	0	2	3	4	5	6	7	8

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SIZE 24 FIG. 602 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

RADIAL PRESSURE, TYPE, NODES

1000.0	1	43	51	50	58	65	72	79	86	93
.10000E+07	2	41	42							

AXIAL PRESSURE, TYPE, NODES

1000.0	1	50	51
-1000.0	1	42	43
-.10000E+07	2	41	42

DEFLECTION	NODE	DIRECTION
.0	1	2
.0	2	2
.0	3	2
.0	4	2
.0	5	2
.0	6	2
.0	7	2
.0	8	2

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SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

1	10.970	0.0	0.	0.
2	11.280	0.0	0.	0.
3	11.720	0.0	0.	0.
4	12.230	0.0	0.	0.
5	12.730	0.0	0.	0.
6	13.230	0.0	0.	0.
7	13.710	0.0	0.	0.
8	14.180	0.0	0.	0.
9	10.970	0.950	0.	0.
10	11.280	0.950	0.	0.
11	11.720	0.950	0.	0.
12	12.230	0.950	0.	0.
13	12.730	0.950	0.	0.
14	13.230	0.950	0.	0.
15	13.710	0.950	0.	0.
16	14.180	0.950	0.	0.
17	10.970	1.850	0.	0.
18	11.280	1.850	0.	0.
19	11.720	1.850	0.	0.
20	12.230	1.850	0.	0.
21	12.730	1.850	0.	0.
22	13.230	1.850	0.	0.
23	13.710	1.850	0.	0.
24	14.180	1.850	0.	0.
25	10.970	2.740	0.	0.
26	11.280	2.740	0.	0.
27	11.720	2.740	0.	0.
28	12.230	2.740	0.	0.
29	12.730	2.740	0.	0.
30	13.230	2.740	0.	0.
31	13.710	2.740	0.	0.
32	14.180	2.740	0.	0.
33	10.970	3.640	0.	0.
34	11.280	3.640	0.	0.
35	11.720	3.640	0.	0.
36	12.230	3.640	0.	0.
37	12.730	3.640	0.	0.
38	13.230	3.640	0.	0.
39	13.710	3.640	0.	0.
40	14.180	3.640	0.	0.
41	10.970	3.920	497493.	-497493.
42	11.170	4.120	502507.	-506375.
43	11.280	4.120	19490.	-3890.
44	11.720	4.120	0.	0.
45	12.230	4.120	0.	0.
46	12.730	4.120	0.	0.
47	13.230	4.120	0.	0.
48	13.710	4.120	0.	0.
49	14.180	4.120	0.	0.
50	11.170	4.670	20353.	3868.

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SIZE 24 FIG. 637 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

51	11.280	4.670	19490.	3890.
52	11.720	4.670	0.	0.
53	12.230	4.670	0.	0.
54	12.730	4.670	0.	0.
55	13.230	4.670	0.	0.
56	13.710	4.670	0.	0.
57	14.180	4.670	0.	0.
58	11.170	5.250	52988.	0.
59	11.720	5.250	0.	0.
60	12.230	5.250	0.	0.
61	12.730	5.250	0.	0.
62	13.230	5.250	0.	0.
63	13.710	5.250	0.	0.
64	14.180	5.250	0.	0.
65	11.170	6.180	65972.	0.
66	11.720	6.180	0.	0.
67	12.230	6.180	0.	0.
68	12.730	6.180	0.	0.
69	13.230	6.180	0.	0.
70	13.710	6.180	0.	0.
71	14.180	6.180	0.	0.
72	11.170	7.130	66323.	0.
73	11.720	7.130	0.	0.
74	12.230	7.130	0.	0.
75	12.730	7.130	0.	0.
76	13.230	7.130	0.	0.
77	13.710	7.130	0.	0.
78	14.180	7.130	0.	0.
79	11.170	8.070	65972.	0.
80	11.720	8.070	0.	0.
81	12.230	8.070	0.	0.
82	12.730	8.070	0.	0.
83	13.230	8.070	0.	0.
84	13.710	8.070	0.	0.
85	14.180	8.070	0.	0.
86	11.170	9.010	66674.	0.
87	11.720	9.010	0.	0.
88	12.230	9.010	0.	0.
89	12.730	9.010	0.	0.
90	13.230	9.010	0.	0.
91	13.710	9.010	0.	0.
92	14.180	9.010	0.	0.
93	11.170	9.970	33688.	0.
94	11.720	9.970	0.	0.
95	12.230	9.970	0.	0.
96	12.730	9.970	0.	0.
97	13.230	9.970	0.	0.
98	13.710	9.970	0.	0.
99	14.180	9.970	0.	0.

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SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

STIFFNESS MATRIX WIDTH FROM 1 TO 22

GAUSS-SEIDEL ITERATION
CONVERGENCE AT ITERATION NO. AND BETA

.12669E-04	100	1.86571
.12583E-05	200	1.86571
.19398E-06	300	1.86571
.27396E-07	400	1.86571

TOTAL ITERATIONS, 451

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SIZE 24 FIG. 6C7 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

NODAL DISPLACEMENTS

NODE	UR	UZ
1	0.0045913	-0.0000000
2	0.0045798	-0.0000000
3	0.0045661	-0.0000000
4	0.0045470	-0.0000000
5	0.0045264	-0.0000000
6	0.0044952	-0.0000000
7	0.0044612	-0.0000000
8	0.0044254	-0.0000000
9	0.0045908	-0.0003090
10	0.0045810	-0.0003048
11	0.0045695	-0.0002871
12	0.0045539	-0.0002537
13	0.0045315	-0.0002130
14	0.0044997	-0.0001716
15	0.0044621	-0.0001398
16	0.0044228	-0.0001246
17	0.0045854	-0.0006288
18	0.0045815	-0.0006176
19	0.0045767	-0.0005602
20	0.0045640	-0.0005038
21	0.0045356	-0.0004105
22	0.0044548	-0.0003202
23	0.0044486	-0.0002493
24	0.0043997	-0.0002058
25	0.0045855	-0.0009935
26	0.0045943	-0.0009929
27	0.0045996	-0.0009384
28	0.0045597	-0.0007420
29	0.0044933	-0.0005798
30	0.0044355	-0.0004362
31	0.0043749	-0.0003196
32	0.0043144	-0.0002309
33	0.0046571	-0.0015950
34	0.0046887	-0.0014896
35	0.0045850	-0.0011806
36	0.0044438	-0.0009064
37	0.0043332	-0.0006950
38	0.0042461	-0.0005119
39	0.0041759	-0.0003520
40	0.0041100	-0.0002069
41	(0.0048521)	-0.0019264
42	(0.0047350)	-0.0018492
43	0.0046290	-0.0016399
44	0.0044006	-0.0012346
45	0.0042493	-0.0009567
46	0.0041471	-0.0007364
47	0.0040672	-0.0005405
48	0.0040015	-0.0003613
49	0.0039332	-0.0001814
50	0.0040383	-0.0016761

w. outward movement = .00[illegible]

energy absorbed = [illegible]

POOR ORIGINAL

1411 327

SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS PICHAUX 07/21/75

NODAL DISPLACEMENTS

NODE	UR	UZ
51	0.0040227	-0.0015136
52	0.0039885	-0.0013031
53	0.0039297	-0.0010172
54	0.0038666	-0.0007862
55	0.0038054	-0.0005740
56	0.0037509	-0.0003730
57	0.0036957	-0.0001632
58	0.0036522	-0.0017165
59	0.0036210	-0.0013307
60	0.0035787	-0.0010931
61	0.0035387	-0.0008443
62	0.0034952	-0.0005133
63	0.0034507	-0.0003924
64	0.0034062	-0.0001617
65	0.0031531	-0.0017713
66	0.0030562	-0.0014651
67	0.0030531	-0.0011891
68	0.0030171	-0.0009287
69	0.0029822	-0.0006769
70	0.0029480	-0.0004362
71	0.0029150	-0.0001932
72	0.0026304	-0.0018260
73	0.0025780	-0.0015277
74	0.0025373	-0.0012554
75	0.0025022	-0.0009929
76	0.0024704	-0.0007338
77	0.0024420	-0.0004866
78	0.0024171	-0.0002440
79	0.0021208	-0.0018683
80	0.0020754	-0.0015731
81	0.0020392	-0.0013021
82	0.0020080	-0.0010392
83	0.0019804	-0.0007791
84	0.0019571	-0.0005320
85	0.0019375	-0.0002929
86	0.0016165	-0.0019004
87	0.0015785	-0.0016061
88	0.0015481	-0.0013357
89	0.0015223	-0.0010733
90	0.0015000	-0.0008137
91	0.0014816	-0.0005678
92	0.0014662	-0.0003309
93	0.0010999	-0.0019231
94	0.0010700	-0.0016285
95	0.0010461	-0.0013588
96	0.0010263	-0.0010971
97	0.0010100	-0.0008384
98	0.0009974	-0.0005934
99	0.0009872	-0.0003570

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SIZE 24 FIG. 637 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

AVERAGED STRESSES AT NODES

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
1	116.	-6535.	10630.	-6.	116.	-6535.	-0.	17165.
2	99.	-6519.	10255.	15.	99.	-6519.	0.	16773.
3	208.	-6020.	9945.	41.	208.	-6020.	0.	15965.
4	224.	-5031.	9717.	59.	225.	-5031.	1.	14748.
5	143.	-3812.	9555.	62.	144.	-3813.	1.	13380.
6	65.	-2565.	9446.	42.	65.	-2565.	1.	12011.
7	75.	-1601.	9304.	11.	75.	-1601.	0.	10905.
8	57.	-1214.	9015.	-32.	58.	-1215.	-1.	10231.
9	83.	-7045.	10466.	121.	85.	-7047.	1.	17513.
10	83.	-6966.	10119.	322.	98.	-6980.	3.	17099.
11	168.	-6422.	9821.	676.	236.	-6490.	6.	16311.
12	204.	-5212.	9668.	942.	364.	-5371.	10.	15040.
13	134.	-3735.	9599.	1005.	380.	-3981.	14.	13580.
14	29.	-2323.	9515.	849.	304.	-2597.	18.	12113.
15	35.	-1197.	9415.	487.	204.	-1367.	19.	10782.
16	95.	-541.	9223.	208.	157.	-603.	17.	9826.
17	101.	-8434.	10040.	384.	118.	-8451.	3.	18491.
18	-103.	-8707.	9542.	786.	-32.	-8778.	5.	18320.
19	27.	-7573.	9451.	1549.	331.	-7876.	11.	17328.
20	87.	-5263.	9643.	1978.	739.	-5915.	18.	15557.
21	-175.	-3305.	9645.	1909.	729.	-4208.	25.	13853.
22	-265.	-1624.	9626.	1478.	683.	-2571.	33.	12197.
23	-165.	-168.	9635.	810.	644.	-977.	45.	10611.
24	139.	1176.	9703.	343.	1280.	35.	73.	9667.
25	-943.	-14041.	8045.	483.	-925.	-14059.	2.	22104.
26	-559.	-12258.	8374.	1808.	-286.	-12531.	9.	20905.
27	-353.	-7333.	9468.	3045.	788.	-8475.	21.	17942.
28	-1461.	-4361.	9438.	2982.	405.	-6227.	32.	15666.
29	-1652.	-2458.	9370.	2229.	210.	-4320.	40.	13690.
30	-1180.	-725.	9486.	1461.	525.	-2431.	47.	11917.
31	-622.	994.	9685.	735.	1279.	-907.	69.	10591.
32	61.	3027.	10054.	312.	3059.	29.	84.	10025.
33	-3058.	-24794.	4409.	7216.	-880.	-26972.	17.	31381.
34	-11793.	-18747.	3388.	9446.	-5205.	-25336.	35.	28724.
35	-7172.	-6046.	7771.	4843.	-1733.	-11435.	48.	19256.
36	-6257.	-3829.	7875.	2460.	-2299.	-7786.	58.	15661.
37	-3943.	-1855.	8472.	1250.	-1270.	-4528.	65.	13000.
38	-2160.	-121.	8944.	670.	80.	-2360.	73.	11305.
39	-995.	1672.	9341.	331.	1712.	-1036.	83.	10376.
40	43.	4201.	9959.	185.	4209.	35.	87.	9934.
41	-16641.	-31272.	-1556.	11132.	-10636.	-37277.	28.	35721.
42	-30722.	-23017.	-3465.	15409.	-10586.	-42753.	52.	39288.
43	-20355.	-10218.	3177.	6943.	-6690.	-23883.	63.	27060.
44	-12027.	-5349.	6052.	1918.	-4837.	-12539.	75.	18590.
45	-5962.	-2660.	7837.	-4.	-2660.	-5962.	-90.	13799.
46	-3246.	-1084.	8474.	-376.	-1020.	-3309.	-80.	11784.
47	-1714.	321.	8805.	-472.	425.	-1818.	-78.	10623.
48	-785.	1878.	9084.	-363.	1927.	-834.	-82.	9918.
49	116.	4219.	9632.	-192.	4228.	107.	-87.	9526.
50	-89[illegible].	774.	10451.	-336.	839.	-960.	-79.	11412.

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POOR ORIGINAL

SIZE 24 FIG. 637 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

AVERAGED STRESSES AT NODES

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
51	1322.	2869.	11635.	-1694.	3558.	233.	-57.	11402.
52	-354.	-1029.	9772.	-887.	259.	-1640.	-35.	11412.
53	-1396.	-1389.	8804.	-945.	-448.	-2338.	-45.	11142.
54	-1371.	-729.	8492.	-1090.	87.	-2187.	-53.	10669.
55	-902.	340.	8463.	-967.	868.	-1430.	-61.	9893.
56	-445.	1613.	8558.	-623.	1787.	-619.	-74.	9177.
57	82.	3202.	8804.	-272.	3226.	59.	-85.	8746.
58	-625.	998.	10180.	141.	1011.	-637.	85.	10817.
59	-362.	-443.	9210.	59.	-331.	-474.	28.	9684.
60	-250.	-1072.	8382.	-628.	89.	-1412.	-28.	9794.
61	-212.	-498.	8129.	-961.	621.	-1321.	-41.	9451.
62	-234.	268.	7935.	-957.	1007.	-973.	-52.	8908.
63	-224.	1109.	7846.	-618.	1366.	-381.	-67.	8227.
64	58.	1885.	7789.	-263.	1922.	21.	-82.	7768.
65	-300.	745.	8602.	-95.	753.	-308.	-85.	8910.
66	-579.	-217.	7686.	-68.	-205.	-592.	-80.	8278.
67	-336.	-526.	7230.	-266.	-149.	-714.	-35.	7944.
68	-129.	-320.	6976.	-453.	239.	-687.	-39.	7663.
69	-59.	88.	6771.	-492.	512.	-483.	-49.	7254.
70	-1.	476.	6593.	-315.	633.	-158.	-64.	6751.
71	-28.	582.	6333.	-106.	599.	-46.	-80.	6379.
72	-656.	357.	6975.	-45.	359.	-658.	-87.	7633.
73	-717.	-14.	6380.	-22.	-13.	-717.	-88.	7097.
74	-472.	-120.	6046.	-80.	-102.	-490.	-78.	6536.
75	-381.	-116.	5759.	-142.	-41.	-386.	-62.	6155.
76	-181.	-13.	5544.	-154.	79.	-273.	-59.	5816.
77	-57.	66.	5346.	-99.	121.	-112.	-61.	5458.
78	-103.	-98.	5054.	-12.	-88.	-113.	-51.	5166.
79	-726.	261.	5556.	-30.	262.	-727.	-88.	6283.
80	-757.	51.	5101.	27.	52.	-758.	88.	5859.
81	-549.	4.	4838.	28.	5.	-551.	87.	5389.
82	-382.	-14.	4613.	20.	-13.	-383.	87.	4996.
83	-239.	-24.	4412.	15.	-23.	-240.	86.	4652.
84	-103.	-58.	4234.	10.	-56.	-106.	78.	4340.
85	-124.	-226.	3994.	33.	-115.	-236.	17.	4230.
86	-790.	139.	4146.	-26.	140.	-791.	-88.	4937.
87	-775.	37.	3819.	40.	39.	-777.	87.	4596.
88	-572.	21.	3632.	57.	27.	-577.	85.	4210.
89	-400.	5.	3469.	62.	15.	-410.	82.	3879.
90	-253.	-17.	3320.	57.	-4.	-267.	77.	3587.
91	-127.	-52.	3188.	36.	-38.	-141.	68.	3329.
92	-120.	-143.	3023.	47.	-83.	-179.	38.	3202.
93	-901.	-193.	2626.	-28.	-192.	-902.	-88.	3528.
94	-867.	-235.	2408.	31.	-234.	-868.	87.	3277.
95	-680.	-236.	2291.	38.	-232.	-683.	85.	2975.
96	-493.	-229.	2203.	44.	-222.	-497.	81.	2700.
97	-314.	-225.	2129.	41.	-209.	-330.	69.	2458.
98	-173.	-230.	2063.	27.	-160.	-240.	21.	2303.
99	-137.	-266.	1953.	47.	-121.	-282.	18.	2249.

