UNCLASSIFIED [redacted]

1316

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
7/9/98
Review Date 7/23/98
W Payne
Determination (Circle Number(s)):
1. Classification Retained
2. Classification Changed to: U
3. Contains No DOE Classified Information
4. Coordinate With:
5. Contains UCNI? NO
Comments: Declassify

AUG 28 1956

Case No. 689.00
Ref. Sym: 1612 (285)
Project No. TM-353
File: TX-27, 3-2

RECEIVED
AUG 28 1956
R & D FILES

MR. R. S. WILSON - 1215

Attn: Mr. J. K. Nakayama - 1215

Re: Static Test of TX-27 Test Cylinder

CRL No.
AUTHORITY
BM
FILE NO. TX-27
3-2

Summary of Results

A test cylinder constructed of Epon plastic sandwiched between 52-H, one-half hard, aluminum skins was subjected to various band and point loading conditions with the following results:

1. The unit was loaded with a 3-1/2 inch wide band in contact with the cylinder through 120 degrees of circumference. Maximum indicated stress at a load of 80,000 pounds was 15,800 psi compression.

2. Loads were applied through a 3-1/2 inch wide band in contact with the cylinder through 180 degrees of circumference to a maximum of 120,000 pounds. Maximum stress measured was slightly in excess of the yield stress for the material (listed as 24,000 psi in ANC-5).

3. A simulated sway brace load was applied through a 4-inch diameter contoured pad. Maximum strain measured at 30,000 pounds was 1830 microinches per inch compression.

4. Loads were applied through a 3-1/2 inch wide band in contact with the unit through 120 degrees of circumference while the unit was stabilized at 150°F. Stresses in excess of the yield stress (24,000 psi) were measured at the first increment of 20,000 pounds.

5. Simulated sway brace loads were applied through a 4-inch diameter contoured pad with the unit stabilized at 150°F. Compressive stresses in excess of yield were indicated at 5000 pounds and both tensile and compressive strains in excess of 10,000 microinches per inch were indicated at 15000 pounds total load.

Object of Test

The object of this test was to obtain design information for cylinders constructed of Epon plastic sandwiched between aluminum skins when subjected to various conditions of band and point loading.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW
DOWNGRADING OR DECLASSIFICATION STAMP
CLASSIFICATION CHANGED TO: U
AUTHORITY: W. C. Layne
Emelda Selph 7/30/98
PERSON CHANGING MARKING & DATE
RECORD ID: 98SN3152
W. C. Layne 7/30/98
PERSON VERIFYING MARKING & DATE
DATED: 7/23/98

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Reason for Test

The test was conducted in accordance with a Work Order Authorization from R. S. Wilson, 1215, to P. H. Adams, 1612, dated November 14, 1955.

Function of Object Tested

The TX-27 test cylinder was constructed for the sole purpose of yielding experimental design information for cylinders made of Epon plastic sandwiched between aluminum skins.

Summary of Past Tests

No previous tests have been performed upon this object by Division 1612. Results of static tests upon a similar structure were reported, however, in a memo, Static Test of XW-27 "A" Cases, Ref. Sym: 1612 (305), Project No. TM-371, from H. P. Wheeler, 1612, to R. S. Wilson, 1215, dated June 28, 1956.

Setup for Test

I. Figures 1 through 8 are photographs depicting the various test setups.

II. The following component was tested:

One UCRL TX-27 test cylinder.

III. The following equipment was used in the test:

1. Two Simplex hydraulic pump and jack combinations - capacity 60 tons.

2. One Blackhawk hydraulic pump and ram combination - capacity 50 tons.

3. Two Baldwin strain indicators, Serial Nos. J-59252 and J-59191.

4. One Sadic automatic data processing system.

5. Three calibrated pull bars, 1-inch diameter, calibration 10 pounds per microinch per inch for the following gage factor settings:

Pull Bar B — 2.080
Pull Bar C — 2.160
Pull Bar J — 2.154

IV. The following instrumentation was used in the test:

1. Stresscoat No. 1204.
2. Thirty-four rosettes constructed from Baldwin A-7 strain gages, resistance 120.5 ± .3 ohms, gage factor 1.90 ± 2%.

Figures 9 and 10 are sketches showing location and orientation of the strain gages used in these tests. Table I shows which gages were used in each test.

Procedure

The unit was stresscoated and mounted as shown in Figs. 1 and 2. The ends of the cylinder were simply supported. Loads were applied through the band in increments listed in Table II (Test No. 1). The loads were relaxed between increments and the Stresscoat crack patterns marked.

Next, the cylinder was instrumented with 29 strain gage rosettes (87 gages) and mounted as shown in Fig. 3 (Test No. 2), and loaded in 10,000 pound increments. The strains measured by the gages listed in Table I were recorded at each increment. The gages not listed were in the vicinity of the sway brace pad at the top of the unit. Only one rosette (3 gages) on each the outer and inner skins in this location was connected.

The unit was then mounted in a specially constructed loading frame (Figs. 4 through 6) and loaded with the band in contact with the cylinder through 180 degrees of circumference (Test No. 3). The loads were applied in 20,000 pound increments to a maximum of 120,000 pounds. The strains measured by the gages listed in Table I were recorded at each increment of load.

With the unit mounted as shown in Figs. 7 and 8, simulated sway brace loads were applied in 5000 pound increments to a maximum of 30,000 pounds (Test No. 4). Strains measured by the gages listed in Table I were recorded at each increment of load.

In test No. 5 the unit was mounted in the loading frame used in tests Nos. 3 and 4 and placed in the Hieatt No. 3 temperature and humidity chamber. When the unit had stabilized at 150°F, loads were applied through the band in contact with the cylinder through 120 degrees of circumference. The loads were applied in increments listed to a maximum of 60,000 pounds. Strain gage readings were recorded at each interval of load.

In test No. 6 the unit was mounted in an identical manner to the test setup for test No. 4 and placed in the Hieatt No. 3 temperature and humidity chamber. When the unit had stabilized at 150°F, simulated sway brace loads were applied through a 4-inch diameter contoured pad in 5000 pound increments to a maximum of 15,000 pounds. Readings from the strain gages surrounding the sway brace pad were recorded at each interval. During the

last interval, however, the Sadic strain recorder became inoperative after only four gages had been read.

Results

The TX-27 test cylinder withstood loads of 50,000 pounds (Test No. 1) and 80,000 pounds (Test No. 2) applied with a 3-1/2 inch wide band in contact with the skin through 120 degrees of circumference without any indication of failure or yield. The unit withstood a load of 120,000 pounds (Test No. 3) applied with a band in contact with the cylinder through 180 degrees of circumference. Highest strains measured in this test indicated tensile stresses slightly in excess of the minimum guaranteed yield stress for the material (52S, one-half band aluminum; listed yield stress in ANC-5 is 24,000 psi).

Strain measurements taken during the simulated sway brace loading (Test No. 4) indicated compressive yield stress had been exceeded near the contoured load pad at a simulated sway brace load of 30,000 pounds.

When stabilized at 150°F tensile yield stresses were indicated when the cylinder was subjected to a load of 20,000 pounds through a band in contact with the cylinder through 120 degrees of circumference. The yielding appeared to be localized, however, as the cylinder was able to sustain continued loads to 60,000 pounds without visible buckling of the cylinder wall.

The ability of the cylinder to withstand sway brace loads when heated to 150°F was greatly impaired. A sway brace load of 5000 pounds produced stresses exceeding compressive yield and 10,000 pounds produced both tensile and compressive yielding. A load of 15,000 pounds produced both tensile and compressive strains in excess of 10,000 microinches per inch.

Load-strain data from the Stresscoat test (Test No. 1) is listed in Table II. Measured strains from tests 2 through 6 are listed in Table III through VII, respectively. Computed stresses for tests Nos. 2, 3, and 5 (band loads) are listed in Tables III, IV, and VI, respectively. No attempt was made to compute stresses for the sway brace loads because the strain gradient in the vicinity of the sway brace pad was so large. Strains for each gage and stresses computed from the band load tests at maximum load are shown diagrammatically in Figs. 11 through 18. Where a value for stress is left blank at least one element of the rosette was inoperative.

Figure 19 is a photograph depicting the Stresscoat cracks in test No. 1. Figures 20 and 21 are photos of the permanent deformations when subject to the sway brace load while stabilized at 150°F.

Conclusions and Recommendations

The TX-27 test cylinder is capable of carrying loads in excess of 80,000 pounds, applied with a 3-1/2 inch wide band in contact with the cylinder through 120 degrees of circumference, without yielding. Simulated sway brace loads of 30,000 pounds applied through a 4-inch diameter contoured pad and a load of 120,000 pounds applied with a 3-1/2 wide band in contact with the cylinder through 180 degrees of circumference are capable of producing stresses in excess of the listed (ANC-5) value of yield stress for the material (52H, one half hard aluminum).

Much of the strength of the cylinder is lost when it is heated to 150°F. Sway brace loads of 5000 pounds and band loads of 20,000 pounds produced strains in excess of yield.

ROBERT I. BUTLER - 1612-2

Approved by: PAUL H. ADAMS - 1612

RIB:1612-2:as

Copy to:
W. A. Gardner, 1610
D. M. Bruce, 1282, Attn: B. G. Prentice and R. J. Sylvester, 1282
R. E. Fisher, 1621
C. L. Gomel, 5523
R. K. Smeltzer, 7222-2 [redacted]
K. M. Sadler, 7222-3

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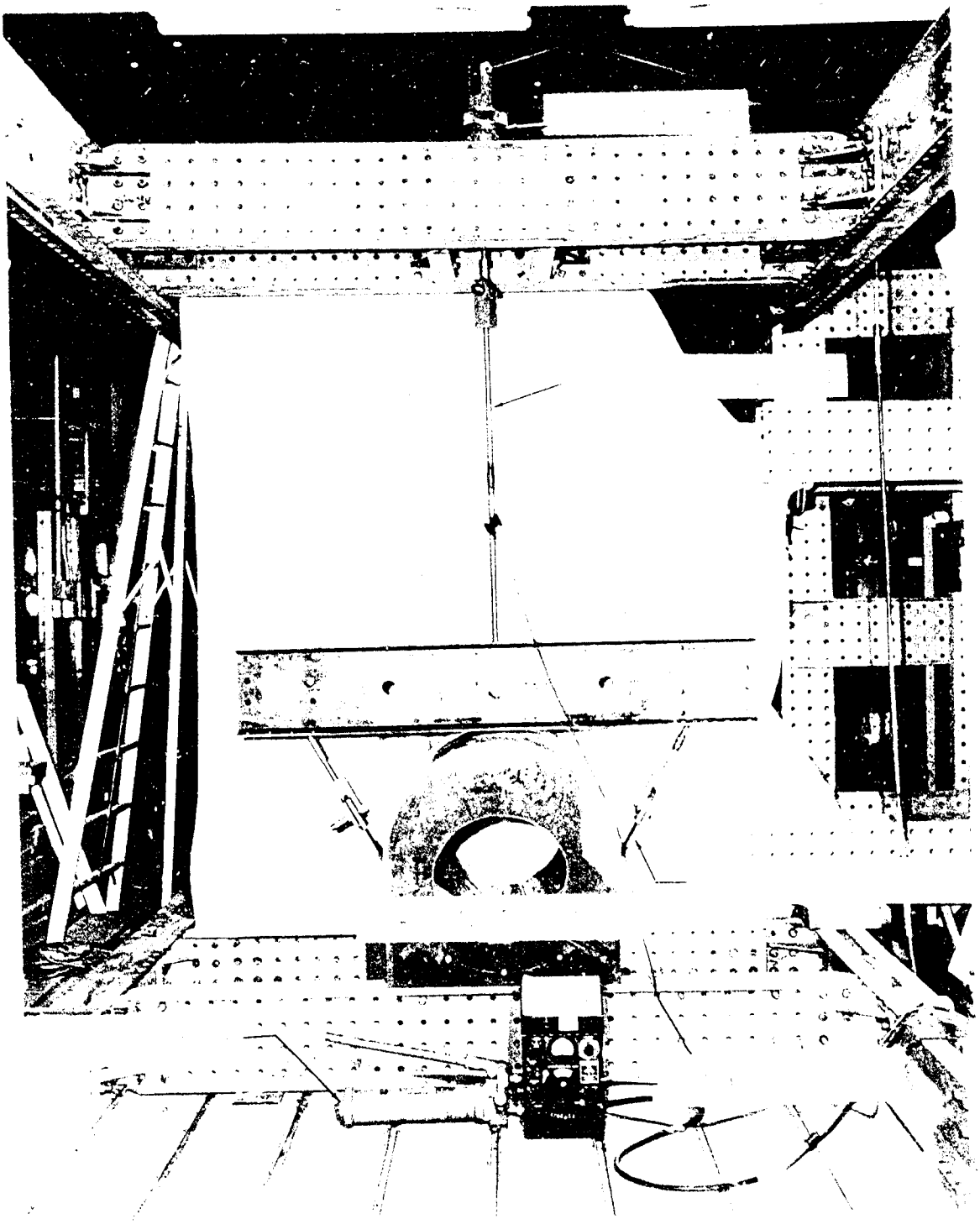