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POOR ORIGINAL

SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

ELEMENT CENTER DATA

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		9 DEG	STRESS INTENSITY
1	161.	-6504.	10456.	83.	162.	-6505.	1.	16970.
2	342.	-6187.	10184.	260.	353.	-6198.	2.	16381.
3	368.	-5438.	9901.	427.	399.	-5490.	4.	15391.
4	231.	-4395.	9658.	531.	291.	-4459.	5.	14128.
5	17.	-3224.	9474.	530.	102.	-3308.	9.	12783.
6	-134.	-2169.	9290.	408.	-55.	-2248.	11.	11538.
7	-118.	-1487.	9080.	175.	-96.	-1509.	7.	10589.
8	163.	-7442.	10181.	257.	169.	-7450.	2.	17632.
9	318.	-7024.	9933.	772.	399.	-7104.	6.	17037.
10	257.	-6065.	9702.	1353.	535.	-6342.	12.	16044.
11	-49.	-4615.	9534.	1638.	477.	-5141.	18.	14676.
12	-235.	-3000.	9470.	1515.	433.	-3668.	24.	13138.
13	-252.	-1548.	9433.	1116.	390.	-2191.	30.	11624.
14	-130.	-420.	9376.	474.	220.	-771.	36.	10147.
15	262.	-9514.	9596.	304.	272.	-9523.	2.	19118.
16	88.	-9043.	9287.	1829.	441.	-9396.	11.	18683.
17	-971.	-7126.	9038.	2867.	157.	-8254.	21.	17292.
18	-1251.	-4483.	9198.	2684.	266.	-6000.	29.	15[illegible]8.
19	-1006.	-2290.	9397.	2080.	529.	-3825.	36.	1322[illegible].
20	-596.	-444.	9577.	1391.	873.	-1914.	47.	11491.
21	-178.	1285.	9768.	579.	1487.	-379.	71.	10147.
22	-719.	-16304.	7384.	3039.	-148.	-16875.	11.	24260.
23	-4960.	-12235.	6891.	5671.	-1861.	-15335.	29.	22226.
24	-4791.	-6292.	8074.	4147.	-1327.	-9756.	40.	17830.
25	-3405.	-3045.	8790.	2502.	-716.	-5733.	47.	14524.
26	-2087.	-1055.	9183.	1491.	7.	-3149.	55.	12332.
27	-1007.	751.	9523.	834.	1084.	-1340.	68.	10863.
28	-244.	2752.	9886.	282.	2779.	-270.	85.	10156.
29	-12037.	-8240.	5863.	6431.	-3432.	-16844.	53.	22706.
30	-7071.	-2964.	8071.	1692.	-2357.	-7678.	70.	15749.
31	-4288.	-1584.	8566.	407.	-1524.	-4348.	82.	12914.
32	-2403.	-232.	8918.	-15.	-232.	-2403.	-90.	11322.
33	-1104.	1253.	9231.	-171.	1265.	-1116.	-86.	10347.
34	-223.	3339.	9665.	-173.	3347.	-231.	-87.	9896.
35	-6302.	-299.	9141.	-1297.	-31.	-6570.	-78.	15711.
36	-4355.	-2306.	8386.	-1297.	-1678.	-4984.	-64.	13370.
37	-2789.	-1290.	8513.	-1087.	-719.	-3360.	-62.	11874.
38	-1671.	-185.	8628.	-568.	293.	-2148.	-64.	10776.
39	-792.	1176.	8820.	-794.	1457.	-1072.	-71.	9892.
40	-209.	2835.	9066.	-388.	2884.	-258.	-83.	9324.
41	-824.	-1595.	8747.	-660.	-447.	-1974.	-30.	10721.
42	-985.	-1275.	8299.	-1219.	97.	-2357.	-42.	10647.
43	-738.	-281.	8196.	-1243.	754.	-1773.	-50.	9970.
44	-422.	815.	8197.	-1012.	1383.	-989.	-61.	9186.
45	-110.	1982.	8257.	-458.	2078.	-206.	-78.	8464.
46	-866.	95.	8664.	135.	114.	-885.	82.	9548.
47	-234.	-540.	8133.	-140.	-180.	-594.	-21.	8727.
48	-170.	-655.	7682.	-621.	254.	-1079.	-34.	8761.
49	-197.	-223.	7408.	-846.	637.	-1057.	-45.	8465.
50	-173.	386.	7236.	-753.	910.	-696.	-55.	7933.

POOR ORIGINAL

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SIZE 24 FIG. 6G7 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

ELEMENT CENTER DATA

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL	STRESSES	3 DEG	STRESS INTENSITY
51	-82.	887.	7085.	-351.	1001.	-196.	-72.	7281.
52	-744.	123.	7328.	19.	124.	-745.	89.	8073.
53	-422.	-90.	6906.	-76.	-73.	-439.	-78.	7344.
54	-204.	-149.	6574.	-226.	51.	-404.	-48.	6978.
55	-137.	-69.	6281.	-341.	240.	-446.	-48.	6727.
56	-127.	75.	6024.	-315.	305.	-357.	-54.	6381.
57	-79.	113.	5779.	-136.	183.	-149.	-63.	5928.
58	-834.	138.	5959.	13.	138.	-835.	89.	6794.
59	-561.	51.	5631.	5.	51.	-561.	90.	6193.
60	-379.	7.	5352.	-28.	9.	-381.	-86.	5733.
61	-254.	-8.	5102.	-50.	2.	-263.	-79.	5365.
62	-165.	-37.	4859.	-41.	-25.	-177.	-74.	5046.
63	-67.	-131.	4650.	-8.	-66.	-132.	-7.	4783.
64	-864.	85.	4614.	38.	86.	-865.	88.	5479.
65	-636.	53.	4353.	60.	59.	-642.	85.	5005.
66	-455.	28.	4152.	67.	37.	-464.	82.	4616.
67	-308.	-0.	3961.	66.	13.	-321.	78.	4282.
68	-181.	-42.	3787.	58.	-21.	-202.	70.	3989.
69	-62.	-107.	3631.	32.	-45.	-124.	28.	3755.
70	-871.	13.	3251.	17.	13.	-871.	89.	4133.
71	-664.	20.	3093.	38.	23.	-666.	87.	3759.
72	-478.	11.	2952.	51.	17.	-484.	84.	3436.
73	-308.	1.	2833.	55.	11.	-317.	80.	3150.
74	-157.	-12.	2728.	46.	1.	-170.	74.	2898.
75	-32.	-25.	2635.	22.	-6.	-51.	49.	2688.
76	-8966.	-38623.	-1455.	11961.	-4743.	-42846.	19.	41391.
77	-24317.	-23921.	-1656.	10303.	-13814.	-34424.	46.	32767.
78	-37126.	-22114.	-5273.	20515.	-7775.	-51466.	55.	46192.
79	343.	-950.	9869.	832.	750.	-1357.	26.	11226.
80	-553.	1013.	10090.	187.	1035.	-575.	83.	10665.
81	-896.	774.	10451.	-336.	839.	-960.	-79.	11412.

POOR ORIGINAL

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SIZE 24 FIG. 607 BODY SEAT AREA FINITE ANALYSIS MICHAUX 07/21/75

ELEMENT CENTER DATA

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
51	-82.	887.	7085.	-351.	1001.	-196.	-72.	7281.
52	-744.	123.	7328.	19.	124.	-745.	89.	8073.
53	-422.	-90.	6906.	-76.	-73.	-439.	-78.	7344.
54	-204.	-149.	6574.	-226.	51.	-404.	-48.	6978.
55	-137.	-69.	6281.	-341.	240.	-446.	-48.	6727.
56	-127.	75.	6024.	-315.	305.	-357.	-54.	6381.
57	-79.	113.	5779.	-136.	183.	-149.	-63.	5928.
58	-834.	138.	5959.	13.	138.	-835.	89.	6794.
59	-561.	51.	5631.	5.	51.	-561.	90.	6193.
60	-379.	7.	5352.	-28.	9.	-381.	-86.	5733.
61	-254.	-8.	5102.	-50.	2.	-263.	-79.	5365.
62	-165.	-37.	4859.	-41.	-25.	-177.	-74.	5046.
63	-67.	-131.	4650.	-8.	-66.	-132.	-7.	4783.
64	-864.	85.	4614.	38.	86.	-865.	88.	5479.
65	-636.	53.	4353.	60	59.	-642.	85.	5005.
66	-455.	28.	4152.	67.	37.	-464.	82.	4616.
67	-308.	-0.	3961.	66.	13.	-321.	78.	4282.
68	-181.	-42.	3[illegible]87.	58.	-21.	-202.	73.	3989.
69	-62.	-107.	3631.	32.	-45.	-124.	28.	3755.
70	-871.	13.	3251.	17.	13.	-871.	87.	4133.
71	-664.	20.	3093.	38.	23.	-666.	87.	3759.
72	-478.	11.	2952.	51.	17.	-484.	84.	3436.
73	-308.	1.	2833.	55.	11.	-317.	83.	3150.
74	-157.	-12.	2728.	46.	1.	-170.	74.	2898.
75	-32.	-25.	2635.	22.	-6.	-51.	49.	2688.
76	-8966.	-38623.	-1455.	11961.	-4743.	-42846.	19.	41391.
77	-24317.	-23921.	-1656.	10303.	-13814.	-34424.	46.	32767.
78	-37126.	-22114.	-5273.	20515.	-7775.	-51466.	55.	46192.
79	343.	-950.	9869.	832.	750.	-1357.	26.	11226.
80	-553.	1013.	10090.	187.	1035.	-575.	83.	10665.
81	-896.	774.	10451.	-336.	839.	-960.	-79.	11412.

POOR ORIGINAL

1411 333

SCALE= 2.00

DEFLECTION SCALE= 206.0956

PLCT COMPLETED

THE GOOD NEWS

04/25/75 ASP SYSOUT DATA SET BLOCKING

BECAUSE THE MAXIMUM CHANNEL-TO-CHANNEL (SYSOUT) BLOCKSIZE FOR ASP 3 HAS BEEN INCREASED TO 2020, SYSOUT=A DATA SETS SHOULD BE BLOCKED SUFFICIENTLY CLOSE TO 2020 TO REDUCE EXCP COUNTS AND CHANNEL TIME.

04/25/75 VS/SORT

PARM='MSG=AP' SHOULD BE REMOVED FROM THE EXEC STATEMENT OF VS/SORT. SPECIFICATION OF THIS PARAMETER MAY RESULT IN A BC6 ABEND.

* * *

CURRENT RESTRICTIONS, WARNINGS AND HINTS.

CHANNEL-TO-CHANNEL ADAPTER (SYSOUT):

DO NOT SPECIFY THE DEN SUBPARAMETER OF THE DCB PARAMETER.

DO NOT SPECIFY DCB=OPTCD=C.

THERE ARE ABSOLUTE MAXIMUM LIMITS IMPOSED ON SYSOUT:

PRINT IS 25,000,000 BYTES PUNCH IS 10,000 CARDS CRT IS 5000 BLOCKS

MAXIMUM CHANNEL-TO-CHANNEL BLOCKSIZE IS 2020.

1411 335

```
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
```

```
ASP JOB NO. = 5370   ID(DAY TIME) = (202 15.46.34)   DATE = 75.202

//NCBE951S JOB 'BODY FINITE TEST   *74404511000501        9999997   ',

          ELAPSED TIME ON MAIN = N168      = 001.92, START TIME = 16.06.09

          DDNAME = SYSMSG                  PRINTED ON RM501PR2, LINES = 000133
          DDNAME = SYSPRINT                PRINTED ON RM501PR2, LINES = 000006
          DDNAME = FT06F001                PRINTED ON RM501PR2, LINES = 000678
          LINES OUTPUT FOR THIS JOB = 000817

        CARDS FROM MAIN FOR THIS JOB = NONE
```

```
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
```

1411 336

EXHIBIT TWO (2)

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

SIZE 24 FIG. 6C7 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

NT	NOREGT	NR	NZ	NPR	NPZ	NF	NSUPP	IBPI	MAXITS	NPLOT	NTRI	NCOUP
99	75	9	14	1	1	0	8	22	1000	13	6	0

NGRIDS
5

CC	BETA	E	MU
.10000E-07	.0	.30000E+08	.30000

GRID 1 -- 7 X 4 -- 1 8 40 33

GRID 2 -- 6 X 1 -- 34 40 49 43

GRID 3 -- 6 X 1 -- 43 49 57 51

GRID 4 -- 5 X 1 -- 52 57 64 59

GRID 5 -- 6 X 5 -- 58 64 99 93

RECTANGULAR ELEMENTS

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

TRIANGULAR ELEMENTS

34	41	33	0	34	42	41	0	34	43	42	0	52	59	51	0	51	59	58	0
51	58	50	0																

R LATTICE

10.970	11.170	11.280	11.720	12.230	12.730
13.230	13.710	14.180			

Z LATTICE

.0	.55000	1.8500	2.7400	3.6400	3.9200
4.1200	4.6700	5.2500	6.1800	7.1300	8.0700
9.0100	9.9700				

POOR ORIGINAL

1411 337

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

SIZE 24 FIG. 6C7 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

NODAL LATTICE POSITIONS

1	1	1
2		1
3	4	1
4	5	1
5	6	1
6	7	1
7	8	1
8	9	1
9	1	2
10	3	2
11	4	2
12	5	2
13	6	2
14	7	2
15	8	2
16	9	2
17	1	3
18	3	3
19	4	3
20	5	3
21	6	3
22	7	3
23	8	3
24	9	3
25	1	4
26	3	4
27	4	4
28	5	4
29	6	4
30	7	4
31	8	4
32	9	4
33	1	5
34	3	5
35	4	5
36	5	5
37	6	5
38	7	5
39	8	5
40	9	5
41	1	6
42	2	7
43	3	7
44	4	7
45	5	7
46	6	7
47	7	7
48	8	7
49	9	7
50	2	8

1411 338

POOR ORIGINAL

FOCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

SIZE 24 FIG. 6C7 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

NODAL	LATTICE	POSITIONS
51	3	8
52	4	8
53	5	8
54	6	8
55	7	8
56	8	8
57	9	8
58	2	9
59	4	9
60	5	9
61	6	9
62	7	9
63	8	9
64	9	9
65	2	10
66	4	10
67	5	10
68	6	10
69	7	10
70	8	10
71	9	10
72	2	11
73	4	11
74	5	11
75	6	11
76	7	11
77	8	11
78	9	11
79	2	12
80	4	12
81	5	12
82	6	12
83	7	12
84	8	12
85	9	12
86	2	13
87	4	13
88	5	13
89	6	13
90	7	13
91	8	13
92	9	13
93	2	14
94	4	14
95	5	14
96	6	14
97	7	14
98	8	14
99	9	14

1411 339

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCES926

SIZE 24 FIG. 607 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

PICTORIAL REPRESENTATION

0	93	0	94	95	96	97	98	99
0	66	0	87	88	89	90	91	92
0	79	0	80	81	82	83	84	85
0	72	0	73	74	75	76	77	78
0	65	0	66	67	68	69	70	71
0	58	0	59	60	61	62	63	64
0	50	51	52	53	54	55	56	57
0	42	43	44	45	46	47	48	49
41	0	0	0	0	0	0	0	0
33	0	34	35	36	37	38	39	40
25	0	26	27	28	29	30	31	32
17	0	18	19	20	21	22	23	24
9	0	10	11	12	13	14	15	16
1	0	2	3	4	5	6	7	8

1411 140

POOR ORIGINAL

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

SIZE 24 FIG. 6C7 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

RADIAL PRESSURE, TYPE, NODES

.10000E+07	2	41	42

AXIAL PRESSURE, TYPE, NODES

-.10000E+07	2	41	42

DEFLECTION	NODE	DIRECTION
.0	1	2
.0	2	2
.0	3	2
.0	4	2
.0	5	2
.0	6	2
-0	7	2
.0	8	2

1411 341

POOR ORIGINAL

SIZE 24 FIG. 6G7 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

1	10.970	0.0	0.	0.
2	11.280	0.0	0.	0.
3	11.720	0.0	0.	0.
4	12.230	0.0	0.	0.
5	12.730	0.0	0.	0.
6	13.230	0.0	0.	0.
7	13.710	0.0	0.	0.
8	14.180	0.0	0.	0.
9	10.970	0.950	0.	0.
10	11.280	0.950	0.	0.
11	11.720	0.950	0.	0.
12	12.230	0.950	0.	0.
13	12.730	0.950	0.	0.
14	13.230	0.950	0.	0.
15	13.710	0.950	0.	0.
16	14.180	0.950	0.	0.
17	10.970	1.850	0.	0.
18	11.280	1.850	0.	0.
19	11.720	1.850	0.	0.
20	12.230	1.850	0.	0.
21	12.730	1.850	0.	0.
22	13.230	1.850	0.	0.
23	13.710	1.850	0.	0.
24	14.180	1.850	0.	0.
25	10.970	2.740	0.	0.
26	11.280	2.740	0.	0.
27	11.720	2.740	0.	0.
28	12.230	2.740	0.	0.
29	12.730	2.740	0.	0.
30	13.230	2.740	0.	0.
31	13.710	2.740	0.	0.
32	14.180	2.740	0.	0.
33	10.970	3.640	0.	0.
34	11.280	3.640	0.	0.
35	11.720	3.640	0.	0.
36	12.230	3.640	0.	0.
37	12.730	3.640	0.	0.
38	13.230	3.640	0.	0.
39	13.710	3.640	0.	0.
40	14.180	3.640	0.	0.
41	10.970	3.920	497493.	-497493.
42	11.170	4.120	502507.	-502507.
43	11.280	4.120	0.	0.
44	11.720	4.120	0.	0.
45	12.230	4.120	0.	0.
46	12.730	4.120	0.	0.
47	13.230	4.120	0.	0.
48	13.710	4.120	0.	0.
49	14.180	4.120	0.	0.
50	11.170	4.670	0.	0.

SIZE 24 FIG. 607 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

51	11.280	4.670	0.	0.
52	11.720	4.670	0.	0.
53	12.230	4.670	0.	0.
54	12.730	4.670	0.	0.
55	13.230	4.670	0.	0.
56	13.710	4.670	0.	0.
57	14.180	4.670	0.	0.
58	11.170	5.250	0.	0.
59	11.720	5.250	0.	0.
60	12.230	5.250	0.	0.
61	12.730	5.250	0.	0.
62	13.230	5.250	0.	0.
63	13.710	5.250	0.	0.
64	14.180	5.250	0.	0.
65	11.170	6.180	0.	0.
66	11.720	6.180	0.	0.
67	12.230	6.180	0.	0.
68	12.730	6.180	0.	0.
69	13.230	6.180	0.	0.
70	13.710	6.180	0.	0.
71	14.180	6.180	0.	0.
72	11.170	7.130	0.	0.
73	11.720	7.130	0.	0.
74	12.230	7.130	0.	0.
75	12.730	7.130	0.	0.
76	13.230	7.130	0.	0.
77	13.710	7.130	0.	0.
78	14.180	7.130	0.	0.
79	11.170	8.070	0.	0.
80	11.720	8.070	0.	0.
81	12.230	8.070	0.	0.
82	12.730	8.070	0.	0.
83	13.230	8.070	0.	0.
84	13.710	8.070	0.	0.
85	14.180	8.070	0.	0.
86	11.170	9.010	0.	0.
87	11.720	9.010	0.	0.
88	12.230	9.010	0.	0.
89	12.730	9.010	0.	0.
90	13.230	9.010	0.	0.
91	13.710	9.010	0.	0.
92	14.180	9.010	0.	0.
93	11.170	9.970	0.	0.
94	11.720	9.970	0.	0.
95	12.230	9.970	0.	0.
96	12.730	9.970	0.	0.
97	13.230	9.970	0.	0.
98	13.710	9.970	0.	0.
99	14.180	9.970	0.	0.

POOR ORIGINAL

1411 343

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. VCCESR26

SIZE 24 FIG. 607 BODY SEAT AREA, ZERO PRESSURE -- FOWLER --   08/05/75

STIFFNESS MATRIX WIDTH FROM 1 TO 22

GAUSS-SEIDEL ITERATION
CONVERGENCE AT ITERATION NO. AND BETA

.19722E-04	100	1.84873
.30098E-05	200	1.84873
.50544E-06	300	1.84873
.88334E-07	400	1.84873
.15375E-07	500	1.84873

TOTAL ITERATIONS, 502

POOR ORIGINAL

1411 344

SIZE 24 FIG. 637 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

NODAL DISPLACEMENTS

NODE	UR	UZ
1	0.0042238	-0.0000000
2	0.0042288	-0.0000000
3	0.0042275	-0.0000000
4	0.0042196	-0.0000000
5	0.0042013	-0.0000000
6	0.0041712	-0.0000000
7	0.0041322	-0.0000000
8	0.0040386	0.0000000
9	0.0042062	-0.0003582
10	0.0042080	-0.0003502
11	0.0042039	-0.0003140
12	0.0042025	-0.0002607
13	0.0041847	-0.0002010
14	0.0041533	-0.0001408
15	0.0041122	-0.0000904
16	0.0040655	-0.0000550
17	0.0041395	-0.0007407
18	0.0041474	-0.0007027
19	0.0041549	-0.0006299
20	0.0041518	-0.0005155
21	0.0041286	-0.0003866
22	0.0040872	-0.0002607
23	0.0040408	-0.0001544
24	0.0039859	-0.0000748
25	0.0040418	-0.0011500
26	0.0040618	-0.0011100
27	0.0040797	-0.0009754
28	0.0040506	-0.0007555
29	0.0039969	-0.0005429
30	0.0039363	-0.0003490
31	0.0038754	-0.0001823
32	0.0039114	-0.0000408
33	0.0039781	-0.0017794
34	0.0040205	-0.0016286
35	0.0039312	-0.0012592
36	0.0038034	-0.0009183
37	0.0037022	-0.0006439
38	0.0036211	-0.0003981
39	0.0035535	-0.0001757
40	0.0034871	0.0000348
41	(0.0041249	-0.0021135
42	0.0039768)	-0.0020073
43	0.0038738	-0.0017876
44	0.0036627	-0.0013180
45	0.0035265	-0.0009661
46	0.0034358	-0.0006773
47	0.0033641	-0.0004133
48	0.0033032	-0.0001864
49	0.0032416	0.0003849
50	0.0031582	-0.0018718

AV. = .00405085

1411 345

POOR ORIGINAL

SIZE 24 FIG. 6C7 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

NODAL DISPLACEMENTS

NODE	UR	UZ
51	0.0031467	-0.0017854
52	0.0031410	-0.0013895
53	0.0031018	-0.0010234
54	0.0030564	-0.0007182
55	0.0030074	-0.0004325
56	0.0029592	-0.0001587
57	0.0029004	0.0001273
58	0.0026971	-0.0019090
59	0.0026575	-0.0014697
60	0.0026436	-0.0010954
61	0.0026198	-0.0007671
62	0.0025906	-0.0004577
63	0.0025562	-0.0001600
64	0.0025187	0.0001501
65	0.0019406	-0.0019533
66	0.0019562	-0.0015461
67	0.0019391	-0.0011834
68	0.0019249	-0.0008350
69	0.0019074	-0.0004997
70	0.0018863	-0.0001781
71	0.0018638	0.0001460
72	0.0012335	-0.0019889
73	0.0012626	-0.0015936
74	0.0012493	-0.0012276
75	0.0012372	-0.0008734
76	0.0012248	-0.0005334
77	0.0012121	-0.0002038
78	0.0012031	0.0001196
79	0.0005996	-0.0020059
80	0.0005904	-0.0016117
81	0.0005832	-0.0012502
82	0.0005758	-0.0008998
83	0.0005705	-0.0005532
84	0.0005647	-0.0002237
85	0.0005500	0.0000954
86	-0.0000739	-0.0020085
87	-0.0000735	-0.0015159
88	-0.0000728	-0.0012552
89	-0.0000720	-0.0009052
90	-0.0000712	-0.0005591
91	-0.0000703	-0.0002311
92	-0.0000692	0.0000851
93	-0.0007629	-0.0019970
94	-0.0007517	-0.0016048
95	-0.0007425	-0.0012451
96	-0.0007337	-0.0008959
97	-0.0007250	-0.0005509
98	-0.0007164	-0.0002241
99	-0.0007082	0.0000911

1411 346

POOR ORIGINAL

SIZE 24 FIG. 667 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

AVERAGED STRESSES AT NODES

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL	STRESSES	θ DEG	STRESS INTENSITY
1	-36.	-8581.	8860.	-274.	-28.	-8989.	-2.	17849.
2	50.	-8423.	8735.	-253.	57.	-8430.	-2.	17165.
3	149.	-7267.	8685.	-226.	156.	-7274.	-2.	15960.
4	172.	-5560.	8734.	-207.	180.	-5567.	-2.	14302.
5	96.	-3671.	8829.	-202.	107.	-3682.	-3.	12511.
6	35.	-1754.	8943.	-217.	61.	-1780.	-7.	10723.
7	56.	-133.	9019.	-244.	223.	-299.	-34.	9319.
8	224.	1006.	9019.	-281.	1096.	134.	-72.	8885.
9	-70.	-9448.	8648.	109.	-68.	-9449.	1.	18097.
10	33.	-8828.	8553.	295.	43.	-8838.	2.	17391.
11	107.	-7636.	8515.	618.	156.	-7685.	5.	16200.
12	150.	-5727.	8636.	863.	274.	-5851.	8.	14487.
13	87.	-3599.	8808.	922.	305.	-3817.	13.	12625.
14	1.	-1534.	8958.	781.	329.	-1862.	23.	10820.
15	17.	233.	9073.	450.	587.	-338.	52.	9411.
16	261.	1631.	9159.	195.	1658.	234.	82.	8935.
17	-50.	-10692.	8099.	353.	-38.	-10703.	2.	18802.
18	-152.	-10429.	7856.	716.	-102.	-10479.	4.	18335.
19	-38.	-8693.	8016.	1415.	188.	-8919.	9.	16935.
20	33.	-5740.	8472.	1800.	548.	-6255.	16.	14727.
21	-218.	-3180.	8710.	1727.	576.	-3974.	25.	12684.
22	-287.	-857.	8917.	1328.	771.	-1955.	39.	10872.
23	-180.	1150.	9133.	725.	1469.	-499.	66.	9632.
24	296.	3191.	9479.	312.	3225.	263.	84.	9216.
25	-1053.	-15916.	5962.	445.	-1039.	-15930.	2.	21892.
26	-591.	-13734.	6535.	1690.	-377.	-13948.	7.	20453.
27	-394.	-8323.	7828.	2813.	503.	-9220.	18.	17048.
28	-1485.	-4737.	8055.	2659.	28.	-6300.	29.	14354.
29	-1670.	-2354.	8212.	1947.	-35.	-3989.	40.	12201.
30	-1190.	-101.	8539.	1230.	700.	-1990.	57.	10529.
31	-629.	2131.	8931.	604.	2258.	-755.	78.	9686.
32	204.	4760.	9553.	262.	4775.	189.	87.	9364.
33	-3142.	-26232.	2090.	7086.	-1141.	-28234.	16.	30324.
34	-11869.	-19991.	1169.	9103.	-5962.	-25898.	33.	27067.
35	-7141.	-6555.	5833.	4522.	-2527.	-11572.	45.	17405.
36	-6193.	-4202.	6211.	2110.	-2864.	-7531.	58.	13742.
37	-3903.	-1793.	7016.	911.	-1454.	-4242.	70.	11258.
38	-2125.	375.	7686.	400.	437.	-2187.	81.	9873.
39	-979.	2584.	8257.	184.	2594.	-989.	87.	9246.
40	178.	5614.	9115.	137.	5617.	174.	89.	8941.
41	-16633.	-32144.	-3718.	10802.	-11091.	-37686.	27.	33968.
42	-30559.	-24142.	-5813.	14732.	-12430.	-42671.	52.	36861.
43	-20497.	-11870.	643.	6260.	-8581.	-23786.	62.	24430.
44	-11854.	-6150.	3975.	1438.	-5807.	-12196.	77.	16170.
45	-5829.	-3006.	6000.	-450.	-2936.	-5899.	-81.	11899.
46	-3132.	-1047.	6843.	-803.	-773.	-3406.	-71.	10249.
47	-1635.	718.	7353.	-816.	973.	-1890.	-73.	9243.
48	-749.	2610.	7786.	-565.	2703.	-841.	-81.	8628.
49	241.	5356.	8537.	-278.	5371.	226.	-87.	8311.
50	48.	555.	8215.	-105.	576.	28.	-79.	8188.

1411 347

POOR ORIGINAL

SIZE 24 FIG. 607 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

AVERAGED STRESSES AT NODES

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL	STRESSES	θ DEG	STRESS INTENSITY
51	2026.	1813.	9148.	-1784.	3707.	132.	-43.	9015.
52	215.	-1634.	7600.	-1194.	882.	-2200.	-25.	9801.
53	-972.	-1671.	6821.	-1378.	101.	-2743.	-38.	9564.
54	-1111.	-718.	6654.	-1504.	602.	-2431.	-49.	9085.
55	-749.	635.	6785.	-1301.	1416.	-1530.	-59.	8316.
56	-375.	2166.	7012.	-817.	2405.	-615.	-74.	7628.
57	191.	4025.	7419.	-351.	4060.	159.	-85.	7260.
58	323.	788.	7830.	156.	835.	275.	73.	7555.
59	451.	-817.	6892.	-111.	460.	-827.	-5.	7718.
60	363.	-1261.	6208.	-935.	790.	-1688.	-25.	7896.
61	181.	-481.	6084.	-1295.	1186.	-1487.	-38.	7571.
62	-8.	471.	6013.	-1[illegible]6.	1491.	-1028.	-50.	7041.
63	-19.	1478.	6031.	-780.	1810.	-352.	-67.	6383.
64	160.	2401.	6097.	-326.	2448.	113.	-82.	5984.
65	541.	584.	5657.	-150.	714.	411.	-49.	5246.
66	207.	-385.	4954.	-154.	245.	-423.	-14.	5377.
67	269.	-646.	4644.	-420.	432.	-809.	-21.	5453.
68	301.	-331.	4527.	-633.	692.	-723.	-32.	5250.
69	204.	185.	4442.	-650.	844.	-455.	-45.	4897.
70	126.	648.	4360.	-406.	870.	-96.	-61.	4455.
71	65.	798.	4202.	-134.	822.	41.	-80.	4161.
72	160.	287.	3574.	-75.	321.	125.	-65.	3449.
73	64.	-50.	3236.	-56.	87.	-73.	-22.	3309.
74	115.	-157.	3052.	-142.	176.	-218.	-23.	3270.
75	102.	-123.	2909.	-216.	234.	-254.	-31.	3164.
76	77.	17.	2806.	-219.	268.	-174.	-41.	2980.
77	70.	111.	2705.	-136.	228.	-47.	-49.	2754.
78	-16.	-53.	2519.	-18.	-9.	-60.	-22.	2579.
79	76.	219.	1699.	-45.	233.	63.	-74.	1636.
80	19.	62.	1536.	24.	73.	8.	66.	1528.
81	28.	3.	1440.	19.	38.	-7.	26.	1447.
82	22.	-13.	1362.	8.	24.	-15.	13.	1377.
83	13.	-19.	1292.	6.	14.	-20.	10.	1312.
84	19.	-63.	1222.	6.	19.	-63.	4.	1286.
85	-37.	-231.	1105.	41.	-28.	-239.	11.	1344.
86	1.	67.	-172.	-37.	101.	-13.	-70.	273.
87	-1.	55.	-172.	48.	82.	-28.	60.	254.
88	3.	29.	-169.	68.	85.	-53.	51.	254.
89	0.	9.	-167.	74.	79.	-70.	47.	246.
90	-5.	-18.	-168.	69.	57.	-81.	42.	226.
91	-11.	-65.	-176.	43.	13.	-89.	29.	190.
92	-32.	-140.	-198.	61.	-5.	-167.	24.	193.
93	-153.	-345.	-2198.	-53.	-139.	-359.	-14.	2059.
94	-135.	-312.	-2058.	32.	-130.	-317.	10.	1928.
95	-151.	-315.	-1961.	48.	-138.	-328.	15.	1823.
96	-124.	-305.	-1858.	56.	-108.	-321.	16.	1750.
97	-85.	-297.	-1759.	51.	-73.	-309.	13.	1685.
98	-65.	-304.	-1678.	31.	-61.	-308.	7.	1617.
99	-54.	-313.	-1608.	56.	-42.	-325.	12.	1566.