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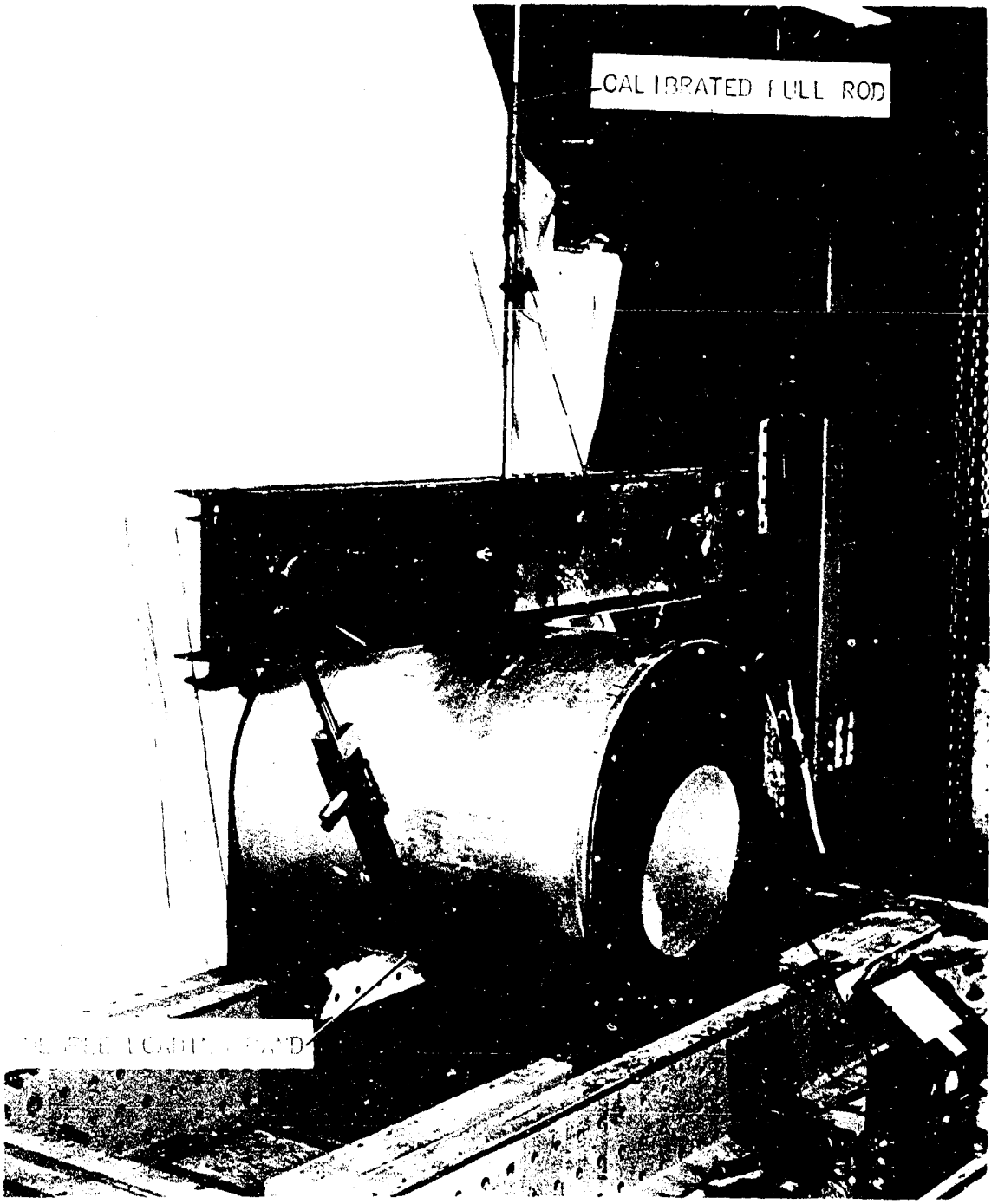

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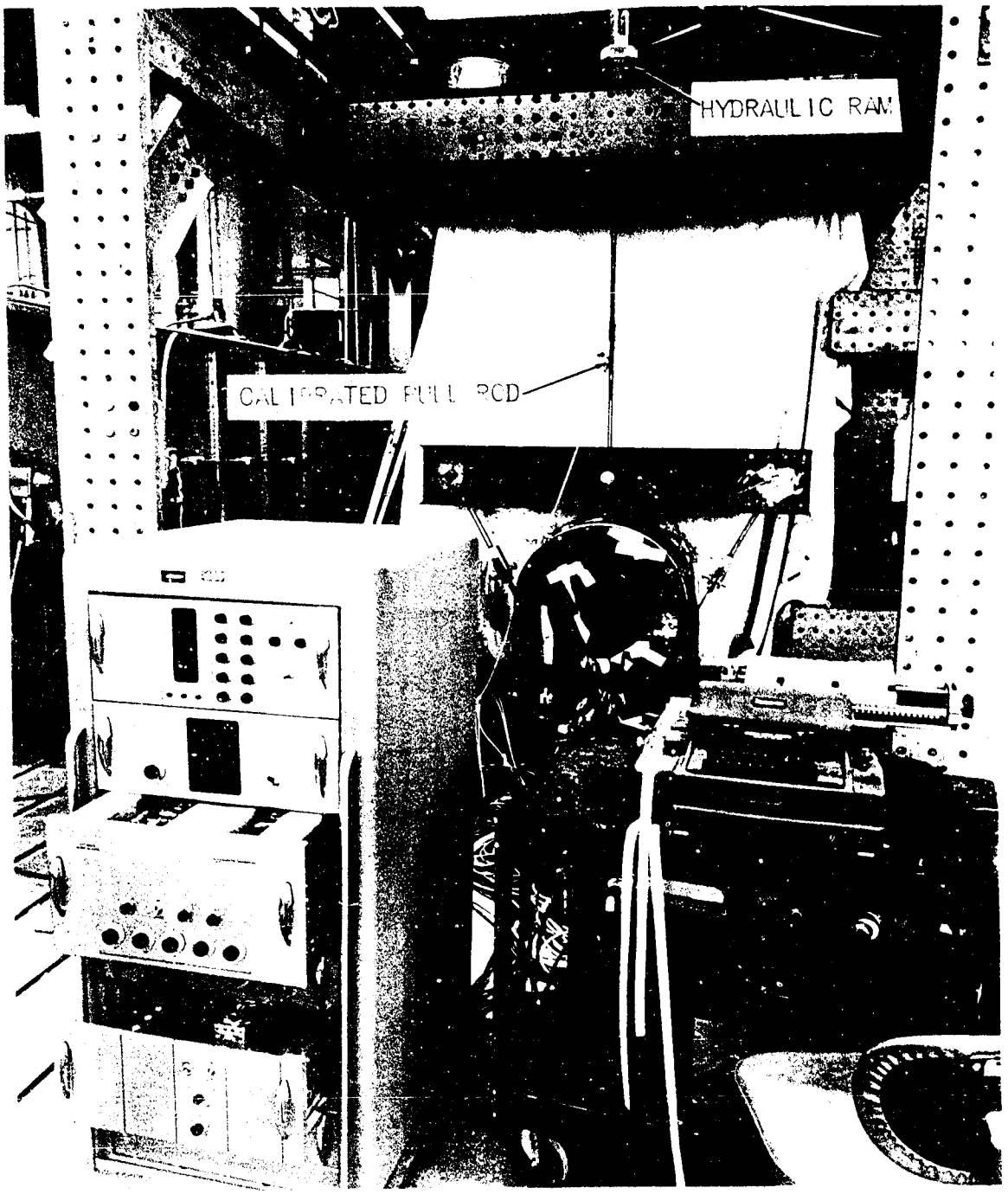

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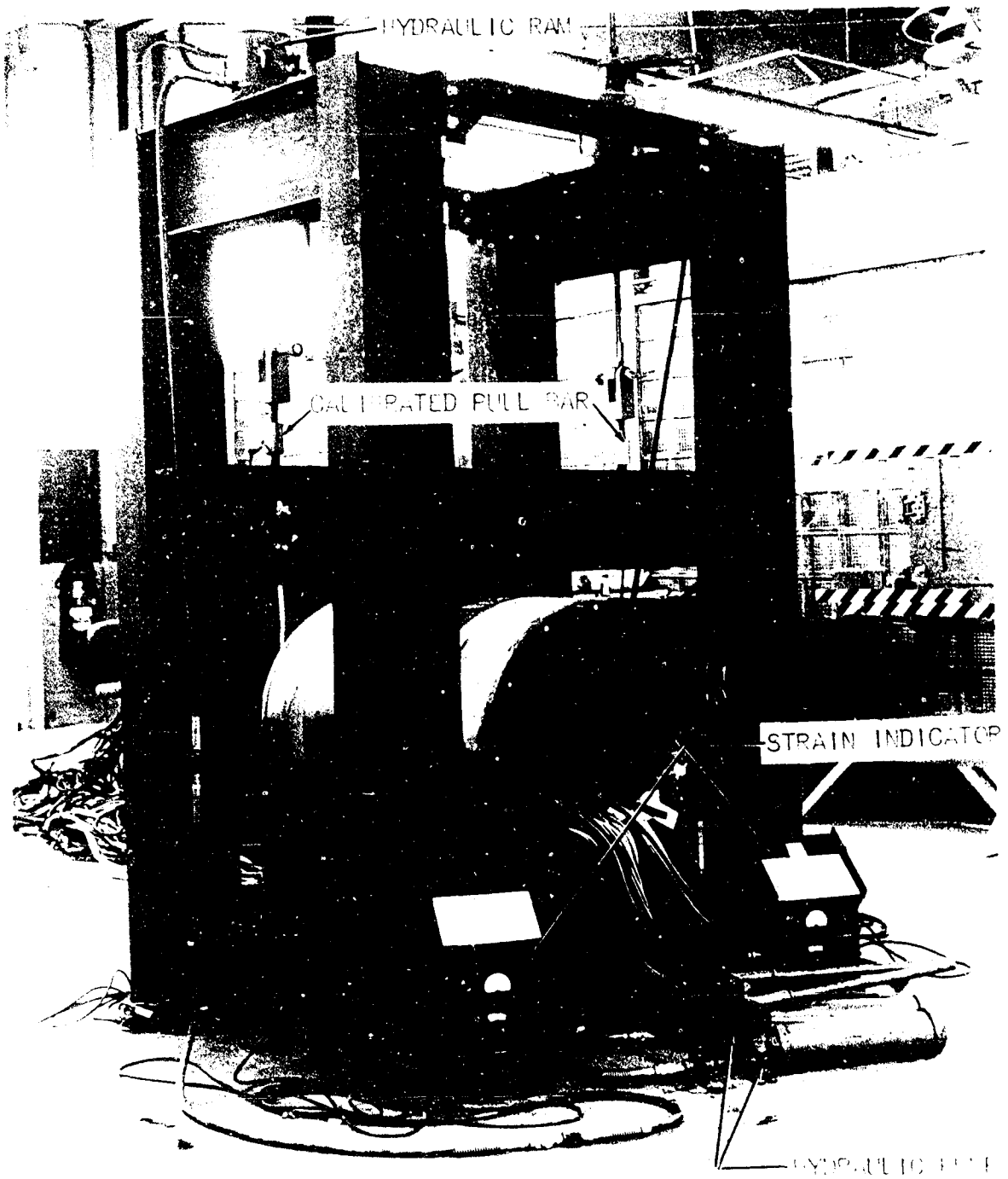

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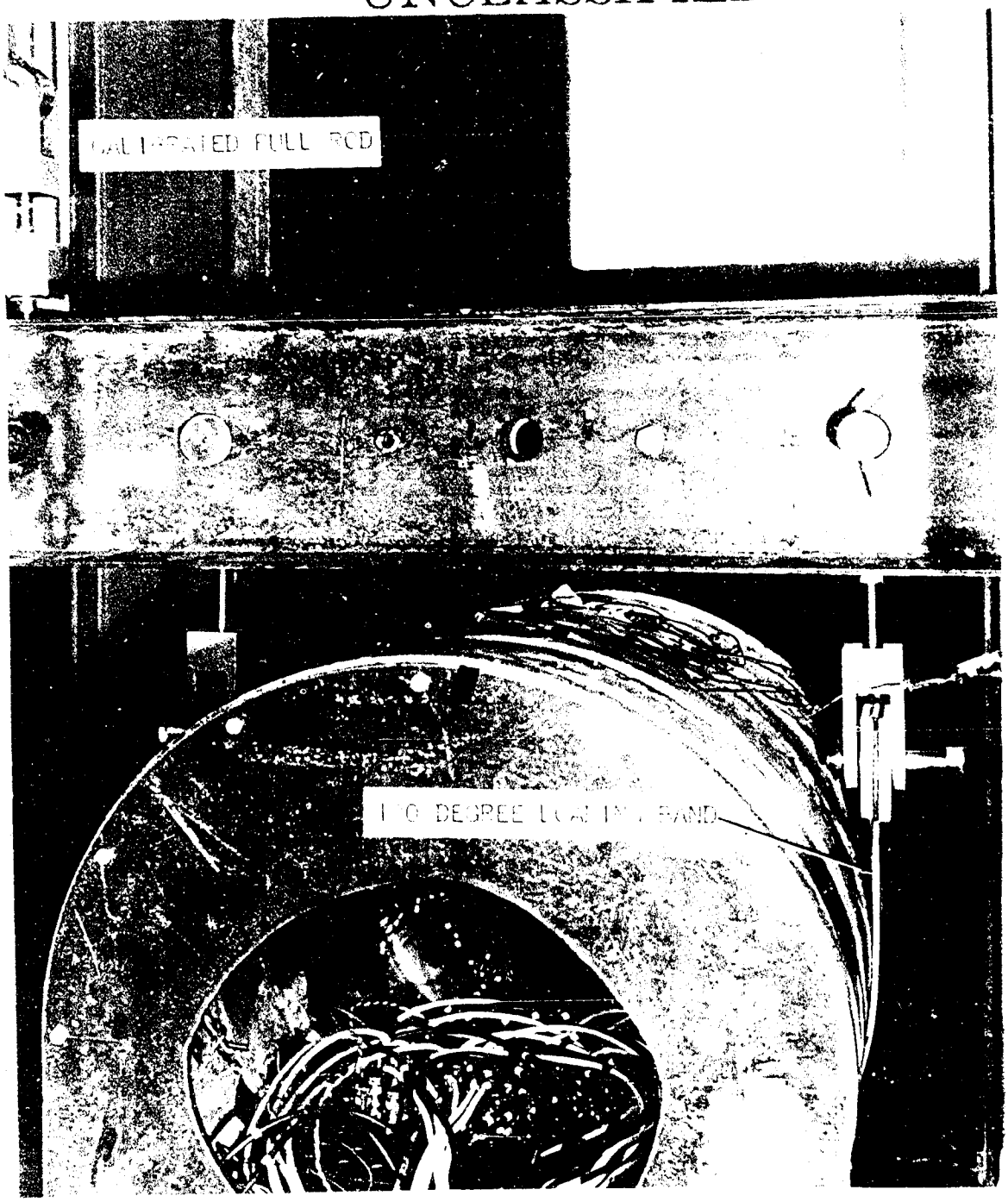