1411 348

POOR ORIGINAL

SIZE 24 FIG. 607 BODY SEAT AREA, ZERO PRESSURE -- FOWLER -- 08/05/75

ELEMENT CENTER DATA

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL	STRESSES	∂ DEG	STRESS INTENSITY
1	134.	-8657.	8820.	73.	135.	-8657.	0.	17477.
2	282.	-7775.	8761.	234.	289.	-7782.	2.	16542.
3	294.	-6364.	8743.	387.	316.	-6386.	3.	15129.
4	167.	-4608.	8773.	483.	215.	-4657.	6.	13430.
5	-24.	-2756.	8825.	485.	60.	-2841.	10.	11667.
6	-152.	-1035.	8873.	376.	-14.	-1173.	20.	10046.
7	-122.	317.	8881.	161.	369.	-174.	72.	9056.
8	131.	-9509.	8448.	229.	136.	-9514.	1.	17963.
9	252.	-8537.	8422.	694.	307.	-8591.	4.	17014.
10	182.	-6920.	8454.	1227.	388.	-7126.	10.	15580.
11	-111.	-4810.	8545.	1491.	322.	-5243.	16.	13788.
12	-272.	-2556.	8722.	1377.	375.	-3203.	25.	11925.
13	-266.	-471.	8912.	1016.	652.	-1389.	42.	10301.
14	-131.	1301.	9069.	432.	1421.	-252.	74.	9321.
15	227.	-11364.	7705.	261.	233.	-11390.	1.	19095.
16	36.	-10390.	7622.	1677.	299.	-10653.	9.	18275.
17	-1025.	-7887.	7625.	2638.	-128.	-8784.	19.	16410.
18	-1293.	-4657.	8032.	2430.	-20.	-5930.	28.	13962.
19	-1033.	-1893.	8463.	1846.	434.	-3357.	38.	11817.
20	-603.	519.	8855.	1218.	1299.	-1383.	57.	10238.
21	-144.	2827.	9250.	510.	2911.	-259.	81.	9509.
22	-713.	-17752.	5317.	2379	-240.	-18226.	9.	23543.
23	-4935.	-13345.	5015.	5392.	-2303.	-15981.	26.	20996.
24	-4769.	-6946.	6428.	3808.	-1897.	-9818.	37.	16246.
25	-3396.	-3202.	7373.	2145.	-1152.	-5445.	46.	12819.
26	-2075.	-729.	7979.	1164.	-58.	-2[illegible]6.	60.	10725.
27	-996.	1547.	8514.	593.	1679.	-1127.	77.	9641.
28	-245.	4013.	9055.	177.	4020.	-252.	88.	9307.
29	-11876.	-9234.	3775.	6010.	-4402.	-16709.	51.	20484.
30	-6978.	-3566.	6191.	1282.	-3138.	-7406.	72.	13597.
31	-4196.	-1720.	6925.	-31.	-1720.	-4196.	-89.	11122.
32	-2336.	20.	7470.	-408.	88.	-2405.	-80.	9875.
33	-1064.	1883.	7957.	-457.	1952.	-1133.	-81.	9090.
34	-209.	4361.	8556.	-292.	4330.	-227.	-85.	8783.
35	-5922.	-1641.	6754.	-1730.	-1030.	-6534.	-71.	13288.
36	-4036.	-2814.	6365.	-1785.	-1538.	-5312.	-54.	11677.
37	-2570.	-1443.	6687.	-1560.	-348.	-3665.	-55.	10352.
38	-1527.	-2.	6978.	-1379.	811.	-2341.	-59.	9319.
39	-713.	1665.	7324.	-1092.	2094.	-1138.	-59.	8462.
40	-186.	3621.	7709.	-509.	3688.	-253.	-83.	7962.
41	-241.	-2047.	6547.	-1041.	233.	-2522.	-25.	9069.
42	-598.	-1430.	6259.	-1640.	678.	-2705.	-38.	8964.
43	-504.	-176.	6314.	-1621.	1289.	-1969.	-48.	8283.
44	-303.	1156.	6447.	-1287.	1906.	-1053.	-60.	7499.
45	-74.	2520.	6621.	-568.	2639.	-193.	-78.	6814.
46	46.	-109.	6074.	85.	83.	-146.	24.	6221.
47	483.	-752.	5680.	-330.	566.	-835.	-14.	6515.
48	321.	-763.	5354.	-889.	821.	-1262.	-29.	6616.
49	106.	-179.	5236.	-1111.	1083.	-1156.	-41.	6362.
50	-22.	567.	5143.	-952.	1268.	-724.	-54.	5867.

1411 349

POOR ORIGINAL

SIZE 24 FIG. 607 BODY SEAT AREA, ZERO PRESSURE -- FOWLER --

08/05/75

ELEMENT CENTER DATA

EL.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL	STRESSES	θ DEG	STRESS INTENSITY
51	-42.	1155.	5082.	-433.	1295.	-182.	-72.	5264.
52	154.	78.	4319.	-12.	156.	76.	-8.	4243.
53	281.	-152.	4054.	-163.	335.	-206.	-18.	4260.
54	308.	-185.	3855.	-349.	489.	-366.	-27.	4221.
55	189.	-56.	3678.	-471.	553.	-420.	-38.	4099.
56	40.	131.	3522.	-414.	502.	-331.	-48.	3853.
57	-36.	174.	3357.	-174.	273.	-134.	-61.	3491.
58	53.	160.	2512.	6.	160.	52.	87.	2460.
59	119.	48.	2360.	-20.	124.	43.	-15.	2317.
60	115.	3.	2228.	-66.	145.	-27.	-25.	2255.
61	68.	-6.	2105.	-88.	127.	-65.	-34.	2170.
62	0.	-37.	1980.	-68.	56.	-87.	-36.	2067.
63	-18.	-155.	1851.	-16.	-17.	-156.	-6.	2008.
64	14.	113.	722.	45.	131.	-3.	69.	725.
65	31.	65.	673.	68.	119.	-22.	52.	695.
66	28.	31.	628.	75.	104.	-45.	46.	673.
67	9.	-3.	582.	74.	77.	-71.	43.	653.
68	-9.	-55.	534.	67.	38.	-102.	35.	637.
69	-11.	-140.	435.	38.	-1.	-150.	15.	635.
70	3.	30.	-1080.	10.	38.	-4.	65.	1118.
71	-9.	25.	-1024.	49.	58.	-45.	54.	1082.
72	-3.	11.	-972.	65.	70.	-62.	48.	1042.
73	11.	-1.	-923.	69.	74.	-65.	43.	997.
74	26.	-15.	-880.	58.	66.	-59.	35.	945.
75	29.	-42.	-845.	27.	38.	-51.	18.	884.
76	-8811.	-39495.	-3543.	11661.	-4882.	-43424.	19.	39880.
77	-24455.	-24793.	-3893.	5943.	-14680.	-34568.	45.	30675.
78	-37462.	-23491.	-7728.	19520.	-9744.	-51209.	55.	43482.
79	1358.	-1433.	7708.	765.	1554.	-1629.	14.	9338.
80	337.	572.	7738.	74.	593.	315.	74.	7423.
81	48.	555.	8216.	-105.	576.	28.	-79.	8188.

46192 under pressure.

∴ ΔSI due to pressure = 2710.

σ_{yp} = 29.1 ksi

∴ SI due to force

$= 29.1^k - 2.71^k = 26{,}390$ psi

$\frac{26390}{43482} = .60692$

POOR ORIGINAL

1411 350

SCALE= 2.00

DEFLECTION SCALE= 236.4745

OUTLINE FROM 9
TO 1
TO 2
TO 3
TO 4
TO 5
TO 6
TO 7
TO 8
TO 16
TO 24
TO 32
TO 40
TO 49
TO 57
TO 64
TO 71
TO 78
TO 85
TO 92
TO 99
TO 98
TO 97
TO 96
TO 95
TO 94
TO 93
TO 86
TO 79
TO 72
TO 65
TO 58
TO 50
TO 51
TO 43
TO 42
TO 41
TO 33
TO 25
TO 17
TO 9

PLOT COMPLETED

1411 351

THE GOOD NEWS

08/05/75

*** ATTN: LIBRARIAN USERS ***

VERSION 5.1 OF LIBRARIAN IS AVAILABLE FOR USER TESTING. THE NEW VERSION MAY BE INVOKED BY ADDING THE SYMBOLIC 'QIB=TSYS' TO THE EXECUTE OF THE LIBRARIAN PROCEDURES.

QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO ECC SATELLITE SYSTEMS PROGRAMMING, CASNET 728-3253.

08/01/75

**** ATTN: ALL USERS ****

AUTOMATIC DISCONNECT SERVICE INSTALLATION

EFFECTIVE 8AM AUGUST 4 1975 IF YOU ARE INACTIVE IN EXCESS OF 20 MINUTES YOU WILL BE DISCONNECTED FROM BRIDGEVILLE (ECC). YOU MAY AVOID UNNECESSARY DIFFICULTIES IF YOU SIGNOFF FROM THE SYSTEM WHEN YOU KNOW YOU WILL BE INACTIVE FOR MORE THAN 20 MINUTES. IF YOU HAVE ANY QUESTIONS OR PROBLEMS PLEASE CALL SERVICE ADMINISTRATION AT CASNET 728-3258 OR DDD 412-221-1100 EXT 258.

JCS 080175

* * *

CURRENT RESTRICTIONS, WARNINGS AND HINTS.

CHANNEL-TO-CHANNEL ADAPTER (SYSOUT):

DO NOT SPECIFY THE DEN SUBPARAMETER OF THE DCB PARAMETER.

DO NOT SPECIFY DCB=OPTCD=C.

THERE ARE ABSOLUTE MAXIMUM LIMITS IMPOSED ON SYSOUT:

PRINT IS 25,000,000 BYTES   PUNCH IS 10,000 CARDS   CRT IS 5000 BLOCKS

MAXIMUM CHANNEL-TO-CHANNEL BLOCKSIZE IS 2020.

```
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>
```

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ASP JOB NO. = 1245    ID(DAY TIME) = (217 14.11.21)    DATE = 75.217

//PCBESSIL JOB 'FOWLER-FINEL        '74404511000501        9999997  ',    "   ?

ELAPSED TIME ON MAIN = N168     = 002.03, START TIME = 14.12.04

DDNAME = SYSMSG                 PRINTED ON RM501PR2, LINES = 000131
DDNAME = SYSPRINT               PRINTED ON RM501PR2, LINES = 000006
DDNAME = FT06F001               PRINTED ON RM501PR2, LINES = 000716
LINES OUTPUT FOR THIS JOB = 000853

CARDS FROM MAIN FOR THIS JOB = NONE
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POOR ORIGINAL

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1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)£$*#£@<;¬'?>
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1411 353

POOR ORIGINAL

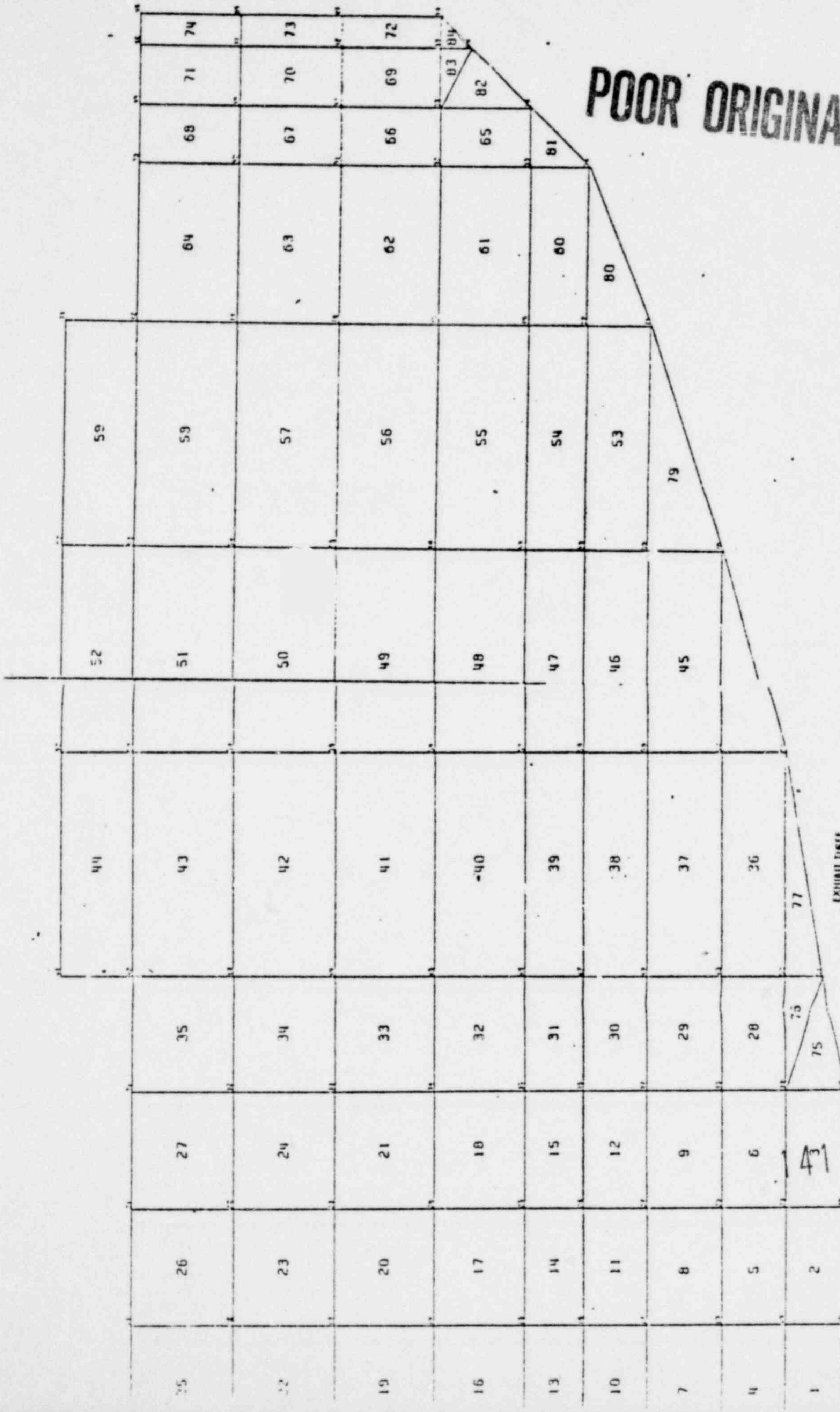


EXHIBIT THREE

1411 354

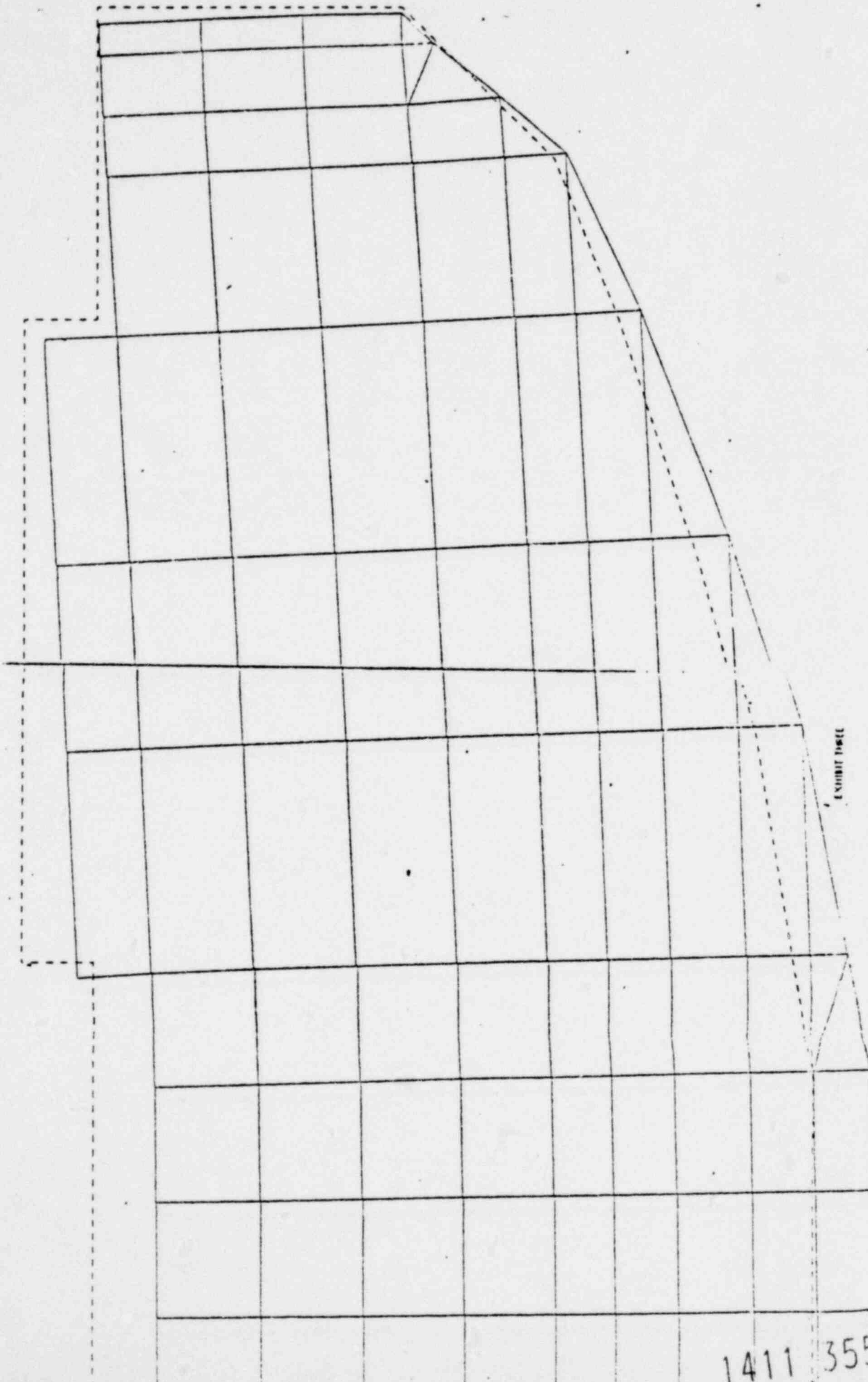
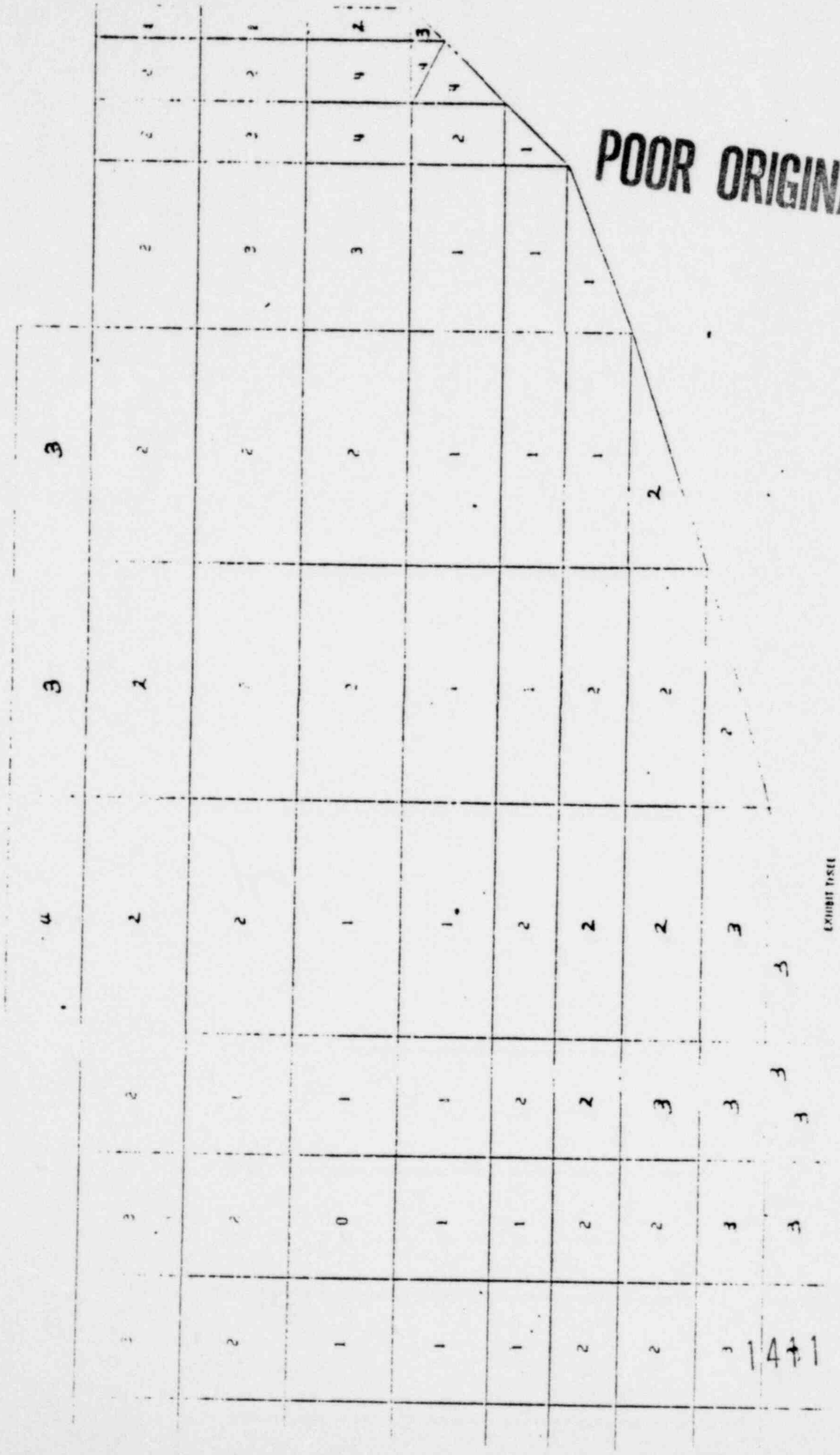


EXHIBIT THREE

1411 355

POOR ORIGINAL



1441 356

EXHIBIT THREE

(3)

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

24 INCH FIG. 607 DISK MICHAUX 08/04/75

NT	NIREGT	NR	NZ	NPR	NPZ	NF	NSUPP	IBPI	MAXITS	NPLOT	NTRI	NCOUP
98	74	12	13	0	11	2	2	40	1000	13	10	0

NGRIDS
9

CC	BETA	E	MU
.10000E-07	.0	.30000E+08	.30000

GRID 1 -- 3 X 9 -- 10 40 31 1

GRID 2 -- 1 X 8 -- 39 50 42 31

GRID 3 -- 1 X 9 -- 50 61 52 41

GRID 4 -- 1 X 8 -- 60 70 62 52

GRID 5 -- 1 X 7 -- 69 78 71 62

GRID 6 -- 1 X 5 -- 77 84 79 72

GRID 7 -- 1 X 4 -- 83 89 85 79

GRID 8 -- 1 X 3 -- 88 93 90 85

GRID 9 -- 1 X 3 -- 93 98 95 90

RECTANGULAR ELEMENTS

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

TRIANGULAR ELEMENTS

40	51	39	0	39	51	50	0	51	61	50	0	61	70	60	0	70	78	69	0
78	84	77	0	84	89	83	0	89	94	88	0	94	93	88	0	94	98	93	0

R LATTICE

.0	.95000	1.8500	2.7500	3.6400	5.3500
7.0900	8.8200	10.030	10.480	10.940	11.180

Z LATTICE

.0	.16000	.44000	.92000	1.4900	1.5700
2.4200	2.8700	3.1000	3.8500	4.6100	5.3700
5.7100					

POOR ORIGINAL

1411 57

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. ACCESR26

24 INCH FIG. 607 DISK MICHAUX

08/04/75

NODAL LATTICE POSITIONS

1	1	12
2	1	11
3	1	10
4	1	9
5	1	7
6	1	6
7	1	5
8	1	4
9	1	3
10	1	1
11	2	12
12	2	11
13	2	10
14	2	9
15	2	7
16	2	6
17	2	5
18	2	4
19	2	3
20	2	1
21	3	12
22	3	11
23	3	10
24	3	9
25	3	7
26	3	6
27	3	5
28	3	4
29	3	3
30	3	1
31	4	12
32	4	11
33	4	10
34	4	9
35	4	7
36	4	6
37	4	5
38	4	4
39	4	3
40	4	1
41	5	13
42	5	12
43	5	11
44	5	10
45	5	9
46	5	7
47	5	6
48	5	5
49	5	4
50	5	3

1411 358

NODAL LATTICE POSITIONS

51	5	2
52	6	13
53	6	12
54	6	11
55	6	10
56	6	9
57	6	7
58	6	6
59	6	5
60	6	4
61	6	3
62	7	13
63	7	12
64	7	11
65	7	10
66	7	9
67	7	7
68	7	6
69	7	5
70	7	4
71	8	13
72	8	12
73	8	11
74	8	10
75	8	9
76	8	7
77	8	6
78	8	5
79	9	12
80	9	11
81	9	10
82	9	9
83	9	7
84	9	6
85	10	12
86	10	11
87	10	10
88	10	9
89	10	7
90	11	12
91	11	11
92	11	10
93	11	9
94	11	8
95	12	12
96	12	11
97	12	10
98	12	9

POOR ORIGINAL

1471 359

ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

24 INCH FIG. 637 DISK MICHAUX

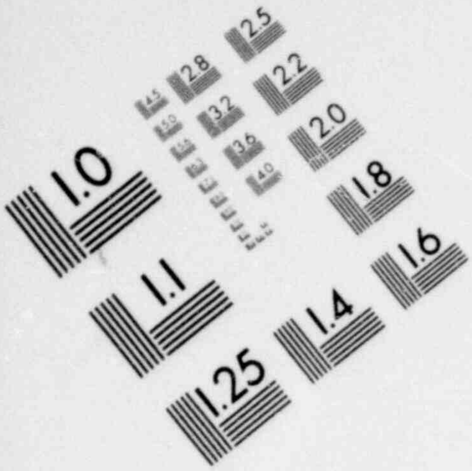
08/04/75

PICTORIAL REPRESENTATION

0	0	0	0	41	52	62	71	0	0	0	0
1	11	21	31	42	53	63	72	79	85	90	95
2	12	22	32	43	54	64	73	80	86	91	96
3	13	23	33	44	55	65	74	81	87	92	97
4	14	24	34	45	56	66	75	82	88	93	98
0	0	0	0	0	0	0	0	0	0	94	0
5	15	25	35	46	57	67	76	83	89	0	0
6	16	26	36	47	58	68	77	84	0	0	0
7	17	27	37	48	59	69	78	0	0	0	0
8	18	28	38	49	60	70	0	0	0	0	0
9	19	29	39	50	61	0	0	0	0	0	0
0	0	0	0	51	0	0	0	0	0	0	0
10	20	30	40	0	0	0	0	0	0	0	0

1411 760

POOR ORIGINAL



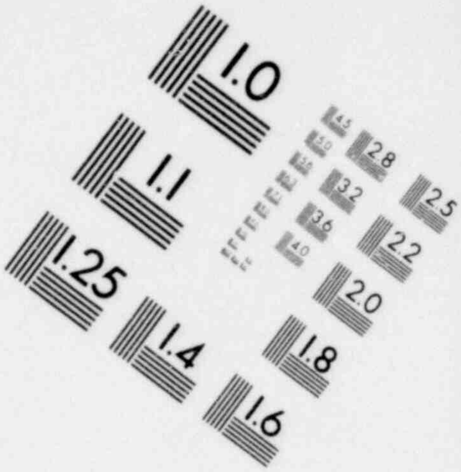
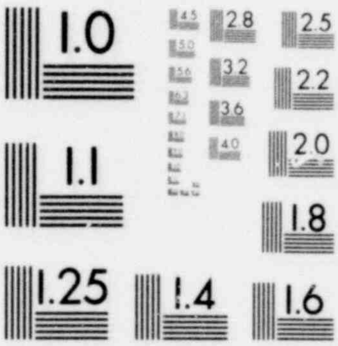
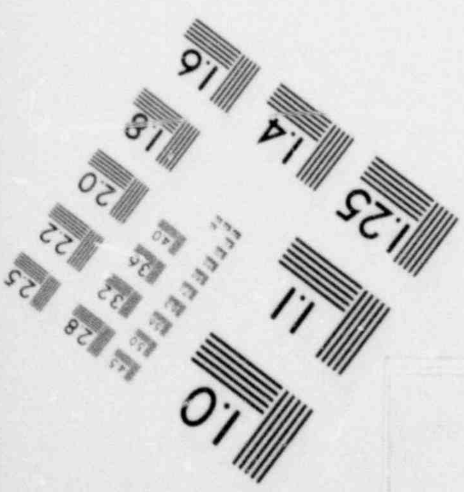
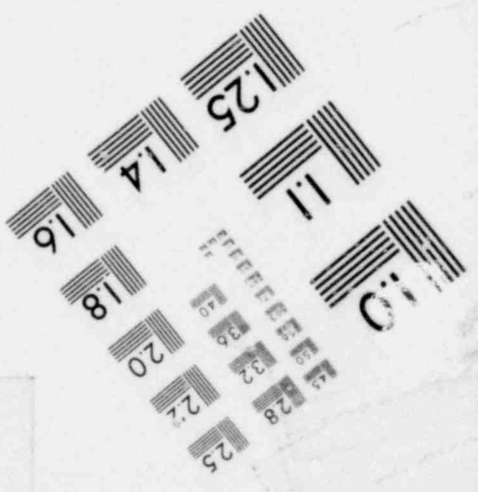


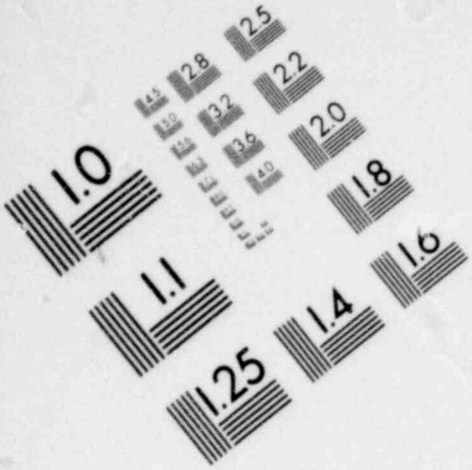
IMAGE EVALUATION TEST TARGET (MT-3)