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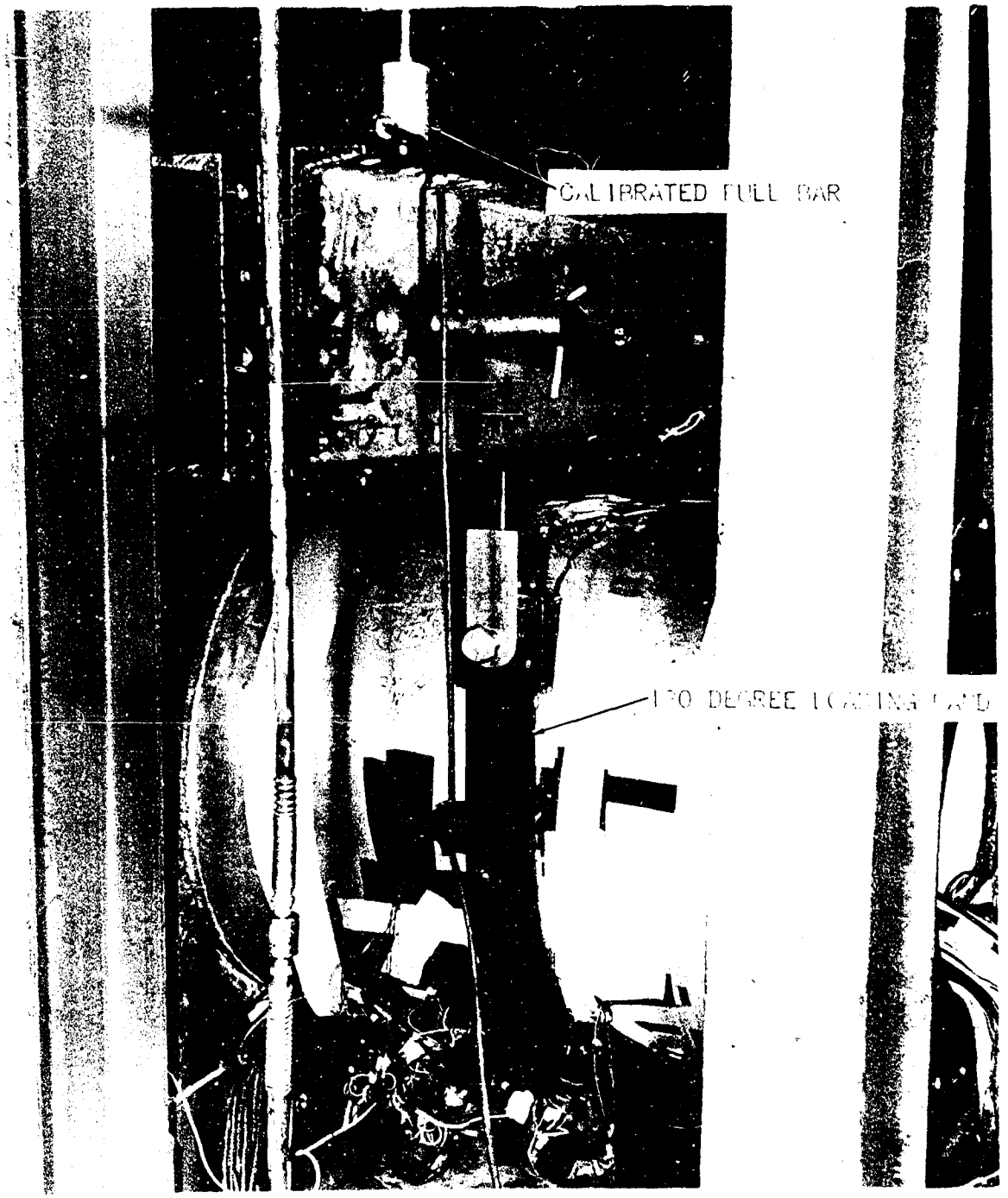

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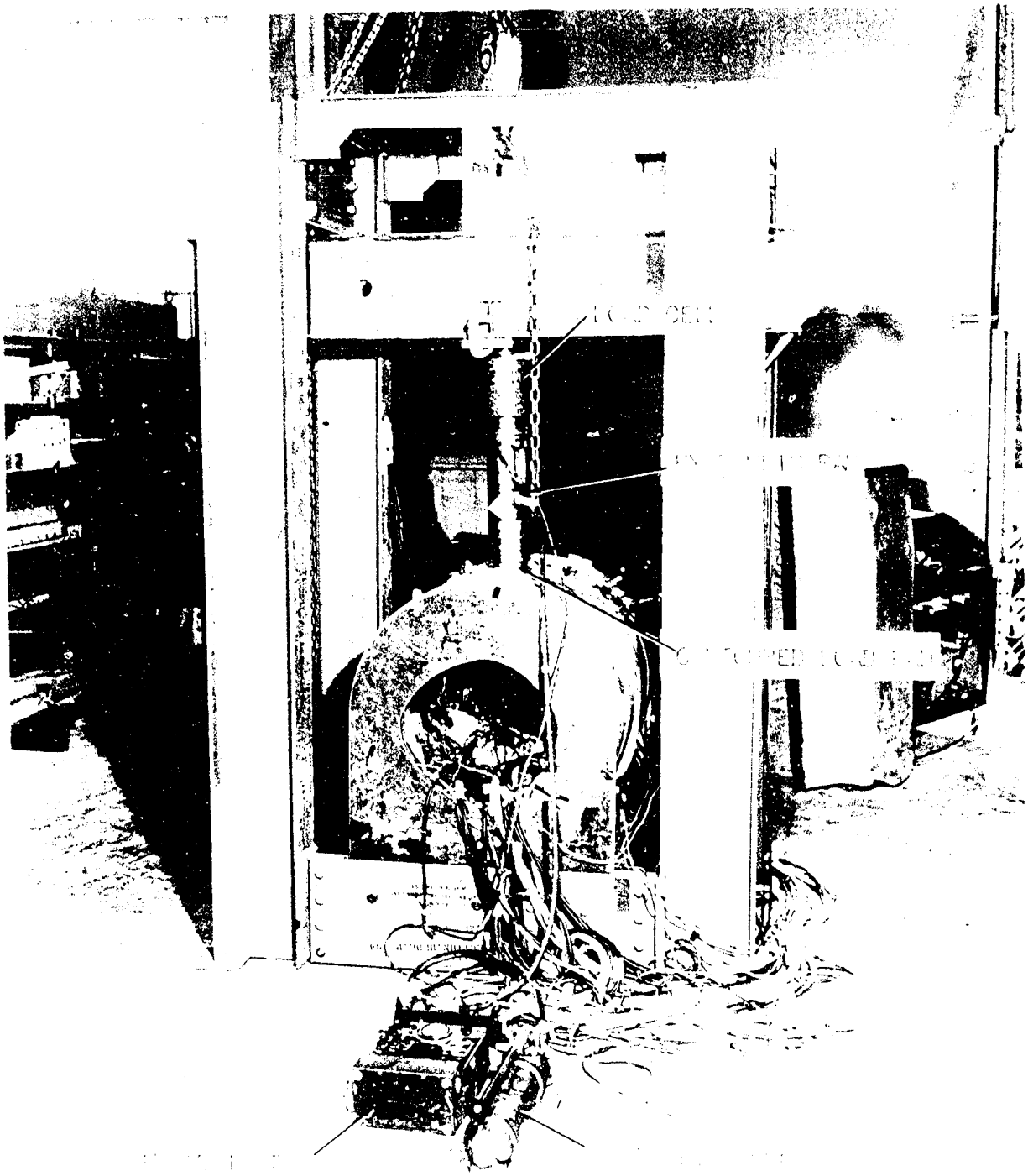

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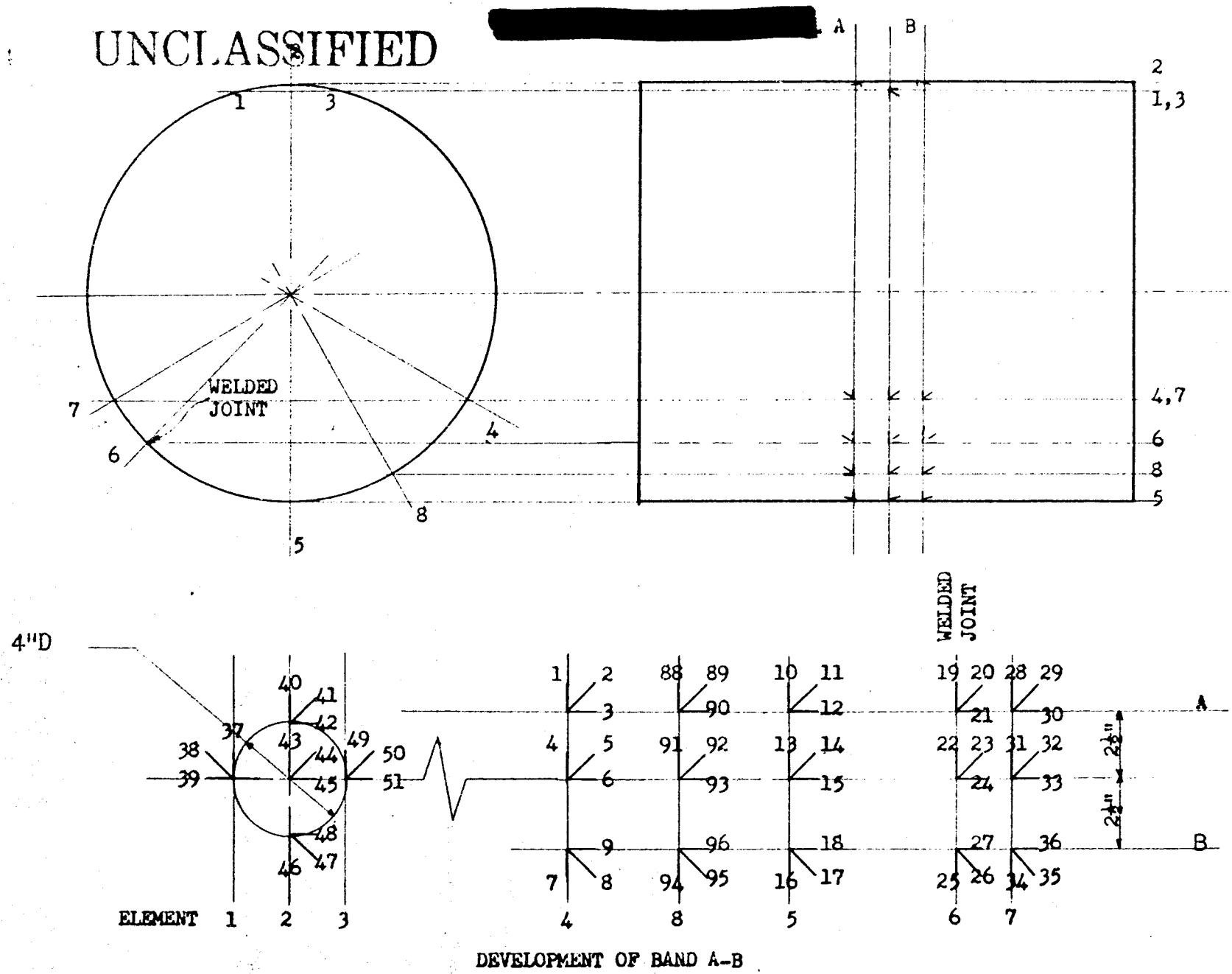

FIG. 9 -- STRAIN GAGE LOCATIONS -- INNER SURFACE -- STATIC TEST OF TX-27 TEST CYLINDER

REF. SYM: 1612 (285)
TM-353

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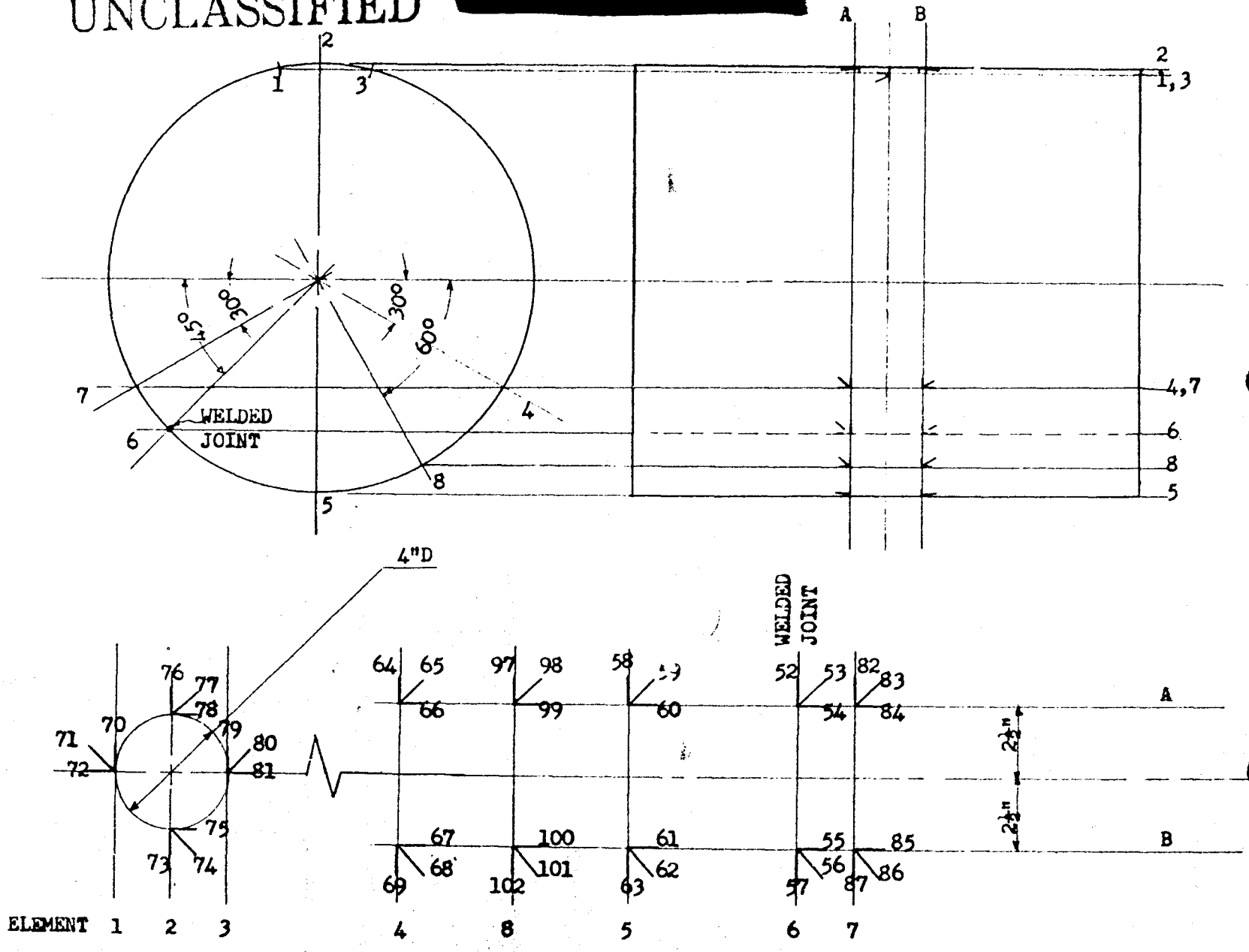