6″







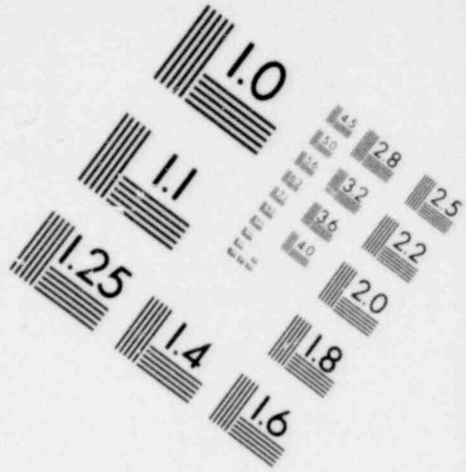
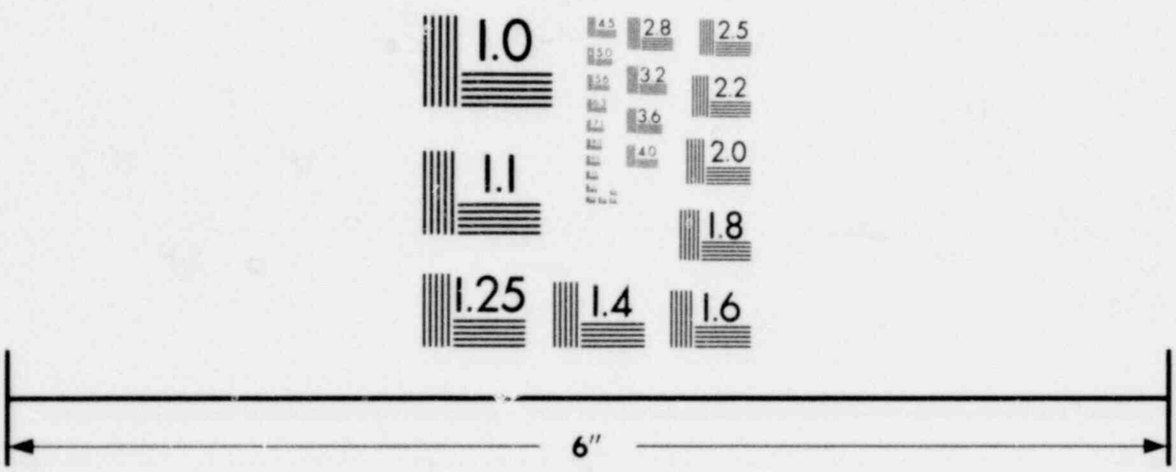
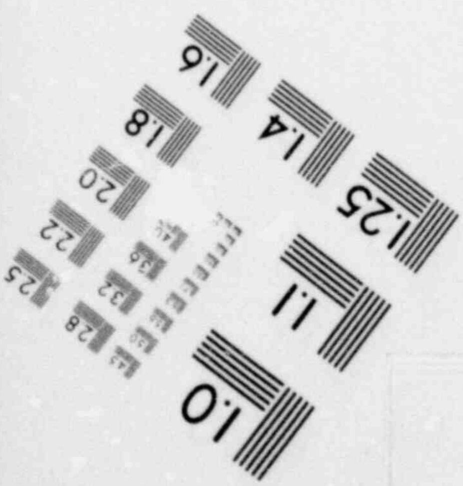


IMAGE EVALUATION TEST TARGET (MT-3)





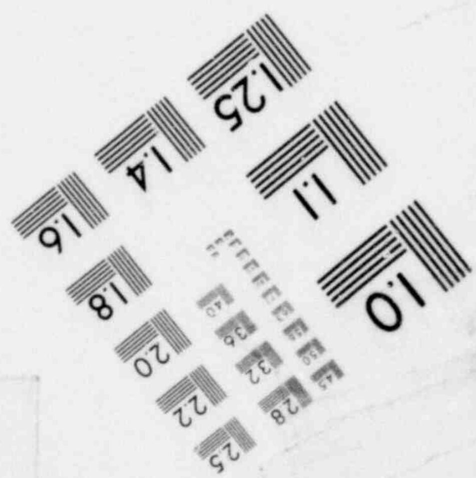
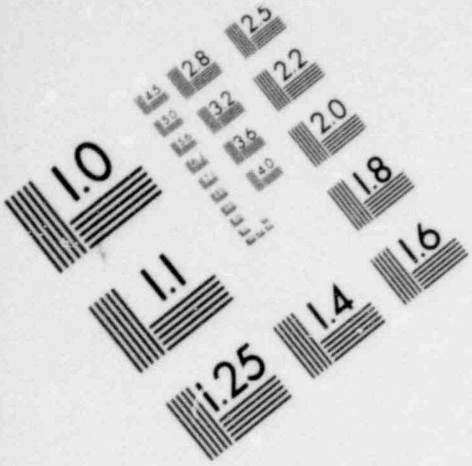


IMAGE EVALUATION TEST TARGET (MT-3)

6″



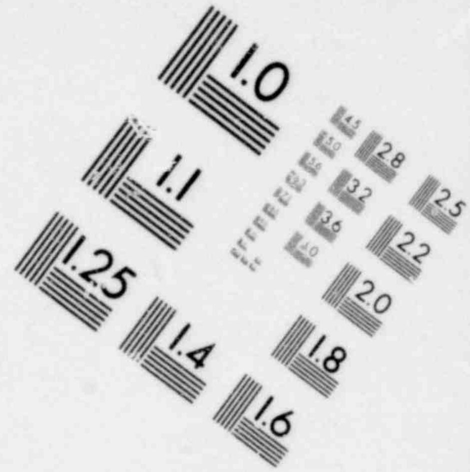
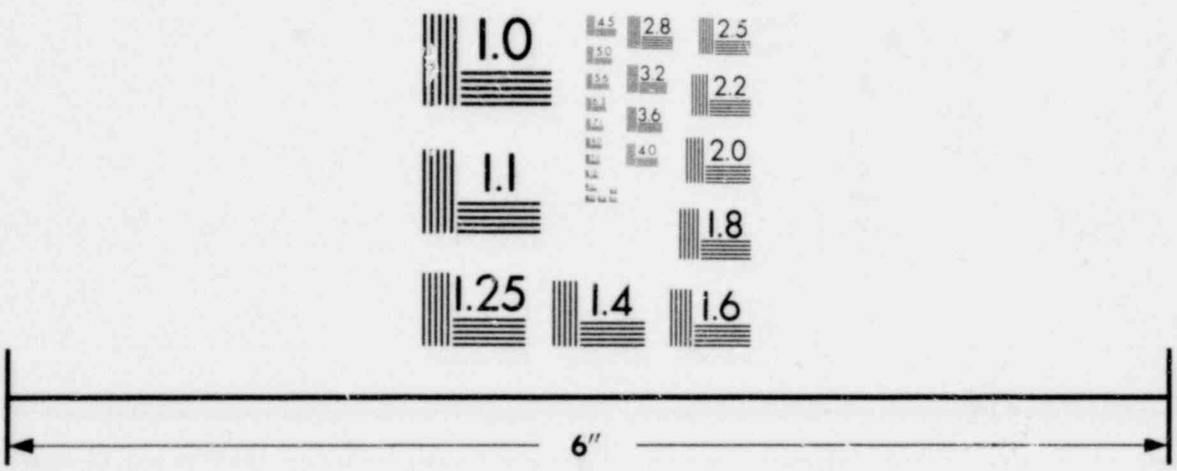
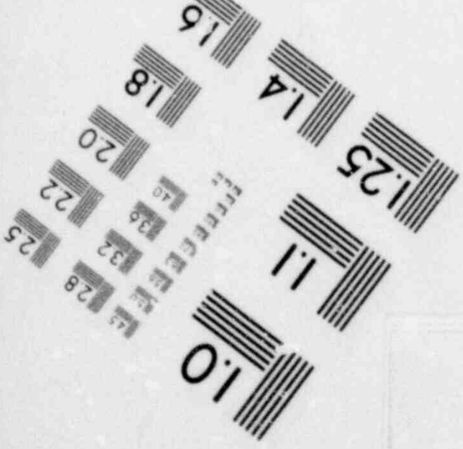
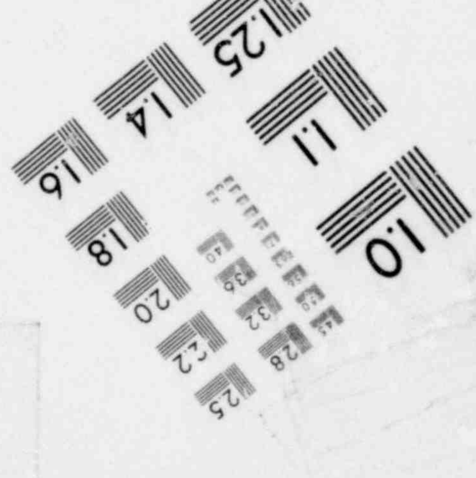


IMAGE EVALUATION TEST TARGET (MT-3)







ROCKWELL INTERNATIONAL
FLOW CONTROL DIVISION
PROGRAM NO. NCCESR26

24 INCH FIG. 607 DISK MICHAUX

08/04/75

AXIAL PRESSURE, TYPE, NODES

-540.00	1	1	11
-540.00	1	11	21
-540.00	1	21	31
-2700.0	1	31	42
-564.00	1	41	52
-526.00	1	52	62
-472.00	1	62	71
-366.00	1	72	79
-316.00	1	79	85
-270.00	1	85	90
-240.00	1	90	95

LOAD	NODE	DIRECTION
-.10634E+06	54	1
-.10634E+06	98	1

DEFLECTION	NODE	DIRECTION
.0	54	2
.0	98	2

POOR ORIGINAL

1412 001

NODES, COORDINATES, AND FORCES

24 INCH FIG. 607 DISK MICHAUX

F*U

08/04/75

1	0.0	5.370	0.	-551.	1.166
2	0.0	4.610	0.	0.	
3	0.0	3.850	0.	0.	
4	0.0	3.100	0.	0.	
5	0.0	2.420	0.	0.	
6	0.0	1.970	0.	0.	
7	0.0	1.490	0.	0.	
8	0.0	0.920	0.	0.	
9	0.0	0.440	0.	0.	
10	0.0	0.0	0.	0.	
11	0.950	5.370	0.	-2826.	5.905
12	0.950	4.610	0.	0.	
13	0.950	3.850	0.	0.	
14	0.950	3.100	0.	0.	
15	0.950	2.420	0.	0.	
16	0.950	1.970	0.	0.	
17	0.950	1.490	0.	0.	
18	0.950	0.920	0.	0.	
19	0.950	0.440	0.	0.	
20	0.950	0.0	0.	0.	
21	1.850	5.370	0.	-5619.	11.521
22	1.850	4.610	0.	0.	
23	1.850	3.850	0.	0.	
24	1.850	3.100	0.	0.	
25	1.850	2.420	0.	0.	
26	1.850	1.970	0.	0.	
27	1.850	1.490	0.	0.	
28	1.850	0.920	0.	0.	
29	1.850	0.440	0.	0.	
30	1.850	0.0	0.	0.	
31	2.750	5.370	0.	-26319.	23.006
32	2.750	4.610	0.	0.	
33	2.750	3.850	0.	0.	
34	2.750	3.100	0.	0.	
35	2.750	2.420	0.	0.	
36	2.750	1.970	0.	0.	
37	2.750	1.490	0.	0.	
38	2.750	0.920	0.	0.	
39	2.750	0.440	0.	0.	
40	2.750	0.0	0.	0.	
41	3.640	5.910	0.	-12400.	23.104
42	3.640	5.370	0.	-25790.	47.66
43	3.640	4.610	0.	0.	
44	3.640	3.850	0.	0.	
45	3.640	3.100	0.	0.	
46	3.640	2.420	0.	0.	
47	3.640	1.970	0.	0.	
48	3.640	1.490	0.	0.	
49	3.640	0.920	0.	0.	
50	3.640	0.440	0.	0.	

POOR ORIGINAL

NODES, COORDINATES, AND FORCES

24 INCH FIG. 607 DISK MICHAUX

08/04/75

51	3.640	0.160	0.	0.	
52	5.350	5.910	0.	-31494.	46.92
53	5.350	5.370	0.	0.	
54	5.350	4.610	0.	0.	
55	5.350	3.850	0.	0.	
56	5.350	3.100	0.	0.	
57	5.350	2.420	0.	0.	
58	5.350	1.970	0.	0.	
59	5.350	1.490	0.	0.	
60	5.350	0.920	0.	0.	
61	5.350	0.440	0.	0.	
62	7.090	5.910	0.	-38400.	42.09
63	7.090	5.370	0.	0.	
64	7.090	4.610	0.	0.	
65	7.090	3.850	0.	0.	
66	7.090	3.100	0.	0.	
67	7.090	2.420	0.	0.	
68	7.090	1.970	0.	0.	
69	7.090	1.490	0.	0.	
70	7.090	0.920	0.	0.	
71	8.820	5.910	0.	-21528.	[illegible]
72	8.820	5.370	0.	-12670.	[illegible]
73	8.820	4.610	0.	0.	
74	8.820	3.850	0.	0.	
75	8.820	3.100	0.	0.	
76	8.820	2.420	0.	0.	
77	8.820	1.970	0.	0.	
78	8.820	1.490	0.	0.	
79	10.030	5.370	0.	-18082.	1.063
80	10.030	4.610	0.	0.	
81	10.030	3.850	0.	0.	
82	10.030	3.100	0.	0.	
83	10.030	2.420	0.	0.	
84	10.030	1.970	0.	0.	
85	10.480	5.370	0.	-8766.	1.949
86	10.480	4.610	0.	0.	
87	10.480	3.850	0.	0.	
88	10.480	3.100	0.	0.	
89	10.480	2.420	0.	0.	
90	10.940	5.370	0.	-6217.	.1
91	10.940	4.610	0.	0.	
92	10.940	3.850	0.	0.	
93	10.940	3.100	0.	0.	14.84
94	10.940	2.870	-106337.	0.	
95	11.180	5.370	0.	-2013.	.12
96	11.180	4.610	0.	0.	
97	11.180	3.850	0.	0.	
98	11.180	3.100	-106338.	0.	21.45

TOTAL = 298.53

× 1/4 =

POOR ORIGINAL

1412 003

24 INCH FIG. 6C7 DISK MICHAUX 08/04/75

STIFFNESS MATRIX WIDTH FROM 15 TO 40

GAUSS-SEIDEL ITERATION
CONVERGENCE AT ITERATION NO. AND BETA

.13994E-04	100	1.90535
.16039E-05	200	1.90535
.23740E-06	300	1.90535
.19253E-07	400	1.90535

TOTAL ITERATIONS, 432

POOR ORIGINAL

1412 004

24 INCH FIG. 667 DISK PICHAUX 08/04/75

NODAL DISPLACEMENTS

NODE	UR	UZ
1	0.0	-0.0021164
2	0.0	-0.0021581
3	0.0	-0.0021807
4	0.0	-0.0021837
5	0.0	-0.0021724
6	0.0	-0.0021594
7	0.0	-0.0021414
8	0.0	-0.0021148
9	0.0	-0.0020875
10	0.0	-0.0020553
11	-0.0000944	-0.0020895
12	-0.0000652	-0.0021330
13	-0.0000374	-0.0021574
14	-0.0000128	-0.0021621
15	0.0000389	-0.0021523
16	0.0000221	-0.0021402
17	0.0000358	-0.0021231
18	0.0000526	-0.0020976
19	0.0000692	-0.0020709
20	0.0000919	-0.0020400
21	-0.0001753	-0.0020503
22	-0.0001299	-0.0020949
23	-0.0000729	-0.0021131
24	-0.0000221	-0.0021104
25	0.0000185	-0.0020970
26	0.0000437	-0.0020835
27	0.0000700	-0.0020652
28	0.0001019	-0.0020382
29	0.0001315	-0.0020105
30	0.0001640	-0.0019819
31	-0.0002646	-0.0020140
32	-0.0001828	-0.0020334
33	-0.0000971	-0.0020323
34	-0.0000269	-0.0020230
35	0.0000333	-0.0020077
36	0.0000663	-0.0019938
37	0.0001042	-0.0019758
38	0.0001476	-0.0019492
39	0.0001891	-0.0019231
40	0.0002275	-0.0018956
41	-0.0005275	-0.0018632
42	-0.0003734	-0.0018869
43	-0.0002198	-0.0019022
44	-0.0001170	-0.0019045
45	-0.0000302	-0.0018983
46	0.0000417	-0.0018858
47	0.0000877	-0.0018738
48	0.0001360	-0.0018575
49	0.0001548	-0.0018340
50	0.0002435	-0.0018089