FIG. 10 -- STRAIN GAGE LOCATIONS -- OUTER SURFACE -- STATIC TEST OF TX-27 TEST CYLINDER

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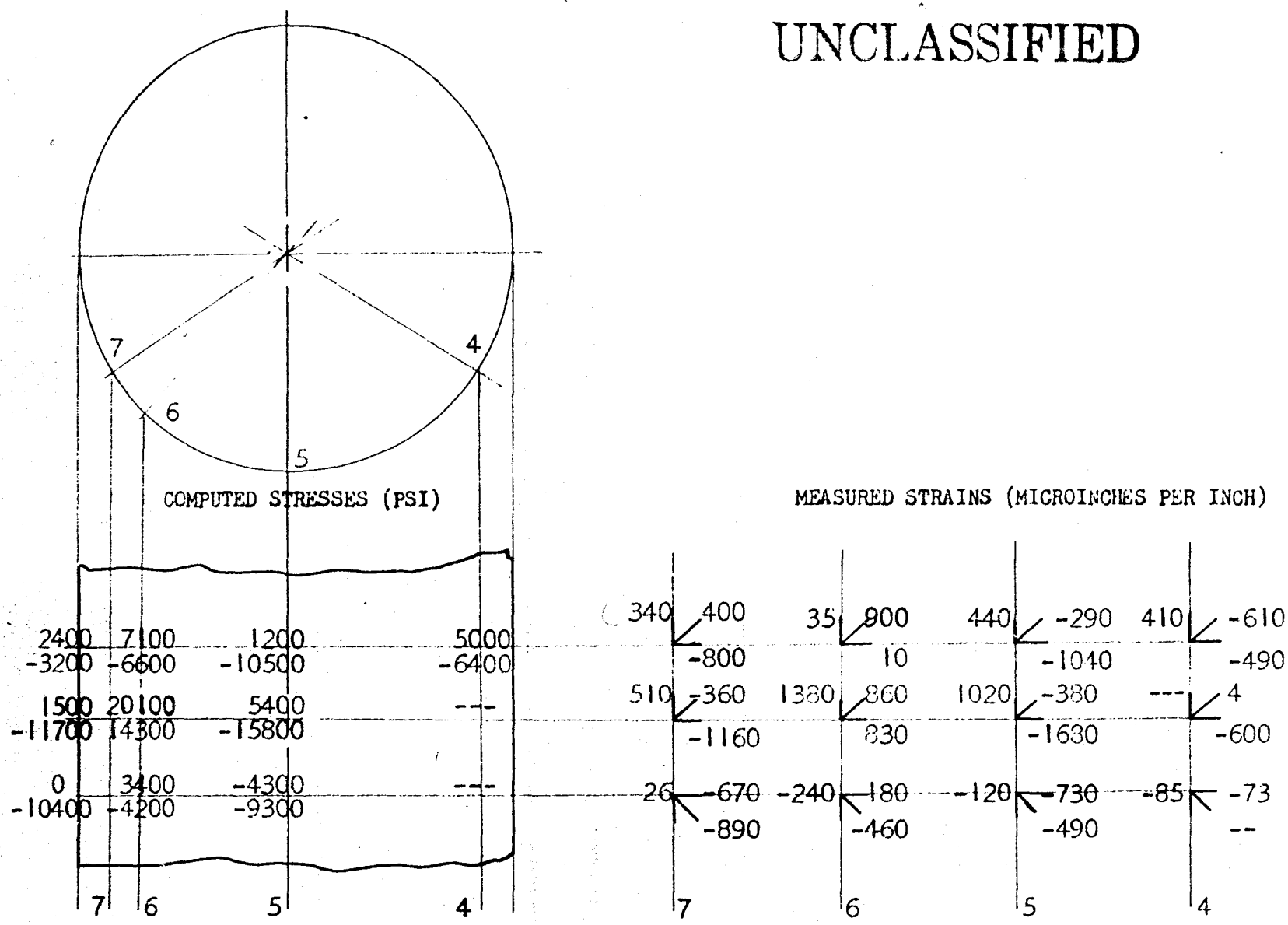

FIG. 11 -- MEASURED STRAINS AND COMPUTED STRESS ON INNER SURFACE AT 80,000 POUNDS TOTAL LOAD-- 120 DEGREE BAND LOAD TEST OF TX-27 TEST CYLINDER

REF. SYM: 1612 (285)
TM-353

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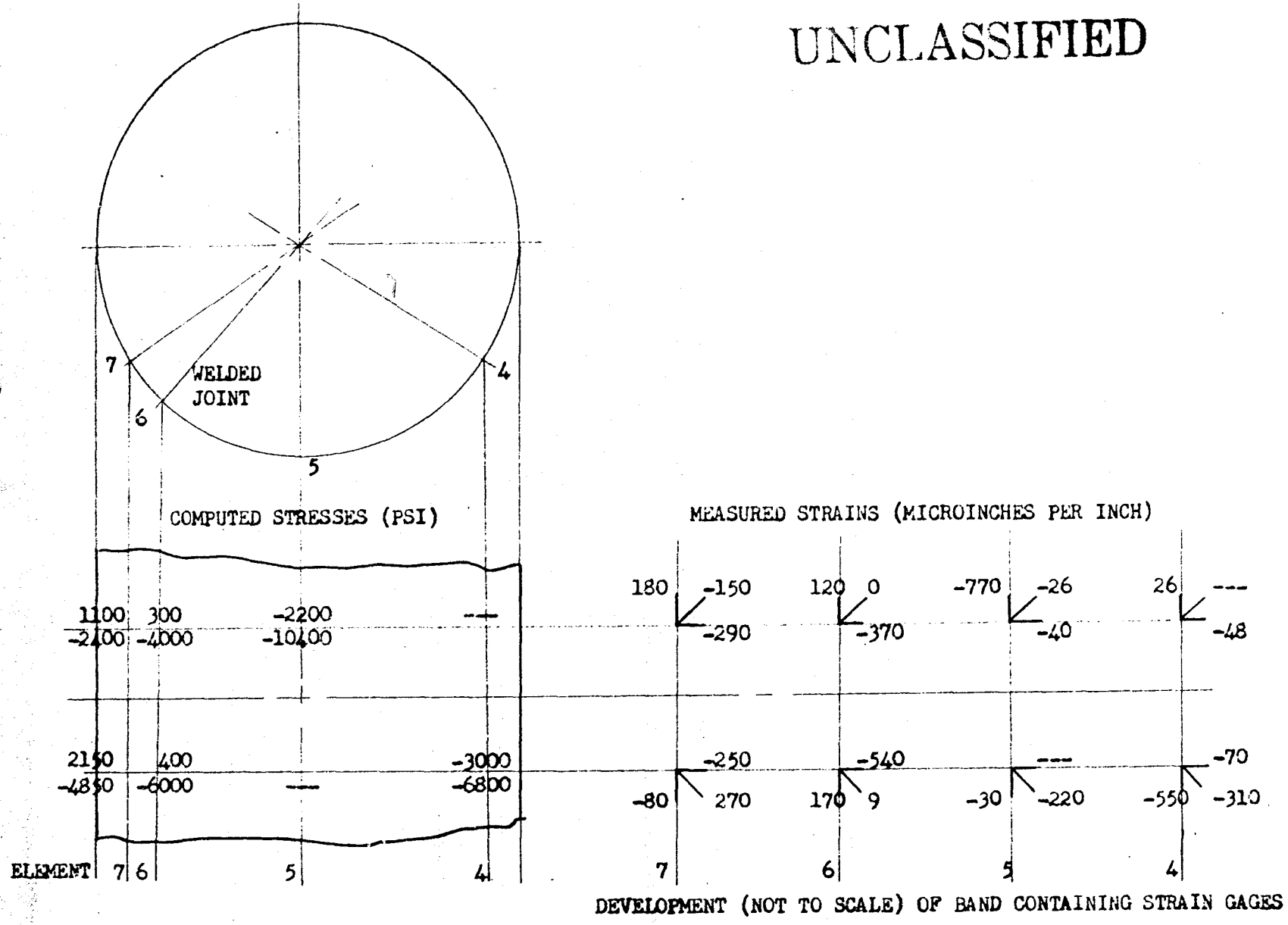

FIG. 12 -- MEASURED STRAINS AND COMPUTED STRESSES ON OUTER SURFACE AT 80,000 POUNDS TOTAL LOAD--120 DEGREE BAND AT ROOM TEMPERATURE TEST OF TX-27 TEST CYLINDER.

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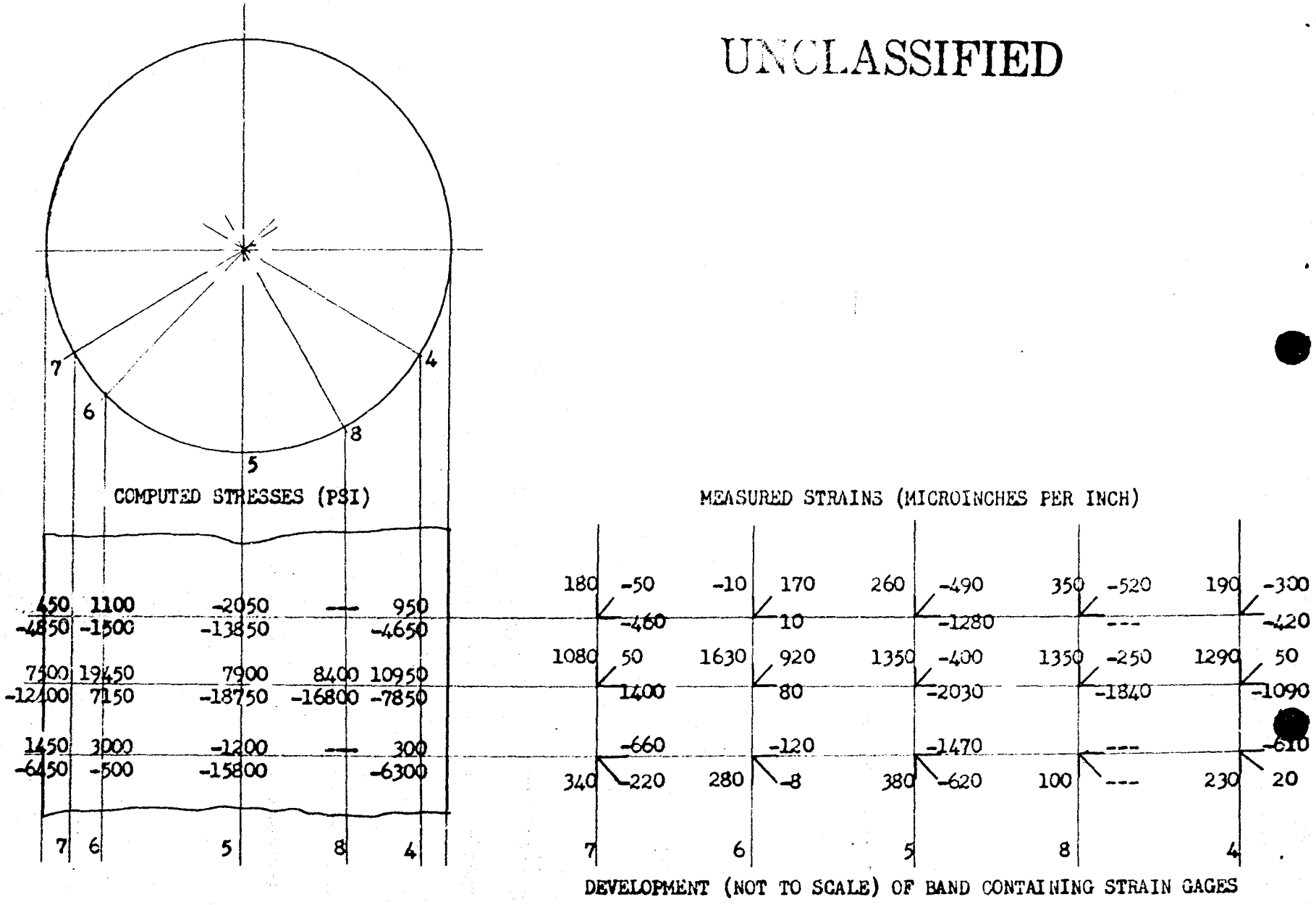

FIG. 13 -- MEASURED STRAINS AND COMPUTED STRESSES ON INNER SURFACE AT 120,000 POUNDS TOTAL LOAD--180° BAND LOAD TEST AT ROOM TEMPERATURE--STATIC TEST OF TX-27 TEST CYLINDER.