1412 005

24 INCH FIG. 637 DISK MICHAUX

08/04/75

NODAL DISPLACEMENTS

NODE	UR	UZ
51	0.0002756	-0.0017939
52	-0.0005558	-0.0014897
53	-0.000[illegible]9	-0.0015137
54	-0.0002534	-0.0015442
55	-0.0001610	-0.0015651
56	-0.0000442	-0.0015738
57	0.0000560	-0.0015720
58	0.0001207	-0.0015657
59	0.0001902	-0.0015550
60	0.0002709	-0.0015355
61	0.0003456	-0.0015161
62	-0.0006362	-0.0010961
63	-0.0005096	-0.0011178
64	-0.0003544	-0.0011443
65	-0.0002061	-0.0011653
66	-0.00[illegible]0641	-0.0011782
67	0.00[illegible]328	-0.0011816
68	0.0001468	-0.0011791
69	0.0002352	-0.0011708
70	0.0003478	-0.0011565
71	-0.0006569	-0.0006719
72	-0.0005571	-0.0006808
73	-0.0004016	-0.0006957
74	-0.0002484	-0.0007111
75	-0.0000903	-0.0007267
76	0.0000626	-0.0007342
77	0.0001677	-0.0007324
78	0.0002846	-0.0007264
79	-0.0005910	-0.0003353
80	-0.0004151	-0.0003452
81	-0.0002794	-0.0003484
82	-0.0001342	-0.0003661
83	0.0000587	-0.0003790
84	0.0001650	-0.0003789
85	-0.0005835	-0.0002223
86	-0.0004139	-0.0002231
87	-0.0002822	-0.0002091
88	-0.0001734	-0.0002061
89	0.0000619	-0.0002321
90	-0.0005734	-0.0001145
91	-0.0004070	-0.0001158
92	-0.0002712	-0.0000938
93	-0.0001887	-0.0000289
94	-0.0001336	-0.0000000
95	-0.0005679	-0.0000611
96	-0.0004044	-0.0000648
97	-0.0002578	-0.0000511
98	(-0.0002017)	-0.0000000

avg. vertical movmt = .0001706

POOR ORIGINAL

1412 006

AVERAGED STRESSES AT NODES

NO	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
1	-4786.	-1225.	-4786.	0.	-1225.	-4786.	9J.	3561.
2	-3224.	-665.	-3224.	0.	-665.	-3224.	90.	2560.
3	-2101.	-755.	-2101.	0.	-755.	-2101.	90.	1346.
4	-884.	-719.	-884.	0.	-719.	-884.	90.	164.
5	144.	-597.	144.	0.	144.	-597.	0.	741.
6	767.	-538.	767.	0.	767.	-538.	0.	1304.
7	1447.	-393.	1447.	0.	1447.	-393.	0.	1841.
8	2299.	-173.	2299.	0.	2299.	-173.	0.	2472.
9	3076.	-105.	3076.	0.	3076.	-105.	0.	3181.
10	4317.	396.	4317.	0.	4317.	396.	0.	3921.
11	-4551.	-1047.	-4652.	134.	-1042.	-4556.	88.	3620.
12	-3251.	-598.	-3212.	131.	-591.	-3257.	87.	2666.
13	-1975.	-624.	-2024.	167.	-604.	-1995.	83.	1420.
14	-785.	-604.	-819.	205.	-470.	-919.	57.	448.
15	203.	-459.	193.	246.	285.	-576.	17.	861.
16	817.	-448.	839.	262.	869.	-500.	11.	1369.
17	1465.	-314.	1482.	258.	1521.	-351.	8.	1872.
18	2313.	-116.	2320.	221.	2333.	-136.	5.	2469.
19	3041.	-45.	3082.	90.	3044.	-52.	2.	3134.
20	4032.	372.	4224.	-38.	4032.	372.	-1.	3852.
21	-4529.	-940.	-4483.	-205.	-928.	-4541.	-87.	3613.
22	-3139.	-677.	-3251.	-139.	-670.	-3146.	-87.	2582.
23	-1802.	-827.	-1971.	-21.	-827.	-1802.	-89.	1144.
24	-726.	-812.	-820.	156.	-606.	-931.	37.	325.
25	222.	-626.	178.	259.	295.	-699.	16.	994.
26	839.	-546.	788.	299.	872.	-609.	12.	1480.
27	1449.	-415.	1445.	306.	1498.	-464.	9.	1962.
28	2223.	-229.	2250.	272.	2253.	-258.	6.	2511.
29	2860.	-94.	2963.	165.	2869.	-103.	3.	3066.
30	3445.	200.	3753.	75.	3447.	198.	1.	3555.
31	-5721.	-2578.	-5420.	-247.	-2558.	-5740.	-86.	3182.
32	-2968.	-1533.	-3344.	-57.	-1531.	-2971.	-88.	1813.
33	-1726.	-1318.	-1973.	156.	-1265.	-1778.	71.	708.
34	-654.	-953.	-776.	343.	-430.	-1178.	33.	748.
35	253.	-661.	208.	416.	414.	-822.	21.	1236.
36	817.	-539.	806.	435.	945.	-666.	16.	1611.
37	1417.	-406.	1441.	424.	1511.	-497.	12.	2010.
38	2164.	-158.	2222.	383.	2225.	-258.	9.	2483.
39	2785.	-8.	2929.	280.	2813.	-36.	6.	2965.
40	3143.	76.	3377.	215.	3158.	61.	4.	3316.
41	-2417.	-1022.	-5379.	-773.	-679.	-2761.	-66.	4701.
42	-4001.	-1803.	-4818.	-424.	-1723.	-4080.	-79.	3095.
43	-2553.	-1308.	-2970.	112.	-1298.	-2563.	85.	1672.
44	-1571.	-1077.	-1759.	526.	-744.	-1905.	58.	1162.
45	-616.	-787.	-670.	625.	-70.	-1333.	41.	1262.
46	236.	-528.	256.	649.	607.	-859.	30.	1506.
47	768.	-432.	823.	647.	1051.	-715.	24.	1765.
48	1355.	-291.	1440.	612.	1557.	-493.	18.	2051.
49	2042.	-135.	2178.	573.	2184.	-276.	14.	2460.
50	2701.	90.	2870.	507.	2796.	-5.	11.	2876.

1412 007

24 INCH FIG. 607 DISK MICHAUX C8/04/75

AVERAGED STRESSES AT NODES

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
51	2821.	43.	3007.	419.	2883.	-19.	8.	3026.
52	-2294.	-541.	-3967.	196.	-519.	-2316.	84.	3448.
53	-2302.	-413.	-3309.	237.	-384.	-2331.	83.	2926.
54	-1942.	-260.	-2306.	378.	-179.	-2023.	78.	2127.
55	-1226.	-178.	-1324.	568.	70.	-1474.	66.	1545.
56	-462.	-134.	-27.	658.	380.	-977.	52.	1357.
57	283.	-51.	383.	673.	809.	-577.	38.	1387.
58	770.	-42.	895.	656.	1136.	-408.	29.	1544.
59	1289.	-25.	1445.	642.	1551.	-286.	22.	1838.
60	2039.	165.	2196.	524.	2176.	28.	15.	2167.
61	2587.	289.	2752.	433.	2666.	210.	10.	2542.
62	-2031.	-432.	-3431.	14.	-432.	-2031.	90.	2999.
63	-1930.	-288.	-2813.	239.	-254.	-1935.	82.	2559.
64	-1583.	-144.	-2018.	519.	24.	-1751.	72.	2042.
65	-1132.	-32.	-1221.	622.	248.	-1412.	66.	1660.
66	-500.	63.	-402.	649.	489.	-925.	57.	1414.
67	226.	175.	386.	633.	834.	-433.	44.	1267.
68	706.	129.	872.	632.	1112.	-277.	33.	1389.
69	1319.	218.	1476.	535.	1536.	1.	22.	1535.
70	1548.	352.	2115.	468.	2075.	225.	15.	1890.
71	-1485.	-827.	-2928.	658.	-395.	-1928.	58.	2544.
72	-1889.	-823.	-2709.	756.	-430.	-2281.	63.	2276.
73	-1219.	-315.	-1826.	823.	172.	-1706.	59.	1598.
74	-1142.	-91.	-1215.	865.	396.	-1629.	61.	2024.
75	-940.	21.	-583.	711.	399.	-1318.	62.	1717.
76	119.	238.	320.	542.	723.	-367.	48.	1091.
77	733.	254.	884.	404.	563.	24.	30.	939.
78	1281.	341.	1425.	388.	1420.	202.	20.	1224.
79	-1022.	-592.	-2252.	425.	-331.	-1283.	58.	1921.
80	-737.	-443.	-1596.	871.	294.	-1474.	50.	1889.
81	-886.	-158.	-1161.	1368.	869.	-1952.	52.	2820.
82	-2220.	-381.	-1181.	1017.	71.	-2671.	66.	2742.
83	346.	566.	457.	292.	768.	144.	55.	624.
84	750.	383.	864.	339.	952.	181.	31.	772.
85	-167.	-591.	1898.	226.	-69.	-689.	23.	1829.
86	-476.	-882.	-1592.	624.	-23.	-1335.	36.	1569.
87	-303.	-765.	-1128.	1372.	858.	-1925.	40.	2783.
88	-3070.	-1576.	-1947.	1745.	-425.	-4222.	57.	3797.
89	-277.	859.	280.	407.	990.	-408.	72.	1398.
90	29.	-447.	-1698.	108.	53.	-471.	12.	1750.
91	-362.	-971.	-1516.	277.	-255.	-1078.	21.	1261.
92	184.	-2671.	-1310.	807.	443.	-2330.	19.	2773.
93	-3915.	-5126.	-3214.	1250.	-3132.	-5909.	32.	2777.
94	-4121.	-4236.	-2899.	785.	-3390.	-4966.	43.	2067.
95	131.	-285.	-1570.	83.	147.	-301.	11.	1717.
96	-309.	-708.	-1390.	98.	-286.	-730.	13.	1104.
97	1113.	-1171.	-709.	509.	1222.	-1280.	12.	2502.
98	-4010.	-4768.	-3155.	-7.	-4010.	-4768.	-0.	1613.

$\sigma_{yp} = 31.2$ ksi

$\frac{31,200}{4701} = 6.63688$

⇒ load to yield = 1,411,49'

∴ factor is 2.85374

(body yield is basic)

24 INCH FIG. 607 DISK MICHAUX 08/04/75

ELEMENT CENTER DATA

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
1	3652.	41.	3652.	-105.	3655.	38.	-2.	3616.
2	3269.	-16.	3445.	35.	3269.	-18.	1.	3464.
3	2954.	-74.	3198.	185.	2566.	-85.	3.	3284.
4	2724.	-53.	2724.	6.	2725.	-53.	0.	2777.
5	2628.	-107.	2664.	212.	2644.	-123.	4.	2787.
6	2474.	-164.	2563.	300.	2538.	-198.	6.	2761.
7	1894.	-235.	1894.	45.	1895.	-236.	1.	2131.
8	1879.	-254.	1882.	260.	1910.	-285.	7.	2195.
9	1829.	-336.	1845.	361.	1888.	-366.	9.	2253.
10	1127.	-418.	1127.	62.	1130.	-421.	2.	1550.
11	1143.	-422.	1134.	255.	1183.	-462.	9.	1646.
12	1153.	-451.	1136.	376.	1236.	-534.	13.	1771.
13	456.	-565.	456.	69.	461.	-570.	4.	1031.
14	493.	-565.	475.	224.	539.	-610.	11.	1149.
15	541.	-601.	497.	363.	647.	-707.	16.	1353.
16	-385.	-695.	-385.	70.	-370.	-710.	12.	340.
17	-316.	-712.	-354.	157.	-261.	-767.	19.	505.
18	-211.	-788.	-305.	304.	-80.	-918.	23.	838.
19	-1496.	-746.	-1496.	68.	-740.	-1502.	85.	762.
20	-1399.	-819.	-1452.	20.	-818.	-1400.	88.	644.
21	-1206.	-1018.	-1391.	148.	-937.	-1287.	61.	454.
22	-2638.	-653.	-2638.	98.	-648.	-2643.	87.	1995.
23	-2670.	-764.	-2678.	-100.	-759.	-2675.	-87.	1919.
24	-2451.	-1204.	-2682.	-170.	-1181.	-2474.	-82.	1501.
25	-3876.	-644.	-3876.	94.	-642.	-3879.	88.	3237.
26	-3702.	-497.	-3757.	-72.	-496.	-3704.	-89.	3261.
27	-3975.	-1128.	-3999.	-369.	-1081.	-4022.	-83.	2941.
28	2392.	-127.	2505.	427.	2462.	-198.	9.	2704.
29	1778.	-232.	1838.	460.	1878.	-333.	12.	2211.
30	1120.	-396.	1143.	507.	1274.	-550.	17.	1825.
31	554.	-533.	536.	517.	761.	-740.	22.	1500.
32	-153.	-730.	-232.	503.	138.	-1021.	30.	1159.
33	-1075.	-1014.	-1268.	428.	-615.	-1474.	47.	859.
34	-2117.	-1361.	-2501.	248.	-1287.	-2191.	73.	1214.
35	-4237.	-1871.	-4286.	-143.	-1863.	-4246.	-87.	2423.
36	2324.	54.	2481.	511.	2434.	-56.	12.	2536.
37	1652.	-58.	1794.	615.	1846.	-293.	18.	2139.
38	1061.	-176.	1162.	645.	1336.	-451.	23.	1786.
39	504.	-283.	580.	679.	895.	-674.	30.	1569.
40	-157.	-404.	-128.	653.	424.	-985.	40.	1409.
41	-997.	-567.	-1050.	675.	-74.	-1490.	54.	1416.
42	-1892.	-746.	-2122.	568.	-512.	-2126.	68.	1613.
43	-2495.	-819.	-3251.	150.	-806.	-2508.	85.	2446.
44	-2294.	-599.	-4127.	-312.	-544.	-2350.	-80.	3584.
45	1629.	137.	1793.	574.	1824.	-58.	19.	1882.
46	967.	40.	1142.	658.	1309.	-301.	27.	1610.
47	483.	40.	626.	669.	966.	-443.	36.	1409.
48	-123.	-11.	-25.	680.	615.	-750.	47.	1364.
49	-835.	-71.	-846.	646.	298.	-1204.	60.	1502.
50	-1465.	-124.	-1707.	521.	55.	-1643.	71.	1761.