REF. SYM: 1612 (285)
TM-353

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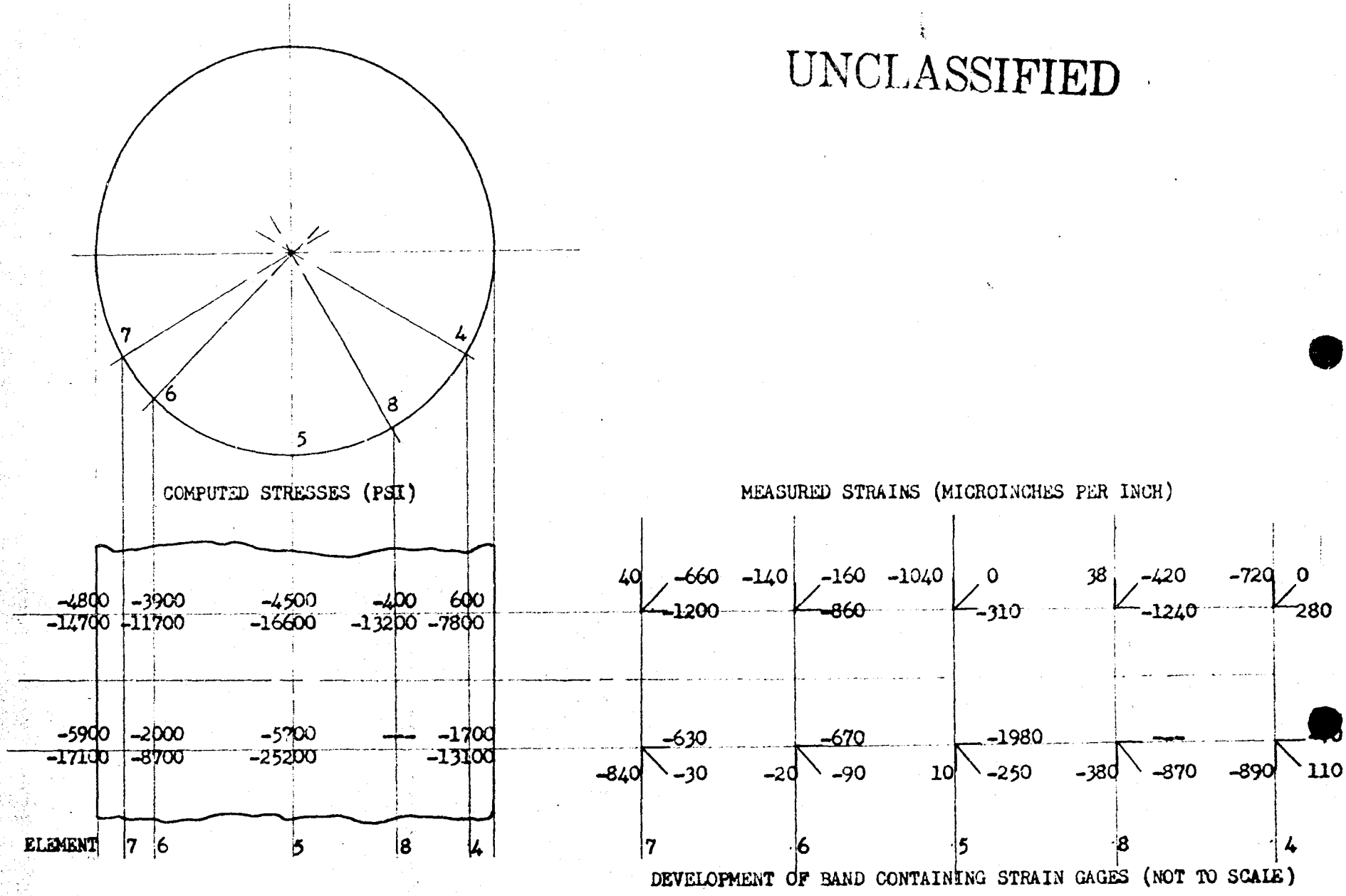

FIG. 14 -- MEASURED STRAINS AND COMPUTED STRESSES ON OUTER SURFACE AT 120,000 POUNDS TOTAL LOAD--180 DEGREE BAND LOAD TEST AT ROOM TEMPERATURE--STATIC TEST OF TX-27 TEST CYLINDER.

REF. SYM: 1612 (285)
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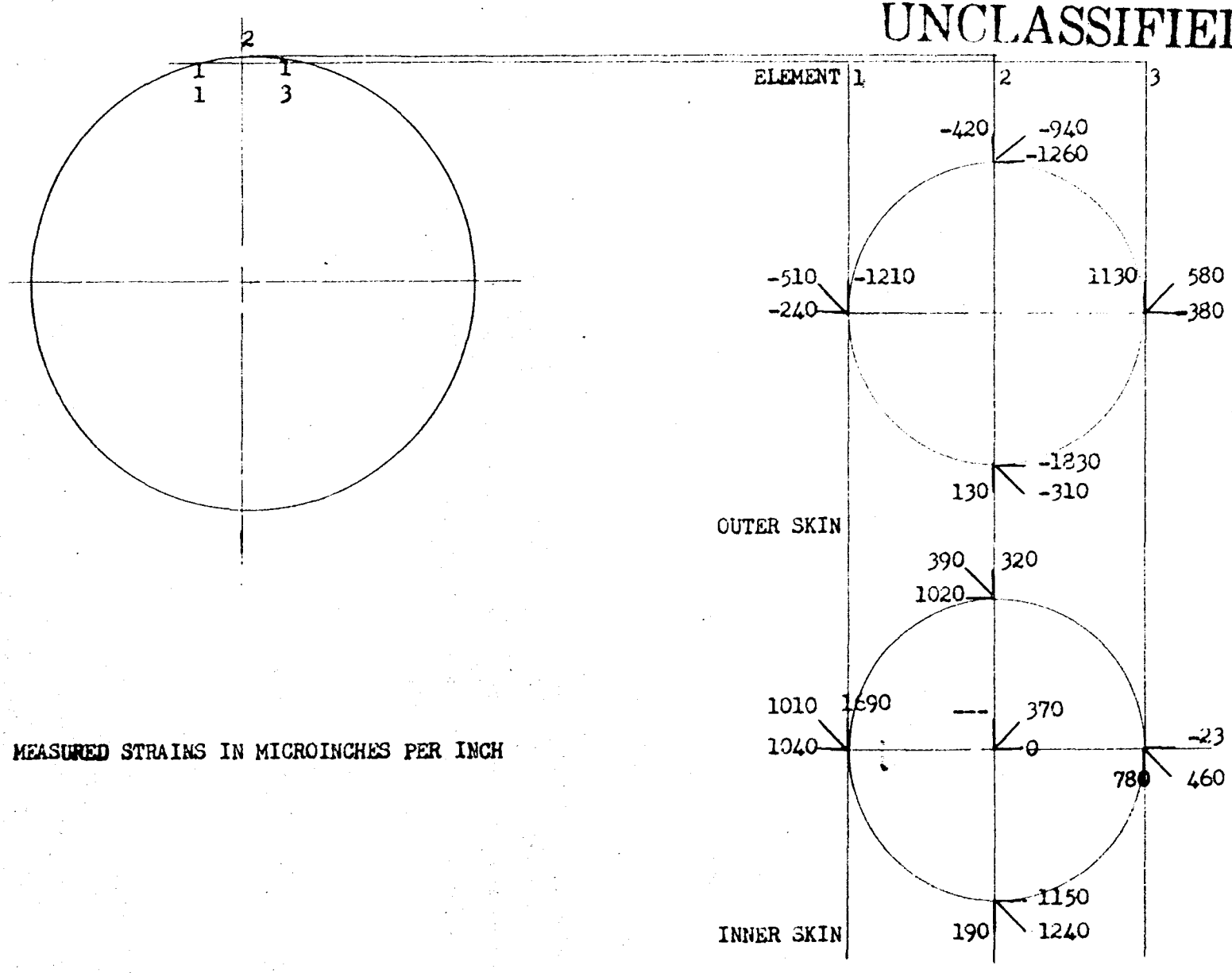

MEASURED STRAINS IN MICROINCHES PER INCH

FIG. 15 -- MEASURED STRAINS AT SWAY BRACE -- SIMULATED SWAY BRACE LOAD OF 30,000 POUNDS AT ROOM TEMPERATURE -- STATIC TEST OF TX-27 TEST CYLINDER

REF. SYM: 1612 (285)
TM-353

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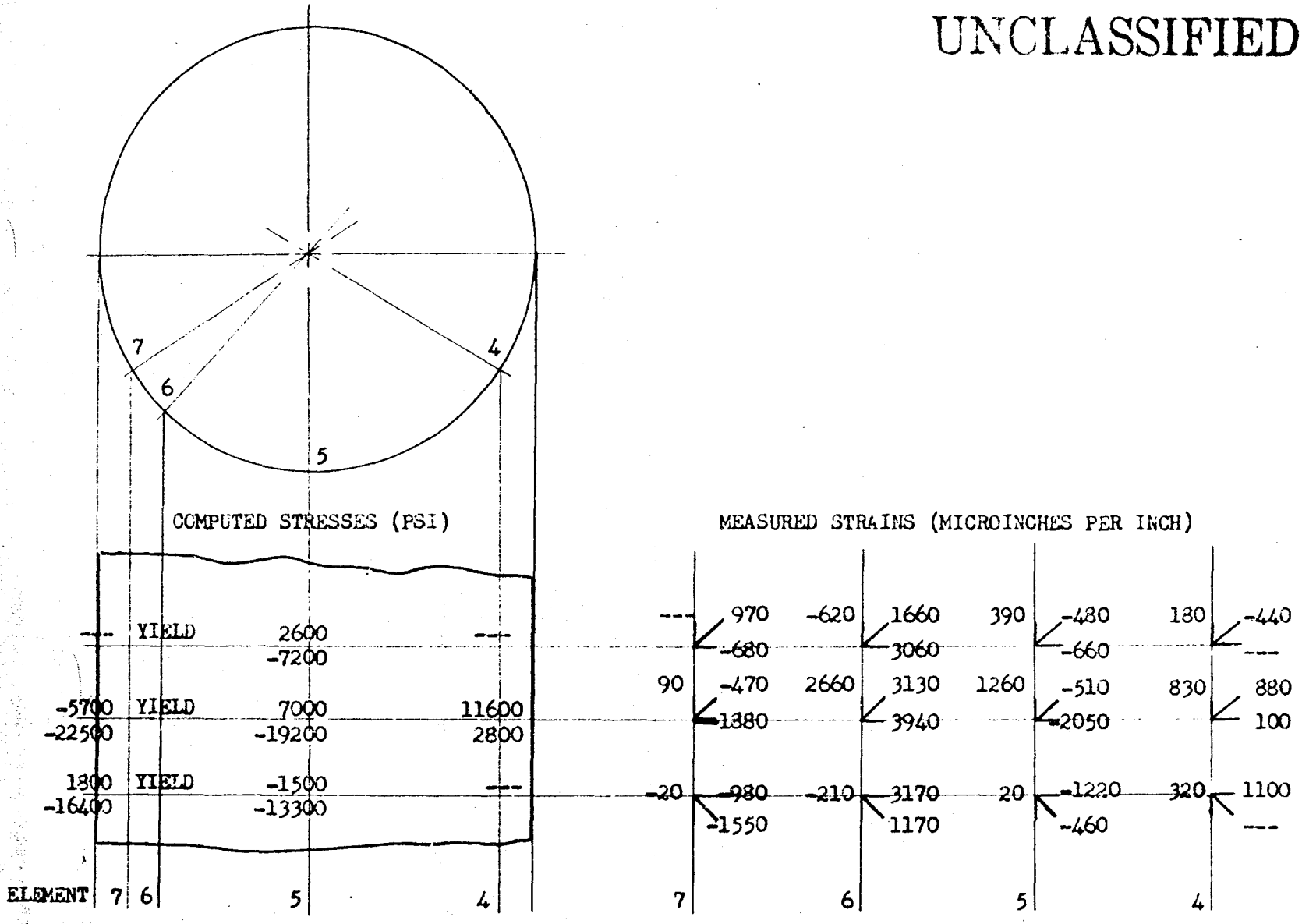

FIG. 16 -- MEASURED STRAINS AND COMPUTED STRESSES ON INNER SURFACE AT 60,000 POUNDS TOTAL LOAD -- 120 DEGREE BAND LOAD TEST AT 150°F -- STATIC TEST OF TX-27 TEST CYLINDER

REF. SYM: 1612 (285)
TM-353

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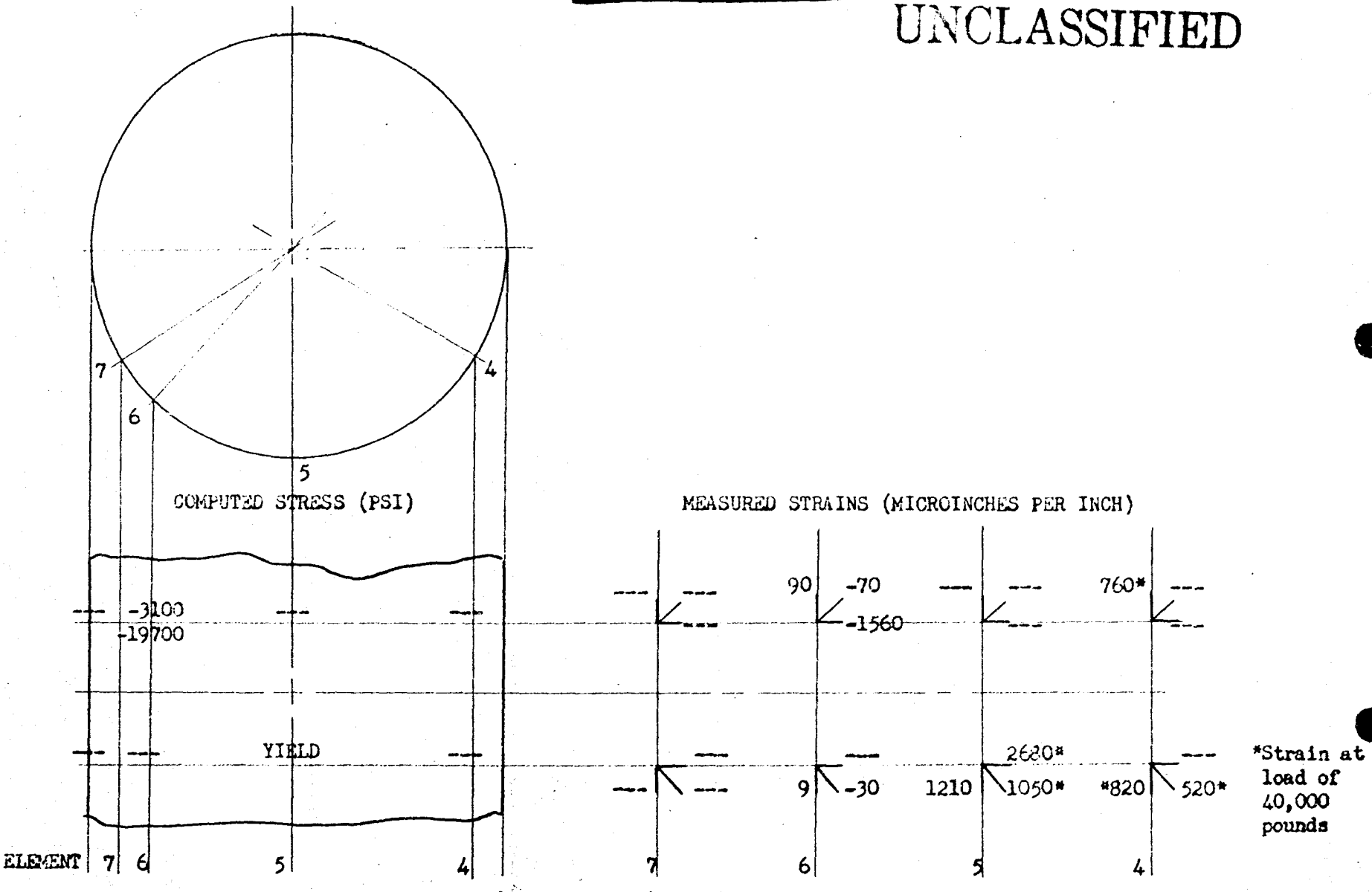

FIG. 17 -- MEASURED STRAINS AND COMPUTED STRESSES ON OUTER SURFACE AT 60,000 POUNDS TOTAL LOAD -- 120 DEGREE BAND LOAD TEST AT 150°F -- STATIC TEST OF TX-27 TEST CYLINDER

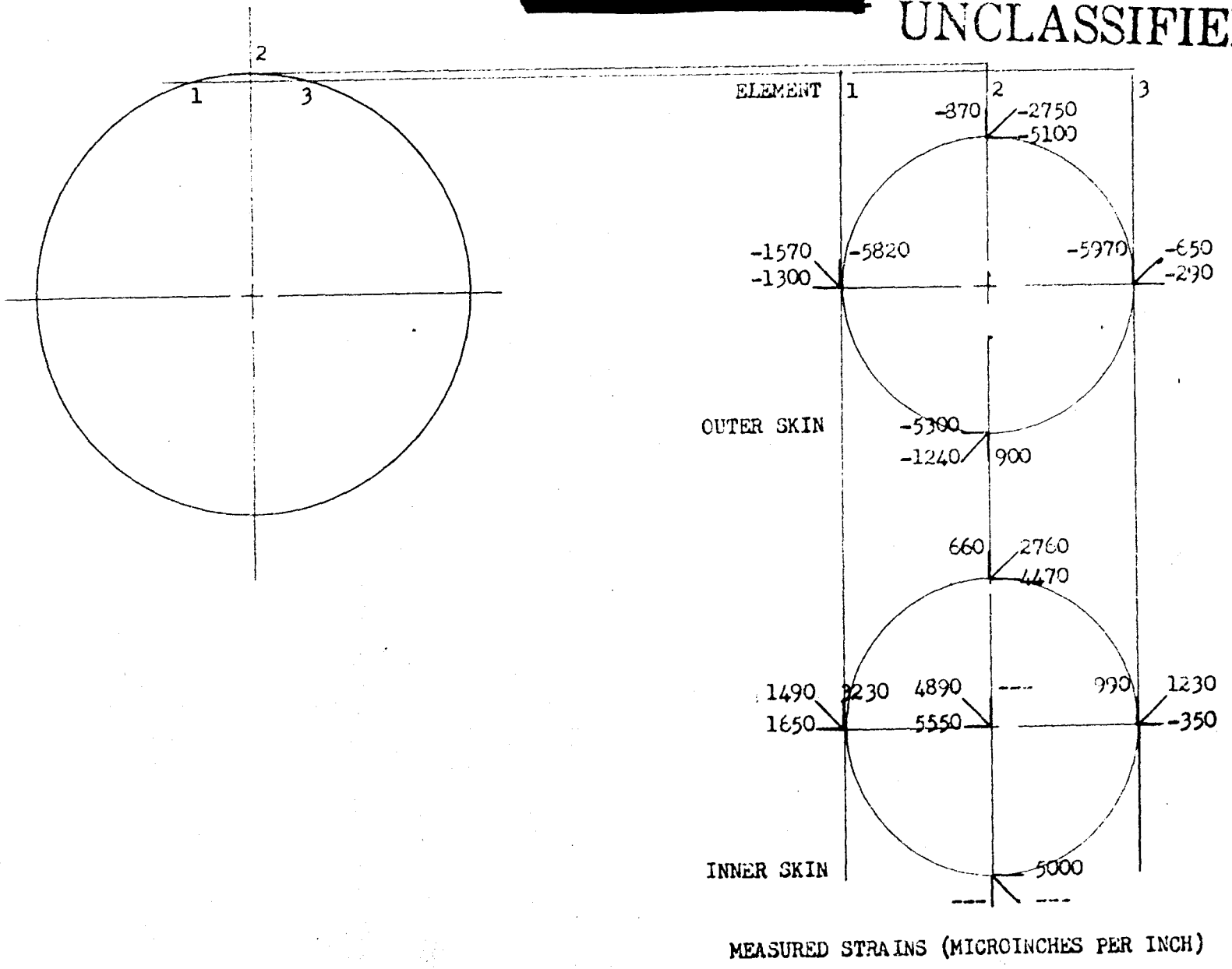

FIG. 18 -- MEASURED STRAINS AT SWAY BRACE FOR SIMULATED SWAY BRACE LOAD OF 10,000 POUNDS AT 150°F -- STATIC TEST OF TX-27 TEST CYLINDER

REF. SYM: 1612 (285)
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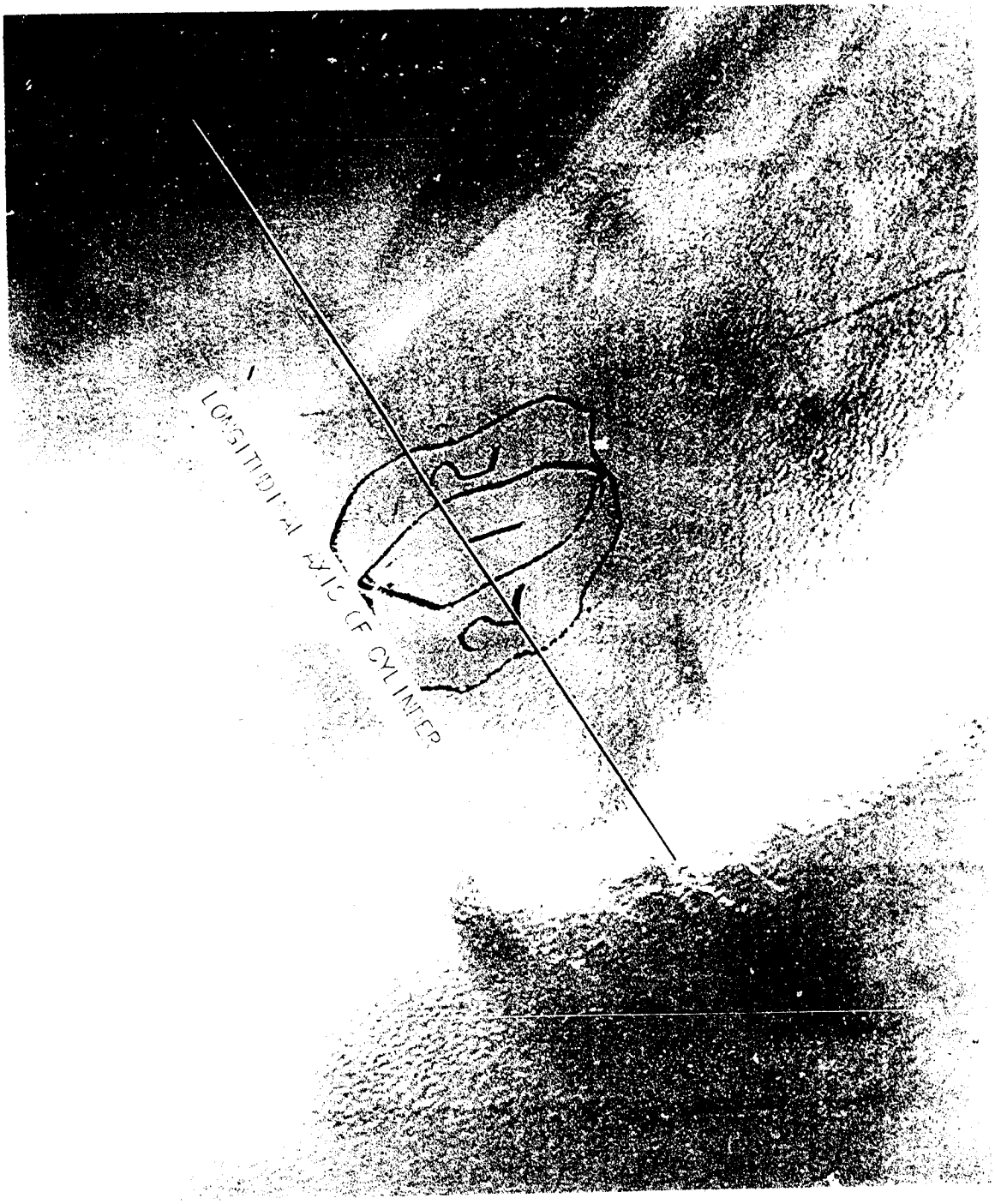

D.# 77432

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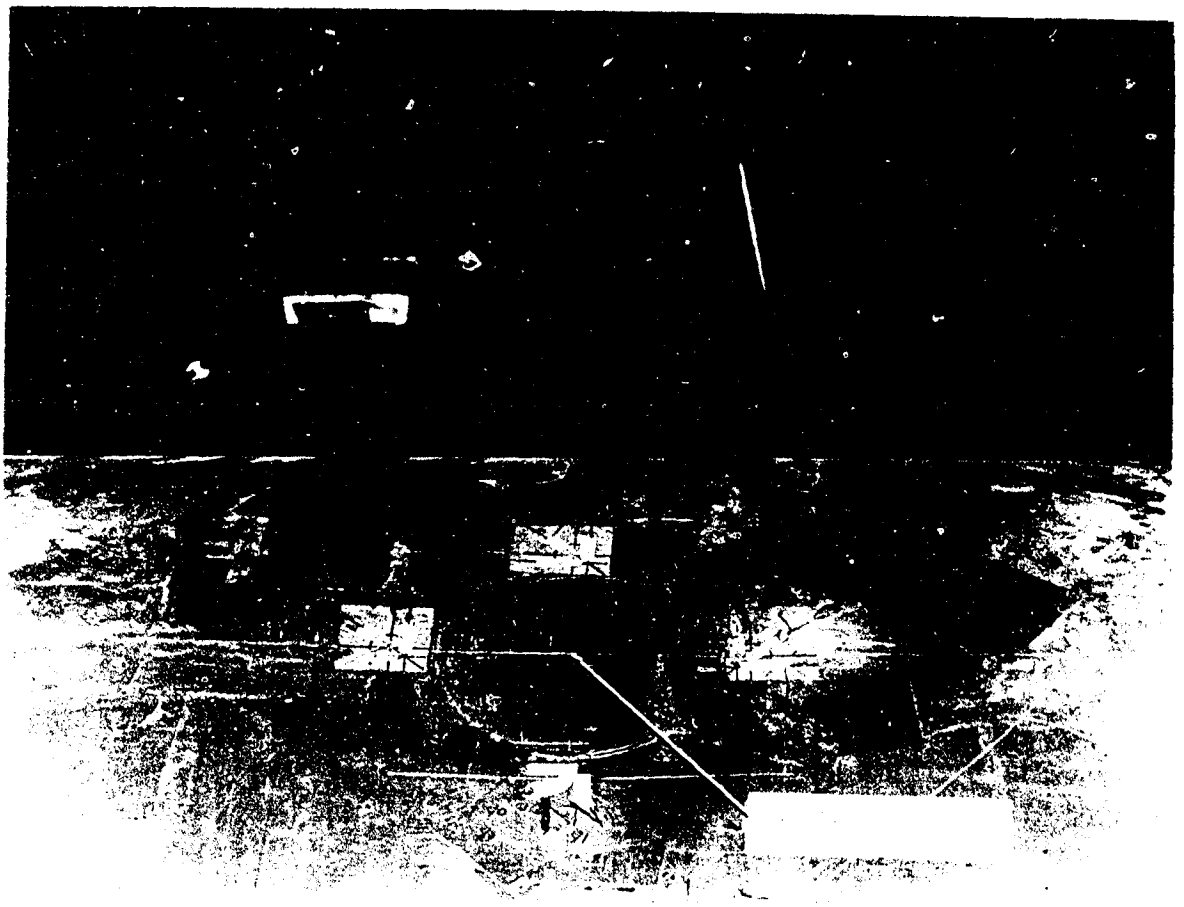

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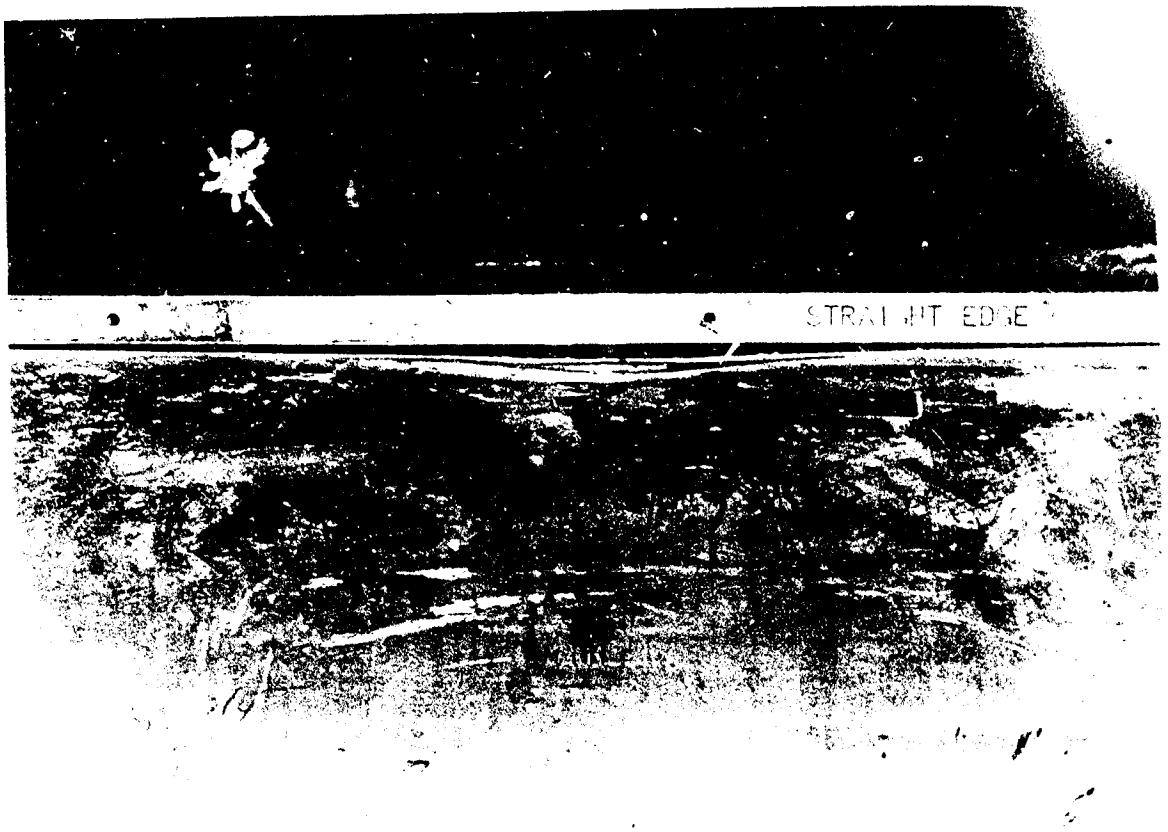