1412 009

POOR ORIGINAL

24 INCH FIG. 607 DISK MICHAUX 08/04/75

ELEMENT CENTER DATA

NO.	RADIAL	AXIAL	HOOP	SHEAR	PRINCIPAL STRESSES		θ DEG	STRESS INTENSITY
51	-1935.	-237.	-2601.	311.	-182.	-1990.	83.	2419.
52	-2458.	-518.	-3508.	80.	-514.	-2462.	88.	2993.
53	1017.	202.	1154.	504.	1257.	-38.	26.	1295.
54	401.	151.	583.	558.	848.	-296.	39.	1144.
55	-132.	180.	-26.	625.	649.	-651.	53.	1300.
56	-801.	94.	-785.	711.	486.	-1194.	61.	1680.
57	-1283.	-139.	-1574.	722.	209.	-1637.	64.	1846.
58	-1632.	-374.	-2331.	595.	-137.	-1869.	68.	2194.
59	-1603.	-490.	-2871.	454.	-328.	-1761.	73.	2543.
60	405.	226.	567.	414.	739.	-108.	39.	847.
61	-583.	221.	-188.	479.	444.	-806.	65.	1251.
62	-1211.	15.	-956.	1115.	675.	-1870.	59.	2545.
63	-1150.	-443.	-1550.	1207.	462.	-2054.	53.	2516.
64	-1414.	-586.	-2168.	802.	-98.	-1902.	59.	2070.
65	-1063.	445.	-319.	327.	513.	-1131.	78.	1643.
66	-1947.	-720.	-1433.	1860.	624.	-3292.	54.	3916.
67	-780.	-905.	-1523.	1322.	481.	-2166.	44.	2647.
68	-331.	-395.	-1684.	392.	30.	-756.	43.	1714.
69	-1471.	-2334.	-1781.	2174.	313.	-4119.	39.	4432. —
70	-180.	-1175.	-1370.	761.	232.	-1587.	28.	1818.
71	-32.	-425.	-1523.	146.	17.	-474.	18.	1540.
72	-1668.	-3470.	-2165.	656.	-1455.	-3683.	18.	2228.
73	413.	-899.	-1055.	109.	422.	-908.	5.	1477.
74	-27.	-339.	-1434.	4.	-27.	-339.	1.	1407.
75	3041.	-14.	3180.	443.	3104.	-77.	8.	3257.
76	2758.	103.	2976.	160.	2767.	93.	3.	2883.
77	2664.	41.	2855.	655.	2818.	-113.	13.	2979.
78	2023.	72.	2255.	717.	2259.	-163.	18.	2422.
79	1373.	134.	1584.	685.	1677.	-170.	24.	1846.
80	760.	139.	961.	560.	1090.	-191.	31.	1281.
81	455.	283.	522.	530.	906.	-167.	40.	1073.
82	-3666.	-387.	-1449.	1448.	161.	-4214.	69.	4375.
83	-4045.	-6027.	-3484.	1982.	-2820.	-7252.	32.	4432. —
84	-4650.	-6292.	-3764.	-1074.	-4120.	-6823.	-26.	3059.

POOR ORIGINAL

1412 010

FINEL

PLOT DATA

SCALE= 2.00

DEFLECTION SCALE= 457.5460

OUTLINE FROM 9
TO 13
TO 20
TO 30
TO 40
TO 51
TO 61
TO 70
TO 78
TO 84
TO 89
TO 94
TO 98
TO 97
TO 96
TO 95
TO 90
TO 85
TO 79
TO 72
TO 71
TO 62
TO 52
TO 41
TO 42
TO 31
TC 21
TO 11
TO 1
TO 2
TO 3
TO 4
TO 5
TO 6
TO 7
TO 8
TO 9

PLOT COMPLETED

1412 011

POOR ORIGINAL

THE GOOD NEWS

08/01/75

**** ATTN: ALL USERS ****

AUTOMATIC DISCONNECT SERVICE INSTALLATION

EFFECTIVE 6AM AUGUST 4 1975 IF YOU ARE INACTIVE IN EXCESS OF 20 MINUTES YOU WILL BE DISCONNECTED FROM BRIDGEVILLE (ECC). YOU MAY AVOID UNNECESSARY DIFFICULTIES IF YOU SIGNOFF FROM THE SYSTEM WHEN YOU KNOW YOU WILL BE INACTIVE FOR MORE THAN 20 MINUTES. IF YOU HAVE ANY QUESTIONS OR PROBLEMS PLEASE CALL SERVICE ADMINISTRATION AT CASNET 728-3258 OR DDD 412-221-1100 EXT 258.

JCS 080175

07/30/75

**** ATTN: ALL USERS ****

DEFERRAL OF NEW DATA PHONE NUMBERS AT ECC UNTIL LATER DATE

THE RECONFIGURATION OF THE 4800 BAUD PHONE SERVICE, ORIGINALLY SCHEDULED TO TAKE EFFECT AT 9 PM, 7-29-75, HAS BEEN POSTPONED UNTIL A LATER DATE. USERS WILL BE INFORMED WELL IN ADVANCE OF THE PLANNED CHANGE.

UNTIL THE DATE OF THE CHANGE TO THE NEW SERVICE IS ANNOUNCED, PLEASE CONTINUE TO USE THE FOLLOWING NUMBERS:

4800 BAUD ONLY

CASNET:	8-728-3240 8-728-3320
DDD:	412-221-1100 EXT 240 OR 320

IF YOU HAVE ANY QUESTIONS PLEASE CALL SERVICE ADMINISTRATION AT CASNET 8-728-3258 OR 3222 OR DDD 412-221-1100 X258 OR X222

04/25/75 VS/SORT

PARM='MSG=AP' SHOULD BE REMOVED FROM THE EXEC STATEMENT OF VS/SORT. SPECIFICATION OF THIS PARAMETER MAY RESULT IN A 806 ABEND.

* * *

CURRENT RESTRICTIONS, WARNINGS AND HINTS.

CHANNEL-TO-CHANNEL ADAPTER (SYSOUT):

DO NOT SPECIFY THE DEN SUBPARAMETER OF THE DCB PARAMETER.

DO NOT SPECIFY DCB=OPTCD=C.

THERE ARE ABSOLUTE MAXIMUM LIMITS IMPOSED ON SYSOUT:

PRINT IS 25,000,000 BYTES PUNCH IS 10,000 CARDS CRT IS 5000 BLOCKS

MAXIMUM CHANNEL-TO-CHANNEL BLOCKSIZE IS 2020.

```
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
```

ASP JOB NO. = 5945   ID(DAY TIME) = (216 11.09.10)   DATE = 75.216

//NCHE9511 JOB 'FOWLER-FINEL   *74404511000501   5995597 ',   ? "

ELAPSED TIME ON MAIN = N168   = 004.00, START TIME = 11.12.57

DDNAME = SYSMSG   PRINTED ON RM501PR2, LINES = 000131
DDNAME = SYSPRINT   PRINTED ON RM501PR2, LINES = 000006
DDNAME = FT06F001   PRINTED ON RM501PR2, LINES = 000718
LINES OUTPUT FOR THIS JOB = 000855

CARDS FROM MAIN FOR THIS JOB = NCNE

POOR ORIGINAL

```
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>1234567890XY/STUVW|:_",=JKLMNOPQR-Z(ABCDEFGHI+.)%$*#&@<;¬'?>
```

1412 013

SHEET OF

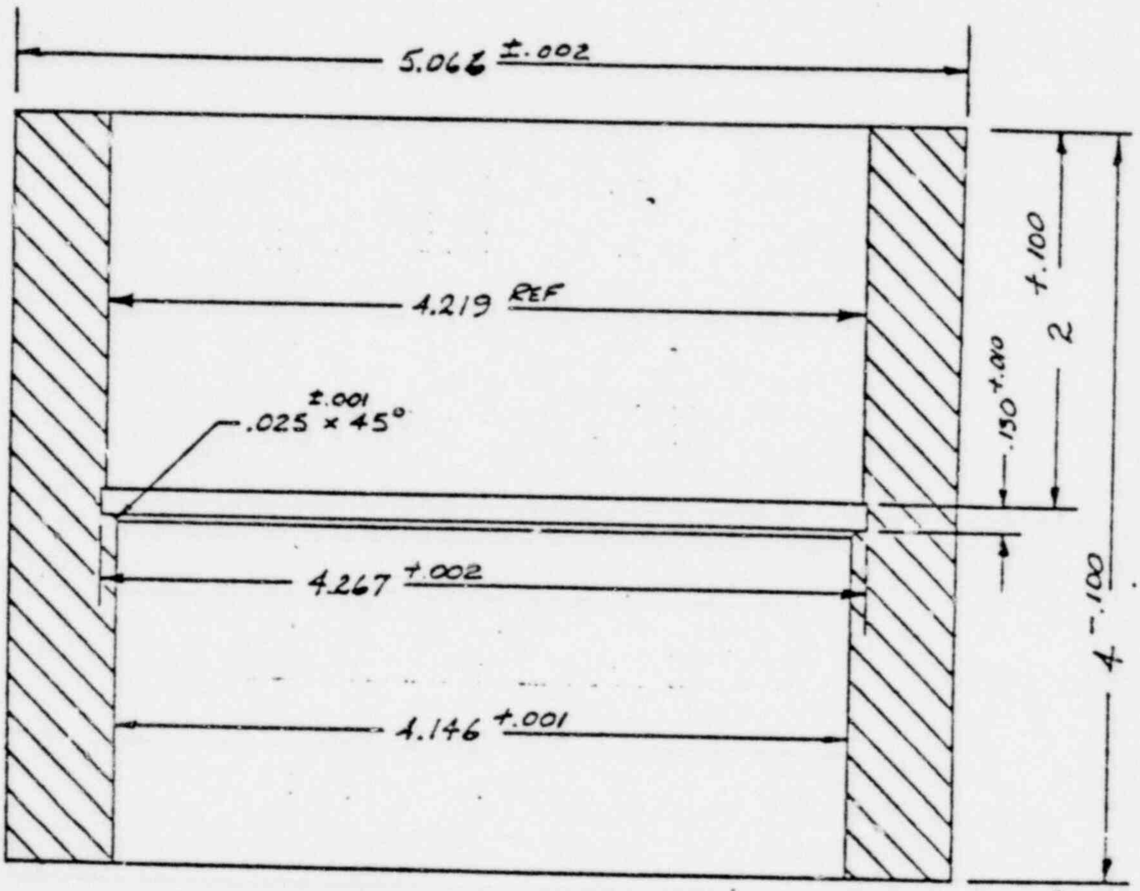
Flow Control Division
Rockwell International

SUBJECT:

EXHIBIT FOUR

SCALE MODEL OF
24-607 VALVE BODY

BY/DATE: jlf 8/11/75 | REVIEWED BY/DATE: | REV/DATE:



SCALE FACTOR (24"-607) = 0.189023

1412 014

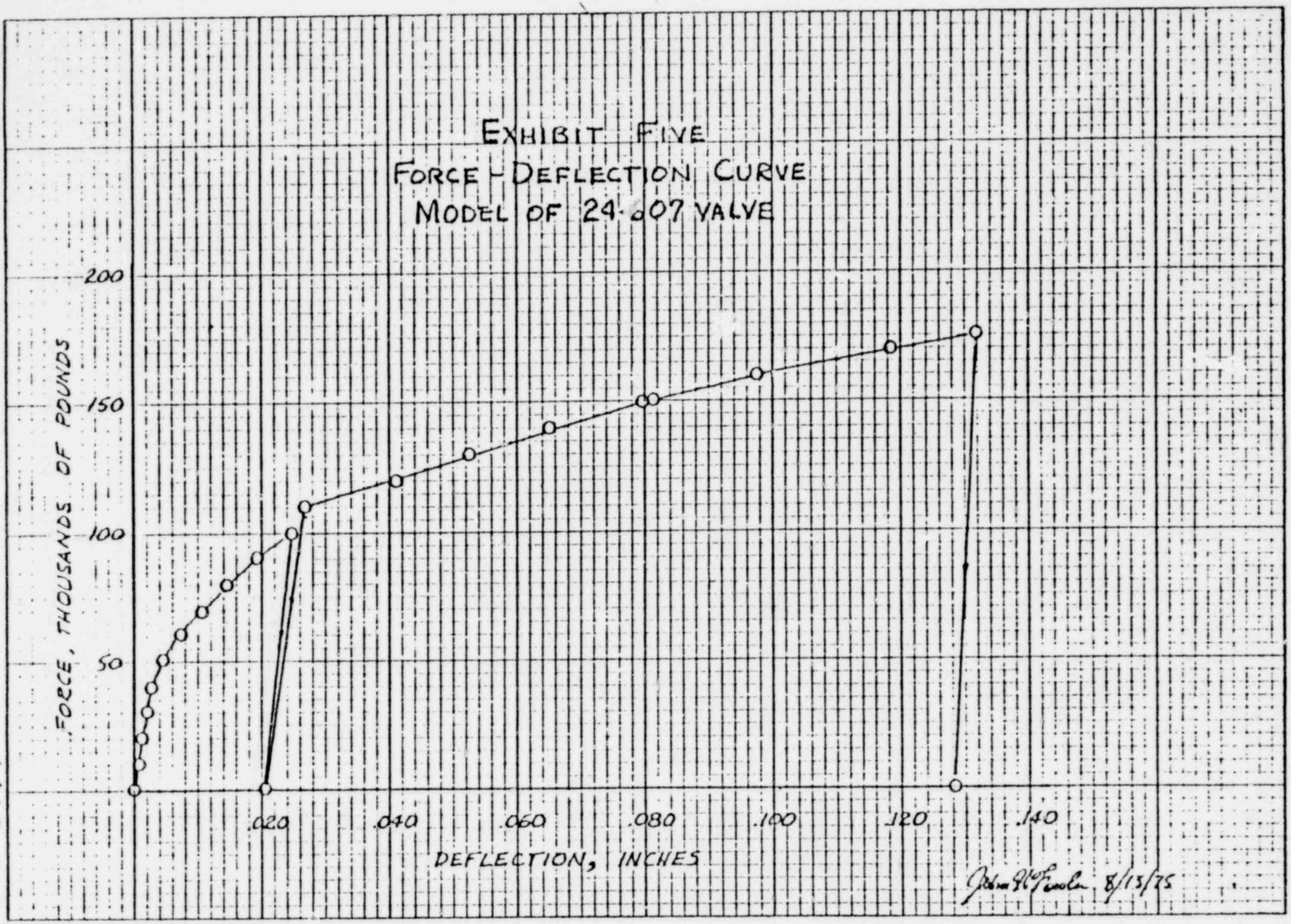
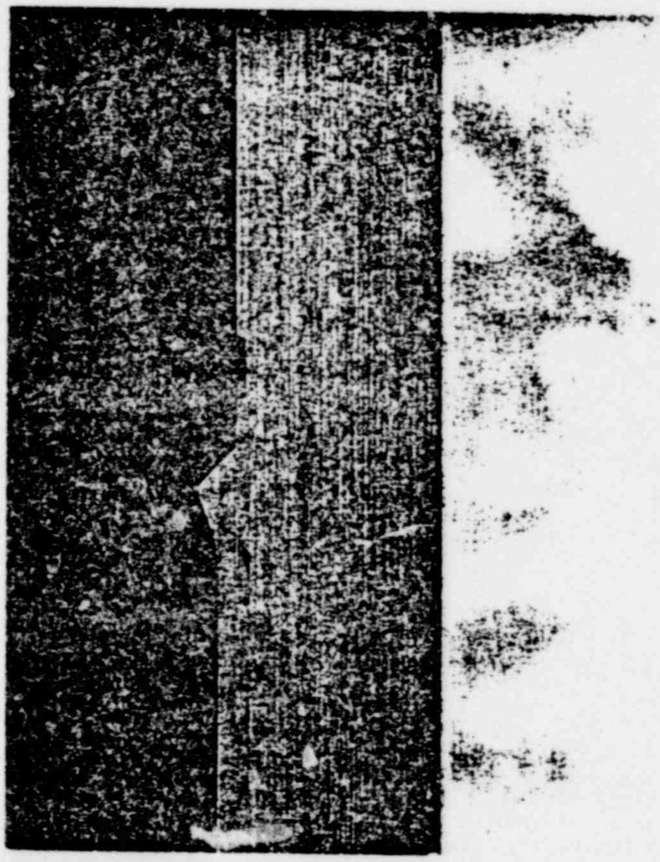


EXHIBIT FIVE
FORCE - DEFLECTION CURVE
MODEL OF 24-007 VALVE
FORCE, THOUSANDS OF POUNDS
200
150
100
50
.020
.040
.060
.080
.100
.120
.140
DEFLECTION, INCHES
8/13/75

1412 015

EXHIBIT SIX

POOR ORIGINAL



This section of the deformed model (x2) shows the manner in which the seat was enlarged and plowed downward. The 45° seat surface was initially adjacent to the lower end of the small relief groove. The width of the seat was increased from .025" to .084". The bore below the seat was originally of uniform diameter.

1412 016