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TABLE I

INSTRUMENTATION USED IN THE VARIOUS TESTS
STATIC TEST OF TX-27 TEST CYLINDER

Strain Gage Rosette	Test No.* 1	2	3	4	5	6
1, 2, 3	Stresscoat Only	X	X		X	
4, 5, 6	Stresscoat Only	X	X		X	
7, 8, 9	Stresscoat Only	X	X		X	
10, 11, 12	Stresscoat Only	X	X		X	
13, 14, 15	Stresscoat Only	X	X	X	X	
16, 17, 18	Stresscoat Only	X	X		X	
19, 20, 21	Stresscoat Only	X	X		X	
22, 23, 24	Stresscoat Only	X	X		X	
25, 26, 27	Stresscoat Only	X	X		X	
28, 29, 30	Stresscoat Only	X	X		X	
31, 32, 33	Stresscoat Only	X	X		X	
34, 35, 36	Stresscoat Only	X	X		X	
37, 38, 39	Stresscoat Only			X		X
40, 41, 42	Stresscoat Only	X	X	X		X
43, 44, 45	Stresscoat Only			X		X
46, 47, 48	Stresscoat Only			X		X
49, 50, 51	Stresscoat Only			X	X	X
52, 53, 54	Stresscoat Only	X	X		X	
55, 56, 57	Stresscoat Only	X	X		X	
58, 59, 60	Stresscoat Only	X	X		X	
61, 62, 63	Stresscoat Only	X	X		X	
64, 65, 66	Stresscoat Only	X	X	X	X	
67, 68, 69	Stresscoat Only	X	X		X	
70, 71, 72	Stresscoat Only	X		X		X
73, 74, 75	Stresscoat Only			X		X
76, 77, 78	Stresscoat Only		X	X		X
79, 80, 81	Stresscoat Only			X	X	X
82, 83, 84	Stresscoat Only	X	X		X	
85, 86, 87	Stresscoat Only	X	X		X	
88, 89, 90	Stresscoat Only		X			
91, 92, 93	Stresscoat Only		X			
94, 95, 96	Stresscoat Only		X			
97, 98, 99	Stresscoat Only		X			
100, 101, 102	Stresscoat Only		X			

* Test No. 1 — 120° band load at room temperature.
Test No. 2 — 120° band load at room temperature.
Test No. 3 — 180° band load at room temperature.
Test No. 4 — Simulated sway brace load at room temperature.
Test No. 5 — 120° band load at 150°F.
Test No. 6 — Simulated sway brace load at 150°F.

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Ref. Sym: 1612 (285)
Project No. TM-353

TABLE II

LOAD-STRAIN DATA FROM TEST NO. 1 (STRESSCOAT) OF TX-27 TEST CYLINDER

Load No.	Load Pounds	Stresscoat Sensitivity (Microinches/Inch)	Pattern No.	Strain at 50,000 Pounds
0	0	800	--	--
1	10,000		--	--
2	12,000		--	--
3	14,400		--	--
4	17,300	850	--	--
5	20,700		--	--
6	24,800		--	--
7	29,800		--	--
8	35,600		--	--
9	40,000	800	1	960
10	50,000	800	2	800

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Ref. Sym: 1612 (285)
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TABLE III

STATIC TEST OF TX-27 TEST CYLINDER
LOAD-STRAIN AND LOAD-STRESS DATA FOR TEST NO. 2 -- 120° BAND LOAD

Strain (Microinches/Inch)

Load (Pounds)	Gage No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	--	0	0	0	--	0	0	0	0	0	0	0	0	0	0
10,000	129	38	38	--	10	-23	29	--	-50	126	6	-103	134	-90	230	17	-62	-65
20,000	155	-70	-38	--	-41	-92	-25	--	-140	157	-71	-278	234	-190	-500	-34	-145	-187
30,000	230	-140	-93	--	-21	-154	-15	--	-164	240	-82	-403	385	-227	-718	-34	-198	-250
40,000	246	-265	-201	--	-15	-241	-34	--	-190	260	-158	-566	511	-257	-912	-58	-296	-354
50,000	300	-370	-290	--	0	-340	-40	--	-210	305	-200	-690	640	-290	-1120	-80	-340	-450
60,000	340	-470	-360	--	0	-450	-50	--	-250	360	-230	-810	770	-320	-1320	-90	-400	-540
70,000	360	-550	-430	--	2	-510	-60	--	-290	390	-270	-930	890	-350	-1500	-110	-440	-640
80,000	410	-610	-490	--	4	-600	-60	--	-320	440	-290	-1040	1020	-380	-1680	-120	-490	-730
0	5	-108	-52	--	-58	-45	-85	--	-73	-7	-28	-43	22	-76	-119	-8	-52	-15

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	1800	700	550	800	-1100	950	700	-2300	1500	-100	-900	-500			
20,000	2200	-300	1250	800	-2700	1750	850	-4950	2900	-1100	-2400	-650			
30,000	3200	-1000	2100	1250	-3750	2500	1800	-7100	4450	-1450	-3250	-900			
40,000	3200	-2400	2800	900	-5700	3300	2600	-8800	5700	-1100	-3900	-1400			
50,000	3700	-3700	3700	900	-6900	3900	3300	-10700	7000	-2600	-5800	-1600			
60,000	4400	-4750	4550	1200	-8100	4650	3900	-12500	8200	-3100	-6900	-1900			
70,000	4500	-5700	5100	1050	-9350	5200	4700	-14100	9400	-3800	-8200	-2200			
80,000	5000	-6400	5700	1200	-10500	5850	5400	-15800	10600	-4300	-9300	-2500			

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Lower HALF #1344

Strain (Microinches/Inch)

Load (Pounds)	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	-14	201	69	197	141	237	-25	4	106	98	120	-17	79	-28	-138	8	-76	-50
20,000	-57	291	35	353	316	352	-126	-91	126	103	120	-193	94	-155	-367	-7	-240	-208
30,000	-43	425	42	530	392	560	-157	-137	196	158	160	-296	168	-207	-516	20	-357	-295
40,000	-36	521	22	690	518	660	-220	-223	188	164	150	-445	236	-252	-657	30	-460	-380
50,000	20	630	61	870	600	730	-240	-290	180	180	180	-540	310	-260	-780	16	-570	-440
60,000	25	730	20	1040	680	770	-240	-350	180	240	260	-620	370	-280	-890	20	-670	-510
70,000	28	810	10	1200	760	790	-240	-420	170	280	320	-720	430	-320	-1040	20	-790	-600
80,000	35	900	10	1380	860	830	-240	-460	180	340	400	-800	510	-360	-1160	22	-890	-670
0	-83	195	35	213	226	368	-127	-60	90	-7	17	-36	2	-144	-290	-60	-185	-187

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	1750	-650	1200	4000	2800	600	1200	0	600	1450	-150	800	250	-1350	800	100	-900	500
20,000	2350	-2650	2500	6200	5300	450	1450	-1450	1450	1050	-2450	1750	300	-4000	1850	-400	-2900	1250
30,000	3300	-3300	3300	9800	7400	1200	1950	-1650	1800	1400	-3600	2500	0	-5400	2700	-100	-4100	2000
40,000	4050	-4350	4200	11800	9400	1200	2100	-2500	2300	1200	-3600	3400	300	-6700	3500	50	-5450	2750
50,000	5500	-4200	4850	14400	11000	1700	2200	-3200	2700	1400	-6800	4100	700	-7900	4300	100	-6700	3400
60,000	5900	-5300	5600	16300	12100	2100	2550	-3500	3050	2000	-7800	4900	1000	-9100	5050	200	-7600	3900
70,000	6650	-5850	6250	18200	13200	2500	2950	-3950	3450	2400	-9200	5800	1100	-10500	5800	100	-9200	4650
80,000	7100	-6600	6850	20100	14300	2900	3400	-4200	3800	3300	-10100	6700	1500	-11700	6600	0	-10400	5200

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1345
Top Half.

Ref. Sym: 1612 (285)
Project No. TM-353

TABLE III (Continued)

STATIC TEST OF TX-27 TEST CYLINDER
LOAD-STRAIN AND LOAD-STRESS DATA FOR TEST NO. 2 — 120° BAND LOAD

Strain (Microinches/Inch)

Load (Pounds)	Gage No. 40	41	42	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	19	33	76	13	28	-18	20	6	-57	-107	-24	40	14	6	--	8	--	-30
20,000	35	72	162	25	66	-17	40	22	-107	-208	-53	56	10	-5	--	8	--	-110
30,000	32	82	165	42	84	-53	56	26	-157	-345	-82	60	4	-25	--	-11	--	-180
40,000	10	70	176	49	67	-145	62	5	-204	-502	-98	64	-18	-79	--	-49	--	-250
50,000	-4	80	180	70	50	-240	70	13	-260	-590	-80	40	-30	-140	--	-70	--	-310
60,000	-4	80	210	90	40	-290	110	13	-370	-660	-70	20	-40	-170	--	-80	--	-350
70,000	-15	100	220	100	20	-340	140	11	-470	-720	-60	-10	-30	-180	--	-110	--	-410
80,000	-24	110	240	120	0	-370	170	9	-540	-770	-26	-40	-30	-220	--	-100	--	-570
0	-5	24	64	-18	-41	-58	35	-59	80	74	280	65	25	-45	--	26	--	-48

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	--	--	--
10,000	1100	500	300	300	-400	350	100	-700	400	200	-1000	600						
20,000	2000	800	600	600	-500	550	200	-1300	750	-100	-2200	1050						
30,000	2000	1000	500	600	-1000	850	300	-1800	1050	-600	-3900	1650						
40,000	2200	1000	600	500	-1900	1200	200	-2200	1200	-800	-5600	2400						
50,000	2200	700	750	400	-2800	1600	300	-2800	1550	-1300	-7100	2900						
60,000	2500	700	900	200	-3500	1850	300	-4200	2250	-1600	-8200	3300						
70,000	2500	500	1000	700	-3400	2050	200	-5400	2800	-2200	-9600	3700						
80,000	2700	400	1150	300	-4000	2150	400	-6000	3200	-2200	-10400	4100						

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#1345
Lower Hat

Strain (Microinches/Inch)

Load (Pounds)	67	68	69	70	71	72	82	83	84	85	86	87
0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	-26	-11	3	6	13	-6	48	42	-20	9	71	-22
20,000	-95	-70	2	20	12	-50	79	24	-50	22	105	-60
30,000	-170	-120	-10	12	4	-75	102	-16	-92	0	125	-94
40,000	-260	-180	-39	-8	-27	-112	110	-71	-141	-51	136	-140
50,000	-390	-210	-60	-2	-17	-140	120	-90	-180	-70	155	-170
60,000	--	-250	-70	-3	-19	-160	140	-110	-210	-80	200	-190
70,000	-480	-280	-70	-4	-21	-180	150	-140	-250	-80	230	-230
80,000	-550	-310	-70	-5	-16	-210	180	-150	-290	-80	270	-250
0	-46	-16	18	15	0	-81	-13	-13	0	32	6	10

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0
10,000	0	-300	150	150	-150	150	500	-200	350	550	-750	650
20,000	-250	-1150	450	100	-400	250	650	-350	500	600	-1500	1050
30,000	-800	-2200	700	100	-800	450	900	-700	800	600	-2200	1400
40,000	-1600	-3400	900	-300	-1500	600	800	-1400	1100	1150	-2650	1900
50,000	-2000	-4300	1150	-400	-1800	700	900	-1700	1300	1450	-3050	2250
60,000	—	--	--	-450	-2050	800	1000	-2100	1550	1800	-3600	2700
70,000	-2900	-5900	1500	-500	-2500	1000	1100	-2400	1750	1950	-4250	3100
80,000	-3000	-6800	1900	-500	-2800	1150	1200	-2800	2000	2150	-4850	3500

Su - Max. tensile or least compressive stress.

Sv - Max. compressive or least tensil stress.

Ss - Shearing stress.

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Ref. Sym: 1612 (285)
Project No. TM-353

TABLE IV

LOAD-STRAIN AND LOAD-STRESS DATA -- TEST NO. 3 -- 180° BAND LOAD AT ROOM TEMPERATURE
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Load (Pounds)	Gage No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0,000	21	-5	-52	140	28	-60	55	-52	-81	30	-45	-174	233	-40	-313	70	-135	-230
0,000	38	-50	-107	350	86	-145	8	-64	-152	80	-120	-374	462	-90	-630	145	-230	-460
0,000	70	-120	-180	550	80	-340	120	-60	-260	135	-200	-580	680	-150	-960	200	-320	-710
0,000	100	-170	-260	780	70	-570	160	-60	-380	175	-290	-810	910	-220	-1310	270	-420	-950
0,000	150	-230	-340	1030	60	-820	200	-40	-490	230	-390	-1040	1120	-310	-1670	330	-520	-1210
0,000	190	-300	-420	1290	50	-1090	230	-20	-610	260	-490	-1280	1350	-400	-2030	380	-620	-1470
0	-38	-8	-13	74	3	-98	-15	-31	-37	35	-64	-88	37	-84	-182	-25	-91	-114

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0,000	0	-700	350	1450	-150	800	550	-850	700	-300	-2000	850	1550	-2850	2200	-50	-2550	1250
0,000	150	-1150	650	3650	-350	2000	500	-1500	1000	-550	-4150	1800	2950	-5650	4300	-200	-4900	2350
0,000	200	-2000	1100	5200	-1800	3500	500	-2600	1550	-650	-6350	2850	4300	-8700	6500	-300	-7600	3650
0,000	350	-2850	1600	7000	-3700	5350	550	-3850	2200	-1000	-8800	3900	5600	-11900	8750	-450	-10150	4850
0,000	700	-3700	2200	8800	-5700	7250	600	-5100	2850	-1300	-11300	5000	6650	-15350	11000	-800	-13000	6100
0,000	950	-4650	2800	10950	-7850	9400	300	-6300	3300	-2050	-13850	5900	7900	-18700	13300	-1200	-15800	7300

Strain (Microinches/Inch)

Load (Pounds)	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	-36	85	30	330	290	264	9	20	120	50	11	-127	142	-60	-315	64	-85	-160
40,000	-40	126	30	580	450	320	37	1	110	90	-30	-233	310	-100	-630	120	-100	-300
60,000	-30	135	30	800	560	280	70	0	60	120	-90	-290	480	-70	-850	160	-90	-380
80,000	-30	150	20	1050	670	230	120	-4	0	140	-120	-350	670	0	-1020	210	-110	-460
00,000	-30	150	10	1340	800	160	190	-6	-50	160	-80	-410	880	40	-1200	270	-160	-550
20,000	-10	170	10	1630	920	80	280	-8	-120	180	-50	-460	1080	50	-1400	340	-220	-660
0	-87	50	58	100	240	264	28	56	190	-22	-33	-64	82	-33	-221	38	-25	-96

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	650	-850	750	4950	4350	300	1700	500	600	200	-1500	850	350	-3250	1800	200	-1800	1000
40,000	950	-1150	1050	8050	5950	1050	1850	450	700	0	-2600	1300	1200	-6200	3700	300	-3200	1750
60,000	1100	-1100	1100	10500	6300	2100	1600	500	550	300	-2900	1600	2400	-8200	5300	500	-3900	2200
80,000	1150	-1350	1250	13200	6700	3250	1650	350	650	250	-3650	1950	4000	-9500	6750	750	-4650	2700
00,000	1100	-1500	1300	16400	7100	4650	2300	-100	1200	250	-4250	2250	5700	-10800	8250	1000	-5400	3200
20,000	1350	-1350	1350	19450	7150	6150	3000	-500	1750	450	-4850	2650	7500	-12400	9950	1450	-6450	3950

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TABLE IV (Continued)

LOAD-STRAIN AND LOAD-STRESS DATA -- TEST NO. 3 -- 180° BAND LOAD AT ROOM TEMPERATURE
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Load (Pounds)	40	41	42	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	16	126	--	-40	-26	-120	-18	-20	-93	-170	-15	-57	-8	-60	-230	-110	-20	5
40,000	37	238	--	-100	-110	-245	-37	-23	-190	-303	-15	-90	-12	-110	-410	-220	-35	30
60,000	70	350	--	-120	-60	-350	-50	-20	-290	-420	-20	-120	-20	-150	-580	-350	-20	90
80,000	110	460	--	-140	-80	-520	-50	-30	-410	-570	-30	-170	-10	-140	-760	-470	-20	160
100,000	150	500	--	-140	-120	-710	-30	-60	-540	-790	-20	-250	-10	-150	-1140	-600	-10	240
120,000	180	560	--	-140	-160	-860	-20	-90	-670	-1040	0	-310	10	-250	-1980	-720	0	280
0	-130	62	--	--	--	--	--	30	47	-280	80	-55	100	8	-99	-14	35	63

Stress (psi)

Load (Pounds)	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	--	--	--	-700	-1800	550	-500	-1300	400	-800	-2800	1000	-900	-2900	1000	-350	-1350	500
40,000	--	--	--	-1900	-3400	750	-800	-2800	1000	-1450	-4750	1650	-1500	-5100	1800	-1000	-3200	1100
60,000	--	--	--	-2050	-5350	1650	-1200	-4200	1500	-2000	-6600	2300	-2200	-7200	2500	0	-4000	2000
80,000	--	--	--	-2600	-7600	2500	-1400	-5800	2200	-2600	-8900	3150	-2450	-9550	3550	200	-5200	2700
100,000	--	--	--	-3350	-9950	3300	-1850	-7150	2650	-3500	-12500	4500	-3450	-14550	5550	800	-6400	3600
120,000	--	--	--	-3900	-11700	3900	-2000	-8700	3350	-4500	-16600	6050	-5700	-25200	9750	600	-7800	4300

Strain (Microinches/Inch)

Load (Pounds)	67	68	69	76	77	78	82	83	84	85	86	87	88	89	90	91	92	93
0	0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	0	0	0
20,000	-25	30	-175	13	-23	-40	66	-70	-215	-130	4	-125	15	--	--	170	-25	-186
40,000	-50	45	-335	30	-34	-80	70	-170	-390	-250	30	-210	40	--	--	385	-62	-477
60,000	-60	50	-480	40	-30	-90	50	-290	-580	-380	-30	-300	50	--	--	610	-110	-800
80,000	-70	70	-610	60	-20	-100	56	-420	-770	-530	-30	-420	60	--	--	840	-160	-1140
100,000	-70	80	-750	80	-20	-120	40	-530	-980	-680	-40	-530	80	--	--	1090	-210	-1480
120,000	-70	110	-890	110	-16	-140	40	-660	-1200	-840	-30	-630	100	--	--	1350	-250	-1840
0	85	47	36	-9	18	38	50	3	-82	-49	30	-51	-5	--	--	17	-73	-149

Stress (psi)

Load (Pounds)	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss	Su	Sy	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	0	0	0
20,000	-400	-2800	1200	-100	-500	200	-50	-2350	1150	-1000	-3100	1050	--	--	--	1200	-1600	1400
40,000	-1000	-5200	2100	-400	-1000	300	-800	-4400	1800	-1500	-5700	2100	--	--	--	2200	-4200	3400
60,000	-1100	-7100	3000	-400	-1100	350	-1700	-6700	2500	-2800	-7800	2500	--	--	--	4300	-7300	5800
80,000	-1300	-9100	3900	-350	-1250	450	-3150	-9750	3300	-3900	-10900	3500	--	--	--	5400	-10200	7800
100,000	-1800	-11200	4700	-500	-1600	550	-4300	-11800	3750	-4950	-13950	4500	--	--	--	7000	-13200	10100
120,000	-1700	-13100	5700	-400	-1800	700	-4800	-14700	4952	-5900	-17100	5600	--	--	--	8400	-16800	12600

TABLE IV (Continued)

LOAD-STRAIN AND LOAD-STRESS DATA -- TEST NO. 3 -- 180° BAND LOAD AT ROOM TEMPERATURE
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Load (Pounds)	94	95	96	97	98	99	100	101	102
0	0	0	0	0	0	0	0	0	0
20,000	60	-50	--	100	11	-130	-65	-165	--
40,000	120	-130	--	170	-58	-336	-130	-340	--
60,000	190	-220	--	240	-140	-550	-170	-470	--
80,000	250	-320	--	290	-230	-780	-240	-600	--
100,000	300	-420	--	340	-320	-1020	-290	-720	--
120,000	350	-520	--	38	-420	-1240	-380	-870	--
0	36	-72	--	4	-3	-58	36	-50	--

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0
20,000	--	--	--	800	-1200	1000	--	--	--
40,000	--	--	--	600	-3400	2000	--	--	--
60,000	--	--	--	600	-5600	3100	--	--	--
80,000	--	--	--	500	-8100	4300	--	--	--
100,000	--	--	--	100	-10700	5400	--	--	--
120,000	--	--	--	-400	-13200	6400	--	--	--

Ref. Sym: 1612 (285)
Project No. TM-353

TABLE V

LOAD-STRAIN DATA FOR TEST NO. 4 -- SIMULATED SWAY BRACE LOAD AT AMBIENT TEMPERATURE
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Gage No.

Load (Pounds)	13	14	15	37	38	39	40	41	42	43	44	45
0	0	0	0	0	0	0	0	0	0	0	0	0
5,000	-6	145	171	497	301	267	87	160	260	--	171	-22
10,000	-8	150	187	760	485	408	76	200	385	--	178	-60
15,000	-10	150	202	1000	650	580	100	240	570	--	200	-70
20,000	-10	160	220	1240	780	770	170	280	660	--	250	-60
25,000	-20	170	240	1470	910	920	250	340	840	--	310	-30
30,000	-20	170	260	1690	1010	1040	320	390	1020	--	370	0
0	0	160	180	380	109	160	139	123	238	--	45	-122

Load (Pounds)	46	47	48	49	50	51	64	65	66	70	71	72
0	0	0	0	0	0	0	0	0	0	0	0	0
5,000	86	230	234	321	264	94	166	84	108	-284	-30	115
10,000	88	380	366	439	343	55	165	80	99	-400	-128	34
15,000	80	540	510	520	400	0	180	70	100	-690	-210	-40
20,000	100	760	680	590	430	-7	360	60	80	-830	-290	-120
25,000	140	990	900	680	460	-15	200	50	80	-1020	-420	-180
30,000	190	1240	1150	780	460	-23	330	40	70	-1210	-510	-240
0	110	350	247	180	136	22	380	82	117	-17	178	350

Load (Pounds)	73	74	75	76	77	78	79	80	81
0	0	0	0	0	0	0	0	0	0
5,000	24	-6	-124	47	-44	-78	-829	100	400
10,000	-14	-60	-345	-28	-175	-245	-1240	-43	425
15,000	-30	-110	-630	-130	-340	-410	-1540	-170	350
20,000	-20	-150	-960	-240	-570	-600	-1840	-200	440
25,000	20	-220	-1360	-350	-810	-920	-2140	-220	560
30,000	130	-310	-1830	-420	-940	-1260	-2430	-230	710
0	383	172	-177	133	12	-20	-380	580	1130

Ref. Sym: 1612 (285)
Project No. TM-353

TABLE VI

LOAD-STRAIN AND LOAD STRESS DATA -- TEST NO. 5 -- 120° BAND LOAD AT 150°F
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Load (Pounds)	Gage No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	75	-250	--	180	170	-40	-60	--	170	100	-110	-180	413	-50	-470	70	-30	-230
30,000	110	-270	--	330	460	60	-130	--	590	200	-150	-200	630	-140	-790	140	-120	-450
40,000	130	-320	--	460	640	80	-200	--	790	260	-270	-400	810	-270	-1220	180	-280	-720
60,000	180	-440	--	830	880	100	-320	--	1100	390	-480	-660	1260	-510	-2050	20	-460	-1220
0	26	56	--	20	20	30	14	--	41	12	60	60	35	44	50	40	60	73

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	--	--	--	2300	-100	1200	--	--	--	700	-1900	1300	3000	-4000	3500	-50	-2550	1300
30,000	--	--	--	5300	800	2250	--	--	--	2000	-2000	2000	4300	-6900	5600	-150	-4750	2300
40,000	--	--	--	7500	900	3300	--	--	--	2000	-4200	3100	4800	-11200	8000	-650	-7750	3550
60,000	--	--	--	11600	2800	4400	--	--	--	2600	-7200	4900	7000	-19200	13100	-1500	-13300	5900

Strain (Microinches/Inch)

Load (Pounds)	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	-300	1020	1890	390	1230	2500	-130	820	2200	--	80	-680	40	-490	-1280	0	-750	-830
30,000	-360	1250	2250	720	1560	2840	-170	880	2450	--	230	-790	50	-480	-1430	30	-920	-920
40,000	-480	1380	2590	1230	1970	3140	-210	980	2720	--	520	-710	70	-430	-1550	10	-1140	-930
60,000	-620	1660	3060	2660	3130	3940	-210	1170	3170	--	970	-680	90	-470	-1880	-20	-1550	-980
0	30	34	50	50	50		40	50	50	--	60	76	45	50	31	-13	-40	-5

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	25300	4600	10552		Yield			Yield		--	--	--	-4400	-15000	5300	-2300	-10700	4200
30,000		Yield								--	--	--	-4700	-16800	6050	-1700	-12300	5300
40,000										--	--	--	-4300	-18900	7300	-700	-13700	6500
60,000										--	--	--	-5700	-22500	8400	1800	-16400	9100

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[redacted]

Ref. Sym: 1612 (285)
Project No. TM-353

TABLE VI (Continued)

LOAD-STRAIN AND LOAD STRESS DATA -- TEST NO. 5 -- 120° BAND LOAD AT 150°F
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Load (Pounds)	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,000	1	-6	7	100	510	450	70	--	-280	--	--	--	80	340	1530	400	--	--
30,000	20	20	18	140	70	-380	170	--	-330	--	--	--	300	650	2340	570	--	--
40,000	10	20	40	170	-26	-1200	260	--	-1200	--	--	--	610	1050	2680	760	--	--
60,000	20	20	40	90	-70	-1560	420	--	-1380	--	--	--	1210	*	*	*	--	--
0	4	4	14	10	-4	-50	9	--	-30	--	--	--						

Stress (psi)

Load (Pounds)	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss	Su	Sv	Ss
0	0	0	0	0	0	0	--	--	--	--	--	--	19400	5800	6800	--	--	--
20,000	200	0	100	6600	2000	2300	--	--	--	--	--	--		Yield		--	--	--
30,000	300	300	0	600	-4400	2500	--	--	--	--	--	--				--	--	--
40,000	600	300	150	-1150	-14950	6900	--	--	--	--	--	--				--	--	--
60,000	650	450	100	-3100	-19700	8300	--	--	--	--	--	--				--	--	--

Strain (Microinches/Inch)

Load (Pounds)	67	68	69	79	80	81	82	83	84	85	86	87
0	0	0	0	0	0	0	--	--	--	--	--	--
20,000	370	250	--	--	--	10						
30,000	650	390	--	--	--	20						
40,000	820	520	--	--	--	40						
60,000	*	*	--	--	--	*						

* System shorted out.

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TABLE VII

LOAD-STRAIN DATA FOR TEST NO. 6 -- SIMULATED SWAY BRACE LOAD AT 150°F
STATIC TEST OF TX-27 TEST CYLINDER

Strain (Microinches/Inch)

Gage No.

Load (Pounds)	37	38	39	40	41	42	43	44	45
0	0	0	0	0	0	0	0	0	0
5,000	260	140	430	490	260	1100	--	610	1100
10,000	3230	1490	1650	660	2760	4470	--	4890	5550
15,000	4450	8750	*	3600	**				

Load (Pounds)	46	47	48	49	50	51	70	71	72
0	0	0	0	0	0	0	0	0	0
5,000	--	--	1130	0	-20	-520	-1040	-660	-970
10,000	--	--	5000	990	1230	-350	-5820	-1570	-1300
15,000	--	--	--	--	--	--	--	--	--

Load (Pounds)	73	74	75	76	77	78	79	80	81
0	0	0	0	0	0	0	0	0	0
5,000	-270	-170	-660	-560	-810	-1050	-1960	-460	-1330
10,000	900	-1240	-5300	-870	-2750	-5100	-5970	-650	-290
15,000	--	--	--	--	--	--	--	--	--

* Off scale - strain in excess of 10,000 microinches/inch.
** Sadic became inoperative.